The 2004 KDI-KAEA Conference on "Current Economic Issues of Korea"

August 10, 2004

Korea Development Institute

Contents

Table of contents

Figure of Contents

Foreword

This collection of conference papers is an accumulation of materials from *"The 2004 KDI-KAEA Conference on Current Economic Issues of Korea,"* held on August 10, 2004 at the Korea Development Institute (KDI) in Seoul, Korea.

The purpose of this conference was to gather papers that are in-line with the KDI's 2004 major research agenda such as Population Aging, Private Education Cost, Fiscal Efficiency, Real Estate Market, Job Creation, and Financial & Corporate Regulatory Reform. Unlike last year's conference, this second annual conference invited not only experts from KDI and Korea America Economic Association (KAEA) but also was open to the economic scholars of domestic academia, institutes, and other related fields. It is our hope that the conference provided a venue to exchange ideas on the future policy direction so that Korea may join the league of advanced economies in the near future. Currently, most of the papers presented during the conference are in review process for publication in the Journal of Economic Policy. This conference was possible thanks to the support of the Knowledge Partnership (KP) Project and collaboration from KAEA.

The conference was split into double sessions. Venue A offered sessions as follows: Session I-*Population Aging*; Session II-*Financial Regulatory Reforms I*; Session III-*Financial Regulatory Reforms II*; Session IV-*Corporate Affairs & Competition Policy*. Venue B included: Session I-*Productivity*; Session II-*Monetary and Fiscal Policy:* Session III-*Macroeconomic Issues*; and Session IV-*Income Distribution and Economic Growth*. This volume comprises of papers that have already been revised by the authors after the pertinent discussion notes were reflected, which are also included in the proceedings. Furthermore, the discussion notes have contributed substantial amount of input into the original papers.

My acknowledgement goes out to all participants and particularly to those who were on the Screening Board with me including Dr. Hwang Hae Shin for assisting in the preliminary paper selection. Moreover, I would like to extend my gratitude to Mr. Ho-Jung Yoon, and Ms. Sang Hee Hong for administrative arrangement and overall coordination along with Ms. Nanhee Kim and Ms. Dong-Young Shin for their support for the conference.

Shim, Sangdal
Chief Editor
Journal of Economic Policy

CHAPTER 1-1

An Analysis on the Recent Fertility Drop in Korea

by
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1. Introduction

Fertility is one of the major determinants of a nation's population, together with mortality and migration. Traditionally and until now in developing countries, concerns about fertility have focused on 'excess' fertility, and on its implication for natural and environmental resources. However, the problem faced by most advanced countries today is that their fertility rates have dropped to the levels below those needed to secure generation replacement and maintain stable population structure.

In Korea, the fertility rate drop is a relatively recent phenomenon compared with those in developed countries. In Europe, the 'demographic transition' was around the late 18th to the early 19th century: Infant mortality rate decline in industrial societies enabled families to achieve a given number of children surviving to maturity with lower fertility levels, and availability of birth control and transition from rural to urban society contributed to the long-term decline of fertility rate. With the end of the Second World War, the fertility rate increased significantly but the "baby boom" ended in the 1950s and by the end of the 1950s the fertility rates resumed their downward trend. By the early 1990s, fertility rates in most advanced countries have dropped well below the replacement level and remained stable around the level.[1] However, in Korea, the fertility rate started to decline as late as the 1960s, but the decline has been accelerated during the 1970s. By the mid 1980s, the fertility rate in Korea has reached a level on a par with those in advanced countries.

Besides the timing and speed of the fertility drop in Korea, another major characteristic of the fertility decline is that recently the rate has reached at a level unprecedented in Korea, as well as in most advanced countries. The total fertility rate in Korea in 2002 is 1.17, and it is 1.13 in 2003. Such a low fertility level has been hardly experienced by countries that are not in drastic transition.

Thus, the trend of fertility drop in Korea poses two questions: One is 'Why is the Korea's fertility drop so late and so fast?' and the other question is 'Why is the recent fertility rate so low?' In this paper, I seek answers for the two questions, though they are not complete.

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[1] The placement rate is around 2.1.

2. Korea's Fertility Trend from a Historical Point of View

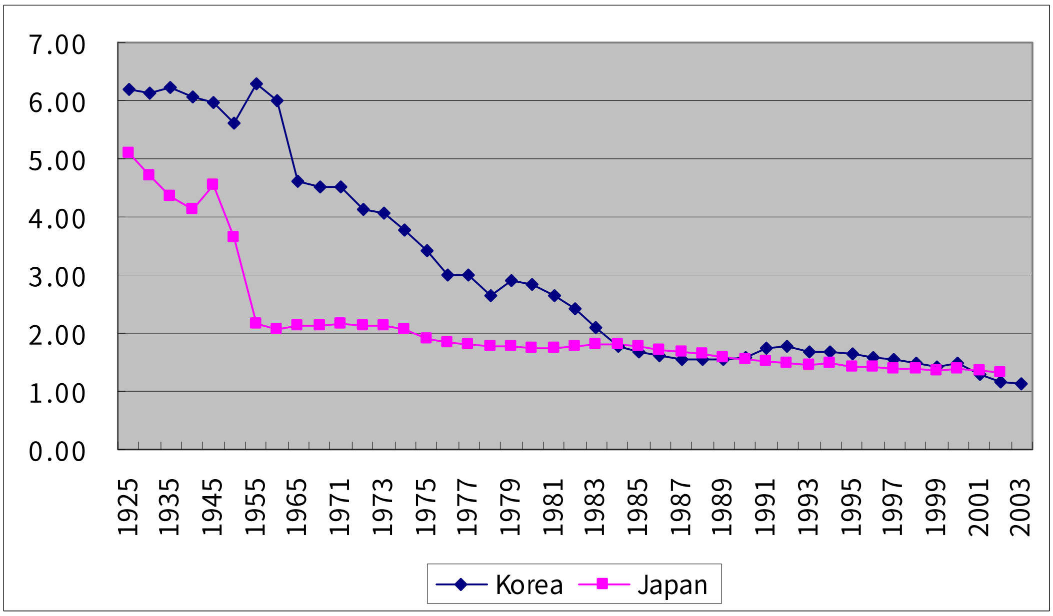
The fertility rate has changed drastically in Korea, as with other social and economic variables. The total fertility rate was roughly over 6 persons per woman before the 1960s, in which Korea's industrialization began. Since a modern population census first conducted in 1925 and repeated with roughly five years' intervals afterwards, fertility rate statistics since 1925 can be found in the literature. Table 1 shows the data along with the Japanese data for comparison. The total fertility rate has been around 6 persons per woman from the 1920s to 1960 without much variation in Korea. In contrast, those in Japan show a slow but steady declining trend since the 1920s. In other words, the 'demographic transition' was a steady process in Japan, but it was much quicker and more abrupt in Korea.

Table 1. Total fertility trend: Korea and Japan, 1925 to 1965

	1925	1930	1935	1940	1945	1950	1955	1960	1965
Korea	6.20	6.13	6.21	6.07	5.96	5.60	6.30	5.99	4.60
Japan	5.11	4.72	4.37	4.12	4.54	3.65	2.16	2.05	2.13

After the 1960, the total fertility trend in Japan shows a very steady downward trend. In contrast, the rate continued to drop fast in Korea during the 1970s and until the mid 1980s. The total fertility rate has been stable during the 1990s, but recently the rate is significantly lower than that in Japan. The 'jump' in fertility rate during 1955 to 1960 in Korea corresponds to her 'baby boom' period. But in Japan the peak was in 1947.

Figure 1. Total fertility rate trend: Korea and Japan, 1925 to 2003



Similar trend can be found in the trend of population growth rates. The population growth rate in Korea until the mid 1950s has been between 1 to 2 per cent per year, despite the high fertility rate. And also the rate is not much different from those in other countries before the industrial revolution. Lucas(2002) estimates that the world population growth rate before the industrial revolution in the 18th century was below 1 percent.

Table 2. Population growth rates of Korea: 1925 to 1955

Year	1925-30	1930-35	1935-40	1940-45	1945-50	1950-55
Population growth rate(%)	1.45	1.67	1.18	1.30	-4.30	1.07

Source: Author's calculation from KNSO, KOSIS.

The population growth rate jumped in Korea during the second half of the 1950s and the 1960s due to birth mortality rate drop and fertility rate rise. But in advanced countries, the population growth rate showed a steady downward trend since the 1950s, and by the end of the 1960s it reached below one percent and remained at the level since then.

Table 3. World population growth rates

Year	1950~55	1955~60	1960~65	1965~70	1970~75	1975~80	1980~85	1985~90	1990~95
Korea	1.02	3.09	2.64	2.25	2.00	1.55	1.36	0.99	0.95
World	1.77	1.85	1.98	2.04	1.95	1.72	1.71	1.70	1.46
Developed countries	1.21	1.18	1.10	0.81	0.79	0.65	0.57	0.60	0.41
Developing countries	2.04	2.15	2.36	2.53	2.37	2.08	2.07	2.02	1.75
Japan	1.43	0.93	0.99	1.07	1.33	0.93	0.68	0.44	0.31
US	1.61	1.69	1.41	1.01	0.94	0.91	0.97	0.99	0.99
France	0.75	1.01	1.30	0.81	0.75	0.44	0.47	0.55	0.45
Germany	0.56	0.66	0.9	0.44	0.25	-0.1	-0.16	0.43	0.57
Sweden	0.7	0.59	0.67	0.78	0.37	0.29	0.10	0.49	0.56

Note: Developed countries are North America, Europe, Japan, Australia and New Zealand.
Source: U.N.(1999)

Such trend suggests that Korea's late rise in population growth rate and rapid fertility rate drop, and the consequent rapid population aging, may be the result of a belated but quick 'demographic transition.' Since modern industrialization began as late as in the 1960s in Korea, population growth rate did not rise until the 1950s. However, as the economic growth since the 1960s was faster than any other country, the 'demographic transition' has progressed quicker than other countries. Figure 2 shows that such a presumption is not groundless. (The population growth rate figures are shown in Table 4.) When population growth rates are plotted against per capita income (in 1985 constant dollars), the pattern of population growth rate change is similar in all regions. Population growth rate rises when per capita income is around 1,000 to 2,000 constant (1985) dollars, and steadily declines in all regions.(Lucas, 2002) Korea's population growth rate change shows a similar pattern with other countries with two distinct characteristics—the population growth rate reached its peak much later but it shows a sharper change. From the pattern, one might conclude that Korea's rapid fertility rate drop—and the consequent rapid aging—is a result of her belated industrialization and rapid economic growth since then.

Figure 2. Trend of Population and Income Growth Rates: 1800~1990

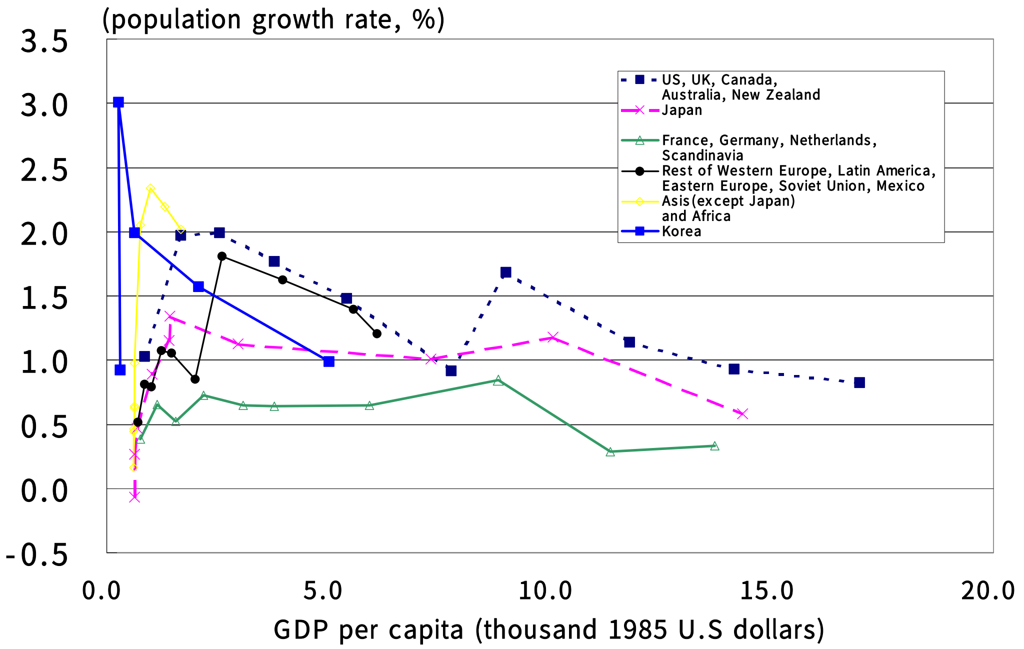


Table 4. Trend of population growth rates: 1800~1990

	Korea	Anglo-Saxon	Japan	Western and North Europe	Other Europe and Latin America	Asia, Africa (except Japan)
1800		1.0	-0.1	0.4	0.5	0.4
1850		2.0	0.3	0.7	0.8	0.5
1875		2.0	0.5	0.5	0.8	0.2
1900		1.8	0.9	0.7	1.1	0.6
1925		1.5	1.2	0.6	1.1	0.6
1950	0.92	0.9	1.3	0.6	0.8	1.0
1960	3.01	1.7	1.1	0.6	1.8	2.1
1970	1.99	1.1	1.0	0.8	1.6	2.3
1980	1.57	0.9	1.2	0.3	1.4	2.2
1990	0.99	0.8	0.6	0.3	1.2	2.0

Source: Lucas(2002) and KNSO.

3. The Characteristics of Fertility Drop

In Korea, the fertility rate continued to drop in the 1970s up to the mid 1980s, and remained relatively stable in the 1990s. The fertility rate rose in the early 1990s, but returned to its previous level in the second half of the 1990s. But it began to fall again since 2000. By comparison, the fertility rates in advanced countries are stable since the 1970s, showing a very mild declining trend. But among them, there are some variations: North and western European countries show relatively high fertility rates, and in some countries they are increasing. Some countries show significant fluctuation of fertility rates. For example, the Swedish fertility rate rose in the late 1980s to the early 1990s, but returned to its mid 1980s level by the late 1990s. Southern European countries, such as Italy and Spain, show rapidly dropping fertility rates, resulting rapid population aging. Central European countries, Germany and the neighboring countries, show intermediate trends.

Figure 3. International Comparison of Total Fertility Rate Trends: 1970~2000

Table 5. Total Fertility Rate Trend of Korea: 1990~2003

1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
1.59	1.74	1.78	1.67	1.67	1.65	1.58	1.54	1.47	1.42	1.47	1.30	1.17	1.13

The general stylized facts of fertility, obtained from international comparison study are as follows: (i) The correlation between women's general education level and fertility is not strong. Within a country, better educated women tend to give fewer births, but in international comparison the country with higher general education does not necessarily have a lower fertility rate. (ii) The correlation between female labor participation and fertility is not strong. For example, the U.S. and Sweden are the countries with the highest level of female labor participation, but the fertility rates are not low. (iii) The methods of birth control and fertility level are also not correlated. The frequency of abortion is correlated with methods of birth control, and not with the fertility rate. (iv) Fertility rates are high in countries with high illegitimacy rate, but the causal relationship is not clear. High illegitimacy rate is an evidence of changing marriage system without any clear implication on fertility. Variables shown to have positive relationship with fertility are youth labor market conditions and housing: A better youth labor market condition is empirically shown to have a positive effect on fertility, and the youth's independent living also have positive relationship with high fertility rates.

Korea's rapid fertility drop has been accompanied by a rise in marriage and first childbirth age of women, and consequently a rise in average age of women at childbirth. As shown in Figure 4, between 1985 and 2002 during in which total fertility rate dropped from 1.70 to 1.17, average marriage age increased from 24.1 to 27.1 and average first childbirth age increase from 24.9 to 28.3. Consequently, during 1980 to 2000 the number of women at childbirth in their twenties has significantly decreased, while those in their thirties increased.(Figure 5)

Figure 4. Trend of Marriage and The First Birth Age

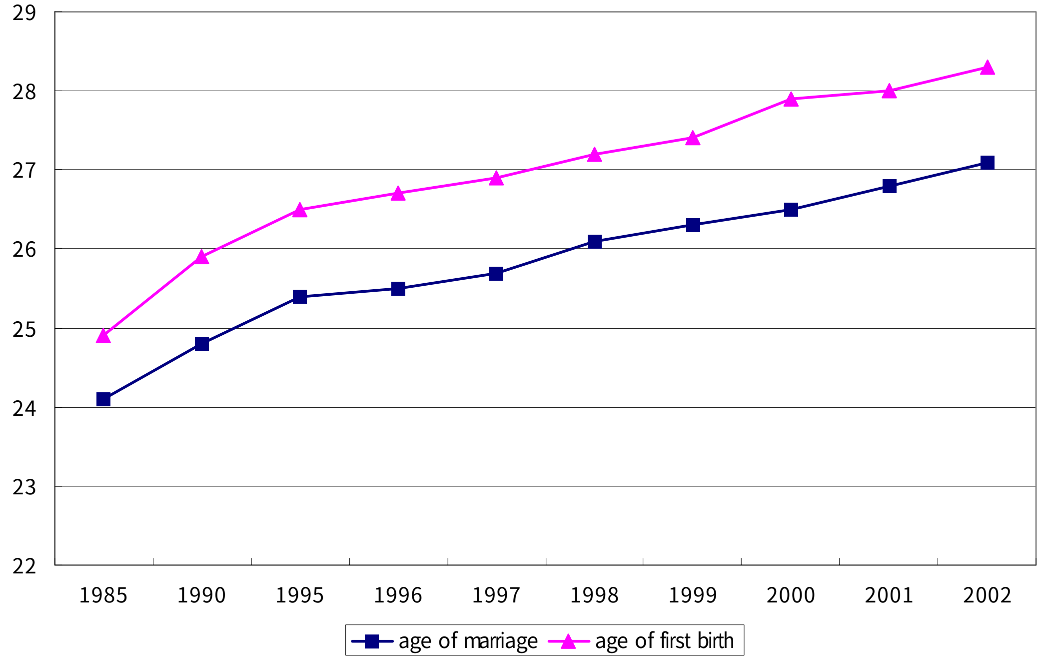
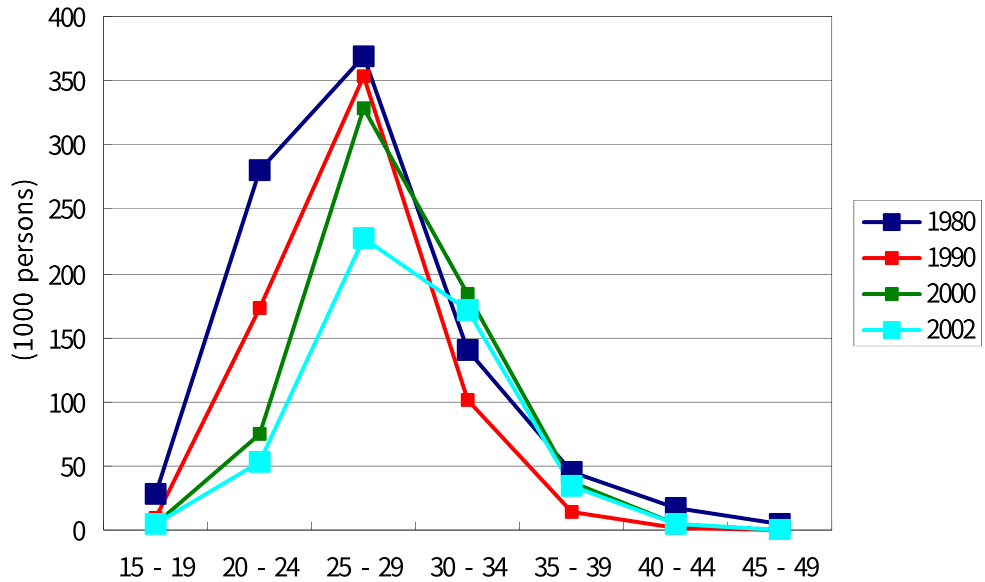


Figure 5. Distribution of Women's Age at Childbirth



Given that the rise in childbirth age is the major cause for fertility rate drop, a candidate for causes of fertility decline is the quick rise in women's educational level. Figure 6 shows the age-fertility pattern by educational level for the cohort of women born in 1965. Middle and high school graduate women tend to begin their childbearing in their early twenties, whereas college graduates begin in their late twenties. Also, the educational composition of Korean women at childbirth is rising very quickly. The share of women with some college education among those who gave childbirth in the year has increase from 6.7% in 1982 to 40.6% in 2001. Hence, educational upgrading of women itself might explain a significant portion of fertility rate drop. Further, the share is expected to increase for a while in the near future. Figure 7 shows the educational composition of women by age obtained from 2000 Census data. As the majority of women at childbirth are from 25 to 35 years old, and the share of college graduate are highest among those in early 20s in 2000, the share of women in some college education among the childbearing women will continue to rise in the near future. To evaluate the effect of educational upgrading to fertility rate, a simple simulation is conducted and the result is reported in Figure 8.

Figure 6. Age Specific Fertility by Educational Level: 1965 cohort

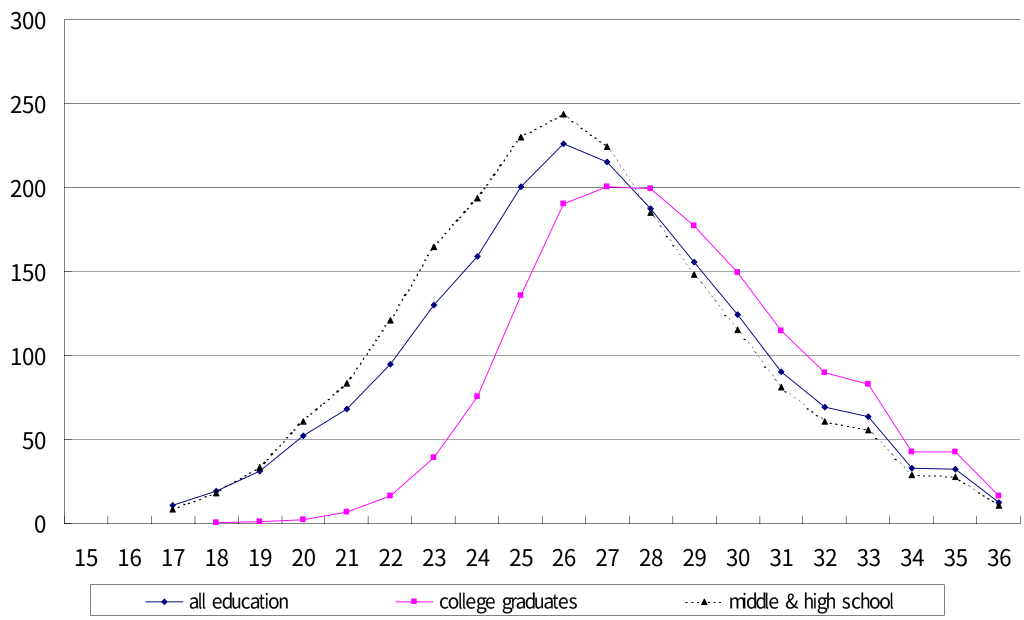


Table 6. Educational composition of Women at Childbirth (%)

	1982	1990	1995	2000	2001
Middle and high school	64.5	76.3	72.3	61.3	58.1
Some college	6.7	19.4	25.7	37.5	40.6

Figure 7. Women's Educational Composition: 2000

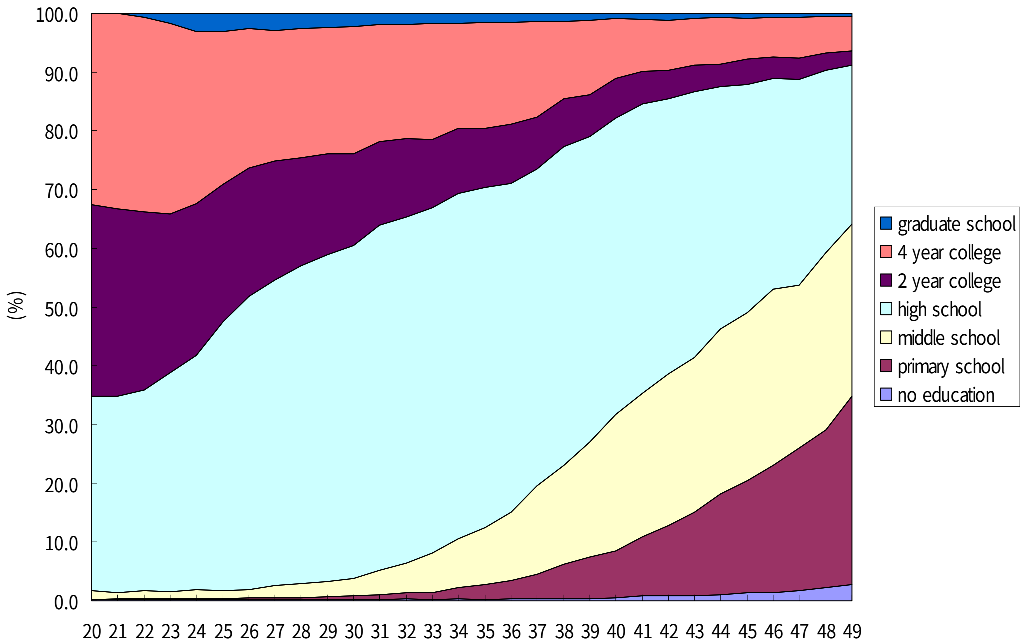
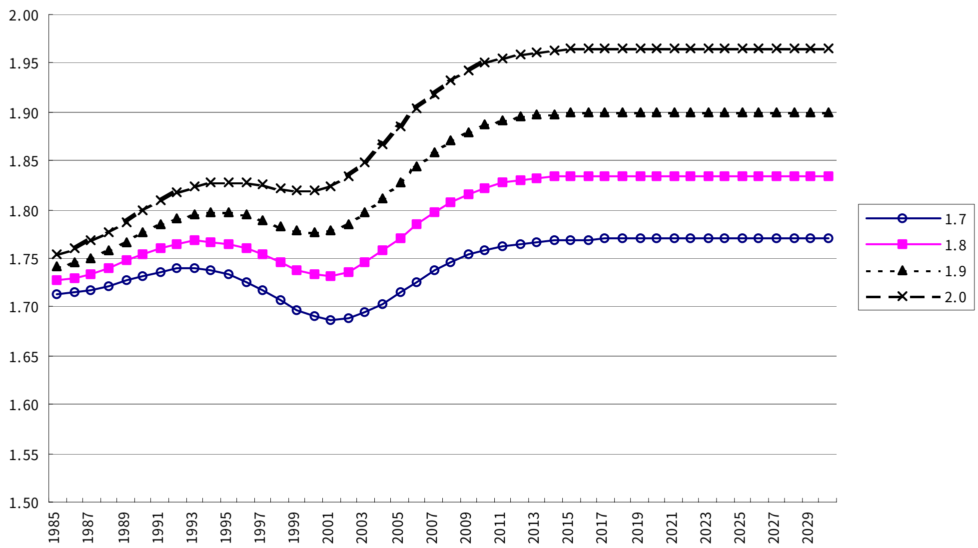


Figure 8. Simulation of Total Fertility Rates



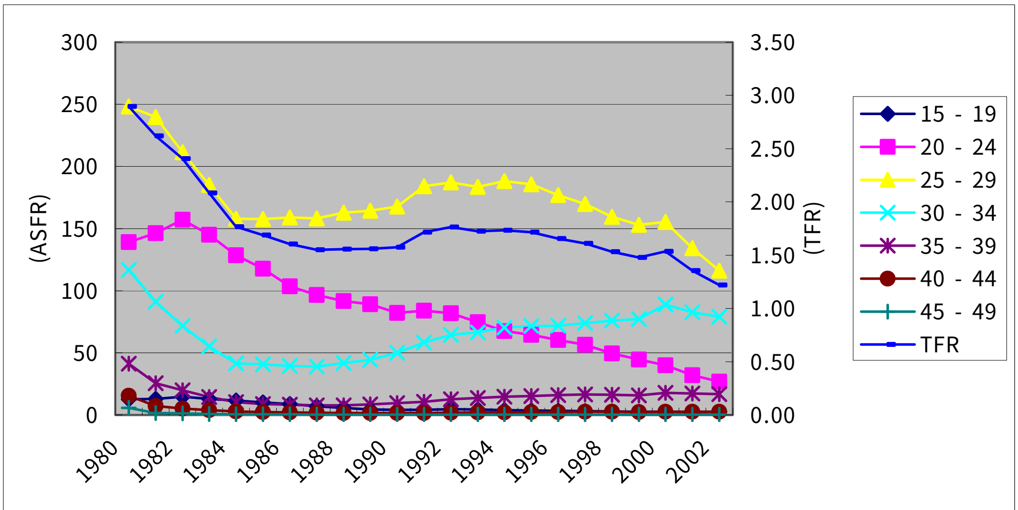
In the simulation, it was assumed that the age specific fertility rates of women in each educational group class are the same of those in 1965 birth cohort with the corresponding education. And future educational composition of women are projected under the assumption that women's educational level does not rise future from those of the 20 years old in 2000. For completed fertility rates, 2.0 and 1.9 are assumed for primary school and middle and high school graduates and 1.7 to 2.0 are assumed for college graduates.

The simulation result shows that the educational upgrading will exert some downward pressure to total fertility rate, but the pressure is highest in the early 2000s, and will disappear since then as the educational upgrading tapers out, which is a result of the assumption that the educational level does not increase further from that of the 20 year old women's in 2000. The simulation also accounted for the rise in fertility rate in the early twenties. As the share of high school graduate women quickly reduced in the late 1980s, the birth timing has been delayed, resulting a fall in the end of 1980s and a rise in the early 1990s. However, the fertility rate change implied by such simulation, which exploits only the change in educational composition without assuming the rise in childbirth ages within the educational groups turned out to be very small compared with the actual drop in fertility rate.

Another candidate explanation for recent fertility drop is the worsened youth labor market condition since the economic crisis that broke out at the end of 1997. However, as the fertility rate continued to drop even after economic recovery thereafter, the explanation is not so persuasive.

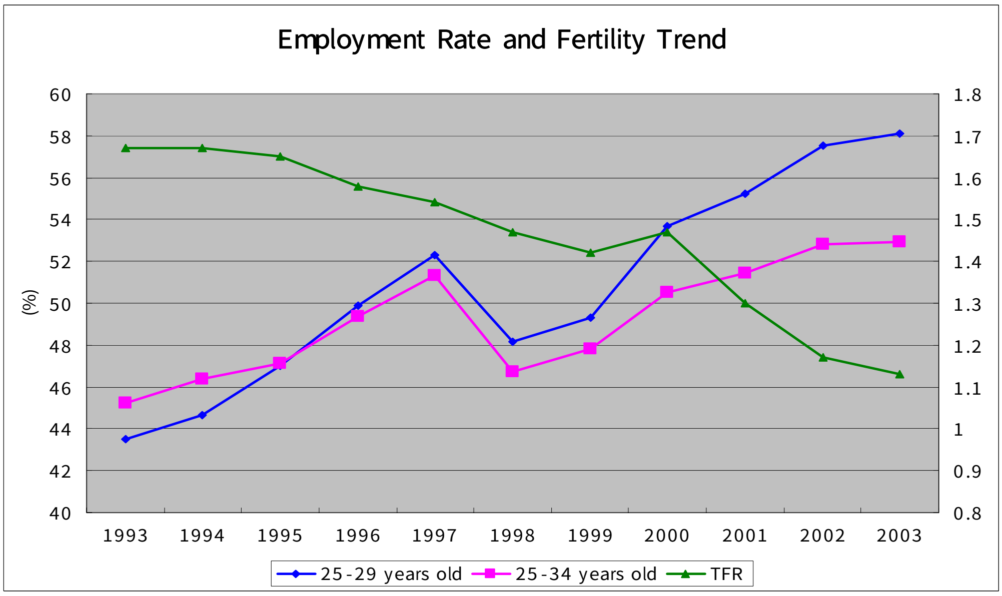
The recent low fertility rate is primarily due to the drop in the fertility rate among the women in their second half of the twenties. Figure 9 shows that in the early 1990s, age specific fertility rate of the second half of the twenties increased while those among the first half of the twenties dropped. However, since the late 1990s and especially in 2002 and 2003, the age specific fertility rate of the second half of the twenties dropped sharply without those of the thirties increasing. This may suggest that women in their second half of twenties are delaying their childbirth, and the age specific fertility rate among the thirties could increase in near future. But if we refer to the trend in foreign countries, the increase may be limited.

Figure 9. Trend of Age Specific Fertility Rates



A plausible explanation for the drop in age specific fertility rate among the women in their second half of twenties is the rise in their labor participation. As shown in Figure 10, the employment rate of women, especially in their second half of twenties has increase remarkably since 1998, especially among those highly educated. Further, the change is in exact opposite direction from that of the fertility trend. Thus, it seems that the rise in women's job opportunity and the rise in shadow cost of childbearing may have contributed significantly to the recent fertility drop, and such effect of labor market condition change is worth further investigation.

Figure 10. Trend of Women's Employment Rate and Fertility



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Comments on "An Analysis on the Recent Fertility Drop in Korea"

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This paper tried to answer two questions about the fertility rate drop in Korea: (i) Why is the Korea's fertility rate drop so late and so fast?; and (ii) Why is the recent fertility rate so low? These two questions summarize the characteristics of Korea's recent demographic transition: Even though the process of population aging of in Korea is belated, its speed is unprecedentedly high, and the fertility rates of recent years are unprecedentedly low. This paper quite successfully answered the first questions: the late and fast fertility rate drop is quite well explained by Korea's late but quick industrialization. The author presented a very persuasive explanation for the characteristics of Korea's fertility drop, which is different from the existing view that the fertility drop is primarily due to the change in social view to marriage and childbirth.

As for the first question, I suggest investigation of the birth control promotion effect for 1970's and 1980's. The author stated that the international comparison does not suggest close relationship between birth control and fertility rate. However, it is not valueless to check whether the overlapping of the period of public birth control with that of fast fertility rate drop in Korea is just a coincidence.

The author's answers to the second question do not seem to be as clear as those to the first question. The reasons for declining trend of fertility rates and unprecedentedly low fertility rates of recent years, that the author presented, are: (i) rise in marriage and first childbirth age; (ii) rise in educational attainment of women; (iii) worsened youth labor market of recent years; and (iv) rise in women's labor participation. Even though Author's simulation based on the assumptions reflecting (i) and (ii) showed that the educational upgrading will exert some downward pressure to total fertility rate in early 21^{th} century, the pressure will disappear soon. This is because the effect of women's educational upgrading will taper out, since the author assumed that the "completed" fertility rate will not change, which implies that the total fertility rate drop of recent years is a temporary phenomenon: i.e. the total fertility rate drop of recent years is not the result of completed fertility rate drop but that of delay of childbirth. I guess the author need to present a clearer view about whether the fertility drop of recent years is a temporary or permanent phenomenon, because temporary fertility drop has different implications for social policies from those permanent fertility drop has. In order to address this issue, I think the author need to use a new data set. In this paper, the author used aggregate time series data in order to find statistical relationship between variables. For more thorough analysis, I guess the author need to use a micro-data set, such as Census data, which contains more detailed information on socio-economic characteristics of individuals. I also suggest literature survey on the case study of countries that has believed in conservative social value but has been experiencing rapid change in social value system, such as Italy and Spain. As the author mentioned in the presentation, these countries have been experiencing rapid fertility drop, therefore, comparison of their experience with that of Korea will be helpful for the analysis.

Author stated that the third reason (iii) is not persuasive, because economic recovery of recent years does not increase fertility rate. I think the author need to interpret the result with reservation, since the decision on childbirth will depends on the expectations on future economic situation as well as realized income.

Related with reason (iv), I suggest investigation of the effect of child-bearing cost, including educational cost and nurturing cost, on childbirth. It is generally recognized that the private educational cost is very high in Korea because of unreliable public education. Inadequacy of nurturing system for the working mothers raises the nurturing cost, which in turn raises the child-bearing cost and contributes to the fertility rate drop of recent years.

CHAPTER 1-2

Population Aging and its Effect on the Inequality: An Extended Empirical Study of the Kuznets' Inverted U-hypothesis

by
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Seung-Hoon Jeon (National Assembly Budget Office)
Byung-In Lim (Research Fellow, Korea Insurance Development Institute)

Abstract

To investigate the relationship between population aging and inequality, we used three test methodologies such as panel data analysis, inverse logistic function estimation, and nonparametric kernel estimation. We compute the Gini index using the Luxembourg Income Study (LIS). Old age dependency ratio and other variables came from the World Development Indicator 2003 (WDI2003).

The estimation result by using the panel data analysis, inverse logistic function estimation, and nonparametric kernel estimation shows that Kuznets' hypothesis does not hold in our sample and degree of inequality increase at increasing rate as old age dependency ratio goes up. And we also find the policy implication that fiscal policy may weaken the effect of the population aging on inequality.

I. Introduction

According to the Kuznets(1955, 1963), there exists an inverted U-shaped relationship between income inequality and economic development: The income inequality gets worsened in the earlier stage of economic development, and then it reaches its peak in the mid-stage, and finally it is getting improved after the peak. The inverted U-shaped curve has been tested numerously in many works to prove empirically since Kuznets(1955).

Recently, however, reliability of the Kuznets' hypothesis was refuted in two ways. First, degrees of the inequality turned to get worsened in the developed countries, implying that Kuznets' inverted-U hypothesis does not hold. Why does this happen? Some studies such as World Bank (2002), Fraser Institute (2002), and Lee and Park (2002) considered the effect of the economic freedom from globalization on inequality to prove the inconsistency. However, we shed light on the effect of the population aging, which can play role as a factor negating the Kuznets' hypothesis. It is because OECD countries have experienced dramatic changes in the demographic characteristics in the past few decades. Fertility rates in almost all OECD countries have declined to the rate below 2.1, which is a critical level for maintaining a stable population. Life expectancy has dramatically extended from 66 in 1960s to 77 in the present. The recent survey undertaken by the United Nations expects the share of the old-aged population to be doubled, on average, over the next 50 years in the major industrialized countries. This gives rise to a presumption that population aging affects the income inequality. The increase in the share of the old aged 65 and above can make the overall inequality worse, since, according to Deaton and Paxson(1994, 1997), inequality increased with age within cohorts of individuals.

Second, Some researches such as An and Lee(1991), Deinginger and Squire(1998), and An(2003) point out the problems of the test methodologies used so far confirming Kuznets' hypothesis. The first problem is that those studies of Kuznets' hypothesis used cross-country data rather than an analysis of historical trends. The second problem is that the previous test results relied on specific functional forms generating inverted-U shaped curve. The third problem comes from the boundedness of the dependent variable to [0, 1] in its range. In this paper, thus, we attempt to investigate the relationship between population aging and inequality using three test methodologies such as panel data analysis, inverse logistic function estimation, and nonparametric kernel estimation to solve the problems of the test methodologies.

This paper is organized as follows: The first section briefly introduces the importance of population aging, and explains the motivation of analyzing the relationship between population aging and growth. The second section discusses three major problems in the test methods commonly observed in the previous empirical studies confirming the Kuznets' hypothesis. In the third section, we present the econometric model, test methodology, data, and variables. Estimation results are discussed in the fourth section. We derive conclusions in the fifth section.

II. Problems and Solutions in the Test Methods

1. Previous Researches

Kuznets (1955, 1963) performed the first systematic work on changes in income equality at different stages of economic development. The well-known Kuznets hypothesis (UH) postulated an 'inverted-U' relationship between the income and the inequality, according to which the degree of inequality would first increase and then decrease with economic growth. Kuznets' original hypothesis relied on historical experience of several developed economies. He employed a two-sector hypothetical economy to show the possibility of the inverted-U pattern. He also compared developed and underdeveloped countries by measuring the income shares of various groups and observed that income inequality is more severe in underdeveloped countries.

The work of Kuznets was followed by numerous empirical studies. Kravis(1960) used eleven countries' data on income share, the Gini coefficient, a coefficient of variation, and the standard deviation of the logarithm of income to draw a conclusion supporting UH. Adelman and Morris (1973) compiled data for 43 developing countries and presented evidence supporting UH. Paukert(1973) expanded Adelman and Morris' data up to 56 countries and confirmed UH.

The most frequently cited studies in the UH literatures are those of Ahluwalia(1976a,1976b). Ahluwalia used data sets compiled by Jain (1975) with more countries added. He took income share of the top 20%, the middle 40%, the bottom 40% and the bottom 60% of the population in 62 countries as dependent variables and regressed them on log (GNP) and $(\log(GNP))^2$ to infer the inverted-U hypothesis from the signs of the estimated coefficients of log(GNP) and $(\log(GNP))^2$. He claimed that the inverted-U pattern is a "stylized fact."

Recently, however, there have been studies that refute reliability of the Kuznets' hypothesis. Saith(1985) pointed out several problems with Ahluwalia's results including their sensitivity to the dropping or adding of a few observations. An and Lee (1991) questioned the test methodologies used so far confirming Kuznets' hypothesis. Using the time-series data in Korea, An (2003) found that the Korea economy seldom supports the Kuznets' Hypothesis. According to Deininger and Squire (1996, 1998), recently, degrees of the inequality in developed countries increased. Although Kuznets' hypothesis has been confirmed in many empirical studies, we have to be more careful when we discuss Kuznets' hypothesis.

Comparing with the researches related on the relationship between inequality and development, it is difficult to find the papers analyzing directly how demographic changes affected the inequality. However we could found some implications from the Deaton and Paxson(1994, 1997). Using the micro data from the United States, Great Britain, Taiwan, and Thailand, they showed that inequality in consumption, income, and earnings increased with age within cohorts of individuals. These results implied that increasing the share of the old people in the total population might aggravate inequality.

2. Three Problems and Solutions

This paper uncovers three major problems commonly observed in the previous empirical studies confirming the Kuznets' hypothesis and proposes new methodologies resolving those problems. These methods contain panel data approach, inverse-logistic approach, and non-parametric kernel fit

The first problem is that those studies of Kuznets' hypothesis used cross-country data rather than an analysis of historical trends over time because of the insufficiency of time-series data for each country that was observed. Learned from one country's time-series data cannot be applied to the other countries unless they share something in common. On the other hand, every country is unique in a certain sense. Hence, a better way to test Kuznets' hypothesis is to employ panel data, taking into account time-invariant country-specific effects.

There are some attempts to test the Kuznets' hypothesis using the panel data set. Tsakloglou (1988) compiled a panel data set. But, instead of invoking estimation methods useful for panel data, he grouped countries by the geographic location and used dummy variables for locations. So the time-invariant country-specific effect has not been properly accounted for in the literature. In this paper, however, we will use a panel data analysis that can properly explain the time-invariant country-specific.

The second problem is that the previous test results relied on specific functional forms generating inverted-U shaped curve. Tsakloglou(1988) observed that Kuznets' hypothesis is a vague statement, for there exist many different functional forms which can generate the inverted-U shape. For instance, $Y=ax + b(1/x)$ as well as $Y=ax+bx^2$ can yield the inverted-U shape, depending on (a, b). Hence specifying the regression function as a quadratic form and drawing conclusions from it may be misleading. The best way to resolve this problem is the Non-parametric Kernel Regression, which does not depend on any functional form but estimates the functional form itself

The third problem comes from the boundedness of the dependent variable to [0, 1] in its range. The range of income inequality measures is limited, so that any well-fit regression function can have ups and downs in which may pass as an inverted-U shape. In this case, Kuznets' hypothesis becomes vague. And such bounds cause estimations of the regression function with the bounded dependent variable to yield the inverted-U shape, although the true function is not nonlinear. To resolve this problem we employed inverse logistic function estimation.

III. Model, Data, and Variables

1. Model and test methodologies

To investigate the relationship between population aging and inequality, we employed a general model enough to accommodate all our estimation method.

$$y_{it} = H(r(x_{it}, \beta, z_i, \gamma) + \mu_{it}),\ t = 1, 2, \cdots T_i,\ \ i = 1, 2, \cdots, N \qquad (1)$$

where x_{it} is the independent variables, z_i is the time-invariant variables including the intercept and country-specific effect, H is a nonlinear function mapping $(-\infty, \infty)$ to [0, 1], $r(\cdot)$ is the regression function of our interest and T_i is the number of observation for the i th country.

Equation (1) is general in that it takes into account the fact that the range of y_{it} is [0,1] by employing H, which may unknown. Equation (1) also considers the possibility of an unknown form of the regression function and time-invariant variables that differ by country. Depending on how much we are willing to assume in (1), we have a variety of models with different interpretations of H

The first model, perhaps the most frequently used one, is panel linear model. In this model, we ignore the bound on y and assume that r is linear.

$$y_{it} = x_{it}'\beta + z_i'\gamma + \mu_{it} \qquad (2)$$

We estimate fixed effects model and random effects model and, to find the best fitted model for our analysis, we undertake two tests. The one is Lagrange Multiplier test which test the existence of the country specific effect. The other is the Hausman test which is usually applied to test for fixed versus random effects model.

The Second model, perhaps the easiest one to implement, is

$$y_{it} = H(x_{it}'\beta + z_i'\gamma + \mu_{it}) \qquad (3)$$

With H known where x_{it} is k×1 vector of variables, and z_i is a column vector of time-invariant variables. Then, inverting H, we get

$$y_{it}^{*} \equiv H^{-1}(y_{it}) = x_{it}'\beta + z_i'\gamma + \mu_{it} \qquad (4)$$

One choice for H is the logit function $H(z) = 1/(1+e^{-z})$ and fit the model

$$\log(y/(1-y)) = x_{it}'\beta + z_i'\gamma + \mu_{it}. \qquad (5)$$

We call this model 'inverse logistic model' and use a panel data analysis that can properly explain the time-invariant country-specific.

For nonparametric kernel regression as the third model, we ignore the bound on y but allow an unspecified regression function:

$$y_{it} = r(x_{it}, \beta, z_i, \gamma) + \mu_{it}\,. \qquad (6)$$

where r is unknown.
To control the country specific effect, we must take the first difference.

$$y_{it} - y_{i,t-1} = r(x_{it}) - r(x_{i,t-1}) + u_{it} - u_{i,t-1} \qquad (7)$$

We cannot, however, separate $r(x_{it})$ from $r(x_{i,t-1})$, and thus we cannot directly apply a nonparametric regression technique to (5), too.
If $r(x_{it}) - r(x_{i,t-1}) \cong r(x_{it} - x_{i,t-1})$ holds, then equation (7) becomes

$$y_{it} - y_{i,t-1} = r(x_{it} - x_{i,t-1}) + u_{it} - u_{i,t-1} \qquad (8)$$

And we can apply a nonparametric regression technique to equation (8). But it means that r is approximately linear. Hence when we allow r to be unknown, it seems better to interpret UH as a relationship between changes in GNP and inequality rather than as a relationship between the levels of GNP and inequality.
With an iid sample with N observations, a kernel estimator for f(x) is given by

$$f(x) = \frac{1}{Nh^k} \sum\nolimits_i K \frac{x_i - x}{h} \qquad (9)$$

Where K is a kernel that is weighting function such as a normal density, $h \Rightarrow 0$ as $N \Rightarrow \infty$, and k is the dimension of x_i. The smaller $|x_i - x|$ is, the larger the weight that is given to the i th observation. So equation (9) is a weighted number of observations falling in a neighborhood of x. The presence of smoothing parameter h makes the neighborhood shrink to 0 as $N \Rightarrow \infty$. Equation (9) is a generalization of estimating f(x) by a histogram where the group interval length plays the same role as h.
It is known that the choice of K is not crucial for the estimate but the choice of h is critical. Although there are many theoretical suggestions of how to choose h, in practice h is usually chosen by a trial and error until local variation of the estimated curve disappear and a certain trend is detected. In our analysis, we use the product standard normal kernel.

2. Data and Variables

The number of countries used in our analysis is 19. The countries were chosen from the Luxembourg Income Study and total observations in this paper are 87. The data used in this paper are from the following sources: Data on inequality are from Luxembourg Income Study(LIS). Data on the other variables are from the world development indicator 2003 published by World Bank.
Details on the variables used in the regression are in <table1> and basic statistics are in <table 2> Sample period and Means of the important variables in each country are reported in <table 3>.

IV. Empirical Results

1. Panel Regression Results

In <table 4>, we attempt to estimate four specifications of the regression equations concerning the shapes of the relationship between before-tax Gini and LGDP or between before-tax Gini and OAGDEP. In our formulation, we tested a linear relationship in Spec.1 and Spec.3 and tested a quadratic form relationship in Spec.2 and Spec. 4. We, initially, tested the cubic relationship but it was not statistically significant. Thus we did not report it.

We undertook two tests so as to find the best fitted model for our analysis. First, in the null hypothesis, which means that there does not exist the country specific effect, it is rejected in all cases at the 1-percentage significance level for Lagrange Multiplier test. It says that the panel data analysis such as fixed effect model estimation or random effect model estimation is better than the simple pooled regression. Second, in the Hausman test for the null hypothesis that there exists the random effect, we found that the four cases were rejected at the 5-percentage significance level. These tests show us that the analysis had better be interpreted using the fixed effect model estimation result.

In our analysis the linear specification between before-tax Gini and LPGDP in spec.1 appears a significantly positive relationship. But the quadratic specification in spec.2 is not statistically significant. According to the Kuznets' hypothesis, degrees of inequality improve in the developed countries and most countries used in our analysis are developed countries. Thus significant negative relationship between Gini and LPGDP implies the Kuznets' hypothesis hold in our sample. But this does not appear. It implies that Kuznets' hypothesis does not hold in our sample.

The relationship between before-tax Gini and OAGDEP in spec.3 appears a significant positive relationship and the quadratic specification in Spec.4 is also significant and positive. It means that degree of inequality increase at an increasing rate as the old age dependency ratio goes up.

Table 5 shows the estimation results of before-tax Gini as the dependent variables and LPGDP, OAGDEP, and the other variables as the independent ones. According to the result of the LM-test and Hausman test, in all cases, we found that the fixed effect model is more useful than the random effect model. The empirical results are almost the same as those in Table 4 in all specifications. The relationship between before-tax Gini coefficient and LPGDP is significant and positive. And the relationship between before-tax Gini coefficient and OAGDEP in spec.7 appears a significant positive relationship and the quadratic specification in Spec.8 is also significant and positive.

Table 6 and Table 7 represent the panel regression results using after-tax Gini coefficient as the dependent variables. The empirical analysis shows little difference from before-tax Gini coefficient results. An interesting finding emerges from the empirical comparison of before-tax Gini coefficient with after-tax Gini coefficient. In other word, the coefficient values of both LPGDP and OAGDEP with respect to the case of after-tax Gini index are lower than in before-tax case. This implies that the impact of the development or the demographic changes on the inequality can be decreased due to the tax policy. Also it offers a policy implication that the fiscal policy can improve the unequal distribution resulted from the aging phenomenon.

2. Inverse Logistic function

Table 8-9 says the estimation results of the inverse logistic function whose dependent variable is before-tax Gini index. It is almost the same as the results from the panel data estimates. Table 10-11 is the results of the inverse logistic function using after-tax Gini as a dependent variable. But Spec. 32 in the Table 11 tells us that the random effect model is a better tool for our analysis, for the null hypothesis is not rejected for the Hausman test. Nevertheless, the signs and significance level conform to the other specification results. Except for this, the other results are the same as the panel data results.

The coefficient values of LPGDP and OAGDEP with after-tax Gini index as dependent variables is lower than that with before-tax Gini, which is the same as the inverse logistic function estimation. In this result, it is found that the fiscal policy can improve an unequal income distribution resulted from the aging.

3. Nonparametric Kernel Fit

Figure1 and Figure 2 show the relationship between LPGDP and before-tax or after-tax Gini coefficients in the kernel method. As we already mentioned above, the kernel fit is useful if it is interpreted as the relationship between changes of log (per capita GDP) and Gini coefficients rather than the relationship between level of log (per capita GDP) and the Gini coefficients. In this context, the horizontal axis in Figure 1 and 2 represents the change of the LPGDP, i.e., the growth rate of GDP in a country. From this perspective, we can find in Figure 1 and 2 that before- and after-tax Gini indexes changes infinitesimally as the growth rate of per capita GDP changes.

Now let's explain Figure 3 and 4. These are the results of the relationship between OAGDEP and before- or after-tax Gini indexes. Interestingly, Gini coefficient decreases at the incipient stage and then increases, but at the end point of the stages it decreases again as is shown in Figure 3. The problem is that two stages, as it were, the first and last stage, cannot be looked on as the reliable trends, because the number of the observations is very small. Considering this, we can conclude that before-tax Gini index increases as OAGDEP grows up. It conforms to the above-mentioned result, which implies that Gini coefficient increases as OAGDEP gets larger. It makes senses in that OAGDEP grows at an increasing rate as the aging keeps going on. On the other hand, after-tax Gini index was not influenced by OAGDEP, as can be seen in Figure 4.

We summarize the following findings from the kernel analyses. First, the growth rate of the per capita GDP does not have an effect on the before- and after- tax income distribution. Second, before-tax Gini coefficient increases in accordance with the size of OAGDEP, while after-tax Gini coefficients have no relation to that. Third, a fiacal policy can improve an unequal income distribution resulted from the aging. In sum, it can be said that these conclusions are the same as results from both the panel data analysis and inverse logistic function estimation.

V. Conclusion

To investigate the relationship between population aging and inequality, we used three test methodologies such as panel data analysis, inverse logistic function estimation, and nonparametric kernel estimation.

The major findings of this paper are as follows; First, Estimation results show that the linear specification between inequality and LPGDP appears a significantly positive relationship, but the quadratic specification is not statistically significant. It implies that Kuznets' inverted-U hypothesis does not hold in our sample. Second, the relationship between inequality and OAGDEP appears a significant positive relationship and the quadratic specification is also significant and positive. It means that degree of inequality increase at an increasing rate as the old age dependency ratio goes up.

Our result also can offer some policy implication. In our analysis, the coefficient values of both LPGDP and OAGDEP with respect to the case of after-tax Gini index are lower than that in before-tax case. This result implies that the impact of the development or the demographic changes on the inequality can be decreased due to the tax policy, i.e. the fiscal policy may improve the unequal distribution resulted from the aging phenomenon.

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<Table 1> Description of the variables used in the empirical analysis

The variables used in this paper include the following variables:

- Dependent variable
  - PREGINI : before-tax Gini coefficient
  - POSTGINI : after-tax Gini coefficient
- Independent variables
  - LGDP: log GDP per capita expressed in 1995 Purchasing Power Parities(PPP).
  - OAGDEP: Old age dependency ratio is used for the indicators of the aging.
  - PGR : Population growth rate
  - URBANR : Ratio of the population lived in the urban area
  - TRADEGDP: import and export per GDP.

<Table 2> Basic Statistics

variable	Means	Standard Deviation	# of observation
PREGINI	0.3952	0.0555	87
POSTGINI	0.2942	0.0647	87
LPGDP	9.8602	0.5668	87
OAGDEP	19.4275	4.7211	87
PGR	0.7425	0.6398	87
URBANR	78.6702	10.0550	87
TRADEGDP	67.7936	42.4375	87

<Table 3> Means of the important variables in each country

COUNTRY	Sample Period	PREGINI	POSTGINI	LPGDP	OAGDEP
Australia	1981,1985, 1989,1994	0.3927	0.2970	9.8030	16.0317
Belgium	1985,1988, 1992,1997	0.3266	0.2333	10.1354	22.3633
Canada	1971,1975,1981 1987,1991,1994, 1997,1998	0.3782	0.2916	9.7790	15.7000
Denmark	1992,1995,1997	0.4431	0.2520	10.4394	22.6992
Finland	1991,1995,2000	0.3957	0.2208	10.1874	20.6430
France	1981,1984, 1989,1994	0.3886	0.2896	10.0580	21.3989
Germany	1973,1978,1981, 1983,1984,1989 1994	0.3671	0.2623	10.1002	22.3951
Ireland	1987,1994, 1995,1996	0.4140	0.3305	9.7183	17.8250
Israel	1979,1986, 1992,1997	0.4065	0.3130	9.5082	15.2780
Italy	1986,1991,1995	0.3958	0.3113	9.7917	22.1368
Luxembourg	1985,1991,1994	0.3045	0.2373	10.4825	19.6692
Mexico	1984,1989,1992, 1994,1996,1998	0.4916	0.4778	8.1022	7.1571
Netherlands	1983,1987, 1991,1994	0.3482	0.2588	10.0714	18.3881
Norway	1979,1986 1991,1995	0.3637	0.2313	10.2456	24.3673
Spain	1980,1990	0.3469	0.3105	9.4183	18.8516
Sweden	1975,1981,1987, 1992,1995	0.4182	0.2160	10.1102	26.4035
Switzerland	1982,1992	0.3863	0.3080	10.6423	21.0494
UK	1986,1991,1994, 1995,1999	0.4173	0.3090	9.7010	23.2254
USA	1974,1979,1981, 1991,1994,1997, 2000	0.4255	0.3407	10.1290	18.1665

<Table 4> Panel Data Analysis: PREGINI 1

	Spec. 1		Spec. 2		Spec. 3		Spec. 4	
	FEM	REM	FEM	REM	FEM	REM	FEM	REM
LPGDP	0.1808 ***	0.1431 ***	-0.3769	-1.3299 ***				
	(0.0259)	(0.0230)	(0.7858)	(0.5201)				
LPGDP2			0.0282	0.0746 ***				
			(0.0397)	(0.0266)				
OAGDEP					0.0208 ***	0.0172 ***	-0.0142	-0.0288 **
					(0.0028)	(0.0025)	(0.0150)	(0.0124)
OAGDEP2							0.0009 **	0.00116 ***
							(0.0004)	(0.0003)
R-square	0.7418	0.3129	0.7437	0.3357	0.7562	0.3567	0.7754	0.4149
LM-test	8.83 ***		7.60***		10.93***		8.02***	
Hausman test	10.11***		7.99**		8.70***		8.48**	

Note: standard errors in ( ). *: 10%, **: 5%, ***: 1% significance level

<Table 5> Panel Data Analysis: PREGINI 2

	Spec. 5		Spec. 6		Spec. 7		Spec. 8	
	FEM	REM	FEM	REM	FEM	REM	FEM	REM
LPGDP	0.0956 *** (0.0342)	0.0709 ** (0.0311)	0.1039 *** (0.0326)	0.0845 *** (0.0291)	0.0924 ** (0.0457)	0.0547 (0.0360)	0.1008 ** (0.0434)	0.0835 ** (0.0342)
PGR					0.0026 (0.0146)	0.0129 (0.0137)	-0.0103 (0.0146)	-0.0036 (0.0139)
URBANR					0.0004 (0.0035)	0.0007 (0.0021)	0.0026 (0.0034)	0.0011 (0.0018)
TRADEGDP					-0.0003 (0.0004)	-0.0003 (0.0003)	-0.0002 (0.0004)	-0.0002 (0.0003)
OAGDEP	0.0133 *** (0.0038)	0.0124 *** (0.0035)	-0.0264 * (0.0146)	-0.0396 *** (0.0130)	0.0142 *** (0.0043)	0.0142 *** (0.0039)	-0.0322 * (0.0169)	-0.0416 *** (0.0150)
OAGDEP2			0.0010 *** (0.0004)	0.0013 *** (0.0003)			0.0011 *** (0.0004)	0.0013 *** (0.0003)
R-square	0.7821	0.4170	0.8057	0.4851	0.7849	0.4189	0.8095	0.4826
LM-test	10.74***		9.67***		7.79***		7.17***	
Hausman test	9.45***		9.16**		10.60*		11.68*	

Note: standard errors in ( ). *: 10%, **: 5%, ***: 1% significance level

<Table 6> Panel Data Analysis: POSTGINI 1

	Spec. 9		Spec. 10		Spec. 11		Spec. 12	
	FEM	REM	FEM	REM	FEM	REM	FEM	REM
LPGDP	0.0657 *** (0.0122)	0.0538 *** (0.0115)	0.4075 (0.3688)	-0.0698 (0.3168)				
LPGDP2			-0.0173 (0.0186)	0.0064 (0.0161)				
OAGDEP					0.0056 *** (0.0015)	0.0042 *** (0.0014)	-0.0087 (0.0080)	-0.0157 ** (0.0072)
OAGDEP2							0.0004 * (0.0002)	0.0005 *** (0.0002)
R-square	0.9579	0.2056	0.9584	0.2231	0.9504	0.0986	0.9528	0.1608
LM-test	31.87***		27.35***		31.28***		25.44***	
Hausman test	8.48***		8.18***		7.72***		8.07**	

Note: standard errors in ( ). *: 10%, **: 5%, ***: 1% significance level

<Table 7> Panel Data Analysis: POSTGINI 2

	Spec. 13		Spec. 14		Spec. 15		Spec. 16	
	FEM	REM	FEM	REM	FEM	REM	FEM	REM
LPGDP	0.0602 *** (0.0175)	0.0496 *** (0.0165)	0.0638 *** (0.0170)	0.0545 *** (0.0160)	0.0744 *** (0.0233)	0.0534 *** (0.0202)	0.0781 *** (0.0225)	0.0622 *** (0.0195)
PGR					-0.0028 (0.0075)	0.0011 (0.0072)	-0.0086 (0.0076)	-0.0062 (0.0074)
URBANR					-0.0017 (0.0018)	-0.0008 (0.0013)	-0.0007 (0.0018)	-0.0002 (0.0012)
TRADEGDP					0.0000 (0.0002)	0.0000 (0.0002)	0.0001 (0.0002)	0.0000 (0.0002)
OAGDEP	0.0009 (0.0019)	0.0006 (0.0019)	-0.0162 ** (0.0076)	-0.0213 *** (0.0071)	0.0003 (0.0022)	0.0007 (0.0021)	-0.0203 ** (0.0088)	-0.0246 *** (0.0082)
OAGDEP2			0.0004 ** (0.0002)	0.0005 *** (0.0002)			0.0005 ** (0.0002)	0.0006 *** (0.0002)
R-square	0.9580	0.2061	0.9612	0.2758	0.9586	0.2108	0.9622	0.2826
LM-test	27.63***		28.79***		23.79***		25.20***	
Hausman test	8.66**		8.86**		9.42*		10.33	

Note: standard errors in ( ). *: 10%, **: 5%, ***: 1% significance level

<Table 8> Inverse Logistic: PREGINI 1

	Spec. 17		Spec. 18		Spec. 19		Spec. 20	
	FEM	REM	FEM	REM	FEM	REM	FEM	REM
LPGDP	0.7686 *** (0.1107)	0.6063 *** (0.0983)	-2.0000 (3.3583)	-5.8810 *** (2.1878)				
LPGDP2			0.1400 (0.1697)	0.3284 *** (0.1118)				
OAGDEP					0.0883 *** (0.0120)	0.0726 *** (0.0107)	-0.0598 (0.0643)	-0.1223 ** (0.0529)
OAGDEP2							0.0038 ** (0.0016)	0.00493 *** (0.0014)
R-square	0.7392	0.3093	0.7418	0.3321	0.7523	0.3497	0.7713	0.4071
LM-test	8.80***		7.70***		10.73***		8.04***	
Hausman test	10.13***		8.21***		8.71***		8.45**	

Note: standard errors in ( ). *: 10%, **: 5%, ***: 1% significance level

<Table 9> Inverse Logistic: PREGINI 2

	Spec. 21		Spec. 22		Spec. 23		Spec. 24	
	FEM	REM	FEM	REM	FEM	REM	FEM	REM
LPGDP	0.4102 *** (0.1467)	0.3028 ** (0.1332)	0.4454 *** (0.1403)	0.3610 *** (0.1251)	0.3874 * (0.1957)	0.2279 (0.1536)	0.4224 ** (0.1867)	0.3500 ** (0.1467)
PGR					0.0173 (0.0627)	0.0618 (0.0586)	-0.0367 (0.0628)	-0.0075 (0.0596)
URBANR					0.0019 (0.0151)	0.0029 (0.0088)	0.0113 (0.0148)	0.0046 (0.0076)
TRADEGDP					-0.0015 (0.0016)	-0.0013 (0.0014)	-0.0008 (0.0016)	-0.0009 (0.0013)
OAGDEP	0.0558 *** (0.0163)	0.0520 *** (0.0151)	-0.1122 * (0.0626)	-0.1691 *** (0.0556)	0.0608 *** (0.0184)	0.0606 *** (0.0168)	-0.1325 * (0.0727)	-0.1729 *** (0.0642)
OAGDEP2			0.0042 *** (0.0015)	0.0055 *** (0.0013)			0.0047 *** (0.0017)	0.0056 *** (0.0015)
R-square	0.7785	0.4105	0.8020	0.4777	0.7820	0.4142	0.8056	0.4751
LM-test	10.63 ***		9.68***		7.54***		6.97***	
Hausman test	9.49***		9.14**		10.68*		11.68*	

Note: standard errors in ( ). *: 10%, **: 5%, ***: 1% significance level

<Table 10> Inverse Logistic: POSTGINI 1

	Spec. 25		Spec. 26		Spec. 27		Spec. 28	
	FEM	REM	FEM	REM	FEM	REM	FEM	REM
LPGDP	0.3143 *** (0.0579)	0.2569 *** (0.0545)	1.4718 (1.7584)	-0.7928 (1.4932)				
LPGDP2			-0.0585 (0.0888)	0.0536 (0.0757)				
OAGDEP					0.0273 *** (0.0070)	0.0203 *** (0.0065)	-0.0487 (0.0377)	-0.0793 ** (0.0340)
OAGDEP2							0.0019 ** (0.0009)	0.0025 *** (0.0009)
R-square	0.9556	0.2073	0.9559	0.2227	0.9480	0.1028	0.9511	0.173
LM-test	33.10***		29.94***		30.65***		27.55***	
Hausman test	8.68***		8.02**		7.96***		8.06**	

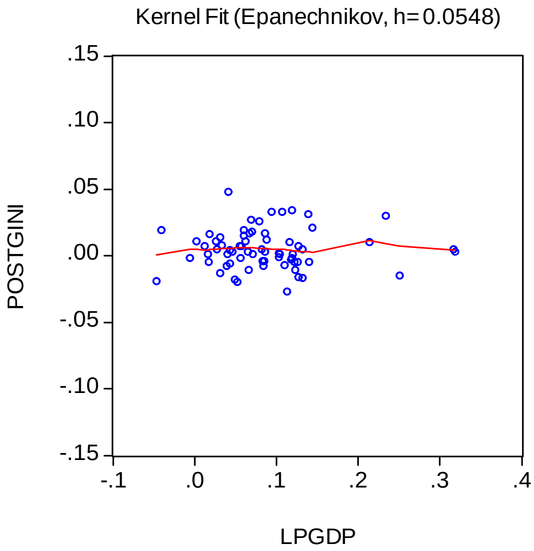
Note: standard errors in ( ). *: 10%, **: 5%, ***: 1% significance level

<Table 11> Inverse Logistic: POSTGINI 2

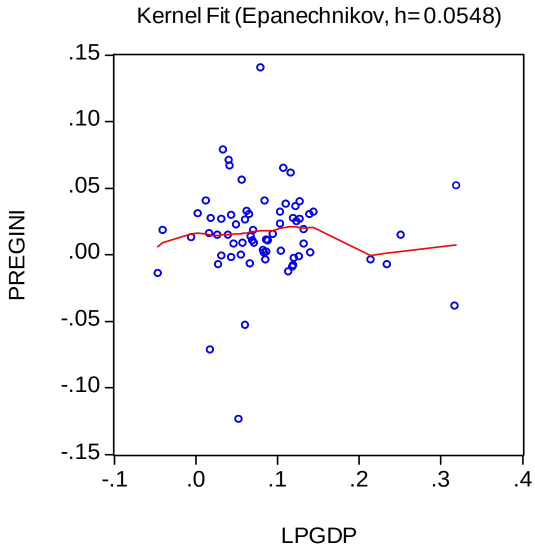
	Spec. 29		Spec. 30		Spec. 31		Spec. 32	
	FEM	REM	FEM	REM	FEM	REM	FEM	REM
LPGDP	0.2836 *** (0.0830)	0.2335 *** (0.0784)	0.3022 *** (0.0800)	0.2593 *** (0.0755)	0.3660 *** (0.1102)	0.2596 *** (0.0954)	0.3846 *** (0.1058)	0.3029 *** (0.0918)
PGR					-0.0104 (0.0353)	0.0087 (0.0338)	-0.0391 (0.0356)	-0.0275 (0.0346)
URBANR					-0.0108 (0.0085)	-0.0054 (0.0063)	-0.0058 (0.0084)	-0.0022 (0.0058)
TRADEGDP					-0.0001 (0.0009)	-0.0001 (0.0008)	0.0003 (0.0009)	0.0002 (0.0008)
OAGDEP	0.0048 (0.0092)	0.0036 (0.0088)	-0.0843 ** (0.0357)	-0.1070 *** (0.0336)	0.0023 (0.0104)	0.0044 (0.0098)	-0.1008 ** (0.0412)	-0.1204 *** (0.0386)
OAGDEP2			0.0022 ** (0.0009)	0.0028 *** (0.0008)			0.0025 ** (0.0010)	0.0030 *** (0.0009)
R-square	0.9558	0.2086	0.9599	0.2890	0.9569	0.2209	0.9611	0.2986
LM-test	28.59***		31.10***		24.80***		27.21***	
Hausman test	8.88**		8.91**		9.48*		10.30	

Note: standard errors in ( ). *: 10%, **: 5%, ***: 1% significance level

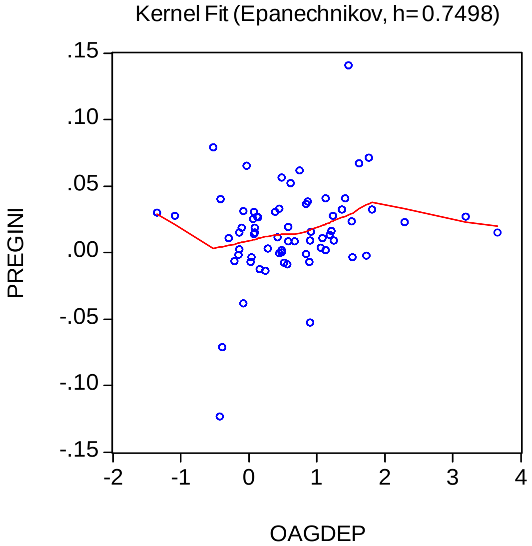
<Figure 1> PREGINI and LPGDP



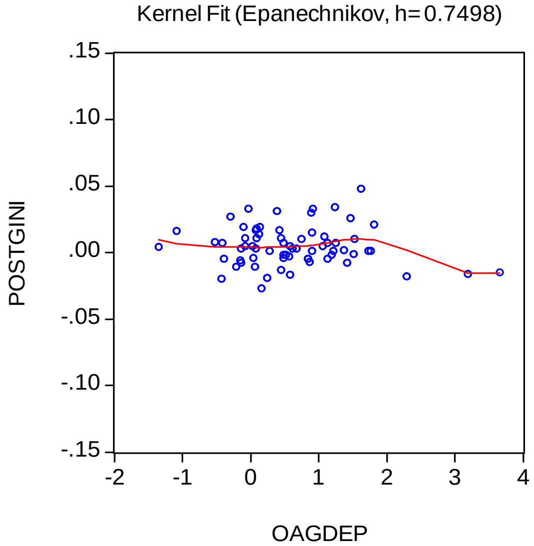
<FIGURE 2> POSTGINI and LPGDP



<Figure 3> PREGINI and OAGDEP



<Figure 4> POSTGINI and OAGDEP



Comments on "Population Aging and Its Effect on the Inequality: An Extended Empirical Study of the Kuznet's Inverted U-hypothesis"

Dae il Kim
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This paper considers the relationships among inequality, growth and population aging, and attempts to explain why Kuznet's conjecture on economic growth and inequality may not hold in many developed countries. The authors use the panel data for 17 countries (total 87 observations), and employ three different estimation strategies to identify the presumed relationships among inequality, grwoth and population aging.

The main findings of the paper are the following. First, there is no clear "Inverted-U" relationship between inequality and log GDP, and if any, there is a positive relationship between inequality and log GDP.. Second, population aging tends to increase income inequality. Finally, after-tax income distribution is more equally distributed in these countries. From these, the authors conclude that the positive relationship between growth and inequality, which is against Kuznet's conjecture, can be at least partially accounted for by population aging, and also that tax policy counteracts the increase in inequality resulting from population aging and growth.

This paper has several interesting results, which motivate further studies. That being said, I would like to make a few comments on the paper. First, this paper mixes two different issues, *growth* and *population aging*, whose relationships are not clearly modeled. Population aging usually results from extended life expectancy and falling fertility, both of which are often linked to growth. But the authors treat these two issues separately both in their reasoning and in estimation, which reduces the credibility of their estimates and interpretations. It would be more desirable to spell out how these issues are related with each other and how such relationships are considered in estimation models.

Second, the motivation for the paper is somewhat weak. The authors focus on the Kuznet's Curve, but this poses a few problems. First, the Kuznet's Curve was originally based on the urbanization of economic growth, moving workers and households from rural areas with more equal incomes to urban areas with more unequal incomes. Thus a true test of its existence would need a long time series covering the transition from underdeveloped to developing stages, and also that from developing to developed stages. For the lack of such panel, most previous empirical studies had to rely on cross-country data producing some supporting evidence, which have been denounced by many newer studies using time-series or panel data. The authors' results against the Kuznet's Curve is thus not new, and futher as their results are based on a very short panel (4 5 year panel) of developed countries, the power of their tests is not high.

Third, the authors use Gini-coefficient in measuring inequality. It would have been all right if they just used it to show the extent of inequality, but they use the coefficient as the dependent variable in estimating the effects of economic growth and population aging. Given that Gini coefficient is just an index and can produce the same numbers under quite different distribution, it is not easily justified to use the coefficient as the dependent variable. It is especially so because they interpret the effects of population aging as reflecting a growth of "poor" old cohorts. There is simply no evidence at all in the paper that the change in Gini-coefficient in the data is caused truly by an increase in "poor" old cohorts. First of all, the authors must be able to establish that old cohorts are "poor" in terms of both contemporary and permanent income in order to interpret their results as population aging causing an increase in inequality.

Finally, their conclusion on tax implication on inequality does not need the three complicated estimation models. One can always just compare the distributions of pre- and post-tax earnings. Perhaps a more meaningful discussion would be on market-related policies and changes such as pension (affecting retirement), household composition, job opportunities for the old (industrial structure), social security system, etc.

CHAPTER 2-1

Performance of Korean Banks and Implications for Regulatory Reform

by
Kang Hoon Park, Southeast Missouri State University

Abstract

Two competing hypotheses have been proposed in regard to the relationship between structure and performance in the banking sector. The market structure hypothesis postulates that banks in a concentrated market can charge higher loan rates and pay lower deposit rates through their market power as well as lowering collusion costs, thus generating more profits. On the other hand, the efficient structure hypothesis states that efficient banks can obtain higher profitability as well as greater market share because of their efficiency, which will lead to a more concentrated market. Numerous studies have tested these two competing hypotheses for U.S. banks and European banks. The purpose of this paper is to identify the major determinants of profitability in the Korean banking sector for the period of 1992-2002 by testing the two competing hypotheses in an integrated model which incorporates the variables representing both hypotheses.

The results obtained for the panel data, including both nationwide and regional banks, indicate that market concentration and market share are insignificant variables in explaining bank performance in Korea while the measures of efficiency affect bank profitability significantly. The unique feature of this paper is the estimation of allocative inefficiency by the directional technology distance function and the use of this estimate in explaining bank performance. Another contribution of this paper is a finding that the major determinants of bank profitability in Korea have changed between pre- and post-crisis periods. Before the currency crisis, all three variables – market concentration, market share and efficiency - were significant explanatory variables. However, after the crisis, the measures of efficiency stand out as the most significant variable, and the importance of equity ratio was also noted. This paper also provides several policy implications for bank regulatory reform.

I. INTRODUCTION

In explaining the relationship between structure and performance in the banking sector, two competing hypotheses have been proposed. The market structure hypothesis postulates that banks in a concentrated market can charge higher loan rates and pay lower deposit rates through their market power, as well as lowering collusion costs, thus generating more profits. On the other hand, the efficient structure hypothesis states that efficient banks can obtain higher profitability, as well as greater market share, because of their efficiency, which will lead to a more concentrated market. Numerous studies have tested these two competing hypotheses for U.S. banks and European banks (to name a few, Smirlock, 1985; Shepherd, 1986; Berger, 1995a; Goldberg and Rai, 1996; Maudos, 1998). In earlier studies (Smirlock, 1985; Evanoff and Fortier, 1988), market share is used as a proxy for efficiency due to lack of available efficiency measures. In many previous studies, a positive relationship between concentration and performance in banks has been inconclusive while a statistically significant positive relationship has been found between market share and bank profitability. As some (e.g., Sherpherd, 1986; Berger, 1995a) questioned the validity of assuming that market share is a proxy for efficiency, direct measures of efficiency have been used in more recent studies (Berger, 1995a; Goldberg & Rai, 1996; Maudos, 1998). These findings support the efficiency structure hypothesis.

To my knowledge, there has been no research done to investigate the structure-performance relation in the Korean banking sector. There are a couple of studies on productivity and efficiency of Korean banks. Gilbert and Wilson (1998) investigated the effects of privatization and deregulation on the productivity of Korean banks over the period 1980-1994. Using Malmquist indexes they decomposed productivity change into technical efficiency and changes in technology. They found that Korean banks dramatically changed their mix of inputs and outputs while they were privatized and deregulated during the 1980s and early 1990s. They also concluded that privatization and deregulation enhanced potential output, as well as productivity, among Korean banks by measuring technological change from the perspective of the new mix of inputs and outputs.

Hao, Hunter, and Yang (2001) extended the analysis of Gilbert and Wilson (1998) in order to identify the key determinants of the efficiency gains. Using the stochastic cost frontier approach, they computed efficiency scores for a sample of nine nationwide banks and 10 regional banks for the period 1985-1995. These efficiency scores were then regressed on several independent variables in order to identify the key determinants of the efficiency gains. Banks with higher rates of assets growth, fewer employees per million won of assets, larger amounts of core deposits, lower expense ratios, and classification as a nationwide bank were found to be more efficient. However, they found that financial deregulation of 1991 had little or no significant effect on the level of the sample banks' efficiency.

While the previous two studies on Korean banks focused on productivity or efficiency and their determinants, the purpose of this paper is to identify the major determinants of profitability in the Korean banking sector for the period of 1992-2002 by testing the two competing hypotheses in an integrated model. Since the Korean banking sector has undergone many changes throughout this period which have affected its performance, it is necessary to discuss those changes in detail. In the next section, after a brief history of the Korean banking system, we will discuss financial liberalization in the early 1990s, the financial crisis of 1997-1998, and the post-crisis banking restructuring. Section 3 presents a structural model which is a modified version of Berger (1995a) and an integrated equation in the reduced form to test the competing hypotheses. The data and the variables used in this study are described in section 4. Section 5 presents estimated results and their interpretation. In section 6 a measure of allocative inefficiency or X-inefficiency is introduced and estimated by a distance function. Furthermore, this estimated measure is used in explaining profitability in the Korean banking sector. Finally, the last section summarizes and presents policy implications for Korean banking.

II. LIBERALIZATION, CRISIS AND RESTRUCTURING

The growth of the Korean banking sector has been matching the rapid growth of the Korean economy since the 1960s. Actually the banking sector has grown faster than the overall growth of the economy in the last twenty years. The total assets of Korean commercial banks increased at an annual growth rate of 22%, compared to an annual nominal GDP growth rate of 14% for the same period. However, the Korean banking sector has undergone many changes including nationalization, privatization, re-nationalization, re-privatization, financial liberalization, financial crisis, and, most recently, restructuring.

1. Pre-liberalization Period

A few modern commercial banks were established in Korea during the Japanese occupation (1910-1945) and Korea inherited these banks when the Japanese colonial rule ended in 1945. After undergoing political instability and chaos prior to, and even after, the establishment of the Republic of Korea in 1948, the Korean government passed two important pieces of legislation in the banking sector in 1950: the Bank of Korea Act authorizing the creation of the central bank and the General Bank Act regulating privately held commercial banks. The General Bank Act of 1950 laid a foundation of sound banking guidelines for modern Korean commercial banks. However, banks were soon nationalized or controlled by the government after the Korean War, which lasted for four years from 1950 to 1953, in order to mobilize scarce financial resources for reconstruction and development of devastated industries. The end of the dictatorial regime of President Rhee and establishment of a new regime by free election in 1960 resulted in a brief period of privatization and autonomy in management. However, a military coup in 1961 and the subsequent regime led by President Park reversed this course.

The government forced nationwide commercial banks, five in total at that time, to sell the major portion of their equity capital to the government. This was done so that the government could channel cheap financing to the targeted industries, initially import substitution industries, and later export promotion industries, and finally heavy and chemical industries, under a series of ambitious 5-year economic development plans. Several specialized banks were also established in the early 1960s to be operated outside of the central bank's authority and to finance government-targeted priority industries.[1] Regional banks which were allowed to do banking business only in their own provinces were introduced in the late 1960s to stimulate regional economic development. Within a few years ten regional banks were established and all of them stayed in business until the Korean financial and currency crisis of 1997-1998. After the crisis, four regional banks were closed or merged with bigger nationwide banks. The government controlled not only allocation of financial resources but also interest rates. They set the interest rates on deposits and loans in such a way that real interest rates on policy loans were usually lower than real rates of return, sometimes becoming negative.

Commercial banks have been the main instrument for carrying out government-initiated economic development plans during the 1960s and 1970s. The proportion of total policy loans to total domestic credit increased from 40% in the 1960s to 50% in the 1970s. It was during this time period, particularly the 70s, that Korean conglomerates, or Chaebols, were formed and expanded under government protection.[2] In order to promote heavy and chemical industries, well-established entrepreneurs with proven records were asked to invest in targeted industries with all kinds of government financial support: allocation of necessary credits, lower interest rates on policy loans, easy access to foreign exchanges, and tax concessions.

2. Denationalization and Deregulation in the 1980s

Facing financial difficulties and inefficiency, the Korean government introduced a series of reforms during the 1980s. With the revision of the General Banking Act in 1982, the Korean government began gradual privatization and deregulation of the industry, including easing entry requirements, limiting autonomy in setting lending rates, reducing discriminatory restriction on foreign banks, and allowing more permissive banking activities.[3] As a result, the number of nationwide commercial banks increased from five in 1980 to ten in 1990 and fourteen in 1993. With regulatory reforms, the idea was that the government would focus more on indirect control of credit through control of monetary aggregate and reserve requirements instead of direct control of allocation of credit, leaving management and operation of the banking business to individual banks. However, in reality, the government continued to influence credit allocation through informal guidance and through its influence on the appointment of top managers until later financial liberalization in the 1990s.

The formal banking sector has coexisted with an unregulated underground sector since the independence of Korea. Lower interest rates on deposit turned away savers and government allocation of scarce financial resources to its favored industrial sectors prevented ordinary businessmen from getting cheaper loans from banks. Through the 1970s this underground market prospered notwithstanding all kinds of government efforts to curb it. In order to stem the underground market and attract funds into formal sectors, the Korean government allowed creation of merchant banks and short-term finance firms during the 1980s.

3. Financial Liberalization in the early 1990s

In order to cope with global financial liberalization and under the pressure from the OECD and the US to open its financial markets to foreigners, the Korean government initiated financial liberalization with revisions in the General Banking Act in 1991 and subsequent years.[4] This financial liberalization program was initially implemented in 1991 in four phases to be completed by 1997 in order to increase efficiency and competitiveness of the domestic financial markets. The main focus of the program was accelerated deregulation of interest rates throughout all four phases. The program also included phasing out policy loans, improving and eliminating credit control system, reducing non-performing loans, widening financial market opening at the third stage, deregulating foreign exchange market, introducing a quasi universal banking system, and restructuring bank ownership. Since 1995, an individual shareholder can own up to 12% of a commercial bank's capital equity. The key element in widening financial market opening was opening the securities market to foreigners in phase three.

In the case of deregulation of interest rates, in phase one, which ended in November 1991, loan interest rates on bank overdrafts and discounts on commercial bills as well as interest rates on short-term, large denomination deposits were deregulated. In phase two, which ended in November 1993, interest rates on all loans except for policy loans as well as interest rates on long-term deposits were deregulated. By the end of 1993, the vast majority of interest rates in Korea were deregulated: 87% for loans and 69% for deposits. In phase three, which ended in December 1996, interest rates on all loans and all deposits except for demand deposits, were liberalized. Interest rates on demand deposits, the only item still under regulation during phase three, were finally deregulated in 1997.

With the completion of all four phases, Korean firms are no longer required to obtain government approval when they borrow money from foreign banks or issue securities abroad. Some attribute such financial liberalization without appropriate supervision as a major cause of the Korean financial currency crisis of 1997-1998.

4. Financial and Currency Crisis of 1997-1998

The Korean financial and currency crisis occurred so suddenly, without any warning signs, and so deeply, that many policy makers were in shock without knowing what to do at the onset of the crisis. Although most economists, whether academics or practitioners, failed to predict the event, we can find several underlying causes from the rubble of the currency collapse. First, financial liberalization and deregulation allowed domestic financial institutions and domestic corporations to have easy access to foreign capital to finance domestic investment and financing. Wyplosz (1998) noted that financial liberalization is the best predictor of currency crises as evidenced in Latin America in the 1980s, Europe in the early 1990s, and Asia in 1997. Easy access to foreign capital alone does not make overborrowing possible unless it is matched by overlending by international creditors. Overborrowing and overlending occurred because of asymmetric information or the moral hazard effect. Foreign lenders perceived that their loans to domestic financial institutions were backed by government explicit or implicit bail-out guarantees. A long period of recession and very low domestic interest rates in Japan led to especially huge capital lending to Asian countries. Although financial deregulation tends to improve the degree of transparency, financial liberalization was not accompanied by appropriate supervision and prudential regulation. Lax supervision not only created a very high level of foreign borrowing, but also allowed the development of serious asset liability mismatches: financing long-term domestic lending through short-term foreign borrowing. Banks borrowed short-term foreign capital at lower rates and made long-term loans at higher rates, with expectation that they could continually renew short-term borrowing. The same mismatches caused the Savings and Loan Association Crisis of 1980s in the US.

Second, overborrowing caused excessive investment in low-return or risky projects. Normally capital inflows can be channeled to productive investment activities, leading to higher economic growth. However, excessive borrowing and the resulting excessive investment beyond the economies' manageable capacity made macroeconomic management more complex and exposed the economies vulnerable to a shift in credit conditions. Excessive borrowing in Korea, which was channeled through financial institutions, mainly financed investment in tradable goods sectors by the conglomerates, the so-called Chaebols, resulting in overcapacity (e.g., automobiles and micro-chips capacity), while excessive borrowing in other countries mainly financed non-tradable sectors, particularly the real estate sector. According to Corsetti, Pesenti and Roubini (1998), the evidence of overinvestment and risky investment can be seen from the high rate of non-performing loans just before the crisis in most Asian countries that experienced the crisis, and very high leverage ratios in the corporate sector of the involved countries. In Korea, cheap financing encouraged the already debt-laden conglomerates (Chaebols) to diversify into many areas unrelated to their specialties, resulting in a very low profitability for the conglomerates. The average leverage ratio for the top 10 conglomerates at the end of 1996 was 383% (see Park, 2003) while Anam group, one of top thirty conglomerates, had the highest leverage ratio as a group at 3,533.9% at the end of 1996. There were five individual corporations whose leverage ratio exceeded 10,000%. Korean conglomerates expected a government bailout if needed because they were too big to be allowed to fail, and this, in turn, encouraged their overborrowing and risk investment, a typical case of moral hazard.

Third, Korean banks not only borrowed too much, but also borrowed in a risky mix. Composition of the capital inflows does really matter. Equity flows through foreign direct investment (FDI) is most stable for sustainability of the current account deficits. This explains why China, with most of its capital inflows in the form of FDI, was able to escape the Asian currency crisis. Short-term capital inflows are most dangerous because hot money flows can reverse at any moment if creditors perceive development of unfavorable market conditions. As far as FDI is concerned, Korea is a net exporter of FDI; in 1996, Korea's FDI inflows were $2.3 billion while its FDI outflows were $4.4 billion. Korea also relied heavily on short-term debts (65% of total foreign liabilities) because of lower financing costs.

Fourth, the banking system in Korea was in trouble as early as 1996. Many recent studies (see Kaminsky, Lizondo and Reinhart, 1998) show that there exists a high correlation between currency crises and financial crises. Korea was no exception. The Korean banking sector was fragile and poorly regulated. Especially, non-bank intermediaries, the so-called merchant banks that emerged after financial liberalization, were largely unregulated. Lax supervision allowed a mismatch between short-term liabilities and long-term assets, making the banking system vulnerable to financial panic. Weak bond and stock markets in Korea put an extra burden on the banking system to intermediate the current account deficits. Korean banks and non-banks borrowed too much from abroad and then, in turn, lent to domestic firms, mainly conglomerates that effectively control some banks. When domestic banks were ending up with an increasing number of non-performing loans, foreign creditors became less willing to roll over the existing loans, igniting speculative attacks. In Korea, the non-performing loans as a share of total loans reached 16% in June 1997 and then 22.5% in the first quarter of 1998 (see Park, 2003).

Fifth, real exchange rate appreciation and resulting current account deficits preceded the currency crisis. Between 1990 and 1996, real appreciation exceeds 12% for Korea (see Radelet and Sachs, 1998). Slow recovery in Japan, overcapacity in Asia's key export industries (e.g., automobiles, micro-chips, steel, wood products, etc.), and Chinese devaluation in 1994 made the current account deficits worse. The importance of the current account balance cannot be emphasized too much. Since the current account sustainability depends on many factors, there is no clear-cut simple rule to apply. However, Lawrence Summers, the former US Deputy Treasury Secretary, notes that a country should pay attention to any current account deficit in excess of 5% of GDP. Corsetti, Pesenti and Roubini (1998) suggest that a non-increasing foreign debt to GDP ratio is a sufficient condition for external solvency. Korea was surely not meeting this sufficient condition. Some might say that, according to Summers's criterion, Korea was not at risk, because its current account deficit as a share of GDP was 4.76% in 1996. Two qualifications are needed. First, the current account deficit, due mainly to a large trade deficit, almost approached the 5% mark in 1996 with no prospect of reversal. Second, the speed at which the deficit grew was so fast that many expressed concern regarding this matter. Even if a country has problems with the current account deficit, the presence of large foreign exchange reserves can reduce the risk of unsustainability. This enables a country to continuously finance current account deficits through foreign borrowing at lower costs. Traditionally, foreign exchange reserves are needed to finance import demand. However, in globalized financial markets with easy capital inflows and outflows, a country should be prepared for sudden outflows of speculative hot money. The most commonly used indicator is the ratio of short-term foreign liabilities to foreign exchange reserves. In Korea, the ratio was 2.06 by the end of 1996, which was not small enough. Real appreciation and huge current account deficits make countries with fixed or quasi-fixed exchange rates (e.g., Korea) very vulnerable to the risk of a reversal of capital inflows.

Finally, a contributing factor present in each currency crisis that occurred in the 1990s is the contagion of financial disturbances across countries. Two unique features of contagion effects in the Asian crisis are (1) that real linkages such as trade or investment links among the countries involved are fairly weak, and (2) that the crisis originated in a small country (Thailand) and spread to the whole region including some larger economies (e.g., Korea). Many creditors seemed to see the region as one entity and assumed that if one country was in trouble, the other countries in the region had similar problems. While part of the contagion might be caused by irrational behavior, most of the contagion actually reflected rational market behavior. One channel of the contagion is the "wake-up call" hypothesis. Trouble in one country (Thailand) acted as a wake-up call for international creditors and investors to reassess the creditworthiness of Asian countries, and their reassessment found weaknesses in the other countries similar to those in Thailand (see Goldstein, 1998). Another channel of the contagion is rational behavior responding to competitive devaluations. As one country (Thailand) devalued its currency, other countries experienced a decline in export competitiveness, which in turn made their currencies more susceptible to speculative attacks. As Krugman (1998) puts it, the development of the crisis involved a sort of circular process. When it became clear that governments were going to have to spend a lot of money bailing out the existing creditors of financial institutions, it became unlikely that money could be spent to bail out any new creditors, so the creditors would not renew short-term debts, resulting in credit crunches and currency crises that undermined still more financial intermediaries and so on.

5. Post-crisis Restructuring

The financial crisis of 1997-1998 brought about a significant transformation in the banking sector in Korea. To correct structural weaknesses in the banking sector and to tackle serious insolvency of the financial institutions, the government carried out unprecedented financial restructuring in two stages: the first restructuring immediately following the crisis and the second one in June 2000. The reform measures of the first stage included the nationalization of two banks for later sale to foreigners, closure of five banks with serious insolvency to be merged later with blue-chip banks, inducement of foreign capital to seven recoverable banks, and injections of public funds into surviving banks to normalize their operations. Korean banks were successful in reducing operational costs by retrenchment of branches and employees, and experienced the fastest disposal rate of non-performing loans among the Asian countries which had suffered from the same financial and currency crisis.

A second stage restructuring process was launched by the government in June 2000, focusing on restoring the profitability of the banking sector. The reform measures this time included the following; encouraging consolidation in the banking sector through voluntary mergers and acquisitions; creation of financial holding company structures to make merger and acquisition easier; clean-up of bank balance sheets by a realistic application of the forward-looking asset classification and provisioning rules to work-out companies and other restructured loans; injecting additional capital into those banks that were most affected by the recognition of these losses.

The restructuring process led to a significant consolidation in the Korean banking sector. The government encouraged consolidation in order to improve the profitability of Korean banks through realization of economies of scale. Mergers have been a main type of consolidation in the banking sector. Concentration before the crisis was moderate, but increased considerably with the consolidation in the sector. However, according to an IMF study (2001), an international comparison suggests that the concentration in the Korean banking sector is not high relative to other OECD countries. During the post crisis period, nationwide commercial banks gained market share both in the deposit and loan markets at the sacrifice of regional banks.

The restructuring process also resulted in an increase in government ownership of commercial banks. Before the crisis, the Korean government had equity shares in only three banks, accounting for less than 18% of total banking sector capital. The recapitalization of troubled banks with public funds, however, led to a significant increase in government ownership in the banking sector. As of the end of 2002, the government owned 56% of total Korean bank equity capital. However the government plans to sell government holdings and recover the public funds injected into banks.

The restructuring of banks has also resulted in an increase in foreign ownership. Until 1999 individual foreign ownership in Korean banks was limited to 50% of equity capital. In the aftermath of the crisis, banks being restructured were exempted from these restrictions. Now foreign ownership represents about 30% of total banking sector assets. For example, 51% of the Korea First Bank is controlled by Newbridge Capital, 30% of the Korea Exchange Bank by Commerzbank.

As the focus shifts from asset growth in the past to profitability in the recent period, bank balance sheets of the banking sector are undergoing a process of rationalization. Banks are reducing non-earning assets and shifting their loan portfolio away from corporate lending toward household loans. This shift was also encouraged by the government to stimulate domestic consumption to compensate for reduction in exports in the face of the world-wide recession. However, severe competition in the household loans market among banks and accompanying easy financing has resulted in a high default rate of consumer and credit-card debts and brought about a consumer loan crisis in 2003. Despite their shift in focus from asset growth to profitability, the performance of Korean banks in terms of profitability has been poor, due to the high share of nonperforming loans in their total portfolio and deficiencies in pricing credit risk. Many nonperforming loans were inherited from banks' Chaebol guarantees prior to the crisis. In recent years there has been an optimistic sign of profitability, with both the return on equity and the return on assets (which were negative during the first three years after the crisis) changing to positive in 2001 and 2002.

III. SPECIFICATION OF THE MODELS

In the literature of bank profitability, there are two main competing hypotheses: the market structure hypothesis and the efficient structure hypothesis. Under the traditional market structure hypothesis, market structure – either concentration or market share – influences behavior of banks through the pricing of their products in an imperfectly competitive market, with increased concentration resulting in higher profits. Under the efficient structure hypothesis, market power is not the cause of higher profits, but both market power and higher unit profits are the results of efficiency in management, operation and technology (X-efficiency hereafter). Banks with superior efficiency can lower their unit costs and thus increase their profits. Others in the efficient structure hypothesis camp advance the scale efficiency version in that banks have similar levels of management and technology efficiency, but some banks simply produce on a more efficient scale than others, leading to lower unit costs and higher unit profits.

The structural model representing the traditional market structure hypothesis is as follows.

$$\pi_i = f_1 (P_i, Z_{1i}) + \varepsilon_{1i} \quad (1)$$
$$P_i = f_2 (MS_i \text{ or } CONC, Z_{2i}) + \varepsilon_{2i} \quad (2)$$
$$CONC = f_3 (MS_i) \quad (3)$$

where π_i is a measure of profitability of bank i, P is a vector of output prices, Z is a vector of control variables, and ε is a random error term. MS represents market share while CONC is a measure of market concentration ratio. According to the market structure hypothesis, output prices are mainly determined by market structure. In equation 2, either MS or CONC is used depending on a specific hypothesis modeled. According to the collusion hypothesis (or structure-conduct-performance hypothesis) the degree of market concentration is an important exogenous variable in determining profits while market share is the major determinant of profits according to the relative market power hypothesis. This model does not exclude the effects of X-efficiency or scale-efficiency on profitability through their inclusion in Z vectors. However, this model views that market structure or market power has more significant influence on profitability.

On the other hand, the structural model representing a more recent efficient structure hypothesis is as follows.

$$\pi_i = f_4(EFF_i, MS_i, Z_{4i}) + \varepsilon_{4i} \quad (4)$$
$$MS_i = f_5 (EFF_i, Z_{5i}) + \varepsilon_{5i} \quad (5)$$
$$CONC = f_6 (MS_i) \quad (6)$$

where EFF is a measure of efficiency, either X-efficiency or scale efficiency, depending on the version of the efficient structure hypothesis used. According to this hypothesis, a positive relationship between MS and π is a spurious effect because both MS and π are affected by efficiency.

In the past MS was used to support both the market structure hypothesis and the efficient structure hypothesis. Some argued that the significance of MS supports the relative market power hypothesis according to equations (1) and (2) (for example, Shepherd, 1982; Kurtz & Rhoades, 1991). On the other hand, the supporters of the efficient structure hypothesis also used MS as an intermediary variable between EFF and π because of the difficulty of measuring EFF, and argued that the significance of MS supports their hypothesis (for example, Smirlock, 1985; Evanoff and Fortier 1988; Molyneux and Forbes, 1995). More recent studies have applied several measures of efficiency directly in determining bank profitability (for example, Berger, 1995a; Maudos, 1998).

In order to test these different hypotheses, it is necessary to develop a model that nests all the hypotheses. The following structural model is a combined model of the above two structural models where CONC is operationalized by HINDEX, the Herfindahl index.[6]

$$\pi_i = f_7 (P_i, EFF_i, MS_i, Z_{7i}) + \varepsilon_{7i} \quad (7)$$
$$P_i = f_8 (MS_i \text{ or } HINDEX, Z_{8i}) + \varepsilon_{8i} \quad (8)$$
$$MS_i = f_9 (EFF_i, Z_{9i}) + \varepsilon_{9i} \quad (9)$$
$$HINDEX = f_{10} (MS_i) = \Sigma MS_i^2 \quad (10)$$

The reduced form for π can be derived from the above structural model as

$$\pi_i = f_{11} (P_i, EFF_i, MS_i, HINDEX, Z_{11i}) + \varepsilon_{11i} \quad (11)$$

Depending on the hypothesis adopted, one specific variable is important while the other explanatory variables are irrelevant. Under the collusion version of the market structure hypothesis, HINDEX is expected to be statistically significant and have a positive sign. Under the market power version of the market structure hypothesis, MS is expected to have a statistically significant and positive effect on profitability. Under the efficient structure hypothesis, EFF, whether X-efficiency or scale efficiency, should be statistically significant while the other variables are irrelevant. Under this hypothesis, MS, in the absence of EFF, may have a spurious effect on profitability because MS is a mediating variable through which effects of EFF are transmitted to profitability. However, MS should be statistically insignificant when EFF is included in the model. Equation 11 allows for the validity of more than one hypothesis.

IV. DATA AND VARIABLES USED

The data are based on the financial statements of Korean banks from 1992 to 2002. As the Korean banking sector went through financial liberalization in the early 1990s, the Korean currency and financial crisis of 1997-1998, and banking restructuring since the crisis, the number of Korean banks rose in the early 1990s, but declined since the crisis due to bank closures, purchases and assumptions (P&As) or mergers and acquisitions (M&As). In 1992, at the beginning of the sample period, there were fourteen nationwide commercial banks and ten regional banks. Just before the crisis twenty-six commercial banks were in existence as two more nationwide banks were added. The number of commercial banks was reduced to seventeen by the end of 1999 and declined to fourteen by the end of 2002 (see Appendix for the list of banks).

As a dependent variable representing profits, three variables are used: (1) ROATOT, the ratio of net after-tax income to assets for both banking and trust businesses; (2) ROABANK, the ratio of net after-tax income to assets for banking business only; and (3) ROE, the ratio of net after-tax income to equity for both banking and trust businesses.

The variable P is measured by MARGIN, the net interest margin, which is the difference between loan interest rate and deposit interest rate. This variable is estimated by the average earning on loans, minus the average interest expenses on deposits. MS is measured in two ways: (1) MS1 is the share of a bank in total industry assets in both banking and trust businesses; and (2) MS2 is the share of a bank in total industry assets in banking business only. MS1 is used in explaining ROATOT while MS2 is used in explaining ROABANK. HINDEX represents the degree of market concentration and is measured by the sum of the squares of each bank's market share in total assets ($\Sigma\ MS_i^2$). HINDEX1 is for both banking and trust businesses while HINEX2 is for banking business only (HINDEX1 = $\Sigma\ MS1_i^2$ and HINDEX2 = $\Sigma\ MS2_i^2$).

Efficiency (EFF) can be measured in many different ways. A frontier cost or production function is typically used to estimate efficiency and inefficiency. As a non-parametric approach, data envelopement analysis (DEA) is frequently used. This approach has the advantage of being distribution free. This approach assumes that the distance between the frontier and actual observation is due entirely to inefficiency. On the other hand, a stochastic frontier approach based on parametric estimation separates an inefficiency component and a random component from an error term. There are two stochastic approaches: distribution-free and distribution-specific. If a distribution-free approach is to be used as in Berger (1995a), then the differences among banks are assumed to be stable over time. This approach requires that banks be in existence for the entire sample period. It is difficult to apply this approach in the case of the Korean banking sector for the period of 1992-2002 because there are many banks that came and went during this time period. If a distribution-specific approach is used as in Maudos (1998), then it is necessary to know the distribution for both components of the error term. Without prior knowledge of the distribution, arbitrary assumptions about distribution were made in most studies.

Alternatively, a simple, though rudimentary, approach is to approximate operating efficiency directly from the financial statements of each bank. We use two alternative proxies for operating inefficiency: LOPEFFW is the operating expenses per employee (in log) and LOPEFFB is the operating expenses per branch (in log). Similarly, we use two alternative proxies for asset efficiency: LASEFFW equals total assets per employee (in log) and LASEFFB equals total assets per branch (in log). Later, we also estimate X-inefficiency from a non-parametric distance function and compare the effects of different measures of inefficiency on profitability.

The following three variables are used as control variables. First, the ratio of equity capital to total assets represented by EQRATIO is used to capture the impact of leverage on banking performance. Traditionally, a negative relationship between equity ratio and return on capital was hypothesized for two reasons: (1) higher equity ratio results in a smaller tax deduction of interest expenses and (2) investors have lower expected return on their investment because there is less risk on their equity with a higher equity ratio. However, new theories have been developed to support a positive relationship as discussed in the above section after several empirical findings with the U.S. bank data. A higher equity ratio reduces the portfolio risk along with the expected costs of financial troubles, thereby increasing confidence among bank customers, leading to higher profitability. According to the signal theory, banks that expect to have better performance credibly transmit this information through a higher equity ratio (see Berger, 1995a). Second, non-performing loans as a percentage of total loans represented by NPLS is used to capture the deficiency in credit risk management and the resultant quality of assets. Inclusion of this variable is essential because loans are the major type of earning assets. Third, a dummy variable, NATIONAL, is defined 1 for nationwide banks and 0 for regional banks. This variable is used to see the different effect of having nationwide networks. Table 1 shows summary descriptive statistics for some major variables used in this study.

V. EMPIRICAL RESULTS

Hsiao (1986) showed that pooled OLS results in biased and inconsistent coefficient estimates because omitted cross-section specific variables may be correlated with the explanatory variables. Use of either a fixed-effects model or a random-effects model can solve this problem. The fixed-effects model is more appropriate when whole population is used in the study while the random-effects model is suitable when a sample is used (Jeon and Miller, 2004). Because all Korean nationwide and regional banks are included in our panel data, the fixed-effects model is used for this study. So, unobserved differences across banks are reflected in different intercept estimates for each bank.

Table 3 shows the results of the estimation of Equation 11, using ROATOT as the dependent variable and introducing HINDEX, MS and EFF progressively. Model 1 shows the estimated results of a model representing the collusion hypothesis. HINDEX is expected to have a positive sign. Most of the previous studies found a statistically insignificant positive relationship between market concentration and profits. By contrast, we found a statistically significant negative effect of market concentration on profitability. This finding is peculiar to Korean banks during this sample period. Ever since the crisis, market concentration has steadily increased because of government restructuring policy to promote P&As or M&As, while returns on assets have been negative due to the crisis and magnitude of non-performing loans, at least until recently (see Table 2). This peculiarity necessitates a breakdown of the sample period into two or three separate periods, which will be done later.

The significance of MS in model 2 can be used in support of the relative market power hypothesis or efficient structure hypothesis, depending on interpretations. Further examination is necessary. Model 3, with inclusion of both HINDEX and MS, is commonly used in the previous studies as an indirect test of the efficient structure hypothesis, using market share as a proxy for efficiency. However, market share in Model 3 could also be used in support of the relative market power hypothesis. Most of the previous studies found that market share has a statistically significant positive effect on profitability, while the effect of concentration is insignificant. Our study confirms the previous findings on MS, but contradicts the previous findings on HINDEX for the reason explained above.

In model 4 we included direct measures of efficiency, with LOPEFFW representing operating inefficiency and LASEFFW representing asset efficiency. Both variables have their expected signs and are statistically significant. When LOPEFFW and LASEFFW are replaced by LOPEFFB and LASEFFB in model 5, similar results as in model 4 are obtained, but with further increased statistical significance of efficiency measures. MS has a statistically significant positive effect on profitability in models 2 and 3. However, when the EFF variables are included, then MS becomes statistically insignificant. This result indicates that the spurious association between MS and π disappears as efficiency variables enter into the model, thus supporting the efficient structure hypothesis. The explanatory power increased from .619 to .735 as the EFF variables are included in the model.

Now we turn to the three control variables included in the models. First, EQRATIO exhibits a statistically significant positive effect on bank profitability in all five models. This empirical finding is consistent with the signaling theory discussed above. Second, NPLS has a strong negative effect on profitability in all five models, though its explanatory power is somewhat lessened with the inclusion of EFF variables. Figure 1 graphs the average percentage of non-performing loans in total loans and ROA for both banking and trust businesses for nationwide banks for 1992-2002, while Figure 2 is for regional banks. Figures 1 and 2 clearly show the inverse relationship between NPLS and ROATOT. Loans are the major income-earning asset of banks, and higher percentages of non-performing loans during 1997-2000 critically affect bank profitability, resulting in negative returns on assets. It is necessary to explain why nationwide banks experienced a continuous increase in NPLS until 1999 while NPLS of regional banks has continuously declined since the crisis. Two explanations can be provided. First, most of the troubled regional banks after the crisis were closed and merged into a few nationwide banks in 1998. This left relatively sound regional banks while NPLS of nationwide banks increased without such forced closures. Second, the Financial Supervisory Commission introduced a more strict "forward-looking criterion" in classifying loans with a grading system of evaluating credit risk. This new criterion led to a substantial increase in non-performing loans. Finally the dummy variable differentiating nationwide banks and regional banks is statistically significant in only model 1, but becomes insignificant when the market share variable is included in the model. This may indicate the spurious effect of the dummy variable in the absence of the market share variable in the model. The results of diagnostic test statistics by VIF (variable inflation factor) indicate no serious problem of multicollinearity in all five models.

Table 4 shows the results of the estimation of Equation 11, using ROABANK as the dependent variable. With a change in the dependent variable, we use MS2 instead of MS1, HINDEX2 instead of HINDEX1, EQRATIO2 instead of EQRATIO1, LASEFFW2 instead of LASEFFW1, and LASEFFB2 instead of LASEFFB1. Similar results as in Table 3 are obtained. Compared to Table 3, the explanatory power of models 4 and 5 increased from .735 to .793 or .797. Although not reported here, we obtained similar results as Table 3 when we estimated Equation 11 using ROE as the dependent variable.

It may be necessary to estimate equation 11 separately for nationwide banks and regional banks because they are different in size and allowed markets. Table 5 and 6 present the estimated results. The dependent variable in Table 5 is ROATOT and the dependent variable in Table 6 is ROABANK. A few noteworthy results are found. First, in Table 3 the negative sign of HINDEX was explained by the peculiarity of Korean banks during the sample period. Another explanation for the negative sign of HINDEX can be offered here. Positive, though statistically insignificant, coefficients of HINDEX are obtained for nationwide banks, whether ROATOT or ROABANK are used as the dependent variable. This finding is in line with previous studies. However, strong negative coefficients of HINDEX, which are also statistically significant, are found for regional banks. The stronger nationwide banks are as a group, the less competitive regional banks are. This strong negative association between market concentration and profitability of regional banks also affects the sign and significance of HINDEX for the pooled data for both nationwide and regional banks, which is presented in Tables 3 and 4. Second, MS has some influence on profitability for nationwide banks but not for regional banks. For regional banks, MS has even a negative effect on profitability when the dependent variable is ROABANK. By law, regional banks are allowed to operate only in their own provinces so that their market share in the entire domestic market is not relevant for their performance and profits. Furthermore, MS is more important for trust transactions than for banking transactions. Third, we also note that EQRATIO is a significant variable for nationwide banks, but not for regional banks. Finally, the explanatory power of the model is higher for regional banks (R^2 ranges from .660 to .717 for national banks while it ranges from .854 to .894 for regional banks).

As discussed in the second section Korean banks underwent many changes during the sample period, including financial liberalization, a financial crisis and most recently banking restructuring. The sample period is not a homogenous period from which a stable relationship between the dependent and independent variables can be established. As a matter of fact, there exist three distinctively different periods: the pre-crisis financial liberalization period from 1992 to 1996, the crisis period of 1997-1999, and the post-crisis restructuring period of 2000-2002. The currency crisis was over by the middle of 1998, but financial crisis causing closures of banks, injections of public funds to troubled banks, and mergers continued until 1999.

Table 7 presents the estimated results of Equation 11 (only model 4 and 5), using ROATOT as the dependent variable. First, for the period of 1992-1996, when the economy was expanding, banking was normal and stable, and financial liberalization continued, all the explanatory variables, except for EQRATIO, have their expected signs and are statistically significant. Even the market concentration ratio measured by HINDEX, which previously had the wrong sign or was insignificant, with the pooled data, turns out to be statistically significant with the right sign. During this period, all of the competing hypotheses - the collusion hypothesis, the market power hypothesis and the efficient structure hypothesis - seem to be at work. However, during the second period (1997-1999) and third period (2000-2002), the coefficients of MARGIN, HINDEX, and MS changed from statistically significant to insignificant, while EQRATIO became statistically significant, indicating the importance of the equity ratio in determining profitability. During the early 1990s when the economy grew and bank deposits and loans expanded very rapidly, the equity ratio did not matter for bank profitability. However, when the economy slows down and the prospects of banking business are bleak, the equity ratio affects the credit rating of banks and their financing costs. The equity ratio became more important as government bail-out was no longer guaranteed after the crisis. The magnitude and significance of the coefficients of operating efficiency and asset efficiency have increased from the first period to the second period and through the third period. Only two variables, EFF and EQRATIO, are significant variables during the third period. The estimated results of Equation 11 for three separate periods, using ROABANK instead of ROATOT as the dependent variable, are not much different from Table 7 and are not reported here.

VI. ALTERNATIVE EFFICIENCY MEASURE

In this section we estimate X-efficiency measure by a distance function in DEA and re-estimate Model 4 and 5 of Table 3 by adding this X-efficiency measure and deleting two simple efficiency measures, LOPEFF and LASEFF, as independent variables. Following Fare and Grosskopf (2004), we assume that there are $k = 1, \ldots, K$ banks which employ x^k vector of inputs to produce y^k vector of outputs. The technology for each bank is written as $\{T^k = \{ (x^k, y^k) :$ inputs can produce outputs $\}$. The piecewise linear DEA technology is written as :

$$T = \{ (x,y) : \Sigma z_k x_{kn} \le x_n,\ n = 1, \ldots, N,\ \Sigma z_k y_{km} \ge y_m,\ m = 1, \ldots, M,$$
$$\Sigma z_k = 1,\ k = 1, \ldots, K \text{ and } z_k \ge 0, k = 1,\ldots, K\} \qquad (12)$$

The intensity variables, z_k, $k = 1, \ldots, K$, serve to form linear combinations of all observed banks' inputs and outputs. The N+M inequality constraints restrict the technology in that for a particular bank no more output can be produced using no less input than a linear combination of all observed inputs and outputs. Requiring the intensity variables to sum to one allows variable returns to scale so that maximal profits can be positive, negative, or zero. We assume that the first N-1 inputs such as labor, capital, and deposits are variable inputs (x^v) and can be used in greater or lesser amounts at the bank manager's discretion, but that the Nth input, equity capital (e), is fixed exogenously by bank regulators and owners. Therefore, we partition bank k's input vector as $x^k = (x^{vk}; e^k)$.

Define the directional technology distance function for each bank as

$$D^k_T (x^{vk}, e^k, y^k; g_x, g_e, g_y) = \max \{\beta: (x^{vk} - \beta g_x, e^k - \beta g_e, y^k + \beta g_y) \in T^k\} \quad (13)$$

where variable inputs are contracted in the direction g_x, equity capital is contracted in the direction g_e, and outputs are expanded in the direction of g_y. For $(x^{vk}, e^k, y^k) \in T^k$, a value of $D^k_T (x^{vk}, e^k, y^k; g_x, g_e, g_y) = 0$ indicates that the bank operates on the frontier of T^k and is efficient for the direction (g_x, g_e, g_y). A value of $D^k_T (x^{vk}, e^k, y^k; g_x, g_e, g_y) > 0$ indicates inefficiency. With the assumption that equity capital (e) is fixed exogenously by bank regulators and owners, $g_e = 0$. For the DEA technology, the directional technology distance function for bank $\acute{k}$ is estimated as

$$\begin{aligned} &D^k_T (x^{vk}, e^k, y^k; g_x, 0, g_y) = \max \beta \text{ subject to} \\ &\Sigma z_k x^v_{kn} \le x^v_{\acute{k}n} - \beta g_x,\ n = 1, \ldots, N\text{-}1 \\ &\Sigma z_k e_k \le e_{\acute{k}}, \\ &\Sigma z_k y_{km} \ge y_{\acute{k}m} + \beta g_y, \quad m = 1, \ldots, M \\ &\Sigma z_k = 1,\ k = 1, \ldots, K \text{ and } z_k \ge 0, k = 1,\ldots, K \end{aligned} \qquad (14)$$

Figure 3 shows how the production technology and inefficiency are estimated from the observed input and output with an example of four banks: A, B, C, and D. The piecewise linear technology, T, is bounded by the lines HB, BD, DA, and the horizontal extension from A. Given a direction vector (g_x, g_e, g_y) where g_e.is assumed to be zero, the directional function is defined as equation (14). This function expands output in the direction g_y, contracts inputs in direction g_x, and is a measure of technical inefficiency (X-inefficiency). Banks A, B, and D produce on the frontier of T are technically efficient. Bank C operates inside the frontier and is technically inefficient. For bank C, when outputs are expanded and inputs are contracted proportionally, $D^c_T(x,y\,;x,y)$ = CG / Og = β^*. Given ouput-input prices p and w, profit maximization occurs at A, where bank C could produce y^* using input x^*. The gain in output from realizing allocative efficiency is $y_T - y$. The gain in output from realizing profit efficiency is $y^* - y_T$.

In this study, we measure X-inefficiency by the directional distance between G and C in Figure 3. For estimation, we use three inputs, which are labor, capital, and deposits, and three outputs, which are commercial loans, consumer loans, and securities. Therefore, X-inefficency is determined by lost *y1*, lost *y2*, lost *y3*, excess *x1*, excess *x2*, and excess *x3*, where *y* = output, *x* = input, and directional vector *g* = (*gy1*, *gy2*, *gy3*, *gx1*, *gx2*, *gx3*). The estimated results show that the average X-inefficiency increased mildly in the early 1990s, but has gradually diminished since the financial crisis. Table 8 shows the estimated results of Model 4 or 5 of Table 3 with replacement of LOPEFF and LASEFF by X- INEFF. X-INEFF has an expected negative sign as X-INEFF is an indicator of allocative inefficiency and is statistically significant, though its t-value is not as high as t values of LOPEFF or LASEFF. All the measures of efficiency used in this study - LOPEFF, LASEFF, and X-INEFF - are found to be important variables in explaining bank profitability. No multicollinearity problem is detected by the VIF diagnostics.

VII. POLICY IMPLICATION

This paper has investigated the relationship between structure and performance in the Korean banking sector. The results obtained for the pooled data over the period 1992-2002 indicate that market concentration is an insignificant variable in explaining bank performance in Korea while both market share and efficiency measures affect bank profitability positively. Banks with higher market share, greater net interest margin, less operating cost per employee or branch, more assets per employee or branch, less allocative inefficiency measured by a distance function, higher equity capital ratio and less non-performing loan share are found to be more profitable, while market concentration measured by the Herfindahl index and classification as a nationwide bank are found to be not important variables in explaining bank profitability. However, when the sample period is broken down into three distinct periods, further insight is obtained. During the stable banking operation period, such as in the first period, all three variables - market concentration, market power, and efficiency - are significant in explaining bank profitability. However, during the crisis and survival periods, the efficiency variable stands out as the primary variable in affecting bank profits. While market concentration and market share became less significant, the importance of the efficiency variable and its magnitude of influence increased as Korean banks went through turbulence. The equity capital ratio is also found to be an important determinant of profitability during both the crisis and survival periods.

This evidence has several policy implications for bank regulation. The first implication is for merger and antitrust policy. Under the collusion hypothesis, mergers might be initiated by banks in order to extract consumer surplus, and the result would be higher prices to consumers and socially inefficient. On the other hand, according to the efficient market hypothesis, banks are motivated to merge in order to achieve efficiency, and the result is socially optimal. Our findings do not support the collusion hypothesis, and enforcement of antitrust policy in the Korean banking sector is not desirable according to our findings. In this sense, recent government policy to encourage mergers in the banking sector may be justified on the grounds of efficiency and international competition.[7] The two most recent mergers, a voluntary merger between Hana Bank and Boram Bank and an involuntary merger between Commercial Bank and Hanil Bank, are also headed in the right direction. An IMF study (2001) found that both merged banks have realized economies of scale by rationalizing their operations or branch networks and employees, but also that mergers are not a sufficient condition for improved profitability if the underlying banks are unsound. The government's increasing emphasis on bank consolidation is to improve profitability through realization of economies of scale. So even if merged banks have not yet improved profitability, their realization of economies of scale will result in higher profitability in the long run.

The second implication is that both banks and regulatory agencies such as the Korea Financial Supervisory Commission (FSC) should focus on how to improve bank efficiency instead of being concerned about market share or market concentration. Korean banks prior to the financial crisis focused on expanding their market shares instead of reducing costs or improving efficiency. Such strategies were based on a philosophy of "too big to fail" and a moral hazard effect coming from perceiving the government as the lender of last resort and implicit bail-out guarantor. However, the financial crisis of 1997-1998 shook the Korean banking sector, and it was a wake-up call to Korean banks to re-evaluate themselves. Though the financial crisis caused much trouble to the Korean economy and particularly Korean banks, one good thing that came out of the financial crisis was the focus on efficiency improvement. The restructuring of the Korean banking sector might not have been possible without the crisis, because inertia against change had prevailed in the Korean banking sector. As bank regulations that limited free competition were gradually removed, the increasing importance of efficiency was clear.

Third, there is a need for banks to improve their credit analysis skill and risk management, as the financial and currency crisis of 1997-98 clearly demonstrated lack of expertise of Korean banks in this area. Because of asymmetric information between lenders and borrowers about investment opportunities and activities of borrowers, banks are engaged in two information-producing activities, screening and monitoring. In particular, the presence of adverse selection in loan markets requires that banks screen out the bad credit risks. Effective information collection and well-programmed screening are essential for credit risk management. It is welcome news that the FSC introduced forward- looking criteria to classify assets in place of backward-looking criteria, along with more stringent procedures for valuation and provisioning of impaired assets. However, Korean banks need to improve their skills of information collection and analysis regarding credit and risk to further reduce occurrences of non-performing loans and potential bank crisis in the future.

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2. Notes

1. The Korea Development Bank was established in 1954 in order to promote industrial development and facilitate the reconstruction of the national economy after the Korean War. The Industrial Bank was founded in 1961 to specialize in financing small and medium firms. The National Agricultural Cooperative Federation and National Federation of Fisheries Cooperatives were established in 1961 and 1962 respectively for their targeted industries. The Export-Import Bank of Korea was set up in 1976 to provide funds for exports, imports and overseas investments.

2. A Chaebol in Korea is a group of firms owned and controlled primarily by a single entrepreneur and his family.

3. Privatization started with Korea Commercial Bank in 1981, Hanil Bank, Korea First Bank in 1982 and Cho Hung Bank in 1983.

4. OECD members warned that Korea would risk jeopardizing its membership in the OECD which was scheduled to take effect in 1996, unless it speeded up the pace of financial liberalization and deregulation.

5. There were four mergers in total. Two of the mergers have involved relatively sound banks and were voluntary transactions. One of these involved Kookmin Bank and Korea LongTerm Capital Bank, and created the largest bank in Korea. The second involved two smaller banks, Hana and Boram, and Boram was merged into Hana. Two mergers were also undertaken to restructure unsound banks. These transactions involved the purchase of nonperforming loans of the merged banks by the government in exchange for equity ownership. The first was between Hanil Bank and Commercial Bank, creating Hanvit Bank, which became the second largest bank in Korea with 95% government ownership. Later the bank was renamed Woori Bank. The second involved the merger of three small banks with the fourth largest bank in Korea, Chohung Bank, resulting in 90% government ownership.

6. This model is a modified version of Berger (1995).

7. In 1988 the government engineered four mergers of banks in order to restructure relatively unsound banks.

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Table 1 Descriptive Statistics

	N	Minimum	Maximum	Mean	S. Deviation
ROATOT	231	-10.190	1.480	-.38542	2.062771
ROABANK	231	-11.4467	2.6200	-.375897	2.3556501
ROE	231	-595.790	34.200	-12.49974	65.443320
MARGIN	232	-.019	.035	.01562	.007649
MS1	234	.002	.295	.04819	.047155
MS2	234	.003	.281	.04821	.047420
HINDEX1	234	.0664	.1542	.092276	.0261013
HINDEX2	234	.0687	.1466	.093700	.0229503
LOPEFFW	232	-1.21	2.69	1.1820	.77573
LOPEFFB	232	2.50	5.47	4.0055	.65042
LASEFFW1	234	2.43	5.06	3.8074	.60523
LASEFFB1	234	5.37	7.80	6.6303	.54875
LASEFFW2	234	2.26	4.89	3.5063	.62587
LASEFFB2	234	5.05	7.65	6.3292	.53383
EQRATIO1	234	-.062	.418	.05364	.038184
EQRATIO2	234	-.075	.465	.07335	.048794
NPLS	231	.0010	.2460	.053756	.0426724
Valid N (listwise)	229				

Ratios and shares are in percentage, and expenses and assets expressed in 100 million Korean won are transformed into natural logarithm. Suffix 1 is for both banking and trust businesses and suffix 2 is for banking business only.

ROATOT: ratio of net after-tax income to total assets for both banking and trust businesses.
ROABANK: ratio of net after-tax income to assets for banking business only.
ROE: ratio of net after-tax income to equity capital for both banking and trust businesses.
MARGIN: net interest margin, which is the difference of loan interest rate and deposit rate.
MS: share of a bank in total industry assets
HINDEX: sum of square of each bank's market share.
LOPEFFW: operating expenses per employee in log.
LOPEFFB: operating expenses per branch in log.
LASEFFW: total assets per employee in log.
LASEFFB: total assets per branch in log.
EQRATIO: ratio of equity capital to total assets.
NPLS: non-performing loans as a percentage of total loans.

Table 2 Herfindahl Index and ROATOT

YEAR	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
HINDEX1	.088	.083	.079	.072	.071	.066	.120	.094	.098	.144	.154
ROATOT	.56	.45	.42	.32	.26	-.93	-3.25	-1.31	-.57	.76	.59

Table 3 Regression Results: Alternative Models
Dependent Variable: ROATOT, n=228

	Model 1	Model 2	Model 3	Model 4	Model 5
MARGIN	69.125 (3.782)	36.430 (1.817)	42.547 (2.161)	66.650 (3.999)	69.078 (4.126)
HINDEX1	-9.892 (-2.727)		-12.067 (-3.338)	-2.762 (-.771)	-.680 (-.203)
MS1		6.936 (2.611)	8.573 (3.242)	3.571 (1.480)	3.997 (1.651)
LOPEFFW				-2.792 (-9.715)	
LASEFFW1				3.313 (8.877)	
LOPEFFB					-2.723 (-9.519)
LASEFFB1					3.389 (8.550)
EQRATIO1	10.323 (2.5130)	17.306 (4.431)	12.521 (3.069)	10.995 (2.617)	9.931 (2.488)
NPLS	-27.584 (-11.732)	-27475 (-11.690)	-29.097 (-12.384)	-11.316 (-4.187)	-11.248 (-4.141)
NATIONAL	.981 (4.045)	.407 (.329)	.262 (.807)	-.095 (-.340)	-.240 (-.811)
R^2	.601	.600	.619	.735	.735

t values in parentheses

The intercept terms which are different for each bank in the fixed-effects model, reflecting bank-specific characteristics, are not reported here and the rest of tables.

Table 4 Regression Results: Alternative Models
Dependent Variable: ROABANK, n=228

	Model 1	Model 2	Model 3	Model 4	Model 5
MARGIN	79.520 (4.164)	40.177 (1.861)	45.044 (2.13)	38.328 (2.418)	41.851 (2.662)
HINDEX2	-14.336 (-2.95)		-16.138 (-3.381)	-21.526 (-5.221)	-18.853 (-4.965)
MS2		9.249 (3.033)	10.357 (3.454)	.572 (.242)	-3.265 (-1.268)
LOPEFFW				-4.148 (-13.036)	
LASEFFW2				5.111 (12.437)	
LOPEFFB					-4.051 (-12.957)
LASEFFB2					5.417 (12.423)
EQRATIO2	7.871 (2.493)	15.395 ((5.162)	10.896 (3.4)	11.393 (3.749)	10.535 (3.699)
NPLS	-31.764 (-11.391)	-30.88 (-11.336)	-33.356 (-12.079)	-14.426 (-5.704)	-14.152 (-5.641)
NATIONAL	1.002 (1.654)	.233 (.619)	.128 (.347)	.2 (.715)	-.077 (-.265)
R^2	.608	.609	.628	.793	.797

t values in parentheses

Table 5 Nationwide versus Regional Banks
Dependent Variable: ROATOT

Variable	Nationwide Banks		Regional Banks	
	Model 4	Model 5	Model 4	Model 5
MARGIN	54.970 (2.871)	56.732 (2.954)	80.387 (2.862)	76.592 (2.713)
HINDEX1	2.417 (. 507)	3.456 (.781)	-17.882 (-3.932)	-10.888 (-2.710)
MS1	4.919 (2.062)	3.914 (1.515)	0.299 (.137)	-5.810 (-1.858)
LOPEFF1	-2.482 (-6.805)		-3.766 (-8.550)	
LASEFF1	2.754 (5.768)		5.096 (9.581)	
LOPEFF2		-2.459 (-6.811)		-3.624 (-8.128)
LASEFF2		2.867 (5.831)		5.587 (9.047)
EQRATIO	12.943 (2.029)	12.722 (2.154)	4.937 (0.976)	6.925 (1.277)
NPLS	-8.451 (-2.222)	-8.146 (-2.161)	-14.770 (-4.729)	-13.253 (-4.120)
N	136	136	91	91
R^2	.660	.661	.855	.854

t values in parentheses

Table 6 Nationwide versus Regional Banks
Dependent Variable: ROABANK

Variable	Nationwide Banks		Regional Banks	
	Model 4	Model 5	Model 4	Model 5
MARGIN	26.082	28.455	73.791	87.125
	(1.328)	(1.463)	(2.327)	(2.761)
HINDEX2	1.312	1.029	-35.810	-36.126
	(1.311)	(1.011)	(-6.054)	(-6.197)
MS2	0.836	-2.289	-11.571	-30.619
	(0.300)	(-0.747)	(-0.695)	(-1.897)
LOPEFF1	-3.869		-4.588	
	(-8.711)		(-9.594)	
LASEFF1	4.683		5.539	
	(7.934)		(10.357)	
LOPEFF2		-3.826		-4.366
		(-8.847)		(-8.940)
LASEFF2		4.964		6.042
		(8.198)		(9.960)
EQRATIO	12.846	11.524	2.574	1.826
	(2.854)	(2.798)	(0.464)	(0.355)
NPLS	-13.043	-13.115	-17.197	-17.460
	(-3.593)	(-3.721)	(-4.691)	(-4.861)
N	136	136	91	91
R^2	.711	.717	.892	.894

t values in parentheses

Figure 1. NPLs of Nationwide Banks

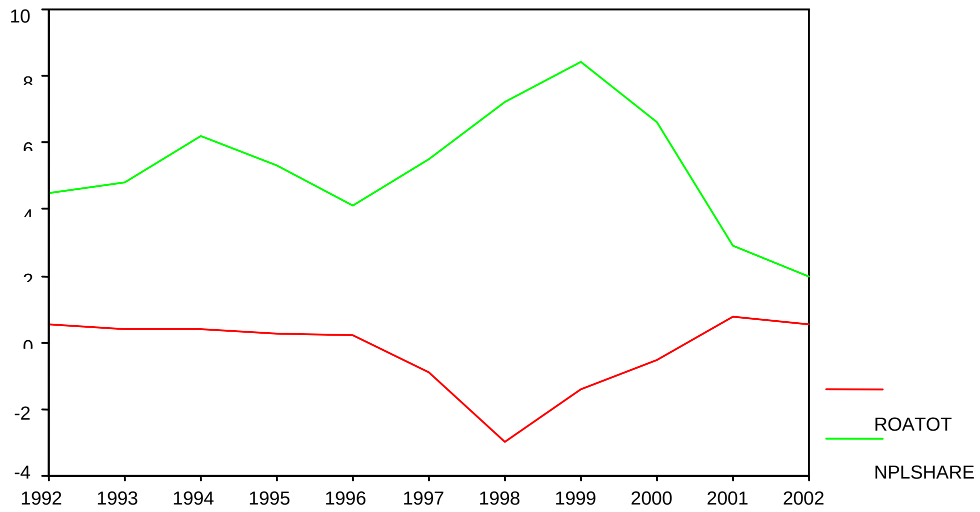

Figure 2. NPLs of Regional Banks

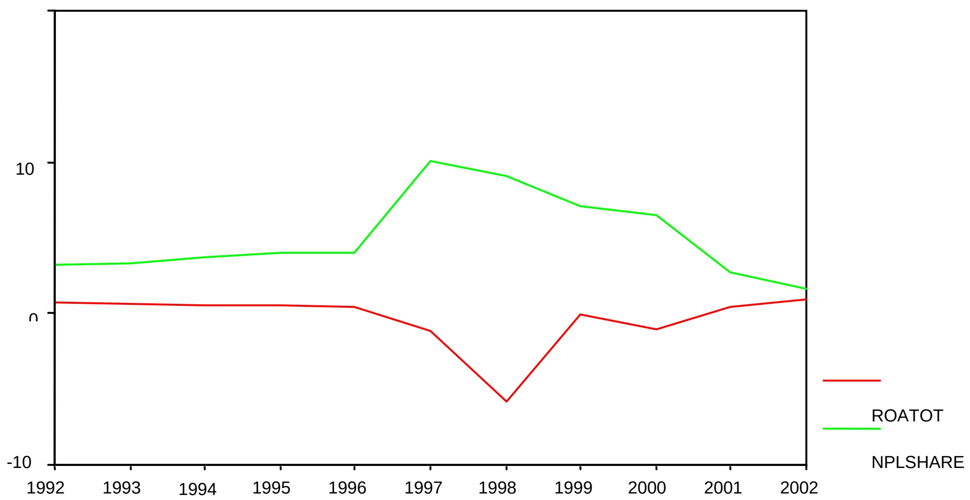

Table 7 Regression Estimates for Three Different Periods
Dependent Variable: ROATOT

Period	Variable	Model 4		Model 5	
		Coefficient	t value	Coefficient	t value
1992-1996 (n=120)	MARGIN	41.949	3.808	45.214	4.108
	HINDEX1	22.235	3.788	17.571	3.819
	MS1	4.472	3.194	3.239	2.032
	LOPEFF1	-.790	-2.813		
	LASEFF1	1.064	3.381		
	LOPEFF2			-.860	-2.390
	LASEFF2			1.194	2.858
	EQRATIO	-.588	-.421	-.263	-.189
	NPLS	-5.793	-3.375	-5.074	-2.887
	NATIONAL	-.237	-1.701	-.263	-2.033
	R^2	.592		.601	
1997-1999 (n=61)	MARGIN	29.344	.687	32.397	.750
	HINDEX1	1.342	.092	2.191	.175
	MS1	7.470	.836	6.083	.646
	LOPEFF1	-4.841	-5.195		
	LASEFF1	5.199	5.620		
	LOPEFF2			-4.818	-5.391
	LASEFF2			5.371	5.287
	EQRATIO	29.949	2.332	29.184	2.268
	NPLS	-10.513	-2.087	-10.157	-1.991
	NATIONAL	-.218	-.250	-.368	-.389
	R^2	.804		.776	
2000-2002 (n=45)	MARGIN	-14.728	-.638	-13.961	-.591
	HINDEX1	-2.693	-.404	-2.419	-.351
	MS1	-2.078	-.833	-2.436	-9.14
	LOPEFF1	-2.542	-3.863		
	LASEFF1	1.791	2.306		
	LOPEFF2			-2.374	-3.577
	LASEFF2			2.353	2.980
	EQRATIO	35.677	2.293	38.418	2.402
	NPLS	-10.636	-1.842	-7.998	-1.353
	NATIONAL	.536	1.250	.252	.508
	R^2	.704		.690	

Figure 3 Frontier Function and Distance Function

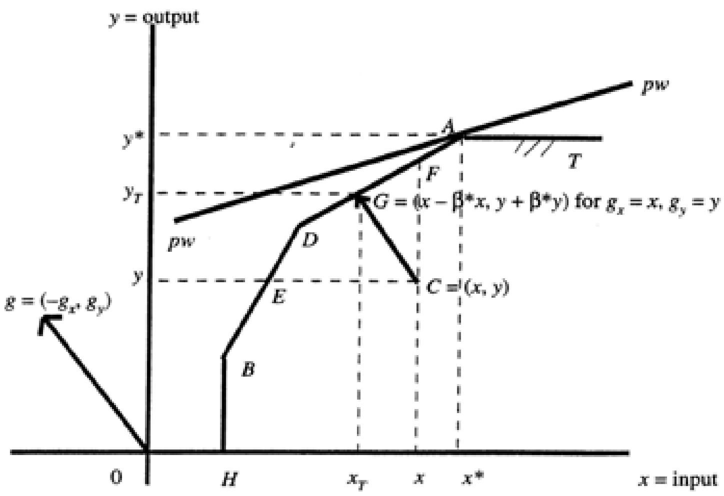

Table 8 Regression Results using X-inefficiency
n=228

	Dep: ROATOT			Dep: ROABANK	
	Coefficient	**t value**		**Coefficient**	**t value**
MARGIN	39.298	2.007	**MARGIN**	39.870	1.894
HINDEX1	-12.405	-3.458	**HINDEX2**	-16.292	-3.448
MS1	8.066	2.631	**MS2**	9.822	3.299
X-INEFF	-7.207	-2.203	**X-INEFF**	-8.715	-2.368
EQRATIO1	12.191	4.048	**EQRATIO2**	11.087	3.495
NPLS	-29.450	-12.613	**NPLS**	-33634	-12.294
NATIONAL	.318	.985	**NATIONAL**	.190	.519
R^2	.627		**R^2**	.637	

X-INEFF is a measure of allocative inefficiency estimated by the directional technology distance function.

APPENDIX

List of Korean Commercial Banks

Nationwide Banks

1. Cho Hung Bank
2. Commercial Bank of Korea (merged to form Hanvit Bank in 1999)
3. Korea First Bank (nationalized in 1998)
4. Hanil Bank (merged to form Hanvit Bank in 1999)
5. Bank of Seoul (nationalized in 1998)
6. Korea Exchange Bank
7. Shinhan Bank
8. Hanmi Bank (KorAm Bank)
9. Dongwha Bank (acquired by Shinhan in 1998)
10. Dongnam Bank (acquired by Housing and Commercial Bank in 1998)
11. Daedong Bank (acquired by Kookmin Bank in 1998)
12. Hana Bank
13. Boram Bank (merged into Hana bank in 1999)
14. Peace Bank (merged into Woori Holding Co. in 2001)
15. Kookmin Bank (converted from a special bank in 1995)
16. Housing and Commercial Bank (converted from a special bank in 1997 and merged into Kookmin Bank in 2001)
17. Woori Holding Co. (former Hanvit Bank renamed in 2002 when it became a financial holding company)

Regional Banks

1. Daegu Bank
2. Pusan Bank
3. Chung Chong Bank (acquired by Hana Bank in 1998)
4. Kwangju Bank
5. Bank of Cheju
6. Kyungki Bank (acquired by Hanmi Bank in 1998)
7. Jeonbuk Bank
8. Kangwon Bank (merged into Cho Hung Bank in 1999)

CHAPTER 2-2

Risks and Supervisory Challenges of Financial Conglomerates in Korea

by
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and
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Abstract

Recent research indicates that one cannot ascertain a clear-cut relationship between financial consolidation and financial stability. Financial consolidation may not always create market power and desired diversification effect for large financial institutions, and various features of conglomeration may actually increase the scope for instability, in particular when they lead to a small number of large conglomerates, which are too big to fail, to discipline, and to liquidate.

This paper examines recent developments in financial consolidation and conglomeration in post-crisis Korea. With a review of the progress in financial restructuring, we study implications of the consolidation and conglomeration for both financial risks of individual conglomerates and systemic risk potential. We provide diagnostic analyses on various channels through which financial consolidation and conglomeration can impact financial stability.

While it is premature to conclude, our analyses suggest that both geographic and cross-industry diversifications in Korea may have a limited scope in reducing financial risks for individual conglomerates. It also turns out that consolidation has increased systemic risk potential as both direct and indirect interdependencies among large banking institutions have substantially increased in the post-crisis period. Furthermore, financial conglomerates have become more vulnerable to contagion risks from non-bank and non-financial sectors as they expand their involvement in high risk activities that are closely tied to non-bank financial firms and capital markets

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In the face of the shifting risk structure, financial supervisory and regulatory systems must be upgraded toward a more risk-based, consolidated supervision. Currently in Korea, only a rudimentary form of consolidated supervision is applied to financial holding companies, and no consolidated supervision has been introduced for other types of financial conglomerates. For instance, prompt corrective action provision for financial conglomerates must be based upon fully consolidated group capital adequacy, and effective supervisory devices need to be introduced to avoid inadvertent extension of public safety net to cross-sectoral activities of financial conglomerates. At the same time, it is also critical to strengthen internal control and risk management capacities at financial conglomerates, and to establish strong market discipline by improving information transparency and monitoring incentives in the financial market. For early detection and better management of potential systemic risk events, it is also necessary to establish an effective institutional mechanism for communication, cooperation, and check and balance among related regulatory authorities.

I. Introduction

The structure of the Korean financial services industry has been rapidly transformed since the 1997 financial crisis. Initially driven by the government restructuring program, the combined trends of financial consolidation, conglomeration and internationalization not only caused a dramatic change in the competition structure but also significantly eroded the effectiveness of existing regulatory regime in maintaining financial stability. Integration among traditionally separated financial services and the emergence of a few large financial conglomerates have brought about a fundamental shift in the nature of financial risks embedded in the financial system.

While it is required to understand the evolving nature and structure of risks implied in the new financial regime, a clear-cut relationship between financial consolidation and financial stability does not exist. Indeed, financial consolidation may increase or decrease risks of individual financial conglomerates. With scale and scope economies, and benefited from increased market power, financial conglomerates may be able to enhance profitability thereby containing financial risks. However, complexity in operation and incentives to take on more risks based upon 'too-big-to-fail' may actually increase financial risks of large conglomerates.

Financial consolidation and conglomeration may also increase systemic risk potential. Incentives of financial markets as well as regulatory authorities in monitoring and supervising large conglomerates can be significantly undermined. Even if individual conglomerates are able to benefit from diversification, interdependency and mutual exposure among large financial conglomerates may substantially increase as they share homogeneous business portfolios and asset structure.

In the face of the increasingly limited ability of supervisory and monetary authorities to cope with financial risks, it has become an urgent task to devise a new regulatory regime capable of preventing excessive risk-taking of financial conglomerates and regulatory forbearance of financial supervisors. It is also required to create an environment where market participants have a strong incentive to monitor risks and penalize financial institutions if they take on too much risk.

Given the imperatives of the supervisory and regulatory reform in the face of on-going consolidation and conglomeration, we address following inquiries in the present paper: How can we characterize the financial consolidation process that has accelerated during the post-crisis period in Korea? What is the evolving nature of risks associated with financial consolidation and conglomeration? Do large financial conglomerates composed of various financial businesses differ significantly from the institutions running a single business in terms of risk characteristics? If so, in what manner should the risks of financial conglomerates be contained and managed? How should the system-wide risk that may be amplified to ignite systemic crises be classified, observed, and responded to? What is the nature of the financial safety net in which the perverse incentives of market participants as well as financial regulators can be curbed to reinforce both financial stability and efficiency?

The present paper is organized as follows: Section 2 summarizes the post-crisis financial restructuring program and characterizes the development in financial consolidation and conglomeration in Korean financial industries. This section also analyses the shift in financial industry structure by examining the degree of concentration. Section 3 presents a conceptual framework in order to understand risk implications of financial conglomeration in Korea. This section also explores potential risk impacts by focusing on the channels through which financial consolidation may influence financial risks of individual conglomerates and systemic risk potential. Section 4 outlines current regulatory framework of financial supervision for financial conglomerates in Korea. Finally, section 5 discusses policy implications and suggestions.

II. The Rise of Financial Conglomerates in Korea

Since the onset of the 1997 financial crisis, the Korean financial industry has seen the rise of financial conglomerates as well as massive consolidation and concentration. Prior to the crisis in Korea, there had existed two types of financial groups. One is the "financial conglomerate"[1] whose business lines were exclusively in financial activities, in which their organizational structure took the form of a parent's participation in financial subsidiaries (parent-subsidiary model) which was partly allowed in the mid 1980s.[2] However, financial institutions in Korea were prohibited from establishing financial holding companies(FHCs)[3]; in that financial activity among financial institutions were strictly separated for fears that financial concentration through holding companies would lead to side effects including the potential for anti-competitive behavior. Later on, as will be mentioned in the proceeding section, financial holding companies were introduced in Korea following the crisis as a part of the government's restructuring efforts. Another form of financial group prevalent in Korea has been the "mixed conglomerate," which are predominantly commercially oriented, but contain at least one regulated non-banking financial institution (NBFI).[4]

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[1] According to the Tripartite Group of bank, securities and insurance regulators (the Basel Committee on Banking Supervision (BCBS), the International Organization of Securities Commissions (IOSCO) and the International Association of Insurance Supervision (IAIS)), the term "financial conglomerate" would be used to refer to "*any group of companies under common control whose exclusive or predominant activities consist of providing significant services in at least two different financial sectors (banking, securities, insurance)*." (Joint Forum on Financial Conglomerates, 'Supervision of Financial Conglomerates,' 1999)

2 Korean banks have been permitted to own securities companies as subsidiaries since 1984.

3 Financial holding companies are defined as entities that control regulated financial intermediaries: typically depository institutions, insurance companies, or securities firms. (Howell Jackson, 1997)

[4] In Korea, many NBFIs are owned by the *chaebols* (large family-owned conglomerates). According to the Financial Supervisory Commission, the amount of assets for the mixed conglomerates totaled about 180 trillion won as of the end of June 2002, of which Samsung's share of assets totaled about 107 trillion won, or 57%.

[Figure 1 here]

During the restructuring process following the crisis, a number of insolvent financial institutions failed or merged with other institutions. Indeed, as can be seen in Table 1, the number of financial institutions in Korea fell from 2,101 in 1997 to 1,381 by the end of June 2003, a drop of 34.3%. For the total number of financial institutions undergoing restructuring, 161 institutions out of 787 merged during the same period. In particular, the number of banks sharply decreased to 19 by the end of June 2003 from 33 in 1997 through closures and mergers — Korea had never once experienced such a dramatic turn of events, which led to the resolution of major financial institutions. In the case of NBFIs, 28 merchant banking corporations (MBCs), 10 securities companies, 7 investment trust companies (ITCs), and 16 insurance companies had been closed down through exits or mergers by the end of June 2003.

[Table 1 here]

1. Resolution of Distressed Institutions and Financial Consolidation

At the time of the crisis, many Korean financial institutions were significantly undercapitalized and several of them were effectively wiped out of their capital base. Because of large non-performing loans (NPLs) and weak capital base, troubled Korean banks struggled to improve their BIS ratios by curtailing lending as raising new capital was virtually impossible. Such financial implosion further intensified already severe credit crunch and resulted in massive corporate bankruptcies. Under these circumstances, the top priority in financial restructuring was the disposal of NPLs and the recapitalization of banks.

The first policy response by the Korean government was to identify insolvent financial institutions and resolve them. In January 1998, the government nationalized two major banks — Korea First Bank and Seoul Bank — that had become insolvent. Moreover, the Financial Supervisory Commission (FSC) ordered twelve other banks that had capital adequacy ratios of less than 8 percent at the end of 1997 to prepare rehabilitation plans by April 1998. In June 1998, five banks were identified as being insolvent and their rehabilitation plans were rejected by the FSC following a comprehensive review of their financial conditions. Each of these banks was acquired through P&A (Purchase and Assumptions) agreement by relatively healthy banks (See Figure 1).[5]

[Figure 2 here]

The plans of the other seven banks with capital adequacy ratios below 8 percent at the end of 1997 were given tentative approval to continue operations under the condition that those banks would pursue cost reductions through branch closures and staff downsizing. In addition, the government offered support by recapitalizing the seven banks and purchasing of their impaired assets. As little progress was being made in the restructuring, the government stepped in by encouraging the mergers of the troubled banks. As such, in January 1999, two major banks, Korea Commercial Bank and Hanil

(See Figure 1 for ownership structure of Samsung Group).

[5] The suspended banks and their respective acquirers are as follows: Daedong Bank by Kookmin Bank, Dongnam Bank by Korea Housing & Commercial Bank, Dongwha Bank by Shinhan Bank, Chungchung Bank by Hana Bank, and Kyungki Bank by KorAm Bank.

Bank merged to form Hanvit Bank, and again in July 1999, another major bank, Chohung Bank acquired two regional banks including Kangwon Bank and Chungbuk Bank.[6]

At the same time, mergers among healthy banks were also undertaken. With support from the government, in January 1999, Kookmin Bank merged Korea Long-Term Credit Bank, which enabled them to achieve synergy between Kookmin's wide retail network and Korea Long-Term Credit's corporate finance. In addition, amid the wave of consolidation, two other healthy banks including Hana Bank and Boram Bank merged.

The bank consolidation trend was marked with the merger of Korea's two larger banks, Kookmin Bank, the largest by asset size, and Korea Housing & Commercial Bank, the third largest, in April 2001, to become the largest bank in Korea, despite significant labor opposition. In fact, as of the end of 2003, the Kookmin Bank's assets totaled 214.8 trillion won, accounting for nearly 27% of total assets in the banking sector. Furthermore, in December 2002, Seoul Bank, which had been nationalized following the crisis and unable to find any strategic investors, ultimately merged with Hana Bank.

In the meantime, to deal with the other weak banks, the government enacted *Financial Holding Company Act* in October 2000, and created a financial holding company in April 2001. Under a holding company structure, numerous synergy effects can be achieved such as enabling the cross selling of financial products, lowering funding costs, and streamlining IT investment. At the same time, the government hoped that affiliated companies would be able to retain their client base while being able to avoid employee downsizing, further helping to lessen employee resistance, in contrast to the P&A approach used in 1998.

At first, two nation-wide banks (Hanvit and Peace) and two regional banks (Kwangju and Kyungnam) were placed under a government-run holding company, Woori Financial Holdings. Before doing so, the NPLs of candidate banks were disposed, and in addition, public funds were injected to raise their capital adequacy ratios above 10 percent. Aside from the banks, a securities company, an ITC, and a credit card company[7] were placed under the Woori holding company structure. Then, in September 2001, a second financial holding company was established, Shinhan Financial Holdings, under which Shinhan and Cheju Banks along with a life insurance company, a securities company, an ITC, and a credit card company were placed under the same umbrella. In September 2003, Chohung Bank, the fourth largest bank at the end of 2002, was also placed under the Shinhan Financial Holdings, making it the second largest financial group in Korea.[8]

[Table 2 here]

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[6] Among the seven troubled banks, only Korea Exchange Bank did not merge but received a capital injection from Commerzbank.

[7] In 2003, Woori Credit Card Company experiencing financial distress under a pile of NPLs was acquired by Woori Bank. According to the OECD report (1993), under a financial holding company, a bank's relation to non-bank affiliates is indirect as there exists a cushion — a holding company — between them. Because the legal separation is more extensive than in the case of the parent-subsidiary model, the cost of producing a given mix of products tends to be more expensive. However, it is often argued that, because of the indirect relationship, the safety and soundness of the bank can be more isolated from the non-bank affiliates and the bank may have less incentive to bail out a faltering non-bank affiliate. In practice, the opposite can be said to be true, as non-bank affiliates in distress tends to be rescued, mainly for the purpose of protecting group's reputation. This is the case for the Woori Credit Card Company, and as a result, the Woori Bank's access to official safety net has been indirectly extended to the non-bank subsidiary.

[8] In 2003, another financial holding company, Dongwon Financial Holdings, was established. However, unlike Woori and Shinhan Financial Holdings, only NBFIs were placed under this holding company.

In tandem with these measures for the resolution of weak or insolvent institutions, the government injected a total of 160.4 trillion won (26 percent of GDP) in fiscal resources to rehabilitate the financial system from the late 1997 until the end of June 2003 (see Table 3). The operating arms of the government in this regard were the Korea Asset Management Corporation (KAMCO) and the Korea Deposit Insurance Corporation (KDIC). Out of the total amount of fiscal support, 60.3 trillion won was used for recapitalization, 39.1 trillion won for the purchase of NPLs, and 29.8 trillion won for the deposit repayments for closed institutions. The recapitalization of financial institutions using public money left a substantial share of the banking sector in the hands of the government.[9]

[Table 3 here]

2. Concentration of the Financial Industry in Korea

As a result of the government-led financial restructuring after the financial crisis, which brought about massive consolidation, market concentration increased significantly in Korea's banking industry. To determine the degree of market concentration in Korea's banking industry, we use two types of measurements. The first is the so-called k-bank concentration ratio (CR_k) which takes the market shares of the k largest banks in the market. The second index we use is the Herfindhal-Hirshman Index (HHI)[10], which is calculated by summing the squares of the individual percent market shares of all the participants in a market. Total assets are taken as the measure of bank size.

As a result of the consolidation trend in the banking industry, market concentration increased significantly, in a large part due to the merger of Korea's two large banks, Kookmin Bank and Korea Housing & Commercial Bank. In terms of CR3, the ratio rose substantially to 53.2% in 2003 from 28.4% in 1997, as can be seen in Figure 3-1. Similarly, the HHI index showed a sharp increase from 664 in 1997 to 1,497 by the end of 2003, which is considered as being "moderately concentrated."

Figures 3-2 and 3-3 show the changes in the concentration ratios of the life-insurance industry and securities industry, respectively. According to the HHI index, Korea's life-insurance industry is considered as being "highly concentrated" with HHI exceeding 2,500, even with Daehan life-insurance company losing market share after the crisis, Samsung and Kyobo life-insurance companies were able to maintain an oligopolistic market structure, as the industry saw a reduction in the number of smaller sized companies. As for the securities industry, though a number of firms were closed, there were also a sizable number of new entries, which allowed the industry to maintain a competitive market environment.

Lastly, in considering the entire financial industry, Figure 3-4 shows the changes in the concentration ratio of the financial groups instead of individual financial entities.

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[9] Indeed, KDIC currently owns Woori Financial Holdings Company with 86.8% ownership, which includes Woori, Kwangju, and Kyongnam Banks, all of three are 100% owned by the Woori Financial Holding Company.

[10] Regulators assessing the effect of mergers on concentration in local financial markets typically rely on HHI. U.S. Department of Justice divides the spectrum of market concentration into three categories: "not concentrated" (HHI below 1,000), "moderately concentrated" (HHI between 1,000 and 1,800), and highly concentrated (HHI above 1,800).

According to the HHI index, although there was a steady increase in the index from 405 in 1997 to 800 in 2003 reflecting the emergence of financial conglomerates following the financial crisis, the level of market concentration is still considered as being competitive.

[Figure 3-1 here]

[Figure 3-2 here]

[Figure 3-3 here]

[Figure 3-4 here]

III. Financial Consolidation and Changing Risks

1. Conceptual Framework

As described above, the financial consolidation in Korea encompasses both consolidation of large financial institutions through mergers and acquisitions (M&As) within the same financial industry, and cross-border conglomeration among bank and non-bank financial institutions - either in the form of parent-subsidiary model or of financial holding company structure. Note that these two types of consolidations often occur simultaneously and banks are in general at the center of the consolidation process. As a result, a few large bank-centered financial groups have emerged, within which various non-bank financial institutions are clustered around a large bank. Henceforth, in this section, we explore risk implications of the typical bank-centered financial conglomeration without explicitly distinguishing bank consolidation from cross-industry conglomeration.

Before we examine the implications of financial consolidation on financial risks, it would be informative to explore the relationship between financial efficiency and stability. Traditional literature often suggests that there exists a potential tradeoff between financial efficiency and stability. That is, while large banks with increased market power may potentially undermine competition and efficiency of resource allocation, large banks can be more profitable and financially robust, which promotes financial stability. For instance, Keeley (1990) found that the erosion of market power due to increased competition led to higher default risk premium and lower capital ratios for U.S. banks in the 1980s. He argued that, with asymmetric information and provision of bank deposit insurance, lower charter values led to higher risk and failure rate of banks due to moral hazard and agency problem.[11] In retrospect, the bank restructuring policy in Korea during the post-crisis period seemed to be based upon this charter value hypothesis, that is, the implied trade-off between competition and stability. In an effort to promote bank profitability and financial stability, mergers between insolvent banks and creation of large leading banks were often an explicit policy objective of the government authorities.

[11] For instance, the view that the erosion of bank market power is associated with financial instability can also be found in Marcus (1984).

Recent research, however, indicates that one cannot ascertain a clear-cut relationship between consolidation and financial stability challenging the traditional view. First, according to a group of research, financial concentration may not always create market power for large institutions.[12] Indeed, even with few participants, financial markets can be sufficiently contestable.[13]

Second, even though we admit that large financial conglomerates can reduce financial risks benefiting from increased market power and diversification of their geographic and business portfolios, various features of conglomeration may actually increase the scope for instability, in particular when they lead to a small number of large 'national champions,' which are too big and few to fail, to discipline, and to liquidate.

It may be a challenging task to systematically characterize and classify potential channels through which financial consolidation and conglomeration has impact on the risk and stability of a financial system. Following the spirit of G10 report (2001) and De Nicolo *et al.* (2003), we distinguish financial risks of individual financial conglomerates on a standalone basis from systemic risk potential for the financial system as a whole. In this regard, the conceptual framework we employ in investigating risk implications of financial consolidation and conglomeration is summarized in Table 4.[14]

[Table 4 here]

1) Risk of Individual Financial Conglomerates

Financial risks of individual conglomerates can be impacted through four conceptually distinctive channels - expected earnings, variability of earnings, operational risk and risk preference of individual conglomerates. First, profitability and earnings potential would be enhanced for large financial conglomerates if they can exploit and realize the scale and scope economies. For instance, financial conglomerates can achieve cost saving by spreading out large fixed cost required in IT investment over larger asset base. Subsidiaries in a financial group can also share marketing and distribution channels as well as database and IT systems. Financial consolidation and conglomeration can lead to revenue enhancement if increased size raises market power and if product diversity and cross-selling increases profit opportunities. With enhanced profitability and cost efficiency, insolvency risk of individual conglomerates would be reduced, ceteris paribus. Note also that increased profitability and higher charter value would lessen moral hazard incentive of large conglomerates.[15]

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[12] G10 report (2001) suggested that consolidation of US banking organizations had only minor effects on market power because most M&As did not increase local concentration in a significant way, and because antitrust authorities, potential market entrants, deregulation and advances in technology increased the degree of competition.

[13] Allen and Gale (2000) showed that, under search cost, a branch banking system with only two nation-wide banks can lead to a perfectly competitive pricing, while the system with multiple unitary banks may lead to monopoly pricing. Also, contrary to the result of Bikker and Haaf (2000), which reported a negative relationship between concentration and degree of competition, Claessens and Laeven (2003) found that bank concentration is only weakly correlated with the degree of competition as measured by H-statistics. Rather, they argued that it is foreign bank participation and low entry barrier that fosters competitive pricing.

[14] Hahm and Hong (2003) provided a diagnostic analysis on the risk implications of bank consolidation for Korean banking industry. This section is mainly based upon the analytical framework of Hahm and Hong (2003).

[15] Empirical evidence is mixed for the argument that large banks are more efficient and more profitable. For instance, Berger *et al.* (1999), Hughes and Mester (1998) reported the existence of a significant

Second, financial consolidation and conglomeration may lower risk of individual financial conglomerates with greater opportunities for risk diversification. Geographic consolidation would yield a potential for risk diversification if merged financial firms operate in heterogeneous markets and are expected to show relatively low or negative return correlations. In a similar vein, cross-industry financial consolidation may also contribute to reductions in earnings variability by facilitating product diversification if expected returns are sufficiently heterogeneous across different financial services. On the other hand, as noted by Cumming and Hirtle (2001), the risk faced by a financial conglomerate could be larger than the sum of risks of each subsidiaries if the volatility of a subsidiary is affected by the actions of other subsidiaries.[16]

Third, while large conglomerates may be able to benefit from the scale and scope economies and risk diversification, operational risk may substantially increase with growing organizational complexity, inefficiencies in management and internal control, heterogeneous culture among subsidiaries, and difficulties of harmonizing risk management, etc. Indeed, large and complex financial conglomerates may no longer be able to understand exact nature of their risks.

Finally, financial consolidation and resulting dominance of a few large financial conglomerates can bring about moral hazard for financial conglomerates especially if they believe they are too big to fail (TBTF). The emergence of a small number of large financial conglomerates creates an incentive for regulatory forbearance because the failure of a large conglomerate will threaten the stability of the entire financial system. In turn, this creates a perverse incentive for financial market participants in monitoring financial conglomerates and penalizing them for taking on excessive risks. Possibilities of regulatory forbearance and weakening market discipline cause moral hazard of large conglomerates, which makes them take risks more aggressively. Note also that, based upon TBTF, risks will be under-priced for large conglomerates and this implicit subsidy provides further incentives toward additional consolidation and conglomeration. All in all, financial conglomerates may have incentives to pursue riskier investments, and more aggressive risk taking may offset the risk reduction effects potentially achievable through revenue enhancement and diversification.[17]

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scale economy in the U.S. banking industry. Numerous authors such as Hannan (1991) and Calem and Carlino (1991) also supported the positive association between bank size and market power measured, for instance, by higher lending rate, lower deposit rate, and higher profitability. Craig and Santos (1997) found that profitability increased and risk decreased after the mergers of U.S. bank holding companies. However, there also exists counter evidence. Boyd and Runkle (1993) reported that there was no significant positive relationship between Tobin's *q* and the size of US bank holding companies. Also, Akhavein *et al.* (1997) and Chamberlain (1998) reported that profitability had not significantly improved for banks that had undergone M&As.

[16] In general, empirical evidence seems to be relatively favorable for the existence of geographic diversification effect. For instance, Benston *et al.* (1995) found that the motivation for mergers in the U.S. in the 80s was mainly risk diversification effect rather than the exploitation of the deposit insurance put option value. Hughes *et al.* (1996) found that well diversified interstate banks could reduce insolvency risks. Craig and Santos (1997) found lower default risks as measured by the z-score and lower stock return volatilities for merged bank holding companies. Demsets and Strahan (1997) also argued that large banks had lower stock return volatility if their portfolios were held constant. As for the product diversification, empirical evidence is more limited. For instance, the studies of Kwast (1989), Boyd et al. (1993), and Kwan (1997), among others, imply that there exists a relatively limited potential for product diversification benefits.

[17] A group of research investigated potential effects of financial consolidation on the risk profile of large financial institutions. While Boyd and Runkle (1993) and Craig and Santos (1997) reported risk reduction effect of bank mergers, Chong (1991) found that interstate consolidation actually increased stock return volatility based upon an event study of U.S. bank mergers. Boyd and Gertler (1993) also reported a similar

2) Systemic Risk Potential

As summarized in Table 4, financial consolidation and conglomeration has potentially significant implications not only for the risk of individual conglomerates but also for systemic risk potential. As discussed above, the dominance of a small number of large financial conglomerates that are too big and few to fail and increased concentration of the financial industry around these large conglomerates could significantly increase systemic risk potential. Note also that the emergence of TBTF institutions would undermine the effectiveness of financial supervision and market monitoring. As a result, excessive risk taking and moral hazard of large financial institutions may lead to higher systemic risk potential.

Even in the absence of the incentive problems, increasing complexity of financial conglomerates would make it more difficult for regulators and market participants to comprehend risks and take early corrective actions. Belated recognition of the problems due to information opacity in turn increases incentives for regulatory forbearance, and sudden disclosure of the problems and possible disorders in the resolution of large ailing conglomerates may cause a serious system-wide disruption.

Increasing degree of interdependence among the large and complex financial conglomerates also implies higher potential for systemic risk. The Group of 10 Ferguson report (2001) indicates that areas of direct interdependency that are most associated with consolidation include mutual credit risk exposures through inter-bank loans, on and off-balance sheet activities such as financial derivatives, and from the payment and settlement relationships. The systemic risk potential may also increase if large conglomerates are simultaneously and similarly exposed to adverse shocks. While financial conglomerates are able to diversify within each group, they are getting more homogeneous as business areas as well as asset and profit structures become increasingly similar. Resulting indirect interdependencies among large conglomerates raise systemic risk potential as well.[18] Finally, financial conglomeration may aggravate the problem of systemic risk as banks expand their involvement in high risk activities that are closely tied to non-bank financial firms and capital markets. As a result, banking institutions would be more vulnerable to contagion risks from non-bank and non-financial sectors as

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incentive effect for more risk taking of large banks using U.S. data. In a similar vein, Demsets and Strahan (1997) argued that financial risks of large banks were not necessarily low as they expanded risky loan portfolios exploiting the diversification effect. De Nicolo (2000) found that default risks of large banks measured by z-score index actually increased with bank size not only for U.S. banks but also for European and Japanese banks, which implies more aggressive risk taking of large institutions. De Nicolo et al. (2003) also reported evidence that z-score index was systematically lower and thus default risk was higher for both financial conglomerates and large financial firms based upon the data for world largest 500 financial firms.

[18] G10 report (2001) suggests that interdependencies among large and complex banking organizations have increased over the last decade in the U.S. and Japan and began to increase in Europe. De Nicolo and Kwast (2002) investigated the systemic risk potential presented in the U.S. banking industry over the period of 1988-99 based upon correlation measures of stock returns of large and complex banking organizations, and found a positive consolidation elasticity of stock return correlations. They interpreted the evidence as suggesting that the systemic risk potential increased with consolidation in the banking industry. As for the cross-country studies, empirical evidence is mixed. Beck *et al.* (2003), using a logit model, found that banking crises were less likely in countries with a more concentrated banking system. On the other hand, De Nicolo *et al.* (2003) reported that the aggregate z-score index obtained from the top 5 banks in each country was significantly negatively associated with the degree of bank concentration. That is, bank consolidation is positively associated with the systemic risk potential.

well as capital markets. The use of identical brand name for affiliated non-bank subsidiaries may also erode firewall within a conglomerate and increases pressure for both managers and financial regulators to protect affiliated non-bank subsidiaries. The shift of financial savings from bank deposits to affiliated non-bank financial subsidiaries also implies de facto extension of public safety net.

2. Diagnostic Analysis of Risk Implications

1) Risk of Individual Financial Conglomerates

As discussed above, financial consolidation and conglomeration may increase or decrease financial risks of individual financial conglomerates. With the scale and scope economies financial conglomerates may be able to enhance profitability thereby reducing financial risks. However, increasing complexity in operation and incentives to take on more risks based upon moral hazard may actually increase financial risk of large conglomerates on a net basis. As there exists no comprehensive measure of financial risks readily observable, rather than directly quantifying the risks of financial conglomerates, this section focuses on the respective channels outlined in Table 4 to explore the potential implications of financial consolidation and conglomeration.

a. <u>Scope of Geographic Diversification</u>

To promote financial stability through geographic diversification, sufficient heterogeneity is required across regional markets so that idiosyncratic risks may be diversified away. To diagnose the scope of geographic diversification over business cycle, we investigated degree of correlations among regional industrial productions.

Figure 4 shows the trend in the average cross-correlation among major cities and provinces in Korea from January 1992 to September 2002.[19] The average correlation coefficient turned out to be positive and less than 0.5 except in the period of 1999.6 - 2001.6, indicating that the potential scope of geographic diversification would be in general limited. However, it is noteworthy that the correlation shows a cyclical pattern with relatively low correlations in business cycle recessions. This implies that geographically well-diversified financial conglomerates would suffer less from the adverse impact of recessions on the asset quality and profitability.

[Figure 4 here]

For more direct evidence on the scope of geographic diversification, we investigated historical profitability of Korean regional banks. As shown in Table 5, earnings of regional banks measured in return on equities (ROEs) for Jeonbuk-Kwangju, Jeonbuk-Kyongnam, Kwangju-Pusan, and Kwangju-Daegu pairs showed relatively low degree of correlations. This again implies that, while the diversification effect may not be substantial, there could be a potential benefit from the cross-regional consolidation among those regional bank pairs.

[19] At each point in time we first computed cross-correlation matrix of industrial production indices among 14 major cities and provinces using the prior 24 months industrial production time-series, and then, the average cross-correlation was obtained based on the matrix. Seasonally adjusted industrial production series were used.

[Table 5 here]

b. Scope of Product Diversification

Next we focus on the scope of diversification across different financial services industries to explore potential benefits from conglomeration. Table 6 shows the cross-correlation in historical earnings measured from the yearly return on assets (ROAs) among three major financial industries in Korea. Note that earnings correlation was relatively high between commercial bank and life insurance industries, while other industry pairs – commercial bank and securities, and securities and life insurance, showed relatively low correlations. This implies that the alliance between bank and life insurance may be able to produce a positive synergy in profitability. However, it may potentially amplify earnings variability as well.

[Table 6 here]

Figure 5 shows the cross-correlation coefficients among monthly stock price indices of bank, securities and life insurance industries.[20] It is noteworthy that the cross-correlation increased substantially after the financial crisis in 1997-98 implying a much limited potential for diversification across different financial industries in the post-crisis period.

[Figure 5 here]

c. Market Power and Increased Profitability

As discussed above, there has been a view that consolidation increases franchise value and profitability of large banks and thus lowers financial risks of consolidated banks. This view in large part hinges upon the assumption that consolidation undermines competition. However, as discussed above, recent studies report evidence that consolidation has only minor effects on competition and market power.

Figure 6 shows the trends in the deposit and lending interest rate spread of major commercial banks in Korea for new deposits and new loans extended in a month. Note that the significantly higher spread for relatively large leading banks such as Kookmin and Woori banks has actually disappeared recently as competition among banks became more intense. This implies that the market power effect of consolidation may not be significant in Korea, and hence, consolidation would not undermine competition due to increased contestability.

[Figure 6 here]

d. Risk-taking and Moral Hazard

Finally, individual financial conglomerates may have incentives to take on risks more aggressively based upon the expectation that they are too big and few to fail. Deteriorations in the monitoring capacity of supervisory authorities and financial

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[20] The cross-correlation coefficient at each point in time was computed using the previous 24 month time-series for monthly changes in log stock price indices of three financial services industries.

markets being faced with ever-increasing complexity and information opacity of financial conglomerates also encourage risk-taking incentives of TBTF institutions.

It is too early to evaluate the change in the risk-taking behavior of Korean financial conglomerates in this regard. As noted above, bank consolidation at early stage in post-crisis Korea has been driven by the government's restructuring initiative, and the banks intervened by the government had no much freedom of taking risks at their own will as they were tightly monitored by the Korean Deposit Insurance Corporation (KDIC) and Financial Supervisory Service (FSS).

A recent study on the risk of Korean commercial banks by Kim (2003) found that bank asset risk indicators such as non-current loan ratio and loan loss provision ratio were not significantly associated with bank size variables. However, Kim reported a weakly positive association between bank size and unsystematic component of stock return volatility, which is a more forward-looking measure of risk relative to the accounting measure. Kim interpreted the evidence as possibly indicating a more aggressive risk taking behavior of large banks.

2) Systemic Risk Potential

As emphasized above, financial consolidation and conglomeration may increase systemic risk potential as incentives of both large financial conglomerates and financial markets and regulatory authorities in monitoring and supervising them may also change. Even without distortions in incentives toward risk taking, the degree of systemic risk potential may increase with financial consolidation because, although the extent of diversification can increase at individual institutions, financial conglomerates tend to share increasingly similar characteristics in their business portfolios and asset structures. Following the conceptual framework outlined above and in the spirit of G10 Ferguson report (2001), this section focuses on these risk channels and explores potential impacts on the systemic risk in Korea.

a. Direct Interdependencies among Conglomerates

One such channel of direct interdependencies is mutual exposure of large banks through short-term lending. Figure 7 shows the size of call loans relative to bank equity capital for top three and top five banking institutions in Korea since 1990. As can be seen, the ratio increased systematically during the post-crisis period. The rising credit risk exposure to short-term inter-bank lending indicates a higher potential for contagion of liquidity risk and hence systemic risk potential. Note also that not only the level but also the variability of the call loan to bank equity capital ratio increased substantially after the crisis.

[Figure 7 here]

While the risk exposure of large banking institutions in short-term lending market has increased substantially, the counter-party risk exposure through financial derivative transactions shows a mixed picture. Figure 8 shows the trend in the net position of derivative transactions for top 3 and top 5 commercial banks relative to bank equity capital, which does not reveal a structural increase after the financial crisis.

[Figure 8 here]

b. Indirect Interdependencies among Conglomerates

While diversified within respective financial conglomerates, the structure of balance sheet and profit strategy may become increasingly similar across financial conglomerates. Figure 9 shows the time-series of standard deviation in the corporate loan to bank asset ratios for top 5 and top 10 commercial banks in Korea since 1990. Note that the standard deviation fell gradually for top 10 banks. For top 5 banks, the standard deviation had increased during the 1998-2001 period, but then it fell sharply from 2002. This reflects that the competition among large banking institutions has become more intense in consumer and retail banking as banks that traditionally focused on large corporate lending gradually shifted their portfolios toward more household and small and medium-sized enterprise loans.

[Figure 9 here]

Stock market also seems to perceive these increasing interdependencies among large banking institutions. Aside from direct and indirect interdependencies reflected in the bank balance sheet, more forward-looking stock market may better capture the degree of mutual exposure and linkage among conglomerates. Indeed, the herd behavior of depositors and financial market investors could provide additional source for systemic risk. Figure 10 shows the trend in the cross-correlation in daily stock prices of top 3 banks – Kookmin bank, Woori Financial Holdings and Shinhan bank.[21] Note that the cross correlations became structurally higher from the second half of 2002, which implies that large banks are increasingly simultaneously exposed to market risk and contagion, indicating heightened systemic risk potential.

[Figure 10 here]

IV. Supervision of Financial Conglomerates in Korea

As emphasized above, financial groups present the risk of contagion - the spread of financial problems among different entities within the group. As such, one entity suffering from financial unsoundness such as an impairment of capital or liquidity or an excessive build-up of risk exposures may place the soundness of the rest of the group at risk, which would otherwise be sound. Considering this, the supervision of financial conglomerates needs to take a group-wide perspective as well a solo perspective. Hence, although solo supervision of individual entities continues to be of primary importance, the complementary role of consolidated financial supervision, which assesses the impact on the safety and soundness of operations of all the entities within a group, needs to be emphasized. Indeed, the Basel Committee on Banking Supervision addressed this issue in the 1997 report on Core Principles for Effective Banking Supervision, which stated that, "*An essential element of banking supervision is the ability of supervisors to supervise the banking group on a consolidated basis.*"

In Korea, among the three types of financial groups - financial holding company, parent-subsidiary model, and mixed conglomerate, a primitive form of consolidated

[21] At each point in time, we computed cross-correlation coefficient from daily stock returns during the last one month period. The sample period began from November 2001 when Kookmin and Korea Housing Bank merged into Kookmin bank. Note also that stock prices of Woori Financial Holdings were available only from June 2002 due to the restructuring and merger process.

supervision has been applied only to financial holding companies. Although entities of parent-subsidiary model and the mixed conglomerate are subject to supervision on a solo basis, there are no group-wide regulations on capital adequacy and restrictions on intra-group transactions such as limits on credit exposure. Moreover, regulators in Korea do not have access to relevant data on non-financial subsidiaries, which may be necessary for adequate supervision of the entire group.

As part of the Korean government's initiative to meet international regulatory standards, the Financial Holding Company Act was introduced in October 2000, which is largely based upon the U.S. Bank Holding Company Act. While sharing most of key features, two acts show some minor differences.[22] Key features of the Korean financial holding company act can be summarized as follows.

First, approval of the Financial Supervisory Commission (FSC) is required for establishing a financial holding company based on the following criteria: 1) sound business plan, 2) qualification for major shareholders, 3) sound financial and management performance, 4) adequate equity swap ratio.

Second, the financial holding company must own 50% or more of the affiliates' voting securities, whereas for a listed company, controlling ownership requirement is 30%. In case an affiliate of a financial holding company seeks ownership control of another affiliate, the same requirements are applied. Financial holding companies are prohibited from owning a non-financial firm.

Third, a financial holding company can engage in all financial activities including banking, insurance and securities.

Fourth, the Financial Supervisory Commission has adopted a risk-based deduction approach proposed by the Joint Forum for Financial Conglomerate[23] to assess the capital adequacy of financial holding companies. Accordingly, the sum of the individual net equity capitals for individual group members must exceed the sum of the solo capital requirements for individual group members.

Fifth, the financial holding companies are ordered to engage in prompt corrective actions (PCAs) when the Financial Supervisory Commission deems it necessary on the basis of the ratio of net equity capital to the regulatory required capital below stipulated

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[22] In the U.S., the financial holding company – a bank holding company that, having met certain capital, managerial, and community reinvestment criteria, can engage in any financial activity pursuant to the Gramm-Leach-Blliley Act of 1999.

[23] Joint Forum, which was established in 1996 under the auspices of the BCBS, IOSCO, and IAIS, has proposed techniques that facilitate the assessment of capital adequacy on a group-wide basis for financial conglomerates and identification of double or multiple gearing, in which the same capital is used simultaneously as a buffer against risk in two or more legal entities (Joint Forum, *Capital Adequacy Principles Paper*, 1999). The Joint Forum prescribes three methods for the measurement of the group capital of financial conglomerates: building-block prudential approach, risk-based aggregation approach and risk-based deduction approach. The risk-based deduction method emphasizes the amount and transferability of capital available to the parent or other members of the group. Essentially, this approach takes the balance sheet of each company within the group and looks through to the net assets of each related company, making use of unconsolidated regulatory data. Under this method, the book value of each participation in a dependant company is replaced in the participating company's balance sheet by the difference between the relevant share of the dependant's capital surplus or deficit. Any holdings of the dependant company in other group companies are also treated in a similar manner. However, any reciprocal interest, whether direct or indirect, of a dependant company in a participating company is assumed to have zero value and is therefore to be eliminated from the calculation.

levels and the composite grade of *LOPECM* (*L*ead subsidiary, *O*ther subsidiary, *P*arent company, consolidated *E*arnings, *C*apital adequacy, and *M*anagement). PCA consists of three sets of progressively more stringent corrective procedures (see Table 8).

Sixth, the Financial Holding Company Act imposes quantitative and qualitative limits on certain kinds of intra-group transactions. An affiliate of a financial holding company cannot make an investment in other affiliate within the same group. Furthermore, an extension of credit to holding company by affiliates is prohibited. The Financial Holding Company Act imposes limits on credit extension among affiliates. An affiliate's total credit extensions to any one affiliate cannot exceed 10% of the affiliate's capital. The affiliate's total credit extensions to all affiliates combined cannot exceed 20% of the affiliate's capital. Extensions of credits among affiliates must be fully secured with qualifying collateral. The collateral must be worth 100 to 130% of the amount of the extended credit, with the percentage depending upon the type of collateral (100% for Korean government securities; 110% for municipal securities; and 130% for others). A financial holding company or any affiliate cannot purchase a low-quality asset from other affiliates.

Seventh, in order to enhance synergy effects such as cross selling of products and services among affiliates in a financial holding company, affiliates within the same group are allowed to share information on customers without customers' consent.

[Table 7 here]

[Table 8 here]

V. Policy Implications and Suggestions

Above diagnostic analysis indicates that one cannot ascertain a clear-cut relationship between financial consolidation and the risk of individual conglomerates or systemic risk potential. However, recent experiences and developments in both advanced countries and emerging market countries seem to indicate that a more consolidated financial system dominated with a few large financial conglomerates may bring about potentially significant financial instability, especially if the concentration and conglomeration create 'too-big-to-fail' problems.

As we have emphasized above, the effectiveness of existing financial regulatory system has been significantly undermined in the face of on-going financial consolidation and conglomeration. With increasingly limited ability of supervisory and monetary authorities to control financial risks and cope with financial disruption, it has become an urgent task to devise a new regulatory regime capable of preventing excessive risk-taking of financial conglomerates and regulatory forbearance of financial supervisors. Given that the regulatory system could become effective only if it is accompanied with strong market discipline, it has also become critical to create an environment where market participants have a strong incentive to monitor risks and penalize financial institutions if they take on too much risk.

In the era of financial consolidation and conglomeration, the regulatory system must be reformed toward a more market and risk-based system, and existing capital-based static financial supervision must also be shifted toward a more dynamic supervision focused on the soundness and effectiveness of management and internal control processes. Furthermore, in safeguarding the financial system, regulations on the governance and disclosure requirements for financial conglomerates need to be further strengthened in order to effectively complement official supervision with internal and market monitoring. With a view to establishing the new regulatory regime, this section addresses policy issues and puts forward a set of policy recommendations for Korea.

1. Strengthening Governance System and Risk Management Capacity of Financial Conglomerates

The first step to cope with risk-taking incentives of large financial conglomerates is to establish a transparent and accountable governance system at financial conglomerates. In the absence of a proper governance mechanism, managers of financial conglomerates may maximize their own benefit at the expense of outside stakeholders such as shareholders and depositors. The costs to investors of monitoring managers are known as agency costs, and the establishment of an effective governance system greatly reduces this agency cost.

Indeed, since 1997 financial crisis, Korean banks have revamped their internal governance systems. Non-executive outside directors, audit committee, and compliance officer systems were introduced in January 2000 to strengthen the governance and internal control procedures within banks. Furthermore, various reform measures have also been implemented to upgrade bank accounting and disclosure systems in order to facilitate bank monitoring by depositors and investors.

While the governance system and internal control mechanisms were relatively well established for individual commercial banks, as for financial conglomerates, the group governance and internal control systems have not yet been fully established. Financial holding companies have not fully come to grips with the complex organizational control and risk structures within group. For instance, as we have seen from the case of credit card industry in Korea, the failure of risk management at non-bank financial subsidiaries is easily transmitted as a financial loss to affiliated bank subsidiaries regardless of the risk management effort on the part of bank subsidiaries. Non-compliance of regulations and illegal activities at non-bank subsidiaries also cause a significant damage to the reputation of bank subsidiary as well as entire financial group that shares identical brand name.

While the governance systems at respective subsidiaries must be strengthened, parent holding companies need to establish a strong internal mechanism to identify, monitor, aggregate and effectively control overall group risk as individual risks of subsidiaries easily propagate in a non-linear way. In particular, the governance system at bank subsidiaries needs to be further strengthened in order to prevent possible transfer of risks circumventing internal firewalls among subsidiaries within a financial group. Even if bank subsidiaries are wholly owned by the parent holding company, there must be independent outside directors at the board of bank subsidiaries in order to monitor bank managers on behalf of depositors and outside investors. This is especially so when the deposit insurance backed by tax-payers money is extended to bank liabilities.

Strengthening risk management capacity at financial conglomerates has become a key task in maintaining financial stability in the face of increased uncertainty and innovative financial flows. With the contagion and non-linear propagation of risks within a financial group, it is especially important for financial conglomerates to implement a consolidated risk management at a group level. Financial holding companies must be able to identify risk exposures of the entire group and implement a system to avoid excessive concentration of risks by allocating risk limits over subsidiaries. At the same time, a transparent group risk management policy framework must be established and consistently applied in which various risk measures and targets are coordinated across holding company and its subsidiaries within a financial group.

With financial consolidation, the management of operational risks has become a particularly challenging task for large financial conglomerates. However, regardless of their increasingly complex scope of businesses, the management of operational risks at Korean financial conglomerates still remains at a rudimentary level. As recently suggested by the Basel Committee (2003), an effective operational risk management framework requires, as crucial elements, clear strategies and oversight by the board of directors and senior management, a strong operational risk and internal control culture including clear lines of responsibility and segregation of duties, effective internal reporting, and contingency planning. Financial conglomerates must establish clear policies and processes to identify, measure and control operational risks, and the framework must be consistently implemented at both group and subsidiary levels.

2. Risk-based Consolidated Supervision of Financial Conglomerates

Given the increased potential for systemic risk in the presence of large and complex financial conglomerates, more intense and sophisticated supervision is necessary for those potentially ‘too-big and few-to-fail’ institutions. Effective devices must be introduced to avoid inadvertent extension of public safety net to cross-sectoral activities such as investment banking and other non-bank financial services. Large financial conglomerates are often important players in capital markets, and hence, failures of financial conglomerates present potentially systemic vulnerabilities in direct financing as well as in indirect financing. As such, ensuring financial conglomerates to maintain a sound asset quality and robust capital base is crucial to the stability of entire financial system.

For timely and effective monitoring of risks at large financial conglomerates, the supervisory framework must be improved to risk-based consolidated supervision. With traditional static capital-based approaches, it is almost impossible to evaluate accurately the development and propagation of risks implied in the cross-border provision of financial services and market activities of complex financial conglomerates. Risk-based consolidated supervision is an essential element of effective prudential regulation in the era of financial consolidation. Consolidated supervision is based upon consolidated information about the entire financial conglomerate and enables systematic monitoring of risks implied in banking and non-banking activities of subsidiaries from a joint perspective. Consolidated accounting and prudential regulatory measures are integral parts of consolidated supervision.

As described above, currently in Korea, consolidated financial supervision has not yet been fully introduced. Only a rudimentary framework is currently applied to financial holding companies and no consolidated framework has been introduced for other type of financial groups. For instance, a key prudential supervisory measure is capital adequacy regulation. The capital adequacy regulation for financial holding company groups in Korea is currently based upon the required capital. That is, the net sum of equity capitals of the holding company and its subsidiaries must be greater than the simple sum of regulatory capital requirements for respective group member subsidiaries.

Following the spirit of pillar 1 of the new BIS Basel accord, capital adequacy standard for financial conglomerates must be more tightly linked with risk capital aggregated for the entire financial conglomerate. The amount of risk for a financial group could be substantially different from the simple sum of risks at its subsidiaries as we have shown in the above diagnostic analysis. The capital adequacy standard for financial conglomerates must be able to reflect potential contagion and propagation of risks within group, and the first step required in this regard is to adopt a framework based upon the group BIS capital ratio computed from fully consolidated financial statements of financial conglomerates.

For an effective consolidated supervision of financial conglomerates, financial supervisors must be equipped with relevant capabilities and organizational structure as emphasized by pillar 2 of the new Basel accord. Special supervisory units for on-going off-site surveillance of financial conglomerates need to be established, and monitoring and early warning systems must be strengthened. In addition, the supervisors must be able to assess the effectiveness of internal risk management and capital allocation approaches of financial conglomerates.

3. Minimizing 'Too-big-to-fail' and Regulatory Forbearance

As discussed above, large financial conglomerates may engage in moral hazard and aggressive risk-taking given the possibility of regulatory forbearance and expectations of 'too-big-to-fail'. An important way to ensure that financial supervisors do not engage in regulatory forbearance is through strict implementation of prompt corrective action provisions, which require supervisors to intervene as early as possible. Prompt corrective action is crucial to preventing failures of financial conglomerates because it creates incentives for financial conglomerates not to take on too much risk in the first place, recognizing that if they do so, they are more likely to be subject to regulatory actions.

In Korea, prompt corrective action provisions were first introduced in April 1998.[24] With the enactment of the *Financial Holding Company Act*, a similar prompt corrective action provision was formally introduced for financial holding companies in October 2000. The prompt corrective action for financial holding company groups is currently based upon the group net equity capital to required capital ratio and the *LOPECM*-based evaluation results.[25] According to the provision, the Governor of the Financial Supervisory Service must recommend, require, and order financial holding companies to take necessary management improvement measures if the ratio of net equity capital to the required capital falls below 100%, 75%, and 25%, respectively. As noted above, the criteria may not fully reflect risks of financial conglomerates, and hence, the criteria for prompt corrective action for conglomerates must be changed into the one based upon the group BIS capital ratio.

Note also that a key element in making prompt corrective action work is the mandatory nature of the scheme, which makes it a credible threat for financial institutions. Hence, discretionary applications of the provision must be minimized. In the case of large financial conglomerates, systemic risk could be a concern when strictly applying the prompt corrective action. However, this systemic risk concern itself brings about moral hazard for

[24] Prompt corrective action provisions were first introduced in April 1998 for commercial banks and merchant banking corporations, and then subsequently extended to securities and insurance companies in June 1998 and to investment trust management companies and credit specialized financial companies in 2001. According to the provision, for instance, banks are classified into five groups by the BIS capital ratio and the CAMELS-based evaluation results of bank management CAMELS is the evaluation criteria for bank performance and denotes capital adequacy, asset quality, management, earnings, liquidity, and sensitivity to market risk, respectively. The supervisory authority could impose various corrective measures whenever banks' BIS ratios and management evaluation grades fall below predetermined criteria.

[25] LOPECM denotes lead subsidiaries, other subsidiaries, parent, earnings consolidated, capital adequacy consolidated, and managerial composite.

large financial conglomerates. Moreover, the expectation of future bailouts causes additional distortions in fund flows and increases market power of large financial groups, which in turn results in de-facto government subsidies to large conglomerates with taxpayers' money as collateral. As argued by Hahm and Mishkin (2000), it is important to recognize that, although large financial conglomerates may be too big to liquidate, they can be closed with losses imposed on uninsured creditors. Except under very unusual circumstances, the least-cost resolution procedure must be strictly applied imposing loss to uninsured depositors and creditors.[26]

In a related context, there must be strict limitations on within financial group transactions to prevent financial conglomerates from transferring deposit insurance subsidy extended to bank subsidiaries to other affiliated non-bank subsidiaries. As argued by Mishkin (1999), financial consolidation opens up opportunities to reduce the scope of deposit insurance and limit it to narrow bank accounts, substantially reducing the moral hazard. The deposit insurance fund backed by tax payers' money must be used only to protect insured depositors of bank subsidiaries and must be effectively insulated from bailing out other subsidiaries.

4. Strengthening Disclosure Requirements and Market Discipline

Note that the increasing complexity of the asset portfolio and business structures of large financial conglomerates substantially attenuates both financial authority's supervisory capacity and monitoring ability of outside stakeholders. An answer to these problems is to have the financial market discipline financial conglomerates by providing more transparent information on the management of large financial group and by establishing a more market-based supervisory framework. In other words, it is necessary to establish a strong market discipline as a complement to official supervision.

Disclosure requirements are essential for market participants to have relevant information, which allows them to monitor financial institutions and keep them from taking on too much risk. A recent study by the U.S. Federal Reserve Board indicates that disclosure requirements for large complex banking organizations need to be strengthened in the areas such as securitizations and loan sales, internal asset risk rating and loan loss reserve calculations, credit concentrations by counterparty, industry, or geography, market risks, and risks by legal entity and business lines (Board of Governors of the Federal Reserve System 2000). In a similar vein, public disclosure requirements need to be further strengthened for large financial conglomerates in Korea.

With the effort to promote information transparency, supervisory authorities need to introduce more market-based regulatory measures, such as requiring financial conglomerates to issue subordinated debt. Subordinated debt with a ceiling on the spread between its interest rate and the interest rate on government bonds could become an effective disciplinary tool. If a financial group is taking on too much risk, it is unlikely to be able to issue subordinated debt within the designated spread cap. Hence, compliance with the subordinated debt requirement would be a direct way for the market to force

[26] In December 2000, the Korean government enacted the *Special Act on Public Fund Management*, according to which, the Public Fund Oversight Committee was established under the Ministry of Finance and Economy. While the principle of the least-cost resolution was formally introduced in the act, it is still possible that the principle can be applied in a discretionary way by the judgment of the committee over systemic risk concerns. To prevent regulatory forbearance for large financial conglomerates, the conditionality for systemic risk exception must be explicitly set out and strengthened further.

financial conglomerates to limit their risk taking. Alternatively, differential deposit insurance premium could be charged according to the interest rate on the subordinated debt. Information about whether financial conglomerates can issue subordinated debts and the interest rate on the subordinated debt itself can help the public evaluate supervisors' action, which in turn reduces the scope of regulatory forbearance.

5. Early Recognition and Effective Management of Systemic Risk: Coordination among the MOFE, FSC and BOK

As emphasized above, in the era of financial consolidation and conglomeration, early detection and prevention of systemic crisis is crucially important. To establish an effective preventive mechanism, it is critical to have an institutional channel for communication, cooperation, and check and balance among related regulatory authorities – especially among the financial supervisory authority, central bank, and the ministry of finance and economy.[27]

While it is financial supervisor's responsibility to maintain the soundness of financial institutions, it is rather a controversial issue who must bear the responsibility for the development and realization of systemic risk. It is especially true when imprudent macroeconomic policies cause unusual fund flows in the financial system and bring about deterioration of asset qualities for financial institutions. For instance, monetary policy of the central bank and foreign exchange policy of the finance ministry are more or less directly linked with credit boom-bust cycles in emerging market countries. Also the prudential regulation policy of the supervisory authority is often influenced by the stabilization policy of the finance ministry, which seems to be more politically concerned. Another area that calls for a tight coordination among the related regulators is the payment and settlement system. Disruptions in the payment and settlement system could be a potentially significant source of systemic risk. The central bank, which is the overseer of the payment and settlement system, must be closely coordinate with the supervisory authority as the failure of large conglomerates may cause a significant disruption for the system.

In Korea, the Ministry of Finance and Economy (MOFE) is ultimately responsible for the stability of the entire financial system. However, there must be operational institutional mechanisms in which financial policies of the MOFE can be coordinated with the prudential regulation and supervisory policies of the Financial Supervisory Commission (FSC) and the monetary policies of the Bank of Korea (BOK). The institutional scheme must be able to systematically identify and monitor potential sources and propagation channels of systemic risk developments, and provide early warning signals for policy makers and financial institutions.

In order for this mechanism to work effectively, an official committee on macro financial supervision needs to be established, where the minister of MOFE, chairman of the FSC, and the governor of the BOK meet on a regular basis and share timely information among the regulatory authorities. For instance, the supervisory authority' institutional micro supervision information must be shared with the central bank's macroeconomic financial market information.

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[27] Kim (2004) provided a comprehensive and detailed case study of the recent failure of credit card industries in Korea and emphasized the importance of a cooperative and mutually accountable system among public regulatory bodies such as the Ministry of Finance and Economy, Bank of Korea, Financial Supervisory Service and the Korea Deposit Insurance Corporation.

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<Table 1> Financial Institutions Closed or Merged
(As of June 2003, unit: number of institution)

	Total No. of Institutions (end-1997) (A)	Type of Resolution					New Entry	Total No. of Institutions (end of June 2003)
		License Revoked	Merger	Others[1)]	Subtotal (B)	Ratio (%) (B/A)		
Banks	33	5	10	-	15	45.5	1	19
Merchant Bank Corporations	30	22	6	-	28	93.3	1	3
Securities Companies	36	5	3	2	10	27.8	18	44
Insurance Companies	50	8	6	2	16	32.0	13	47
Investment Trust Companies	31	6	1	-	7	23.3	9	32
Mutual Savings and Finance Companies	231	100	27	1	128	55.4	12	115
Credit Unions	1,666	2	106	463	571	34.3	9	1,104
Leasing Companies	25	9	1	1	12	48.0	4	17
Total	2,101	157	161	469	787	37.5	67	1,381

Note: 1) Includes dissolution and asset transfers to bridge institutions.
Source: Public Fund Management Committee, Ministry of Finance and Economy, *White Paper on Public Fund*.

<Table 2> Affiliates of Financial Group in Korea
(As of September 2003, unit: number of institution)

			Bank	Insurance	Securities	ITC	Card	Others	Total
Financial Conglomerate	Financial Holding Company	Woori	3	0	1	1	0	0	5
		Shinhan	3	1	1	2	1	1	9
		Dongwon	0	0	1	1	0	2	4
		Subtotal	6	1	3	4	1	3	18
	Parent-Subsidiary Model	Banking	8	2	2	4	1	8	25
		Insurance	0	3	1	2	0	1	7
		Securities	0	1	9	7	0	3	20
		Subtotal	8	6	12	13	1	12	52
Mixed Conglomerate		Samsung	0	2	1	1	1	2	7
		LG	0	0	1	1	1	2	5
		SK	0	1	1	1	0	1	4
		Others	0	7	7	6	2	13	35
		Subtotal	0	10	10	9	4	18	51
Total			14	17	25	26	6	33	121

Source: Choi (2004), Establishment of the Korean Supervisory system for Financial Conglomerates.

<Table 3> Fiscal Support for Financial Restructuring (11/1997 ~ 6/2003)

(Unit: trillion won)

	KDIC and Others				KAMCO	Total
	Recapitalization	Capital Contribution	Deposit Repayment	Purchase of Assets	Purchase of NPLs	
Banks	34.0	13.7	0	14.0	24.6	86.2
NBFIs	26.3	3.3	29.8	0.3	14.5	74.2
Merchant Banking Corporations	2.7	0.2	17.2	0.0	1.6	21.7
Insurance Companies	15.9	2.9	0.0	0.3	1.8	21.0
Securities and ITCs	7.7	0.0	0.01	0.0	8.5	16.2
Mutual Savings Banks	0.0	0.2	7.9	0.0	0.2	8.2
Credit Cooperatives	0.0	0.0	4.7	0.0	0.0	4.7
Others	0.0	0.0	0.0	0.0	2.4	2.4
Total	60.3	17.0	29.8	14.3	39.1	160.4

Source: Public Fund Management Committee, Ministry of Finance and Economy, *White Paper on Public Fund*.

<Table 4> Financial Consolidation and Financial Risks

Types of Risk	Channels	Factors
Financial Risk of Individual Conglomerate	Profitability and Cost Efficiency	- Scale and scope efficiencies - Market power rents
	Earnings Variability	- Geographic diversification - Product diversification
	Operational Risk	- Complexity in business - Organizational diseconomies - Difficulties in monitoring / control - Heterogeneity in culture - Difficulties of harmonizing risk management
	Risk Preference	- Moral hazard based upon TBTF
Systemic Risk Potential	Effectiveness of Supervision, Monitoring and Market Discipline	- Regulatory forbearance - Concentration and difficulty of orderly workouts - Opacity and information asymmetry
	Direct Interdependencies	- Short-term inter-bank lending - Medium and long-term loans - OTC derivatives transactions
	Indirect Interdependencies	- Homogeneous balance sheet structure - Homogeneous business / profit structure - Common exposure to market risks
	Contagion from Integration, Alliance and Reputation, De facto Extension of Public Safety Net	- Risks from non-bank subsidiaries - Risks from strategic alliance with non-financial companies - Exposure to foreign and capital market shocks

<Table 5> Cross-Correlations in the Profitability of Regional Banks

(ROAs / ROEs, 1991-2002)

	Cheju	Jeonbuk	Kwangju	Kyongnam	Pusan
Jeonbuk	0.93 / 0.82				
Kwangju	0.89 / 0.67	0.78 / 0.23			
Kyongnam	0.82 / 0.86	0.69 / 0.48	0.90 / 0.93		
Pusan	0.90 / 0.91	0.87 / 0.86	0.86 / 0.44	0.80 / 0.70	
Daegu	0.93 / 0.93	0.90 / 0.90	0.87 / 0.46	0.81 / 0.71	0.99 / 0.99

<Table 6> Cross-Correlations in ROAs of Financial Industries (1991-2001)

	Commercial Banks	Securities Companies
Securities Companies	0.1014	
Life Insurance Companies	0.8755	0.0882

<Table 7> Key features of Financial Holding Companies in Korea and the U.S.

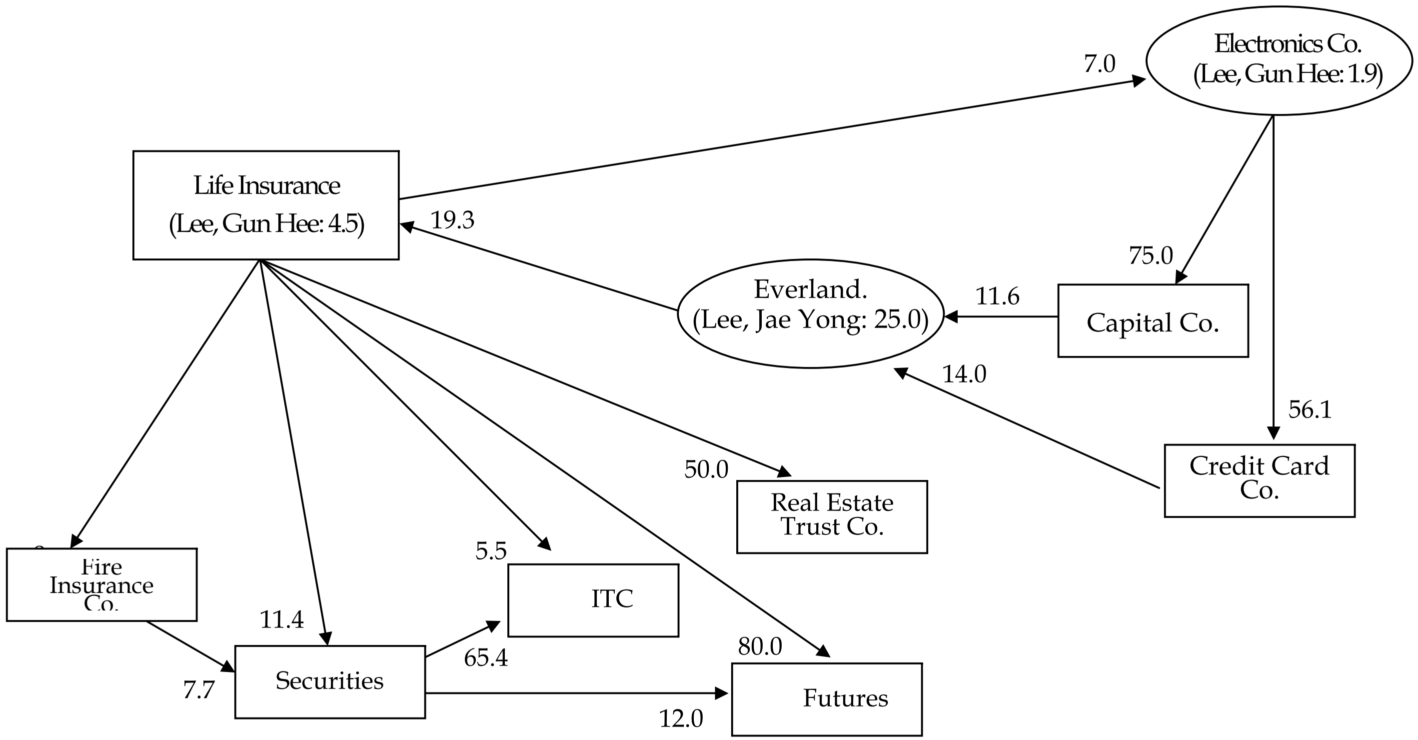
	Korea	United States
Prior approval and standards of authorization	□ Approved by FSC □ Criteria: 1) sound business plans, 2) requirements for being major shareholders, 3) sound financial and management performance, 4) adequate equity swap ratio	□ Approved by FRB □ Financial holding company is a bank holding company that, having met certain 1) capital, 2) managerial, and 3) community reinvestment criteria
Criteria for Controlling Ownership in Subsidiaries	□ FHC must own 50% or more of the affiliates' voting shares (30% or more for a list company) □ In case an affiliate of a FHC seeking ownership control of another affiliate, the requirements are same □ Financial holding companies are prohibited from owning a non-financial firm.	□ More broad interpretation of criteria for being subsidiaries 1) Any company 25% or more of the affiliates' voting securities, 2) any company the election of a majority of directors is controlled in any manner by holding company, 3) any company with respect to the management of which holding company has the power, directly or indirectly, to exercise a controlling influence, as determined by the FRB.
Permissible Activities	□ All financial activities including banking, insurance, and securities, etc.	□ Activities, FRB has determined to be 1) "financial in nature," 2) "incidental to such financial activity," or 3) "complementary to a financial activity" and posing no "substantial risk to the safety and soundness of depository institutions or the financial system generally"
Capital Adequacy	□ The sum of the individual net equity capital for individual group members should exceed the sum of the solo capital requirements for individual group members.	□ BIS capital adequacy ratio for the entire group is formulated on a consolidated basis
Prompt Corrective Action (PCA)	□ The FHCs are ordered to engage in PCAs when the FSC deems it necessary on the basis of the ratio of equity capital to the requisite capital below stipulated level and the composite grade of LOPECM.	□ The PCA applies only to FDIC-insured depository institutions and not to bank holding companies.
Restrictions on intra-group transactions	□ Affiliates are prohibited from investment between affiliates in the same group and extending credit to the FHC. □ An affiliate's total credit extension with any one affiliate cannot exceed 10% of the affiliate's capital. The affiliate's total credit extensions with all affiliates combined cannot exceed 20% of the affiliate's capital. □ Extension of credit among affiliates must be fully secured with qualifying collateral, which must be worth 100 to 130% of the amount of the extension of credit, with the percentage depending on the type of collateral (100% for Korea government securities; 110% for municipal securities, 130% for others) □ A FHC or any affiliates cannot purchase a low-quality asset from an affiliate.	□ A Bank's total covered transactions1) with any one affiliate cannot exceed 10% of the bank's capital. The bank's total covered transactions with all affiliates combined cannot exceed 20% of the bank's capital. □ Most covered transactions must be fully secured with qualifying capital. The collateral must be worth 100 to 130% of the covered transaction, with the percentage depending on the type of collateral: 100% for US government securities; 110% for state and municipal securities; 120% for other qualifying debt, and 130% for stock, leases, or other real or personal property. □ A bank cannot purchase a low-quality asset from an affiliate
Information sharing	□ Affiliates within the same group are allowed to share personal information on customers without consent.	□ Affiliates within the same group are allowed to share personal information on customers without consent. □ Consumers have the right to opt out of having their information shared with certain third parties

Note: 1) A bank engages in a covered transaction when it 1) extends credit to, or for the benefit of, an affiliate; 2) issues a guarantee for the benefit of an affiliate; 3) purchases assets from an affiliate; 4) accepts securities issued by an affiliate as collateral for an extension of credit, including an extension of credit to a third party; 5) invests in securities issued by an affiliate.

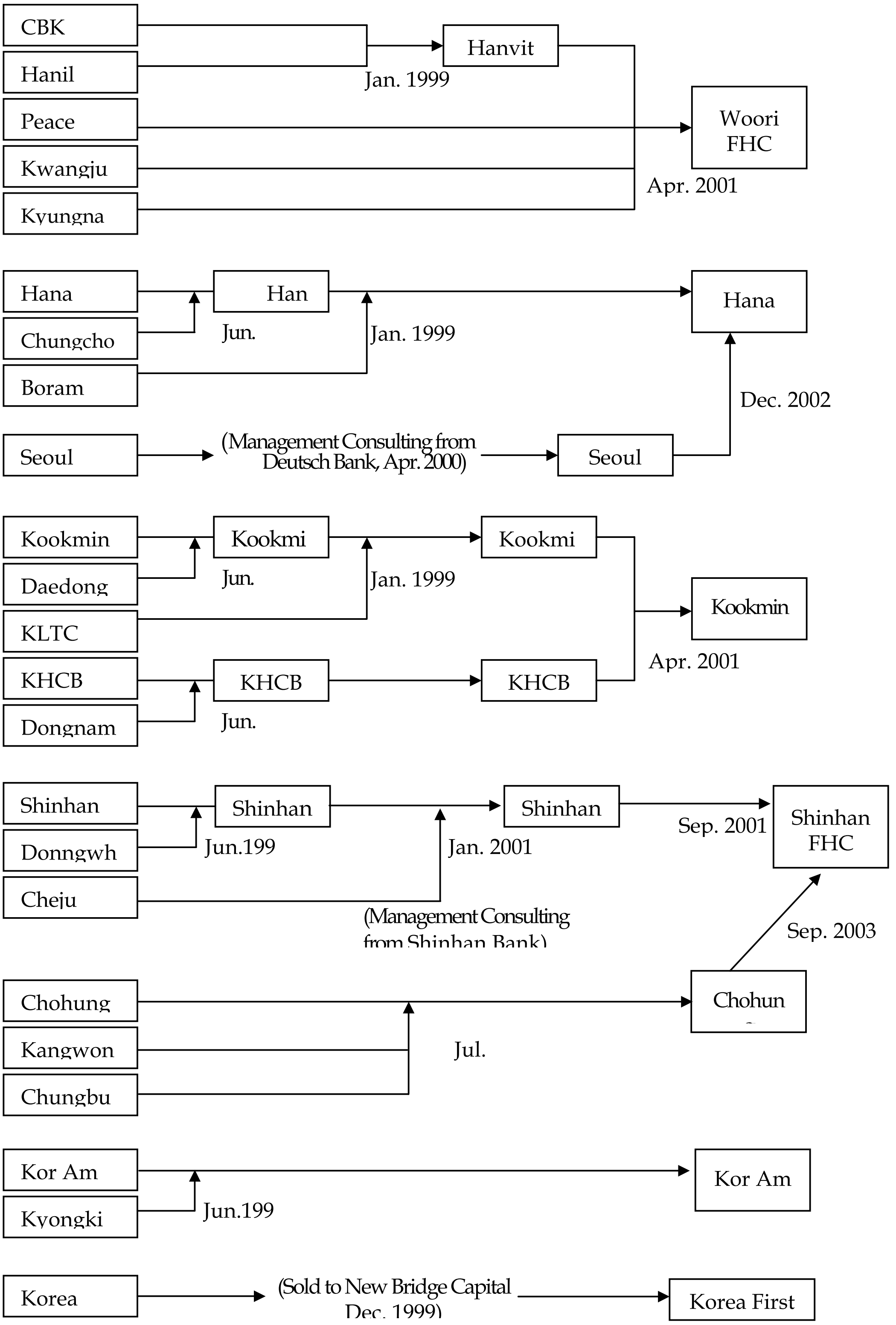
<Table 8> Prompt Corrective Actions for Financial Holding Company in Korea

Measures (Decision maker)	Conditions when measures are taken		Detailed Measures
	Ratio of Equity Capital to Regulatory Required capital	Management Performance	
Management Improvement Recommendations (Governor of FSS)	Below 100%	□ Above the third grade in LOPECM, but below the fourth grade in the evaluation item of "parent company" or capital adequacy □ It seems evident that the above cut-off conditions are not satisfied because of the large financial debacle	□ Improvement in personnel management and organizational operation □ Cost reduction □ Restrictions in fixed asset investment, entry to new business, and new financial investment □ Disposal of insolvent assets □ Recapitalization □ Restriction of dividend payout □ Arrangements of special loan loss provisioning
Management Improvement Requirements (FSC)	Below 75%	□ Below the fourth grade in LOPECM □ It seems evident that the above cut-off conditions are not satisfied because of the large financial debacle	□ Retrenchment of organization □ Restriction of holding risky assets and disposal of assets □ Requirement of management turnover □ Partial suspension of business operation □ Restructuring of subsidiaries □ Planning of M&A, or transfer of business entirely or partially
Management Improvement Orders (FSC)	Below 25%	□ Unsound financial Institutions specified in The Act Concerning Structural Improvement of Financial Industry	□ Write-off of shares □ Prohibition of execution by management and nomination of manager □ Merger □ Full or partial transfer of business operation □ Third-party takeover of the FHC □ Suspension of business operation for less than 6 months □ Full or partial transfer of contracts

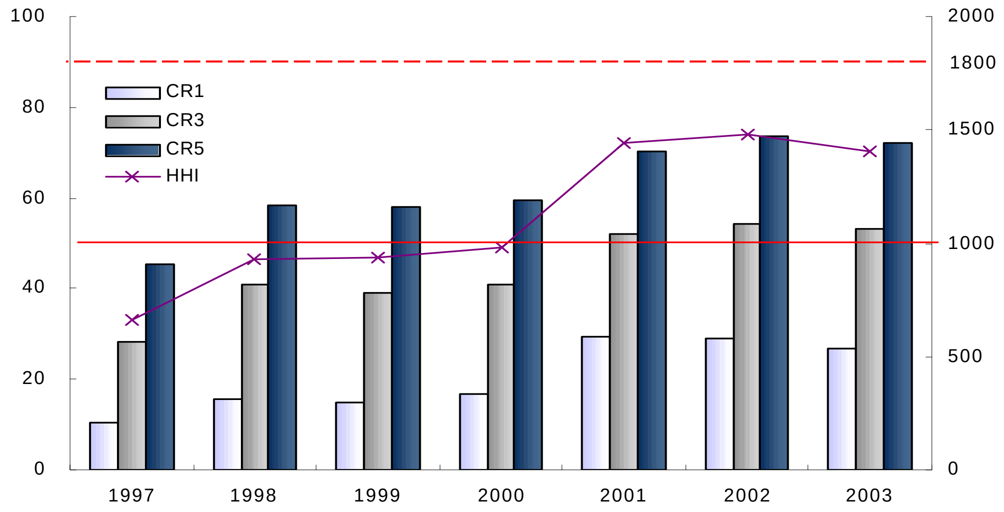
<Figure 1> Ownership Structure of Samsung Group



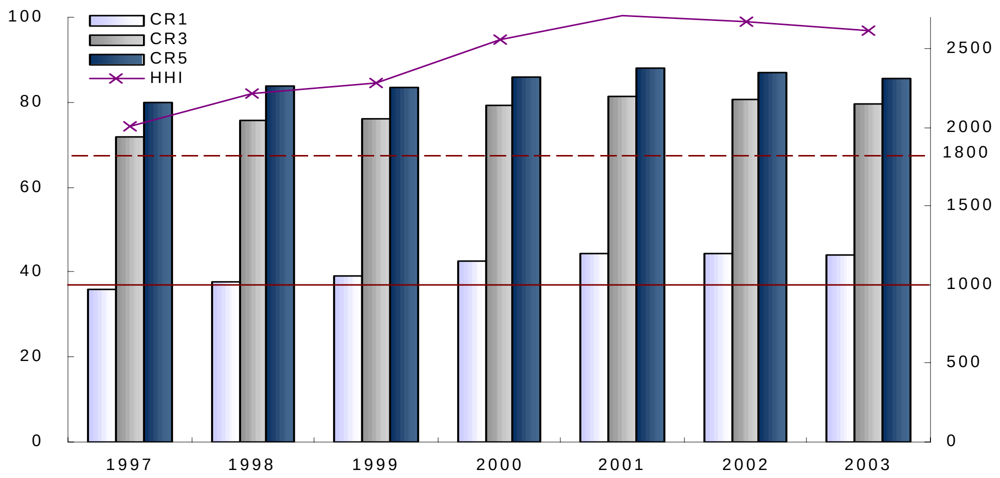
<Figure 2> Consolidation of Korean Banking Industry Following the Crisis



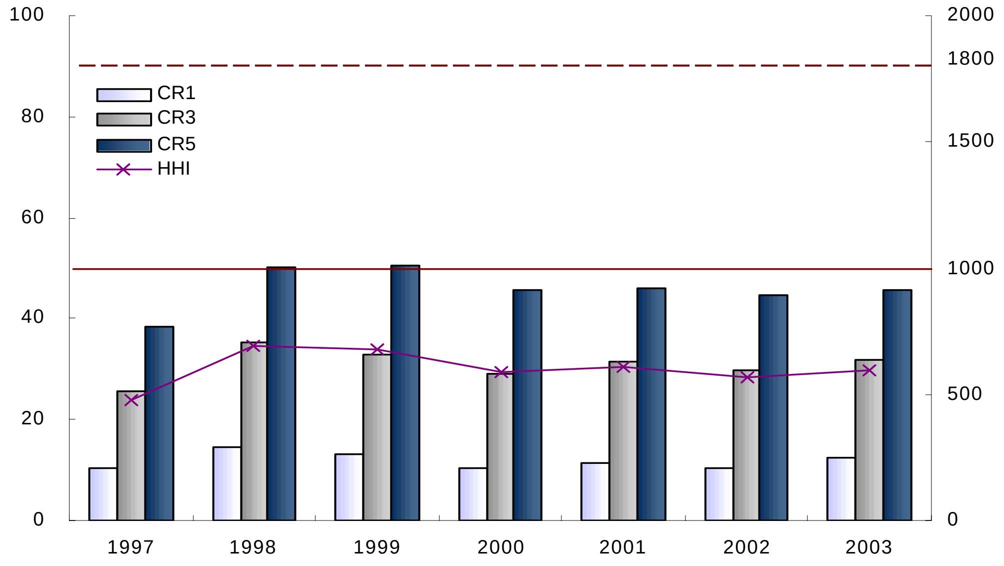
<Figure 3-1> Concentration Ratio of the Korean Banking Industry (based on Assets)



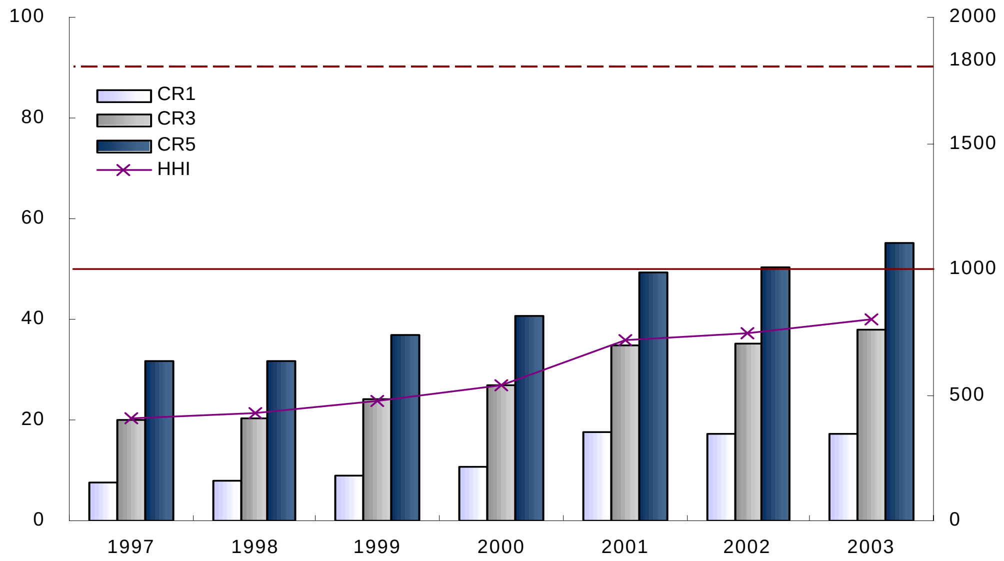
<Figure 3-2> Concentration Ratio of the Korean Life-Insurance Industry (based on assets)



<Figure 3-3> Concentration Ratio of the Korean Securities Industry (based on assets)

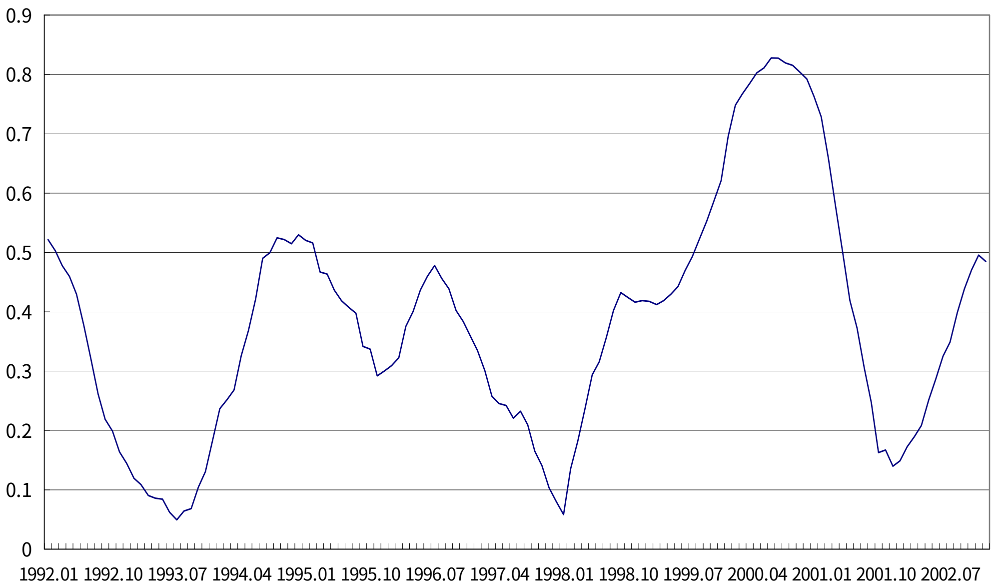


<Figure 3-4> Concentration Ratio of the Korean Financial Group (based on assets)

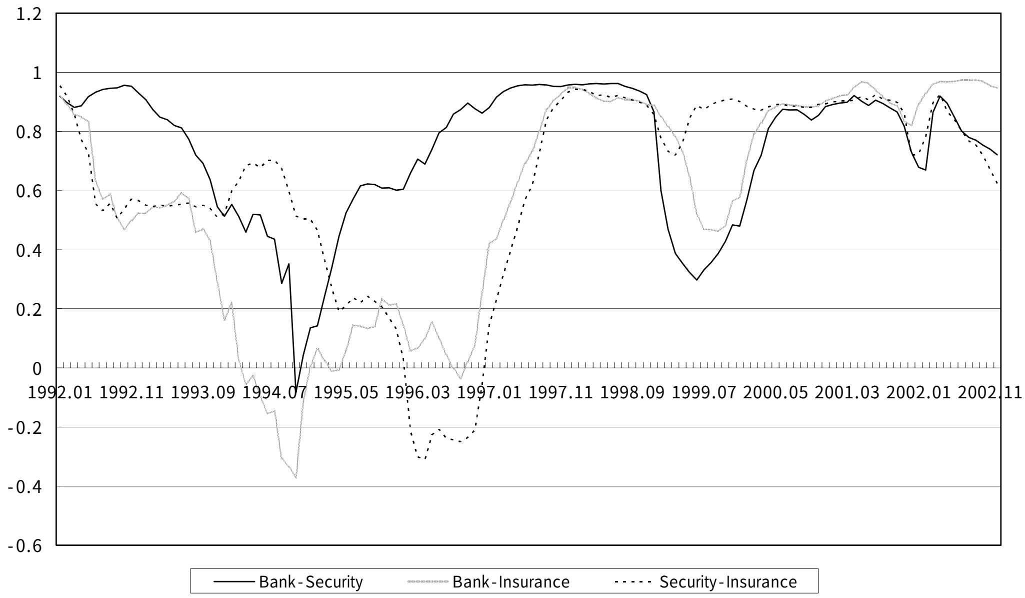


Source: Bank of Korea (2004)

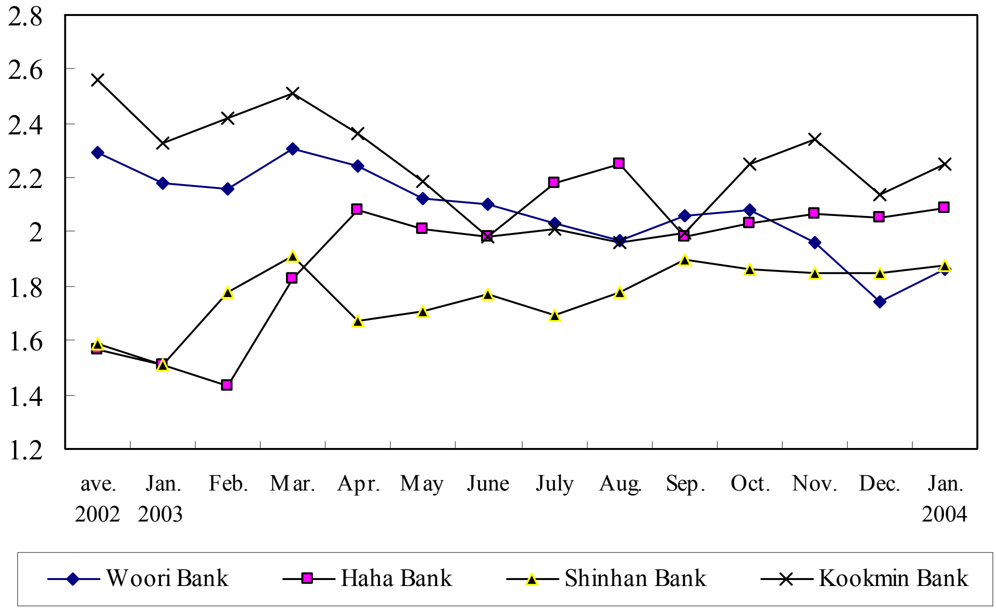
<Figure 4> Average Cross-Correlation in Regional Industrial Productions



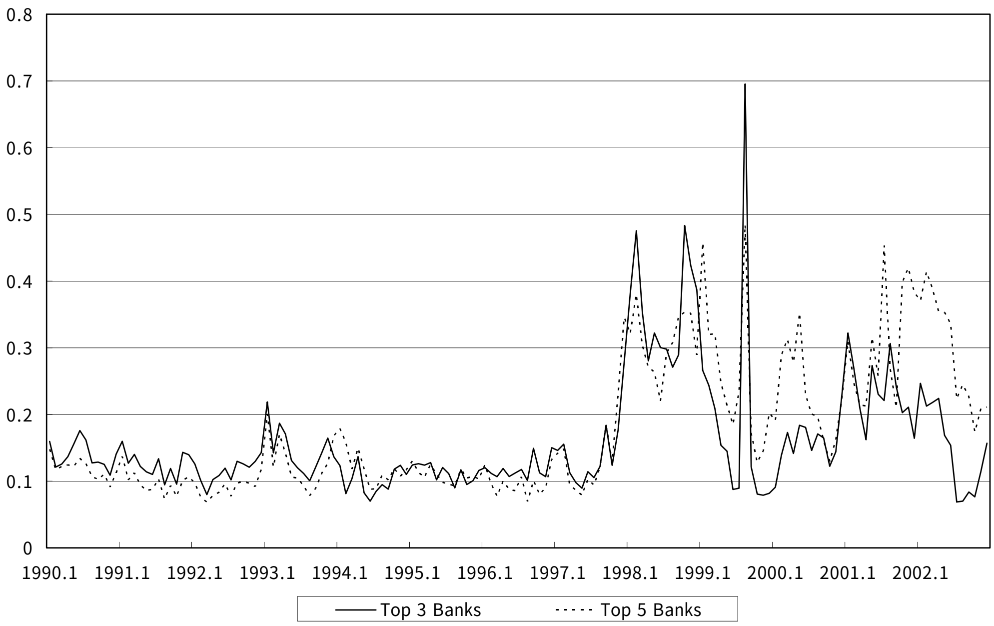
<Figure 5> Cross-Correlations in Stock Price Indices of Financial Industries



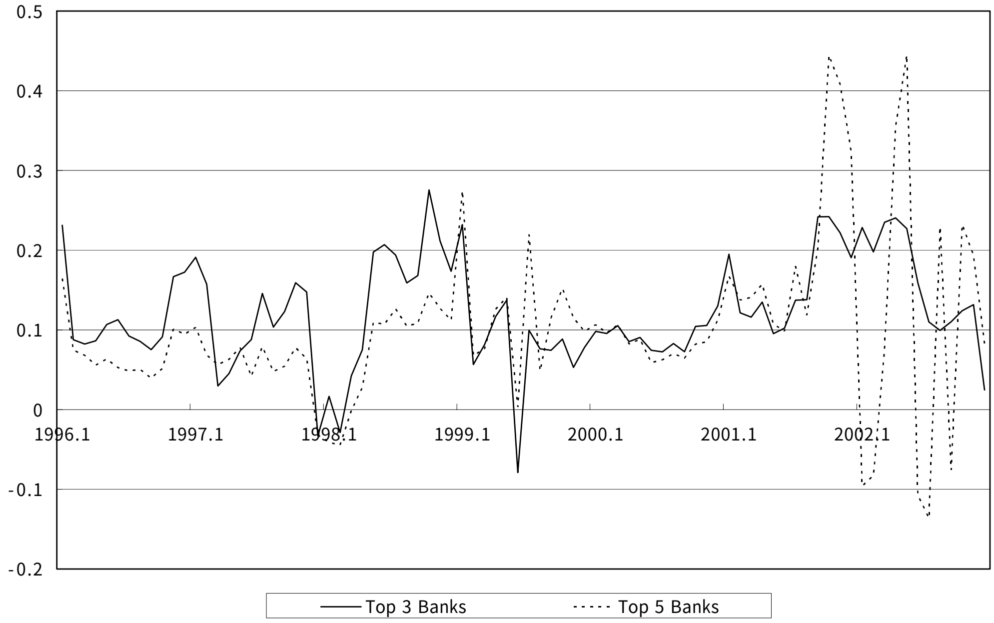
<Figure 6> Deposit-Lending Interest Rate Spreads of Major Banks



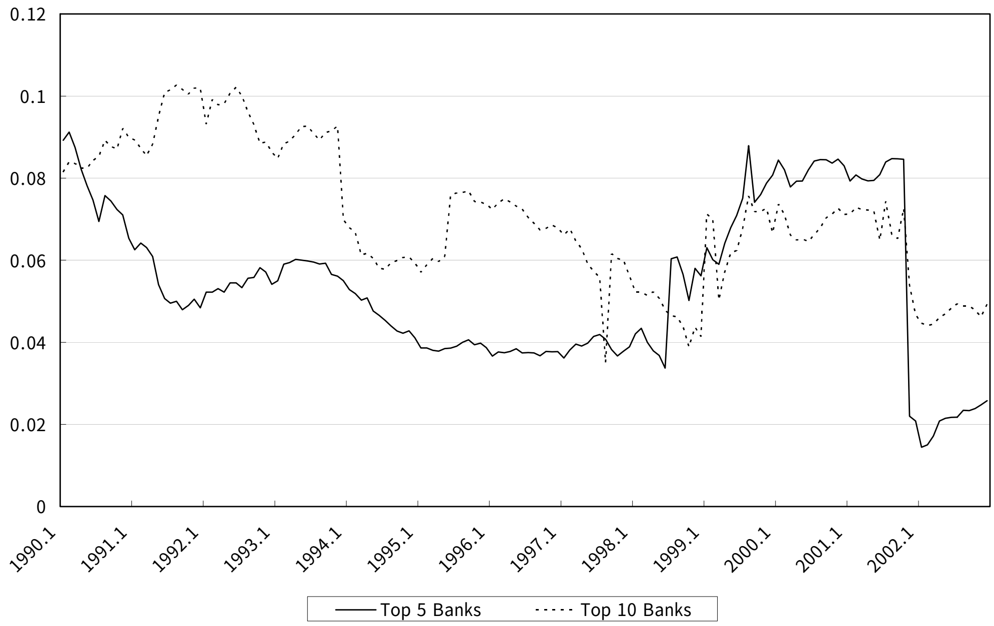
<Figure 7> Call Loan to Bank Equity Capital Ratios



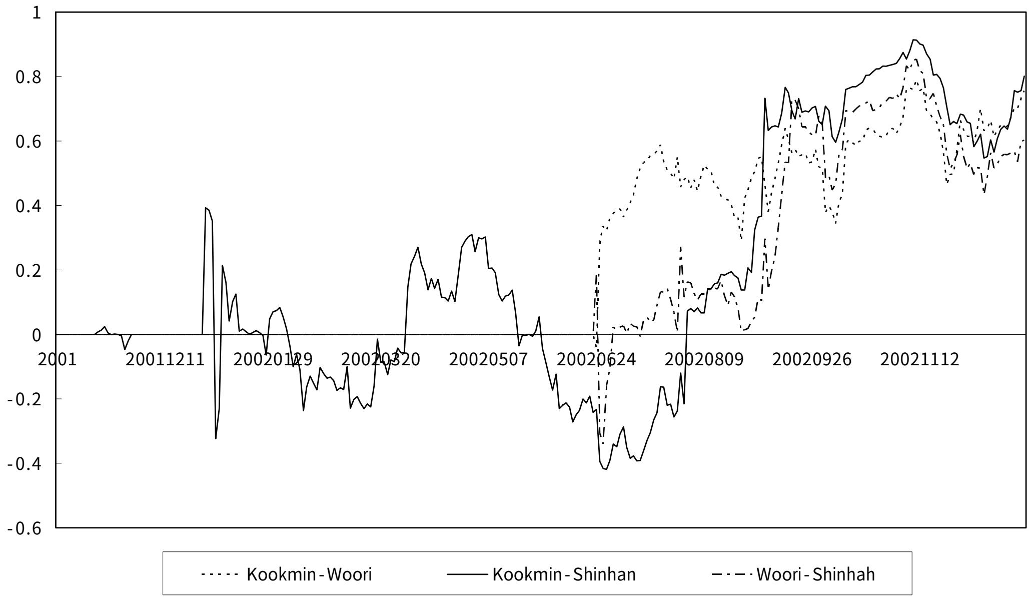
<Figure 8> Net Positions in Financial Derivative Transactions



<Figure 9> Standard Deviations in Corporate Loan to Bank Asset Ratios



<Figure 10> Cross-Correlations in Daily Stock Price Returns of Top 3 Banks



Comments on "Risk and Supervisory Challenges of Financial Conglomerates in Korea"

Kun Ho Lee
KDI School of Public Policy and Management

The paper first presents a brief summary of consolidations and conglomerations in the post-crisis Korean financial industry, and shows changes in measures (CR and HHI) of concentration. The paper then investigates whether increased concentration has resulted in increase of systemic risk in the industry. It turns out that empirical evidences are somewhat inconclusive, but the paper argues that experiences in other countries are consistent with the hypothesis that consolidation and conglomeration cause significant increase in financial instability. The paper concludes with some policy implications and suggestions to cope with such negative implications of a build-up of concentration in the financial industry.

A reader may find the diagnostic analysis of risk implications presented in sub-section III-2. The analysis is not really a test of any hypothesis in statistical sense, but it provides several interesting ideas on testing whether systemic risk in the financial industry had really increased after the consolidation frenzy in post-crisis Korea. The paper's failure to reach a decisive conclusion on this part may be explained by the following.

The number of commercial banks in Korea has never been large, and several large banks dominated the industry even before the crisis. 6 largest banks (CHB, CBK, KFB, Hanil, Seoul, and KEB) dominated the banking industry, and these banks were almost identical both in composition of credit portfolio and in customer bases. KB and KHCB were not regarded as major players despite significant shares in the retail credit market. Shinhan, Hana, and Hanmi were growing rather fast, but were not regarded as major players, either. Small regional banks did not have any real impact in the market. The point is that systemic risk in the banking sector was very large before the crisis. As a matter of fact, the 1997 crisis was the very realization of this huge systemic risk.

As of the end of 2003, there were 5 large banks - KEB, Woori, Shinhan(+CHB), Hana, and Hanmi. KFB and KEB were there, but these two banks were not generally regarded as major players. A small number of regional banks survived. KB now was the sum of KB, KHCB and some of the small players in the pre-crisis period. Similarly, we have Woori=CBK+Hanil+small banks, Hana=Hana+Seoul, and CHB=CHB+small banks. Moreover, KB now was no more a retail-dominated bank, and as a result, the 5 largest banks had become similar in portfolio compositions and in customer bases. There were smaller number of players in the banking sector, and 5 large and almost-one-of-a-kind banks dominated. There were a higher degree of concentration, but this might not have lead to an increase in systemic risk simply because the level of systemic risk had already been very high before the crisis.

To conclude, an intelligent question to be asked may have been whether systemic risk were too large before the crisis, not whether this risk had been increasing after the crisis. If it were, next question to be answered should be whether the risk had been reduced, not increased, during the post-crisis period. Though inconclusive whether there had been an increase, analyses in the paper seem to suggest that there had been no reduction during the post-crisis period. Policy implication and suggestions of section V may still be important.

CHAPTER 2-3

Risk and Capital Regulations on Financial Institutions in Korea: With a special reference to measuring credit risk of SME loans

by
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Abstract

This paper examines current issues regarding capital regulation in Korean banking industry, focusing on the capital requirement framework for SME exposures. By constructing a multi-factor risk model using large samples of Korean SMEs, the results of the empirical analysis show that that the correlation of SME exposures decreases as the asset size of the obligor firm increases. This indicates that the positive relationship between the obligor's size and credit correlations assumed using the risk-weight formula proposed by the Basel Committee cannot be supported in Korea, and financial regulators should be careful when treating small business exposures as retail exposures. Our results also suggest that financial supervisors need to deeply consider the industrial composition of SME exposures, when adopting the New Accord and proposed special treatment of SME exposures using the risk-weight formula. In particular, regulators may require banks to have a higher level of capital for SME portfolios which are concentrated with firms from the construction or service industry.

I. Introduction

In a global financial market, many emerging market financial systems face serious challenges stemming from two separate but closely related issues. The first challenge is the growing trend toward the conglomeration and convergence of financial services across the global financial markets. In coping with these trends, not only financial institutions but also financial regulators are working diligently to measure the risks brought about by consolidation and concentration, as well as, seeking optimal directions to manage those risks. Second, a new capital adequacy framework is being prepared to replace the original Basel Accord by year-end 2006, and is expected to change the financial regulation system into being more risk sensitive. In fact, the Basel Committee on Banking Supervision is responsible for proposing capital requirements for banks operating internationally; however, countries that are not members of the 13 nations represented in the committee are not required to adopt the guidelines established by the committee. However, pressures from the evaluations of international financial markets have been strong enough to get the attention of financial regulators, and begin preparation plans.

Korea, especially from the perspective of financial system development, as an emerging market country, has not proven to be an exception to these challenges. To address the growing trends of financial globalization and consolidation, there is recognition that it is necessary to replace traditional institution-based regulations on capital with one that is function-based. In this respect, Korean financial regulators launched a project to integrate financial laws into a consolidated legal system based on financial activities. However, the directions of the newly proposed amendments to the financial laws indicate that, though the removal of regulatory asymmetries is necessary, the Korean financial system will maintain the principal regulation of separating the three major financial activities such as banking, insurance, and securities, for the foreseeable future. Thus, the Korean financial regulators seem to have more time to address the challenge of financial consolidation.

In contrast, the challenge of strengthening regulation on capital adequacy, in preparation of adopting the New Basel Accord, appears to have more imminence in the eyes of Korean financial regulators as well as financial institutions. In Korea, any changes in capital requirement in respect to credit risks of SME exposures are a matter of particular interest, reflecting the decrease in the proportion of credit to large corporations from 15.6% at year-end 1997 to 5.3% at year-end 2003. In contrast, household and SME credit increased from 51 trillion won to 249 trillion won and from 92 trillion won to 217 trillion won in the same period, respectively. In light of this, comprehensive regulatory measures have been implemented to curb household lending, as well as, to alleviate the rising threat of default on household loans. Moreover, increasing delinquency rates on SME loans recently, have grabbed the attention of Korean regulators in preparation of the proposals by the Basel Committee.

Loans to small- and medium-size enterprise (SMEs) are generally considered to differ from loans to large businesses. Since lenders face fixed lending costs, lending to small firms is by definition more expensive in terms of per dollar lent. In addition, the relationship between the owner/manager of a SME and a bank is often very close and SMEs are more informationally opaque. Because of these structural features, many comments have been directed at the first draft of the New Accord, in particular, the problem associated with calibrating credit risk for SMEs. Many of the comments argued that the risk-weight curve was too steep and too high, which induced too-high risk-weights for SMEs, since many of these firms are generally characterized by relatively high probabilities of default, relative to large businesses. Indeed, there are concerns that capital charges, which are too large, could lead to credit rationing of small firms, thereby, possibly reducing economic growth, given the importance of SMEs in the Korean economy.[1] In response to these comments and concerns, the Basel Committee (BIS, 2003) introduced major changes in formulating the risk-weight in order to reduce the risk-weight on SME exposures, assuming there is a positive relationship between the obligor's size and correlation, as well as, a negative relationship between PDs and correlation.[2]

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[1] In Korea, for example, there were approximately 3.0 million SMEs employing 10.4 million persons, or 86.7% of the workforce. As for the manufacturing value-added, SMEs accounts for 52% (in 2002) of GDP.

[2] The most important change was to propose different risk-weight functions for SMEs and large businesses. Indeed, the committee introduced an adjustment in the risk-weight formula for firms with turnover between €5 and €50 million. More precisely, the correlation formula is adjusted by a term that reduces the value of the correlation proportionately to the size of the firm. In addition, banks are allowed to apply the more favorable retail risk-weight formula to very small businesses (with turnover between €1 and €5 million),

However, it may not be rational for bank regulators of emerging market countries to loosen their grip by giving special treatment favorable to SME exposures since adopting the New Accord without any consideration of a country's specific risk correlation in terms of SME portfolios could be problematic in the sense that the mandatory capital requirement may not be sufficient to cover the economic capital for SME portfolios.

Despite the overall importance of credit correlations in credit risk modeling, but more importantly, when calibrating the risk weight formula under the New Accord, there are few literatures that attempt to compute credit correlations. Lopez (2004) used a KMV type structural model with asymptotic single risk factor approach and equity markets data to provide estimates for large firms. To our knowledge, only Dietsch and Petey (2004) give estimates of correlation especially for SMEs. The authors used a one-factor credit risk model to find that a negative relationship between credit correlation and probability of defaults assumed in formulas in the New Accord cannot be supported by data on French and German SMEs.

In this paper, we examine the current issues regarding capital regulation in Korea, while placing emphasis on the importance of identifying the risk profile of bank lending portfolios for financial regulators to design a sound capital requirement scheme. Using large samples of Korean SMEs with a multi-factor risk model that extends the framework of Merton (1974), this paper investigates the relationships between the obligor SME's size and credit correlation of SME portfolios.

Our paper is organized as follows. Chapter II presents a brief overview of the current system of capital regulation in Korea. Chapter III gives a brief background on the portfolio structure of Korean banking industry, along with concerns related to financial regulators, focusing on SME exposures. Chapter IV presents the multi-factor credit risk model used to compute credit correlations and data, in addition to an analysis on the relationship between credit correlations and size of SMEs in the bank's portfolio. Chapter V concludes this paper.

provided that the bank's total exposure to any one firm remains below €1 million.

II. Capital regulation in Korea

1. Economics of capital regulation

Capital is generally regarded as a long-term source of funding for a firm to realize a return for investors, and provide a cushion against losses, expected or unexpected. Such funding is generally accessed through equity or retained earnings. Though it is not theoretically clear as to why the capital structure of a financial institution is much more stringently regulated than that of an ordinary firm, two explanations seem to offer the most convincing argument for this special treatment. First of all, financial institutions, as often pointed out, are special in that they possess highly leveraged and inter-linked balance sheets. These two features are what make economic shocks highly contagious, so that we observe an extremely high correlation in failure of financial institutions in distress. Massive failures in the financial sector are not confined within the sector, but are rapidly transferred to the real sector, which ultimately, ends up hurting the whole economy. The role of capital as a cushion against temporary losses and a safeguard for soundness of a financial institution is particularly emphasized. The other line of argument for stringent regulation of financial institutions, found in Modigliani and Miller (1958), makes the case that in a frictionless world with full information and complete markets, the value of a firm is independent of its capital structure, thereby, making the regulation of a firm's capital structure futile. Since then, research has been directed towards studying the implications of deviating from the perfect world à la Modigliani-Miller, such as taxes, product market imperfection, transaction cost and asymmetric information. In the financial industry, capital structure, in a large part, is made irrelevant due to widespread information asymmetry coupled with the fact that uninformed investors hold most of the debt of financial institutions - especially banks and insurance companies. The principal-agent problem between investors and management is ubiquitous, but the problem is considerably more serious in the financial sector. Due to the very technical nature of financial contracts and activities, it is too expensive for investors to monitor management, directly or indirectly, with a reasonable degree of accuracy. Moreover, asymmetry of information and lack of monitoring by investors, when it is accompanied by an implicit and explicit public guarantee on repayment of debts such as deposit insurances, may create systemic risk by encouraging financial institutions to take overly excessive risks (Gennotte and Pyle (1991)). It is generally believed that requiring financial institutions to meet a sufficiently high level of capital is an effective device to guard against risks stemming from asymmetry of information3.

Losses cushioned by capital arise from risks, which firms are exposed to in their business activities. Those risk factors are usually classified into several groups for the convenience of theoretical analysis and regulatory practice. Different researches use different schemes of classification. For example, GAO (1998) identifies risks with six categories: credit risk, market risk, liquidity risk, operational risk, business/event risk and insurance/actuarial risk. Different forms of financial institutions face different risk profiles. A bank's major concerns may come from credit risk, liquidity risk and market risk, while operational risk is less of a factor. Life insurers pay attention mostly to liquidity and market risks even though credit and insurance risks are also important

[3] However, Furlong and Keely (1989) question the adverse effect of too stringent capital standards.

factors. A property and casualty insurance company usually focuses on insurance/actuarial and liquidity risks. On the other hand, the most important risk factors investment companies usually face come from market and operational risks. The modern approach to capital regulation is to quantify the degree of risks regulated bodies face, and require them to accumulate a sufficient amount of capital thought to cover the risks. The degree of sophistication in risk-based capital regulation is widely different across various financial sub-sectors. Banks are regulated in the most sophisticated manner, as documented by the Basel Committee on Banking Supervision. Recently, a new and 'advanced' version of supervisory standards4 has been circulated. In case of insurance companies, both the European style fixed ratio and American style risk-based capital requirement are used in practice. However, neither approach can provide the theoretical or logical justification to take one method over the other. For further details on capital regulation of insurance companies in Europe and U.S., see Shin (2004). Capital regulation of investment firms is cruder compared to insurance companies. The main objective of capital regulation of investment firms is to maintain solvency in response to market and credit risks it is, in most cases, exposed to.

Facing the global trend of consolidation of financial institutions operating in different sectors, regulators from different countries and sectors have taken significant measures to harmonize the breadth and strength of capital regulation across countries and sectors. At an individual country level, the Financial Services Authority (FSA) of the United Kingdom is undergoing the process of integrating standards and practice of prudential regulations for banks, insurance companies and investment firms5.

Another form of capital regulation deserving serious consideration is regulation on the initial level of capital. It is a universal practice to require a potential financial service provider to set aside a minimum amount of capital to obtain a license. But in fact, the regulation incidentally sets up an entry barrier by sheltering incumbents from competitive pressures generated by potential competitors. To be sure, this harms social welfare. Then, why have an initial capital requirement at all? The problem of providing financial services, such as selling life insurance or pension products and offering financial advice, is simply asymmetric information. Lack of expertise on the part of buyers means that they find it hard to assess the true quality or 'type' of individual products and suppliers. That leads to a situation under which consumers are very vulnerable to fraud, theft, and non-contractual wealth transfers like churning or turnover of portfolios to generate additional commission. These elements present a serious challenge to financial regulators whose main mission includes the protection of consumers in financial markets. In addition to criminal activities, consumers are also exposed to the risk of poor quality of services that can be reflected in negligence, incompetence, and dishonesty. In this kind of asymmetric information situation where non-sophisticated ordinary financial consumers have a hard time in distinguishing the good from the bad, a pooling equilibrium is bound to exist, in which the commissions suppliers receive reflect the reputation of the industry's quality as a whole. Moreover, it is likely to result in widespread adverse selection and moral hazard in the markets.

As Akerlof (1970) shows in his seminal paper, a more serious consequence of asymmetric information on the true type of a service provider may lead to non-existence of the market itself. Various measures can be taken to avoid the worst case scenario. If the interactions between suppliers and consumers are repetitive games, consumers accumulate a credibility record of each individual supplier, in which the true type of each supplier becomes public knowledge. On the other hand, if a good type supplier can find

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[4] See 'The New Basel Accord: Consultative Document (CP3)' by BIS (2003).

[5] See 'Integrated Sourcebook of Prudential Regulation' by FSA (2003).

a signaling device to send a message of its true type to consumers and no bad type supplier can mimic the signal the good type supplier sends without incurring significant costs, a non-existent market dilemma can be averted. Both reputation and signaling equilibrium present solutions that can be provided by the market under certain conditions. In some cases, suppliers form a voluntary regulatory body (self-regulatory organization) to provide information on the true nature of individual suppliers. The government may also intervene to screen out bad suppliers from the market. It may require individual suppliers to pass an exam or attain a certain achievement in the market. Moreover, by setting a minimum level of initial capital to be operational, the government can effectively prescribe bad type suppliers from entering the market. The presumption is that there should be a strong negative correlation between the quality of supplier and cost of capital; that is, cost of financing one unit of capital should be much cheaper for good type suppliers.

The role of the initial capital requirement is not confined to being a screening device. As discussed above, it is needless to say that funds transferred to a financial institution as an initial capital constitutes an important portion of the buffer against which various risks are hedged by the company.

2. Current bank regulation system in Korea

The minimum amount of capital to obtain a license to provide financial services widely varies. Two different levels of initial capital are set by law to establish a bank, depending on the geographic coverage of operation. For initial capital, 100 billion won is required for a bank with national operations, and 25 billion won for a provincial bank. Those amounts seem to be reasonable considering the importance and broad array of functions banks perform. In reality, the initial capital requirement for a bank is high enough to be an effective entry barrier. Considering the fact that it is difficult to find a bank possessing the ability to mobilize funds matching the initial capital requirement other than industrial conglomerates, *chaebols*, it is highly likely that various restrictions on ownership of a bank's share prohibits a potential entrant funded by firms other than those in the financial industry from entering the market. However, empirical studies[6] show that competition among incumbents has been able to maintain a competitive atmosphere, whereby direct evidence on negative effects caused by the initial capital requirement is not found.

The insurance industry in Korea is divided into three areas according to product: life, non-life and the third.[7] Life insurance companies are prohibited from underwriting or selling insurance contracts provided by non-life insurance companies and *vice versa*. However, both life and non-life insurance companies are allowed to handle any product falling under the area of the third insurance. One can obtain a license to provide the whole range of products belonging to life, non-life or the third insurance by mobilizing 30 billion won for the license. It is also possible to obtain a license for providing a limited array of products in one of the three areas. In that case, the required level of initial capital ranges widely between 5 billion won to 30 billion won. Different levels of required initial capital reflect the degree of risks the licensee faces in daily operation, as well as, the need for consumer protection.

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[6] For example, Kim (2003) shows that competition in Korean banking sector has not decreased in spite of a significant decrease in the number of banks after foreign exchange crisis in 1997.

[7] See Appendix 1 for the list of products each can handle.

The initial capital requirement for securities companies differs from 3 billion won to 500 billion won depending on the range of functions the company plans to perform. For example, if a company wants to perform a whole range of functions such as underwriting, dealing and brokering securities, it is required to arrange at least 50 billion won in capital.

Contrary to the case of the bank, initial capital requirements for insurance and securities companies are not likely to present serious entry barriers that hamper competition in the markets. Since, minimum amounts are set at much lower levels than banks, and there are diverse combinations of products or functions an entrant can choose from. Moreover, because chaebuls can own insurance and securities companies, the threat of potential entrants must be much stronger.

Other than regulations on the initial level of capital, the most important element in the capital regulation of banks in Korea is the capital adequacy ratio (CAR) suggested by the Bank for International Settlement (BIS), which is the ratio of capital and risk weighted asset. Capital consists of shareholders' equity such as capital stock, capital surplus, retained earnings, and capital adjustment (Tier 1), in addition to other funds which provide a buffer against temporary losses, such as subordinate debt and deferred tax payments (Tier 2). All assets owned by a bank are classified into five categories, and one out of five weights – 0, 10, 20, 50, 100 – is assigned to each category according to the credit risk based on historical default tendencies. The total amount of assets in a category is multiplied by the risk weight, and five categories of risk weighted assets are aggregated. Additional amount is considered to accommodate market risk. In the calculation of CAR, the denominator is attained by the sum of credit and market risk weighted assets. The ratio was originally designed for banks that had main offices in 10 initial member countries of BIS and actively participated in international transactions. However, it is now an internationally accepted indicator of a bank's financial soundness. It was first introduced in Korea in 1992. After the foreign exchange crisis in 1997, the practice of risk management in Korean financial institutions went through radical changes. The ratio became one of the most important monitoring measures in supervision process. If the ratio falls below 8%, the minimum required by the Korean bank regulators as well as BIS, the regulator has to determine whether to take prompt corrective measures as soon as possible. <Table 1> illustrates the recent trend in BIS capital adequacy ratio for banks. As can be seen, the ratio hovers around 10~11% for both of the groups.

// <Table 1> here //

As for insurance companies in Korea, regulation focuses on the maintenance of liquidity rather than solvency. Since the majority of the debt on the balance sheet of a typical insurance company has a long-term maturity and the lion's share of cash outflow can be estimated with reasonable accuracy, the main objective of capital regulation on insurance companies is centered on the ability to meet the duty specified in insurance contracts. Insurance companies are required to maintain a certain level of reserves. The minimum amount of reserves is determined using a fixed rate of expected cash outflow that depends on the size of total contracts underwritten by the company[8]. The qualified items for reserve are capital stock, reserves for participating insurance, provisions for loss, subordinate debt and other items recognized by the regulator. An indicator of risk-based capital is customarily included in the financial report of most insurance companies but is

[8] The formula is given as 1.5*[(surrender charge of policy reserves * portion of risk coefficient of policy reserves) + (amount at risk * portion of insurance risk coefficient)] in case of life insurance and 1.5* [max ((0.178 * premium for a year), (0.252 * average loss for three years))] in case of non-life insurance.

not required by law. If an insurance company cannot meet the required level, it may invite regulatory intervention such as prompt corrective actions.

Capital regulation of securities companies in Korea is based on a risk-based approach that considers mainly market and credit risks. The companies are required to maintain at least a 150% of net capital ratio. The ratio can be calculated by dividing net capital with total risk equivalent. In this case, net capital means shareholders' equity after some adjustments. The total risk equivalent is assessed by aggregating expected loss due to market risk, counter-party risk and credit risk for total asset. In any case, failure to achieve the required standard invokes regulatory intervention.

III. Features of Korean banking industry

1. Changes in portfolio structure of Korean banking industry

Before the crisis of 1997, Korean banks concentrated on lending to industrial conglomerates (*chaebol*), making it difficult for consumers and SMEs to secure credit. Afterwards, Korean banks strengthened their commercial orientation, allowing them to refocus their activities on their most profitable lending opportunities. Indeed, Korean consumer credit has risen rapidly during the post-crisis years, in which outstanding household loans increased from 51 trillion won at the end of 1997 to 249 trillion won at the end of 2003.

// <Table 2> here //

A large part of this increase was due to structural changes in the banking sector. Following the crisis, banks became increasingly aware of the risks associated with lending to *chaebol*-affiliated firms, at which time, the banks were focused on reducing their debt. Consequently, this led to intense competition between banks to increase lending in the high-profit and low-risk household sector.[9] The rising share of household loans was accompanied by an expansion in total lending, as the financial health of banks were restored as a result of the successful restructuring program. Moreover, rising real estate prices raised the collateral value of households, allowing them to borrow more money.

In addition, loans to SMEs expanded quite substantially in the post-crisis period. Although bank loans to large businesses decreased slightly due to the reduced demand for funding by large companies, there was heightened demand for short-term funding among SMEs in order to increase their production activities, as the domestic economy recovered from the crisis. In particular, following the government's measures to rein in household lending, banks having difficulties in identifying suitable targets for the operation of their funds, extended their loans to service-oriented businesses and small-business proprietors, which was a contributing factor in expanding loans to SMEs. During the 5 years following the crisis, from the end of 1998 to 2004, Korean banks' SME loans more than doubled, increasing from 89 trillion won to 217 trillion won. Indeed, the figures show that as total corporate loans increased from 121 trillion won to 245 trillion

9 Household loans carry higher interest rates than corporate loans and are exempt from the burden of contributions to the Korea Credit Guarantee Fund (0.3% p.a.). Loans secured by housing collateral also attract a lower risk weighting (50%, corporate loans 100%) in the calculation of the BIS capital adequacy ratio.

won in the same period, the share of SME loans increased from 73.7% to 88.7%, while loans to large companies decreased from 32 trillion won to 28 trillion won.[10]

// <Figure 1> here //

2. Risk management of banks and regulatory response

These changes in the portfolio structure of the Korean banking industry suggest that the appropriate credit risk management of household loans and SME loans is key in maintaining the soundness of banks. With respect to household credit, various measures have been taken by the Korean financial supervisory authority to lessen the negative impact of a possible massive default among existing household loans. As household credit rapidly increased as described in the previous section, concerns surfaced that the soundness of banks were at risk due to the looming threat of default among household loans. In the second half of 2002, delinquency rates for household loans started to rise, and since then, the Korean government has worked to curb household lending among banks.[11] The financial supervisory commission raised mandatory provisions for household loans (April 23 and October 11, 2002) and made adjustments by lowering the loan-to-value ratio for loans secured using housing collateral (September 9 and October 11, 2002). Those measures, by and large, succeeded in curbing the upward trend of household loans or accelerating its downward trend afterwards. Considering that these measures taken by the regulatory authority were expected to help Korean banks in alleviating the cost burden related with managing household credit risk, the somewhat generous treatment of household or individual consumer exposures under the modified risk weights formula recently proposed by the Basel Committee (BIS, 2003), seems suitable for Korean banks in this respect.[12]

With respect to SME exposures in the Korean banking industry, there seems to not have been a regulatory reaction against its risk so far. The delinquency rates on SME loans have been increasing recently, partly due to continuing stagnant domestic demand since the second half of 2003. In fact, delinquency rates as a whole for SME loans increased from 2.69% in September 2003 to 2.98% in April 2004. For individual enterprises, such as small-business proprietors, loans increased from 2.89% to 3.10% during the same period. In comparing the delinquency rates for loans to large companies that decreased from 0.84% to 0.42%, these numbers suggest that the credit risk associated with SME loans is quite substantial, especially considering the large proportion of SME loans to total corporate loans. In response to the rising risk of SME loans, Korean banks appear to be taking a more prudent approach in their credit assessment of SMEs.

10 During the same 5 years (1999-2003), the total loans of Korean banks increased from 196 trillion won to 515 trillion won.

11 The delinquency ratio of Korean banks' household loans had been decreased from 2.4% at the end of 2000 to 1.2% in June 2002, but from the second half of 2002 it took a rising trend to 2.6% in the first half of 2003.

12 The New Basel Capital Accord allows banks using Standardized Approach to compute the minimum capital requirements against retail credits, including consumer loans and very small business loans, with the 75% risk weight that is substantially smaller than 100% risk weights under the current rules. In fact, it is an empirical question to be analyzed whether the proposed level of 75% risk weight is enough to cover the risk of retail credit in the emerging market countries that are generally considered to have different risk profiles for consumer credits compared to advanced countries such as member countries of the Basel Committee.

// <Table 3> here //

// <Figure 2> here //

However, on the government side, it seems that preventing a possible credit crunch in the SME sector is the only matter of concern for the Korean financial supervisory authority. When banks tighten credit controls over the SME sector, it may lead to credit rationing among SMEs, and could reduce economic growth. However, financial regulators have the role of supervising the activities of financial institutions, as well as, maintaining stability in the financial system to support economic growth. In regulating the banks, financial authorities are burdened with a fine balancing act between curtailing the activities of domestic banks as part of its regulatory mission and providing enough support so as to ensure the role of banks in the allocation of sufficient capital resources to the production industries. While the motives of regulators seem to be at odds, economic growth potential could be threatened if regulators are consumed by the role of supporting economic growth. For example, regulators overly concerned with ensuring an adequate supply of loans to SMEs to secure financial stability may loosen regulation on bank capital.

Even in the discussions and comments surrounding the New Basel Capital Accord, also known as Basel II, we could find similar concerns. After the first version of the New Accord was drafted, many economists and policy makers in various countries pointed out the problem of calibrating credit risk for SMEs.[13] They criticized that the risk-weight curve was too steep and too high, which induced too-high risk-weights for most of the SMEs. These criticisms shared a common belief that loans to SMEs differ from loans to large businesses since the relationship between the owner/manager of a SME and a bank is often very close and SMEs are more informationally opaque. That is, because lenders face fixed lending costs, lending to small firms is by definition more expensive in terms of per dollar lent. In fact, the concern is that capital charges, which are too large, could lead to credit rationing among SMEs, thereby possibly reducing economic growth.

As a response to these comments and concerns, the Basel Committee (BIS, 2003) introduced changes in the formula used to calibrate the risk-weights in order to reduce the risk-weight on SME exposures.[14] The committee introduced an adjustment in the risk-weight formula under the IRB (internal ratings based) approach for corporate credit to firms with turnover between €5 and €50 million by, more precisely, changing the correlation formula with a term that reduces the value of the correlation proportionately to the size of the firm. Furthermore, banks that treat their SME exposures as a homogeneous portfolio (in the same way as they treat their retail exposures) are permitted to apply the retail IRB capital requirements to the portfolio with more favorable retail risk-weight formula as long as the exposure to the bank of any individual SME (with turnover between €1 and €5 million) is less than €1 million.[15]

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[13] SMEs are defined by the Basel Committee as those with less than €50 million in annual turnover.

[14] The committee first proposed the New Basel Capital Accord in December 2001, with revisions in July 2002 and April 2003. More revisions are likely before the final adoption of the accord. By year-end 2006, Basel II is expected to replace the original Basel Accord, which was implemented in 1992.

[15] The Bank for International Settlements (BIS, 2001, p. 55) defines retail credit as "homogeneous portfolios comprising a large number of small, low value loans with either a consumer or business focus, and where the incremental risk of any single exposure is small". These types of loans include loans to individuals such as credit cards and residential mortgages, and SME loans could also be included as long as the bank treats these facilities the same way it treats other

These recent adjustments in the risk-weight formula for SME loans also allow Korean bank regulators to have some more leeway. Since the proportion of SME loans to total corporate exposure in the Korean banking industry is slightly less than 90%, and about 60% of SME loans can be treated as 'retail exposures' by banks. Thus, Korean regulators may be persuaded not be concerned about the occurrence of a serious SME credit tightening, when adopting the New Accord as a financial supervisory standard.

3. Agenda for the Korean bank supervisors

The treatment of SME exposures is viewed as especially important in countries like Korea where SMEs comprise a significant component of the industrial sector and the banking industry's loan portfolio. Under the New Accord proposed by Basel Committee, lower capital requirements are allowed at up to 20% on exposures for SMEs compared to exposures to larger firms. Given the importance of SMEs in the Korean economy, treating credit risk differently on loans for SME and large businesses by applying different correlation terms proportional to the size of a firm as proposed by the New Accord seems to be somehow acceptable.

Credit correlation, which is also referred as default correlation, is an important factor used to determine the distribution of losses in a bank loan portfolio. In order to assess risk at the portfolio level, capturing the correlations between individual exposures is crucial. In most of the credit risk models, the correlation measures the degree of sensitivity of the probability of default to the systematic risk factors that represent the "state of the economy".[16] The more individual bank loans tend to react simultaneously to systematic risk factors, the greater the risk of a portfolio will be.

Under the proposed New Accord, banks will be permitted to separately distinguish exposures to SMEs from large firms. For banks opting to use the standardized approach for SME exposures, a risk-weight for general corporate exposures would be applied, while continuing to use the 8% capital requirement (under the original Basel Capital Accord). However, for exposures to very small firms, banks would be able to apply the fixed retail credit risk-weight of 75% to calculate the minimum capital requirement: $K = EAD \times 0.75 \times 0.08$ where K is the capital requirement for SME exposures and EAD is the exposure at default of the SME credit.

If a bank chooses the advanced internal ratings based (A-IRB) approach for SME exposures, the bank must estimate PD and LGD, as well as EAD and consider the maturity factor.[17] With these risk components, the minimum capital levels required against SME credit are calculated using the same formula used for general corporate exposures:

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retail credits.

[16] In the estimation of loan loss distribution, parameters such as the probabilities of default and their variance determine credit correlations. Therefore, a good calibration of these parameters is an important element in portfolio risk management.

[17] The Basel Committee has made two sub-broad approaches of the IRB approach: a foundation and an advanced. Under the foundation approach, as a general rule, banks provide their own estimates of PD and rely on supervisory estimates for other risk components. Under the advanced approach, banks provide more of their own estimates of PD, LGD, EAD, and M, subject to meeting minimum standards. In both cases, banks must use the risk weight functions provided for the purpose of deriving capital requirements.

$$K = EAD \times LGD \times \Phi\left(\frac{\Phi^{-1}(PD) + \sqrt{\rho} \times \Phi^{-1}(C)}{\sqrt{1-\rho}}\right) \times \frac{1 + (M - 2.5) \times B(PD)}{1 - 1.5 \times B(PD)}$$

where $\Phi(\cdot)$ is the cumulative distribution function for the standard normal, C is the confidence level, ρ is the credit correlation, M is the maturity of exposure, and $B(PD)$ is the maturity adjustment term that is a function of PD.

Therefore, one can find that the required capital as a function of the probability of default can vary substantially depending on the correlation coefficient assumed. In particular, since the foundation approach sets the maturity at 2.5 years and assumes no maturity adjustment, the formula for minimum required capital could be simplified as

$$K = EAD \times LGD \times \Phi\left(\frac{\Phi^{-1}(PD) + \sqrt{\rho} \times \Phi^{-1}(C)}{\sqrt{1-\rho}}\right),$$

and it is also easy to find that if the correlation is zero, as in an extreme case, the capital requirement is just $K = EAD \times LGD \times PD$, and if the correlation is one, the extreme opposite, the capital requirement is $K = EAD \times LGD$.

The New Accord proposed various formulas to calculate the correlation for corporate exposures, and made a firm size adjustment (i.e. $0.04 \times (1 - (S-5)/45)$) for exposures to SME obligors:[18]

$$\text{Correlation for exposures to large firms } = 0.12 \times \left(\frac{1 - e^{-50 \times PD}}{1 - e^{-50}}\right) + 0.24 \times \left(1 - \frac{1 - e^{-50 \times PD}}{1 - e^{-50}}\right),$$

and

Correlation for SME exposures

$$= 0.12 \times \left(\frac{1 - e^{-50 \times PD}}{1 - e^{-50}}\right) + 0.24 \times \left(1 - \frac{1 - e^{-50 \times PD}}{1 - e^{-50}}\right) - 0.04 \times \left(1 - \frac{(S-5)}{45}\right).$$

The small business exposures also can be treated as retail exposures when taking the IRB approach. For retail exposures other than residential mortgage exposures and qualifying revolving retail exposures, lower ranges in credit correlation are allowed under the New Accord compared to corporate exposures:[19]

[18] *S* is expressed as total annual turnover in millions of euros with values of *S* falling in the range of equal to or less than €50 million or greater than or equal to €5 million. Reported turnover of less than €5 million will be treated as if they were equivalent to €5 million for the purpose of the firm-size adjustment for SME obligors. Subject to national discretion, supervisors may allow banks, as a failsafe, to substitute total assets of the consolidated group for total turnover in calculating the SME threshold and the firm-size adjustment. However, total assets should be used only when total sales are not a meaningful indicator of firm size. (BIS, 2003)

[19] The credit correlation formula for the retail exposures indicates that the New Accord assumes that the

$$\text{Correlation for retail exposures } = 0.02 \times \left(\frac{1 - e^{-35 \times PD}}{1 - e^{-35}} \right) + 0.17 \times \left(1 - \frac{1 - e^{-35 \times PD}}{1 - e^{-35}} \right).$$

Therefore, considering that the required capital calculated using formulas under the IRB approach increases with the correlation, banks can reduce the capital requirement for SME exposures by treating them as retail exposures.

Since the Basel Committee's new proposal allows banks to apply a more favorable retail risk-weight formula to very small businesses as shown above and Korean financial regulators may adopt the New Accord with quite minor modifications subject to national discretion, Korean banks that provide corporate credit mainly to SMEs will be able to benefit substantially by adopting the New Capital Adequacy Accord.

However, it is not proven to be rational for bank regulators of emerging market countries to loosen their grip and allow banks to treat more than half of their corporate credit portfolio as retail exposures. Since small firms are considered to be more sensitive to downturns in macroeconomic conditions than larger firms, the probability of default among risky small businesses tends to increase in a recessionary period. Therefore, handling small firms as retail exposures using a more favorable risk-weight formula has two implications for regulators. First, regulators should assume that the degree of increase in the credit correlation of a bank's SME portfolio in respect to the size of the borrowing firm is greater than what is assumed under the firm-size adjustment term. Second, regulators should also assume that the degree of decrease in the correlation of SME portfolio in respect to the PDs is greater than what is assumed by the correlation formula for the corporate exposures.[20] However, if these assumed positive relationships between obligor's size and correlation, as well as, the negative relationship between PDs and correlation are not verified, adopting the New Accord without any consideration of a country's specific risk profile in the SME sector could be problematic in the sense that the mandatory capital requirement may not be sufficient to cover the economic capital for SME portfolios.

In addition, the problem of the systemic risk adds a new dimension that needs to be resolved by financial regulators in adopting the special treatment of SME exposures. Under the new regulation on capital, banks would be allowed to establish their own credit risk management system to find levels of risk characteristics, which is calculated by the system as the most reasonable for their own portfolio, such as the probability of default (PD), the loss given default (LGD), exposure at default (EAD), and default correlation. However, even though each bank maintains capital above the level that is equivalent to the economic capital of its portfolio, it may not be enough when

correlation for retail exposures cannot be smaller than 0.02 and larger than 0.17, that is, should be in the range of [0.02, 0.17]. It can be also noticed that the correlation for the corporate exposures is assumed to be in the range of [0.12, 0.24] and, for the SME exposures, [0.08, 0.24]. In January 2004, the Basel Committee on Banking Supervision modified the risk weight functions and related formulas to move to a 'unexpected-loss-only' risk weighting construct by decomposing the original risk weight functions in to 'expected loss' and 'unexpected loss'. As a result, the correlation coefficients for the retail exposures were changed from 0.02 to 0.17 in the original formula to 0.03 to 0.16.

[20] The assumption of an inverse relationship between PD and correlation assumed in the correlation formula for the corporate exposure is already quite controversial. Most academic studies find a direct relationship such that firms with higher quality and thus lower default probability tend to have less systematic risk and therefore lower correlations, whereas firms with lower quality and thus higher default probability are more subject to market shocks and therefore have higher correlations. See Allen and Saunders (2003) for a discussion.

considering that the increasing credit risk of a bank's portfolio can easily spread to other banks. Therefore, in setting out the credit correlation formula for SME exposures, the financial regulatory authority has to examine not only the correlation of the individual bank's SME portfolio, respectively, but also the default correlation for SME portfolios in aggregate for the whole banking industry.

In the following chapter, we analyze the credit correlations of Korean SMEs to provide direction for modifying the risk-weight formula that the Financial Supervisory Services may need to determine the level of national discretion, when it adopts the New Accord as the major regulatory framework for bank capital.

IV. Empirical Analysis

1. The model

The multi-factor credit risk model

Most of the credit risk models assume that the variance of PDs and correlations are driven by one or several risk factors. Here, the "risk factors" represent various sources that change in the obligor's financial situation, which then influences the credit worthiness of obligors, and as a consequence, the asset value of portfolio (business cycle, for example). Though we used the multi-factor model to compute the asset correlation in this paper, a brief introduction of the one-factor model may be better suited for illustrative purposes (Gordy, 2000; Dietsch and Petey, 2004). In the one-factor model, each obligor i's state (that is, the credit indicator for the obligor i) is driven by an unobserved latent random variable U_i, which is defined as a linear function of a single systematic factor Z and a specific idiosyncratic factor ε_i:

$$U_i = \beta_i Z + \sqrt{1-\beta_i^2}\,\varepsilon_i$$

where Z and ε_i are i.i.d. random variables following the standard normal distribution and $E[Z\varepsilon_i] = 0$. The systematic factor represents the state of the economy and measures the effect of the business cycle on the default rate. Hence, the weight β_i assigned to the systematic risk factor measures the sensitivity of obligor i to evolving general economic conditions. Since these sensitivities are identical for all obligors in the same portfolio ($\beta_i = \beta, \forall i$), the correlation between latent variables for the two obligors i and j in the same portfolio can be written as:

$$Corr[U_i, U_j] = Cov[U_i, U_j] = E[U_i U_j] - E[U_i]E[U_j] = \beta^2$$

As β increases, all obligors tend to be more correlated, while as β decreases, idiosyncratic risk prevails. Therefore, the degree of correlation between loan values is determined by the sensitivity of the latent variables to the systematic factor and the squared sensitivity β^2 is the asset correlation ρ.

In the multi-factor model, it is assumed that the variances and correlations of obligors' credit indicators are determined by two or more risk factors. Analogous to the definitions of the one-factor model, one can decompose the unobserved latent random variable U_i

deriving obligor i's credit indicator into K systematic risk factors and the idiosyncratic risk factor as in (1)

$$U_i = \sum_{k=1}^{K} \beta_{ik} Z_k + \sigma_i \varepsilon_i \tag{1}$$

where $\sigma_i = \sqrt{1 - \sum_{k=1}^{K} \beta_{ik}^2}$, Z_k is the k th systematic risk factor ($k = 1, \cdots\cdots, K$) and β_{ik} measures the obligor i's sensitivity to the systemic factor Z_k . Here, we also assume that Z_k and ε_i are i.i.d. standard normal random variables and $E[Z_k \varepsilon_i] = 0$. In the multi-factor model, it is generally assumed that the sensitivity of one obligor to a certain systematic factor is identical to that of another obligor in the same portfolio or group ($\beta_{ik} = \beta_k, \forall i, k$). Under these assumptions, it can be easily shown that the correlation between credit indicators of the two obligors i and j in the same portfolio is calculated as the squared sum of sensitivity parameters β_k :

$$Corr[U_i, U_j] = Cov[U_i, U_j] = \sum_{k=1}^{K} \beta_k^2 = \rho \tag{2}$$

where ρ is now the degree of correlation between credit indicators of two obligors in the same portfolio.

We further divide the systemic factors into K^M macroeconomic factors and K^P portfolio-specific factors. Since a portfolio-specific factor, by definition, affects only a single portfolio, the credit indicator for an obligor i in portfolio l can be written as:

$$U_i = \sum_{k=1}^{K^M} \beta_{lk}^M Z_k^M + \beta_l^P Z_l^P + \sigma_l \varepsilon_i \tag{3}$$

where

$$\sigma_l = \sqrt{1 - \sum_{k=1}^{K^M} \left(\beta_{lk}^M\right)^2 + \left(\beta_l^P\right)^2} \ .$$

Computation of correlation

The multi-factor model presented above shares its structure with the basic one-factor model framework of Merton (1974). Following Merton's model, the obligor's state or financial position at the end of the planning horizon also depends on the location of the latent variable relative to a "threshold" value, which defines default in the multi-factor model. That is, an obligor defaults if the credit indicator falls below the default threshold.

Since the latent variable is assumed to be a standard normal random variable, we can set the default threshold level for portfolio l such that the probability of default for an obligor i in the portfolio l, p_l is equivalent to the probability of the latent variable being smaller than the threshold value: $p_l = \Pr(U_i^l < \alpha_l) = \Phi(\alpha_l)$, where $\Phi(\cdot)$ is the cumulative distribution function for standard normal. Thus, the cut-off value α_l is simply calculated as $\alpha_l = \Phi^{-1}(p_l)$.

From the discussions above, we can construct the conditional probability of default with the realization of the factors in the latent variable:

$$p_l(\widetilde{Z}) = \Pr\left(U_i^l < \alpha_l \mid \widetilde{Z}\right) = \Pr\left(\sum_{k=1}^{K^M} \beta_{lk}^M Z_k^M + \beta_l^P Z_l^P + \sigma_l \varepsilon_i < \alpha_l \mid \widetilde{Z}\right)$$

$$= \Pr\left(\varepsilon_i < \frac{\left(\alpha_l - \sum_{k=1}^{K^M} \beta_{lk}^M Z_k^M - \beta_l^P Z_l^P\right)}{\sigma_l}\right) = \Phi\left(\widetilde{\alpha}_l\right)$$

where $\widetilde{\alpha}_l = \dfrac{\alpha_l - \sum_{k=1}^{K^M} \beta_{lk}^M Z_k^M - \beta_l^P Z_l^P}{\sigma_l}$.

Applying an inverse transformation and making the change in the variable gives:

$$\Phi^{-1}\left(p_l\right) = \hat{\alpha}_l + \sum_{k=1}^{K^M} \hat{\beta}_{lk}^M Z_k^M + \hat{\beta}_l^P Z_l^P \tag{4}$$

where $\hat{\alpha}_l = \left(\alpha_l / \sigma_l\right)$, $\hat{\beta}_{lk}^M = -\left(\beta_{lk}^M / \sigma_l\right)$, and $\hat{\beta}_l^P = -\left(\beta_l^P / \sigma_l\right)$.

By regressing the inverse normal of the conditional probabilities to the macroeconomic factors, we can estimate the parameter vector $\begin{pmatrix}\hat{\alpha} & \hat{\beta}_{l1}^M & \cdots & \hat{\beta}_{lK^M}^M\end{pmatrix}$ from the regression:

$$\Phi^{-1}\left(p_{lt}\right) = \hat{\alpha}_l + \sum_{k=1}^{K^M} \hat{\beta}_{lk}^M Z_{kt}^M + \xi_{lt} \tag{5}$$

On the other hand, the residual volatility gives the sensitivity of the inverse normal to the portfolio-specific factor:

$$\hat{\beta}_l^P = \sqrt{\sigma_{\tilde{\alpha}_l}^2 - \sum_{k=1}^{K^M} \left(\hat{\beta}_{lk}^M\right)^2} \tag{6}$$

where $\sigma_{\tilde{\alpha}_l}^2 = \frac{1}{T}\sum_{t=1}^{T}\left(\Phi^{-1}(p_{lt}) - \overline{\Phi}^{-1}(p_l)\right)^2$ and $\overline{\Phi}^{-1}(p_l) = \frac{1}{T}\sum_{t=1}^{T}\Phi^{-1}(p_{lt})$. Note that $\sigma_l^2 = 1 - \sum_{k=1}^{K^M}\left(\beta_{lk}^M\right)^2 + \left(\beta_l^P\right)^2 = 1 - \left(\sigma_l^2 \sigma_{\tilde{\alpha}_l}^2\right)$ and $\sigma_l^2 = \left(1/1 + \sigma_{\tilde{\alpha}_l}^2\right)$.

Finally, we can obtain a set of parameter estimates by substituting back to get:

$$\alpha_l = \left(\hat{\alpha}_l \cdot \sigma_l\right),\ \beta_{lk}^M = -\left(\hat{\beta}_{lk}^M \cdot \sigma_l\right),\ \beta_l^P = -\left(\hat{\beta}_l^P \cdot \sigma_l\right) \tag{7}$$

We can calculate an estimate of the correlation using the relationship in (2).

2. Estimation

Data and construction of portfolios

The data consists of information taken from the balance sheets and income statements of Korean SMEs complied by D&B Korea. This database provides financial and non-financial information on companies in three categories; (1) companies listed on the Korean Stock Exchange (KSE) and KOSDAQ, (2) externally audited companies[21], and other companies. The database includes all listed and externally audited companies and some other companies for which periodic acquisition of required information are possible.

For the purpose of this study, an SME is defined as a company that either does not exceed total capital of 8 billion won or 300 employees. We construct the SME portfolio according to the industrial classification (SIC) or asset size. In doing so, a delicate balancing effort between two criteria was required. First, the portfolios were designed with companies that had similar industrial characteristics or asset size of economic interest. The second criterion was insuring that these portfolios had a sufficient size of obligors and credit to reduce small sample concerns.

The SMEs in the database were rearranged in seven groups according to industrial categories. There are three portfolios for the manufacturing sector (Portfolios A, B, C), one for construction (Portfolio D), one for wholesale and retail sales (Portfolio E), one for real estate related services (Portfolio F), and one for other services (Portfolio G)[22]. With respect to asset size, an economically meaningful criterion for constructing the portfolios was less obvious. Hence, we chose size categories that were sufficiently different to

[21] The law on the external auditing of incorporated companies in Korea requires that an incorporated company with asset larger than 7 billion KRW should have various financial documents such as balance sheet examined by external auditor(s).

[22] Further details on the constructing portfolios of SMEs can be found in Appendix 2.

ensure that we captured important aspects in terms of size differential, however careful attention was given to make the portfolios large enough to provide meaningful empirical results. We allocated all companies into five groups according to asset size so that each of the portfolios 1, 2, and 3 include 25% of the sample, while each of the portfolios 4 and 5 include 12.5% of SMEs in the sample[23]. <Table 4> and <Table 5> summarize the financial characteristics of the SME portfolios classified by industrial category and asset size, respectively.

// <Table 4> and <Table 5> here //

We also construct portfolios based on both industrial category and asset size. The challenge here was to create portfolios, in which the number of obligors and the amount of total credit are more or less uniformly distributed across both criteria. However, given the extremely uneven distribution of companies across industry and asset size, achieving this task proved impossible. Thus, for the bivariate analysis, we combined two smaller portfolios (Portfolios 1 and 2) together so that the previous five categories based on asset size are collapsed into four categories, which generated 28 industry-asset size SME portfolios.

Macroeconomic factors

To extract macroeconomic factors assumed to dictate the latent variable in (3), and consequently, to systemically drive the default probabilities of each portfolio, eight macroeconomic variables are considered: KOPSI stock index (KOSPI), industrial production (IP), wholesale and retail index (SALE), unemployment rate (UNEMP), GDP, yield on three-month CD (CD), yield on three-year corporate bond with A- grade (CBOND), and terms of trade (TOT).

To do so, annual data for the variables from 1992 to 2003 was obtained from the Bank of Korea's statistical database and Korea National Statistical Office. First, subtracting the sample mean and dividing by the sample standard deviation, we obtain a time series of standardized factor returns for the macroeconomic factors. Next, we obtain a set of independent factors such as the linear combination of the correlated macroeconomic factors through principal component analysis. The use of principal components reduces the number of factors used in the estimation of the model. <Figure 3> shows the proportion of variance that each of the principal components explain and the cumulative contributions. The first four principal components explain about 96% of the co-movements of all eight macroeconomic factors. Hence, we keep the first four principal components for the analysis to follow and treat the last four principal components as capturing co-movements among macroeconomic variables due to non-systematic noise.

// <Figure 3> here //

<Figure 4> plots the factor loadings for the remaining four principal components. For example, the first principal component, which explains 43% of the co-movements of the macro variables, has a positive weight (loading) on CD, CBOND, UNEMP, GDP and TOT, and a negative weight on KOSPI, IP and SALES.

// <Figure 4> here //

[23] The threshold values dividing portfolios are different across fiscal years covered by the sample.

Definition of default event

The D&B Korea database does not assign a credit rating to almost all of the SMEs unless they are listed on the KSE or KOSDAQ markets. Therefore, it is impossible to compile a time series based on credit ratings for each obligor or credit measures based on historic records of default rates, which is regarded as elemental in most credit risk models.

Instead, we define a default event when a firm cannot cover its interest payments with operating profits three years in a row, that is:

$$y_{it}^{l} = \begin{cases} 1 & \textit{when} \quad \bigcap_{r=0}^{2} \left(\mathrm{IPCR}_{it-r}^{l} < 1 \right) \\ 0 & \qquad \textit{otherwise} \end{cases}$$

where y_{it}^{l} is the default indicator for obligor i in portfolio l at time t and IPCR_{it}^{l} is the interest payment coverage ratio for obligor i in portfolio l at time t defined as the ratio of earnings before interest and tax (EBIT) to interest payment. We can calculate the default rate for portfolio l at time t, p_{lt} as:

$$p_{lt} = \frac{1}{I_l} \sum_{i=1}^{I_l} y_{it}^{l} \tag{7}$$

where I_l is the number of obligors belonging to portfolio l.

There are at least two reasons, theoretical and practical, for choosing IPCR as the default indicator rather than a traditional measure such as historically observed default probabilities of each portfolio. First of all, IPRC would be a reasonable substitute for observations on actual defaults in the absence of an extensive and reliable set of records on the default history of SMEs. Analyzing the default behavior of Korean firms with D&B Korea's database, Kang *et. al.* (2000) show that an IPRC of less than 1 for three successive years is an excellent predictor for 'actual' default in the near future.

Second, since we are more interested in accessing the degree of credit correlation for SME portfolios existing in the economy rather than SME portfolios an individual financial institution is exposed to, it would be better to take IPRC as a measure of creditworthiness. Due to the lack of an extensive and reliable network of credit rating systems and accumulation of credit history on individual borrowers, financial institutions in Korea have almost always depended on the value of a collateral in making loan decisions, especially for SMEs. Though the practice of risk management in Korean financial institutions, particularly banks, has improved significantly since the foreign exchange crisis in 1997, it is still too early to declare that the Korean financial industry has equipped itself with a properly working risk management system. The system does not seem to work appropriately mainly due to the lack of sufficient data to feed into already installed risk management models. It seems to be now a well-established proposition that it would take at least one more business cycle to accumulate an adequate amount of information to evaluate the performance of the current risk management system.

We obtain a time series of default probabilities for each portfolio using (7) annually from 1992 to 2003. The summary statistics of default probabilities for each portfolio are reported in <Table 6>, <Table 7> and <Table 8>. Portfolio F (real estate) exhibits the highest average and volatility followed by Portfolio G (services). On the other hand, the manufacturing sector represented by portfolio A, B, and C shows a low and stable default pattern. In terms of asset size, the most conspicuous pattern is the positive correlation between asset size and average default rate; that is, larger firms measured by asset size tend to fail more frequently than smaller ones. Considering the correlation structure among portfolios in <Table 7>, firms in the lower half tail of size distribution (Portfolio 1, 2) show a different default pattern from the ones in the upper half tail (Portfolio 3, 4, 5).

// <Table 6>, <Table 7>, and <Table 8> here //

Estimation of parameters

Equipped with a time series based on default rates for each portfolio and standardized factors obtained from a principal component analysis of correlated macroeconomic factors (variables), we can estimate the regression model in (5). The results are reported in <Table 9>, <Table 10> and <Table 11>.

// <Table 9>, <Table 10>, and <Table 11> here //

Based on the estimates from the regression and the relationships given in (6) and (7), we can calculate a set of estimates for the parameters of final interest. See <Table 12>, <Table 13> and <Table14> for the results.

// <Table 12>, <Table 13>, and <Table 14> here //

It is pretty straightforward work to obtain the proportion of variances in the inverse normal values of default rates contributed by systemic factors and portfolio specific factors. The larger the contribution of systemic factors, the bigger the portion of correlation explained by systemic co-movement of macroeconomic variables. Both systemic and portfolio specific factors constitute the correlation of default probabilities of obligors belonging to the same portfolio. See <Table 15> and <Table 16> for the results.

// <Table 15> and <Table 16> here //

3. Interpretation and policy implications

The first and second columns of <Table 15> present the proportion of variance attributable to systemic and portfolio specific factors for the 7 portfolios based on the industrial characteristics of obligors and 5 portfolios based on the obligor firms' asset size. From the first 7 portfolios classified by industry, we could find that the portfolios of SME exposures in the real estate related service industry and other service industries (portfolio F and G) have credit risks that are not sensitive to macroeconomic factors. In contrast, the credit risks of SME exposures in the construction industry (portfolio D) and wholesale & retail sales industry (portfolio E) are highly susceptible to systematic risk factors.

For portfolios classified by size of the obligor SMEs, our analysis shows that the portfolios of larger SMEs tend to have risk characteristics that are less dependent on systematic elements. This result seems inconsistent with the general theory on portfolio diversification, since as a firm grows larger and takes on more assets, its risk and return characteristics should more closely resemble the overall asset market and be less dependent on idiosyncratic elements of individual business lines.[24]

The third column of <Table 15> presents the credit correlation for the same 12 portfolios of Korean SMEs constructed according to the obligor firm's industrial characteristics and asset size. The estimated correlation values for the first 7 portfolios indicate that the differences between the portfolios based on industrial characteristics are very large. In particular, the SME portfolio in the construction industry (portfolio D) has the highest credit correlation value, 5.46%, and the SME portfolio in the real estate related service industry has the second highest value, 0.92%. Portfolio A, representing the SMEs in the medium-tech manufacturing industry, has the lowest correlation value; however, even the estimated correlation values for each portfolio in the manufacturing sector represented by portfolio A, B, and C are quite different from each other. These differing values suggest that the financial supervisory authority needs to take into consideration the industrial composition of the banks' SME exposures when it adopts the New Accord and proposed special treatment of SME exposures using the risk-weight formulas. In other words, regulation on a higher level of capital may be required for banks whose SME portfolios are concentrated with firms from the construction or service industry.

For the following 5 portfolios based on asset size, we found a greater difference between the estimated correlation values. The portfolio with the smallest SMEs (portfolio 1) has the highest credit correlation value, 14.24%, and the portfolio with the largest SMEs (portfolio 5) has the lowest correlation value, 0.64%. In addition to the large differences in correlation values between the portfolios based on firm size, we found that the default correlation values for portfolio decreases as the asset size of the obligor firms increase. As already mentioned above regarding the proportion of variance contributed by systemic and portfolio specific factors, this result seems also inconsistent to the general theory on portfolio diversification. This also indicates that the positive relationship between the obligor's size and credit correlations assumed using the risk-weight formula proposed by the Basel Committee cannot be supported in Korea. However, considering that <Table 7> shows a positive relationship between SME size and average probability of default of the respective portfolio, our results can be supporting evidence for the negative relationship between probability of default and credit correlation.

Results of the bivariate analysis using the constructed portfolios based on both industrial characteristics and asset size, presented in <Table 16> also shows evidence arguing against the existence of a positive relationship between the obligor's size and credit correlation. Even though the proportional relationship is not clear in some industry categories, the estimated credit correlation values of the smaller SME portfolios are consistently greater than those of the larger SMEs in all respective industry categories.

[24] The general theory of portfolio diversification suggests that, as the number of different securities within a portfolio increases, the portfolio becomes more diversified, and the idiosyncratic element of the portfolio's return becomes less important (Lopez, 2004). An analogous view could be taken with respect to a firm's asset size as above.

V. Conclusion

In this paper, we examined the current issues regarding capital regulation in Korea, while placing emphasis on the importance of identifying the risk profile of bank lending portfolios for financial regulators to design a sound capital requirement scheme. After considering the directions of the newly proposed amendments to the financial laws, we came to a tentative conclusion that Korea will most likely continue to maintain separation between banking, insurance, and securities for the foreseeable future. Hence, rather than focusing on capital requirement issues under a consolidated financial structure, our analysis focused on other important issues related to risk-based capital (RBC), as well as, on the regulatory capital requirement framework that is about to change with the adoption of the New Capital Adequacy Accord.

In carrying out our study, we take into consideration the following facts of the Korean banking industry. First, most of the bank asset portfolios consist of household and SME credit. Second, the recently implemented regulatory measures to curb the expansion of household credit have been by and large successful in maintaining the soundness of the banks' portfolios for that sector. Accordingly, priority of this paper has been placed on analyzing the risk characteristics of SME exposures, along with the capital requirement as a way to cope with risks of SME obligors.

Using large samples of Korean SMEs with a multi-factor risk model that extends the framework of Merton (1974), therefore, this paper draws an important policy implication on the relationships between the obligor SME's size and credit correlation. Note that the recently proposed formulas for the risk-weight by the Basel Committee allows for favorable lending treatment of small businesses under the assumptions of positive relationships between obligor's size and correlation, as well as, the negative relationship between PDs and correlation. Accordingly, if the assumptions turn out to be incompatible with empirical evidence provided by Korean experience, the regulatory capital requirement set by the New Accord may not be sufficient to cover the economic capital for SME portfolios.

The results of our analysis, first of all, show that the correlation of SME exposures decreases as the asset size of the obligor firms increases. This indicates that the positive relationship between obligor's size and credit correlations assumed in the risk-weight formula proposed by the Basel Committee cannot be supported in Korea. In this light, Korean financial regulators should be careful in adopting the New Accord, especially when treating small business exposures as retail exposures. However, in contrast to our second concern, our analysis found a negative relationship between the probability of default and credit correlation assumed under the risk-weight formula proposed by the Basel Committee.

Our results also suggest that the financial supervisory authority needs to place emphasis on the industrial composition of SME exposures when it adopts the New Accord and proposed special treatment of SME exposures. The differences between the estimated correlation values for portfolios based on industrial characteristics were quite large. In particular, regulators may require banks to have a higher level of capital for SME portfolios that are concentrated with firms from the construction or service industry.

It may be too early to evaluate the capital requirement framework for SME exposures in the New Accord and suggest detailed directions of its application to the Korean financial regulatory system, since more revisions are likely before the final draft. To cover all the bases, it is also worthwhile to mention the limitations of our analysis. First, the observation period might be too short to cover at least an entire business cycle. This could bring about a selection bias in the measurement of PDs, giving way to the possibility of a misleading low PDs volatility. The only solution that addresses this would be to accumulate new data through time. Second, the estimated correlations were computed based on a very large sample of Korean SMEs that maybe quasi-exhaustive. This could lead to an underestimation of the credit correlation, since the size of the individual bank's SME portfolios can be far smaller than the data we used, and consequently, a bank may observe a higher correlation in its book. Thus, the results of the empirical analysis in this paper should be interpreted with some caveats in mind.

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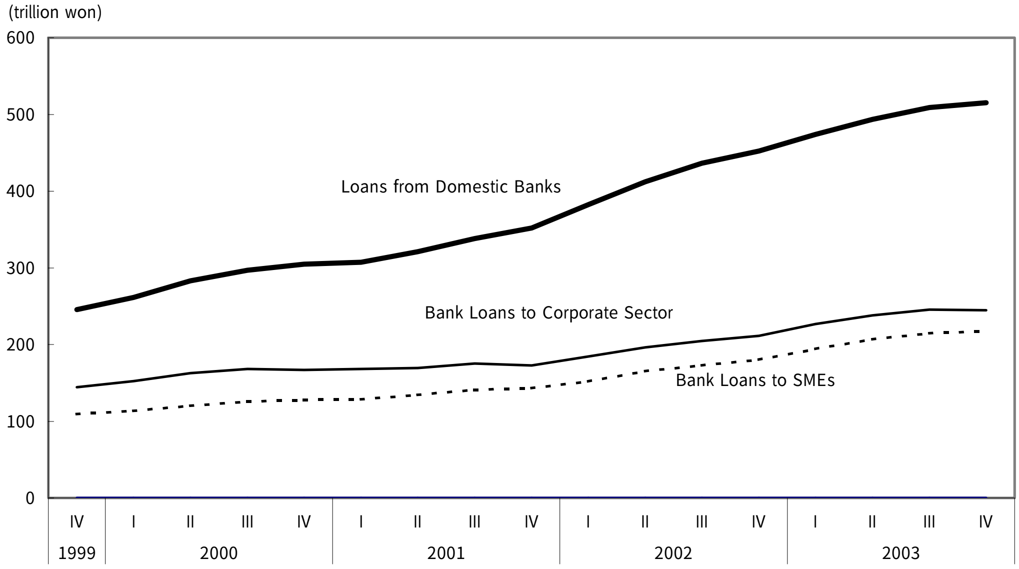
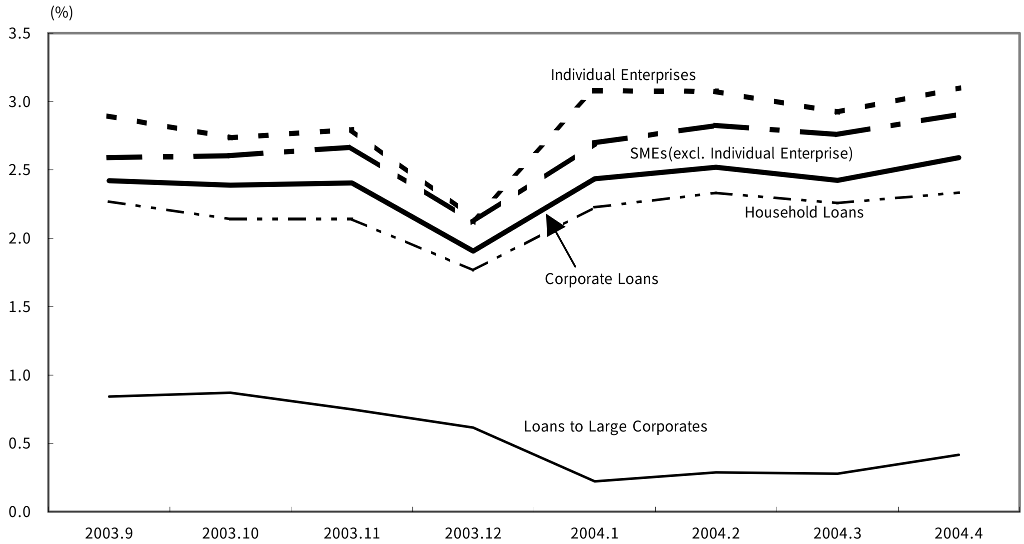
<Figure 1> Loans outstanding of Korean domestic banks by sectors



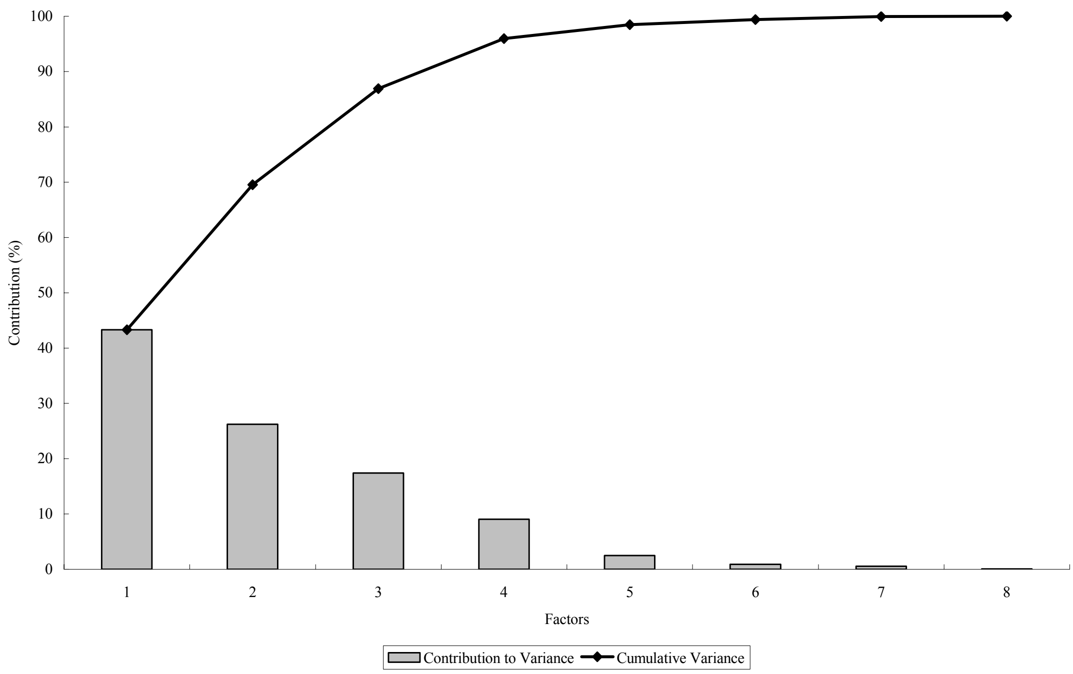
Note: Numbers are of the deposit money banks in Korea.
Source: The Bank of Korea. Financial Supervisory Services.

<Figure 2> Delinquency rates on the loans of Korean banks by sectors

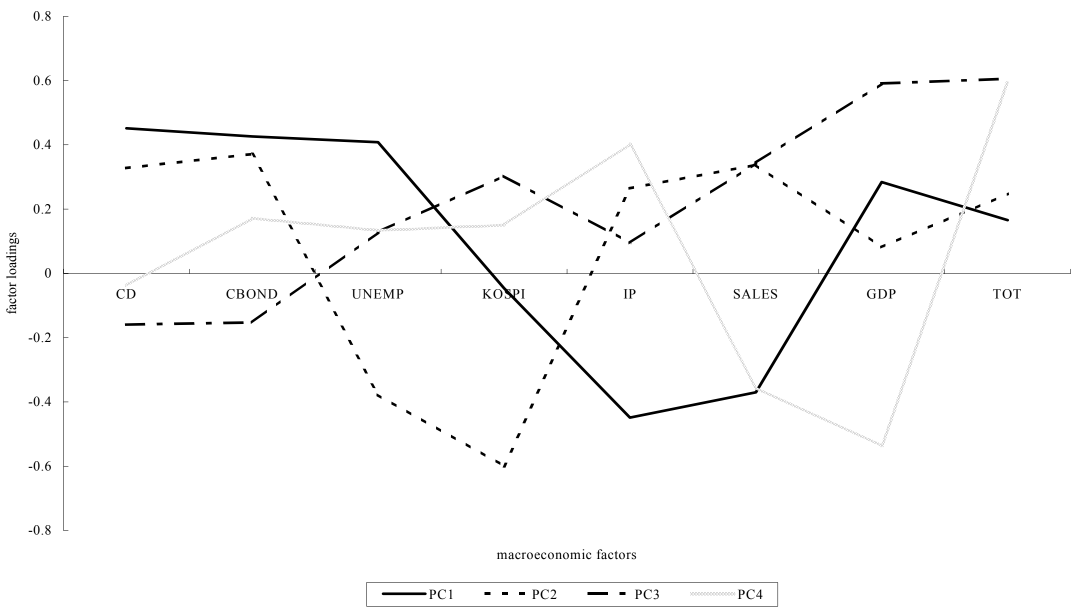


Source: Financial Supervisory Services.

<Figure 3> Proportion of Variance Explained by Principle Components



<Figure 4> Factor Loadings for the First Four Principle Components



<Table 1> BIS Capital Adequacy Ratio of Korean Banks

(%)

	Banks with national operation	Banks with provincial operation
2001	10.80	10.74
2002	10.46	11.26
2003	10.40	11.13

<Table 2> Changes in outstanding Loans of Korean banks

(Billion KRW)

End of	1998	1999	2000	2001	2002	2003
Total loans	-61	48,981	59,361	47,158	100,336	63,174
Corporate Loans	-1,971	23,328	22,588	5,794	38,693	33,155
to Large Businesses	1,111	3,008	4,484	-9,814	1,681	-3,633
to SMBs	-3,081	20,320	18,104	15,608	37,012	36,788
Household Loans	1,910	25,653	36,772	41,736	61,797	29,599

Note: Numbers are of the deposit money banks in Korea.
Source: The Bank of Korea. Financial Supervisory Services.

<Table 3> Delinquency rates on the corporate loans of Korean banks by sectors

(%)

End of	2001	2002	Sep. 2003	2003	Apr. 2004
Total Corporate loans	1.9	1.8	2.4	1.9	2.6
To Large Businesses	1.8	1.1	0.8	0.6	0.4
To SMBs	1.9	2.0	2.7	2.1	3.0
(Individual Enterprises)	2.0	2.1	2.9	2.2	3.1

Source: Financial Supervisory Services.

<Table 4> Portfolios of SMEs by Industrial Categories

(Million KRW)

Portfolio	Number of Companies	Current Asset	Total Asset	Current Debt	Total Debt	Capital Stock
A	2034	11841	25284	10204	14002	3670
B	2834	10556	20123	9227	13414	3171
C	1831	10637	22546	9504	13343	2664
D	982	23163	33943	17026	29511	4290
E	1784	9933	17495	10458	22169	2879
F	305	36038	98927	23882	66305	21978
G	1287	8329	23834	8141	15462	4311

Note: All numbers are averages for companies in each portfolio based on balance sheet of year 2003.
Data: D&B Korea

<Table 5> Portfolios of SMEs by Asset Size

(Million KRW)

Portfolio	Upper Bound	Current Asset	Total Asset	Current Debt	Total Debt	Capital Stock
1	3672	950	1539	769	1053	452
2	10594	3951	7224	3677	5086	1546
3	22950	8399	15585	7762	10484	2480
4	58978	18832	36067	16824	23975	5212
5	-	65106	161531	57448	124799	24520

Note: 1) All numbers are averages for companies in each category based on balance sheet of year 2003.
2) Upper bound indicates the largest total asset for each portfolio.
Data: D&B Korea

<Table 6> Correlation Matrix for Default Probabilities: Industrial Categories

	A	B	C	D	E	F	G
A	1	-0.5201	0.4589	-0.0216	0.0769	0.5871	-0.1431
B		1	0.1125	0.2408	0.6374	-0.6033	0.7656
C			1	0.5657	0.5865	0.4986	0.1805
D				1	0.2029	0.2912	-0.0393
E					1	0.0702	0.4516
F						1	-0.6494
G							1
Average	0.0307	0.0259	0.0429	0.0502	0.0317	0.1474	0.0634
S.D.	0.0033	0.0136	0.0113	0.0210	0.0083	0.0373	0.0201

<Table 7> Correlation Matrix for Default Probabilities: Asset Size

	1	2	3	4	5
1	1	0.8626	-0.0028	-0.2041	-0.7174
2		1	-0.0033	-0.1997	-0.6658
3			1	0.7854	0.1182
4				1	0.5135
5					1
Average	0.0157	0.0221	0.0520	0.0714	0.0908
S.D.	0.0120	0.0138	0.0091	0.0134	0.0126

<Table 8> Correlation Matrix for Default Probabilities: Industrial Categories and Asset size

	A2	A3	A4	A5	B2	B3	B4	B5	C2	C3	C4	C5	D2	D3	D4	D5	E2	E3	E4	E5	F2	F3	F4	F5	G2	G3	G4	G5
A2	1.00	-0.706	-0.725	-0.851	0.788	0.188	0.231	-0.230	0.752	-0.253	-0.434	-0.657	0.540	0.530	0.627	0.156	0.855	-0.216	-0.426	-0.636	0.410	-0.562	-0.309	0.209	0.862	-0.301	-0.563	-0.688
A3		1.000	0.636	0.575	-0.660	-0.134	-0.084	-0.164	-0.606	0.546	0.461	0.560	-0.366	-0.299	-0.271	0.017	-0.772	0.100	0.333	0.307	-0.325	0.290	0.365	-0.383	-0.538	0.449	0.633	0.620
A4			1.000	0.664	-0.674	-0.095	-0.154	0.302	-0.493	0.287	0.708	0.634	-0.421	-0.516	-0.686	-0.331	-0.656	0.306	0.716	0.744	-0.285	0.457	0.305	-0.065	-0.693	0.187	0.583	0.833
A5				1.000	-0.890	-0.560	-0.433	0.380	-0.803	-0.024	0.264	0.665	-0.539	-0.569	-0.595	-0.046	-0.877	-0.090	0.424	0.755	-0.297	0.695	0.336	-0.102	-0.880	-0.038	0.420	0.690
B2					1.000	0.608	0.612	-0.139	0.864	-0.062	-0.354	-0.705	0.451	0.390	0.507	-0.119	0.942	0.224	-0.297	-0.718	0.127	-0.591	-0.502	0.148	0.929	0.006	-0.300	-0.644
B3						1.000	0.522	-0.107	0.486	0.520	0.209	-0.358	0.019	0.103	0.125	-0.472	0.414	0.535	0.106	-0.449	-0.455	-0.507	-0.366	0.196	0.477	0.333	0.217	-0.090
B4							1.000	-0.132	0.360	0.060	-0.258	-0.538	-0.085	-0.241	-0.047	-0.443	0.431	0.330	-0.215	-0.450	-0.184	-0.500	-0.605	-0.232	0.559	0.354	0.193	-0.078
B5								1.000	0.023	-0.249	0.234	0.203	-0.317	-0.264	-0.251	-0.258	-0.063	0.157	0.515	0.595	-0.189	0.492	0.171	0.418	-0.185	-0.275	0.050	0.294
C2									1.000	0.053	0.012	-0.403	0.688	0.647	0.659	0.134	0.907	0.406	-0.002	-0.433	0.234	-0.244	-0.142	0.061	0.824	0.094	-0.395	-0.583
C3										1.000	0.694	0.444	0.083	0.266	0.260	0.097	-0.227	0.564	0.445	-0.061	-0.378	0.093	0.411	-0.379	-0.053	0.758	0.575	0.418
C4											1.000	0.734	0.092	0.170	-0.048	0.073	-0.323	0.639	0.818	0.538	-0.169	0.517	0.656	-0.189	-0.383	0.507	0.431	0.584
C5												1.000	-0.003	0.039	-0.133	0.342	-0.618	0.356	0.702	0.708	0.011	0.839	0.836	-0.376	-0.700	0.397	0.450	0.643
D2													1.000	0.866	0.720	0.699	0.561	0.197	-0.076	-0.365	0.663	0.006	0.282	-0.329	0.385	0.193	-0.343	-0.507
D3														1.000	0.904	0.759	0.480	0.158	-0.110	-0.355	0.488	0.023	0.451	-0.230	0.412	0.246	-0.426	-0.530
D4															1.000	0.681	0.522	0.056	-0.224	-0.512	0.313	-0.082	0.284	-0.221	0.606	0.222	-0.387	-0.567
D5																1.000	-0.011	-0.130	-0.178	-0.092	0.623	0.342	0.666	-0.542	-0.064	0.246	-0.276	-0.249
E2																	1.000	0.191	-0.248	-0.550	0.322	-0.445	-0.380	0.199	0.898	-0.127	-0.497	-0.724
E3																		1.000	0.608	0.225	-0.267	0.343	0.182	-0.308	0.096	0.691	0.288	0.190
E4																			1.000	0.649	-0.280	0.625	0.460	0.070	-0.331	0.202	0.519	0.621
E5																				1.000	-0.167	0.821	0.461	0.021	-0.686	-0.028	0.116	0.569
F2																					1.000	-0.023	0.323	-0.236	0.101	-0.122	-0.323	-0.330
F3																						1.000	0.681	-0.273	-0.576	0.201	0.106	0.395
F4																							1.000	-0.366	-0.447	0.365	0.179	0.364
F5																								1.000	0.152	-0.797	-0.227	-0.201
G2																									1.000	-0.043	-0.388	-0.671
G3																										1.000	0.420	0.294
G4																											1.000	0.807
G5																												1.000

<Table 9> Regression for Multi-factor Merton Model: Industrial Categories

	A	B	C	D	E	F	G
α	-1.8725	-1.9740	-1.7298	-1.6816	-1.8676	-1.0617	-1.5461
PC1	0.0089	0.0169	0.0397	0.0126	0.0318	0.0063	0.0376
PC 2	0.0179	-0.0293	0.0022	-0.0158	0.0051	0.0104	-0.0208
PC 3	0.0138	-0.0413	-0.0119	-0.1605	-0.0017	0.0055	0.0289
PC 4	0.0081	0.0320	0.0009	0.0331	0.0565	0.0391	0.0001
$\overline{R}^2$	0.9627	0.6333	0.2134	0.3385	0.1395	0.2464	0.5018

<Table 10> Regression for Multi-factor Merton Model: Asset Size

	1	2	3	4	5
α	-2.3486	-2.0708	-1.6312	-1.4722	-1.3401
PC 1	0.0219	0.0352	0.0259	0.0276	0.0041
PC 2	-0.0373	0.0036	-0.0044	0.0110	0.0005
PC 3	-0.2058	-0.1385	0.0066	0.0327	0.0206
PC 4	0.2883	0.0597	-0.0271	-0.0013	-0.0074
$\overline{R}^2$	0.5954	0.5507	0.4021	0.4471	0.1057

<Table 11> Regression for Multi-factor Merton Model: Industrial Categories / Asset Size

Portfolio	α	PC 1	PC 2	PC 3	PC 4	$\overline{R}^2$
A2	-2.2874	0.0141	0.0013	-0.1276	0.1167	0.3780
A3	-1.8417	0.0048	0.0158	0.0278	-0.0158	0.2534
A4	-1.6553	0.0267	0.0603	0.1003	-0.0254	0.7490
A5	-1.6562	-0.0243	0.0357	0.1114	-0.0795	0.3240
B2	-2.3983	0.0305	-0.0834	-0.1841	0.1100	0.4984
B3	-1.8345	0.0406	-0.0110	0.0074	-0.0708	0.3173
B4	-1.6614	0.0074	-0.0128	0.0169	0.0634	0.2005
B5	-1.7340	-0.0159	-0.0003	0.0480	0.0272	0.4448
C2	-2.1864	0.0387	0.0297	-0.1533	0.1530	0.4719
C3	-1.6864	0.0359	-0.0078	0.0055	-0.0621	0.5622
C4	-1.4880	0.0478	0.0352	0.0430	-0.0495	0.5854
C5	-1.3867	0.0312	0.0166	0.0657	-0.0539	0.1947
D2	-2.0606	0.0372	0.0321	-0.2791	0.2430	0.4684
D3	-1.7367	0.0178	-0.0085	-0.1696	0.0356	0.6001
D4	-1.4514	0.0013	-0.0618	-0.2202	0.0375	0.4330
D5	-1.5019	-0.0118	-0.0080	-0.1230	0.0180	0.6455
E2	-2.3542	0.0276	-0.0001	-0.1572	0.2042	0.5810
E3	-1.7143	0.0544	-0.0007	0.0211	0.0404	0.4130
E4	-1.3736	0.0473	0.0234	0.0672	0.0071	0.5047
E5	-1.2546	0.0064	0.0499	0.0944	0.0192	0.4273
F2	-1.7648	0.0272	-0.0033	-0.2148	0.5941	0.3552
F3	-1.0175	0.0082	0.0258	0.0439	0.0528	0.0776
F4	-0.9812	0.0149	0.0023	0.0117	-0.0229	0.0334
F5	-1.0067	-0.0335	-0.0017	0.0504	-0.0267	0.1391
G2	-1.9848	0.0336	-0.0618	-0.1803	0.1825	0.4639
G3	-1.6041	0.0573	-0.0518	-0.0061	-0.0068	0.2660
G4	-1.4994	0.0309	-0.0269	0.0781	-0.0419	0.5740
G5	-0.8663	0.0261	0.0056	0.1303	-0.0777	0.7195

<Table 12> Parameter Estimates: Industrial Categories

	A	B	C	D	E	F	G
α_l	-1.8704	-1.9455	-1.7176	-1.6698	-1.8544	-1.0542	-1.5352
β_{l1}^M	-0.0089	-0.0167	-0.0395	-0.0125	-0.0316	-0.0062	-0.0373
β_{l2}^M	-0.0179	0.0289	-0.0022	0.0157	-0.0051	-0.0104	0.0207
β_{l3}^M	-0.0138	0.0407	0.0119	0.1594	0.0017	-0.0055	-0.0287
β_{l4}^M	-0.0081	-0.0315	-0.0009	-0.0328	-0.0561	-0.0388	-0.0001
β_l^P	-0.0401	-0.1580	-0.1111	-0.1665	-0.0931	-0.1660	-0.1568
σ_l	0.9989	0.9855	0.9930	0.9734	0.9935	0.9855	0.9865

<Table 13> Parameter Estimates: Asset Size

	1	2	3	4	5
α_l	-1.9446	-1.9518	-1.6193	-1.4615	-1.3303
β_{l1}^M	-0.0182	-0.0331	-0.0257	-0.0274	-0.0041
β_{l2}^M	0.0309	-0.0034	0.0044	-0.0109	-0.0005
β_{l3}^M	0.1704	0.1305	-0.0065	-0.0325	-0.0205
β_{l4}^M	-0.2387	-0.0563	0.0269	0.0013	0.0074
β_l^P	-0.2348	-0.1812	-0.0761	-0.0880	-0.0771
σ_l	0.8280	0.9425	0.9927	0.9903	0.9935

<Table 14> Parameter Estimates: Industrial Categories / Asset Size

Portfolio	α_l	β_{l1}^M	β_{l2}^M	β_{l3}^M	β_{l4}^M	β_l^P	σ_l
A2	-2.1028	-0.0129	-0.0012	0.1173	-0.1073	-0.2208	0.9193
A3	-1.8283	-0.0044	-0.0145	-0.0256	0.0145	-0.0714	0.9927
A4	-1.6028	-0.0245	-0.0554	-0.0922	0.0234	-0.1224	0.9683
A5	-1.5306	0.0224	-0.0328	-0.1024	0.0731	-0.2278	0.9242
B2	-2.0893	-0.0266	0.0726	0.1604	-0.0958	-0.2671	0.8712
B3	-1.7802	-0.0354	0.0096	-0.0064	0.0617	-0.1341	0.9704
B4	-1.6301	-0.0065	0.0111	-0.0148	-0.0553	-0.1055	0.9812
B5	-1.7162	0.0138	0.0003	-0.0418	-0.0237	-0.0732	0.9897
C2	-1.9519	-0.0345	-0.0265	0.1369	-0.1366	-0.2376	0.8927
C3	-1.6644	-0.0320	0.0069	-0.0049	0.0554	-0.0797	0.9870
C4	-1.4511	-0.0427	-0.0315	-0.0384	0.0442	-0.1184	0.9752
C5	-1.3057	-0.0279	-0.0148	-0.0587	0.0481	-0.2065	0.9416
D2	-1.5406	-0.0278	-0.0240	0.2087	-0.1817	-0.3328	0.7476
D3	-1.6227	-0.0133	0.0064	0.1268	-0.0266	-0.1493	0.9343
D4	-1.2976	-0.0010	0.0462	0.1646	-0.0280	-0.1903	0.8941
D5	-1.4296	0.0088	0.0059	0.0920	-0.0135	-0.1397	0.9518
E2	-2.1100	-0.0248	0.0001	0.1409	-0.1831	-0.1975	0.8963
E3	-1.6657	-0.0487	0.0006	-0.0189	-0.0362	-0.1393	0.9717
E4	-1.3335	-0.0424	-0.0209	-0.0602	-0.0063	-0.1353	0.9708
E5	-1.2038	-0.0057	-0.0447	-0.0846	-0.0172	-0.1562	0.9595
F2	-0.9250	-0.0143	0.0017	0.1126	-0.3114	-0.3736	0.5241
F3	-0.9407	-0.0043	-0.0135	-0.0230	-0.0277	-0.1447	0.9245
F4	-0.9430	-0.0078	-0.0012	-0.0061	0.0120	-0.1043	0.9611
F5	-0.9523	0.0175	0.0009	-0.0264	0.0140	-0.1204	0.9460
G2	-1.8893	-0.0286	0.0526	0.1534	-0.1553	-0.2749	0.9519
G3	-1.5709	-0.0487	0.0441	0.0052	0.0058	-0.2052	0.9793
G4	-1.4385	-0.0263	0.0229	-0.0665	0.0357	-0.1072	0.9594
G5	-0.8550	-0.0222	-0.0048	-0.1108	0.0662	-0.1158	0.9870

<Table 15> Systemic and Portfolio Specific Risks

Portfolio	Systemic factors	Portfolio specific factors	Correlation
A	28.9229	71.0771	0.2264
B	13.0969	86.9031	2.8710
C	12.1366	87.8634	1.4037
D	49.2466	50.7534	5.4603
E	32.4715	67.5285	1.2848
F	5.7457	94.2543	2.9246
G	9.6943	90.3057	2.7236
1	98.8605	1.1395	14.2427
2	86.0280	13.9720	5.4152
3	98.2879	1.7121	0.7229
4	97.1565	2.8435	0.9679
5	94.5877	5.4123	0.6438

<Table 16> Systemic and Portfolio Specific Risks: Industrial Categories / Asset Size

Portfolio	Systemic factors	Portfolio specific factors	Correlation
A2	34.2731	65.7269	7.4201
A3	17.6467	82.3533	0.6198
A4	45.9257	54.0743	2.7701
A5	25.1248	74.8752	6.9320
B2	36.4287	63.5713	11.2223
B3	22.4120	77.5880	2.3164
B4	23.5901	76.4099	1.4576
B5	31.7744	68.2256	0.7864
C2	41.0379	58.9621	9.5761
C3	39.6180	60.3820	1.0518
C4	30.8163	69.1837	2.0248
C5	13.6711	86.3289	4.9397
D2	41.2917	58.7083	18.8672
D3	43.2845	56.7155	3.9280
D4	45.3334	54.6666	6.6240
D5	30.9651	69.0349	2.8285
E2	58.0538	41.9462	9.2984
E3	17.2415	82.7585	2.3432
E4	24.3742	75.6258	2.4195
E5	27.9975	72.0025	3.3872
F2	44.0457	55.9543	24.9417
F3	6.6777	93.3223	2.2426
F4	2.1946	97.8054	1.1127
F5	7.6717	92.3283	1.5693
G2	40.3932	59.6068	12.6825
G3	9.4135	90.5865	4.6499
G4	37.5350	62.4650	1.8393
G5	56.1418	43.8582	3.0600

Appendix 1: Initial Capital Requirement

(Billion KRW)

	Area of operation	**Initial capital**
Bank	National bank	100
	Provincial bank	25
Insurance	Life insurance	30
	life	20
	annuity	20
	Non-life insurance	30
	fire	10
	marine	15
	auto	30
	guarantee	30
	reinsurance	30
	Third insurance	30
	casualty	10
	disease	10
Security Company	Underwriting, dealing, brokerage	50
	Dealing, brokerage	20
	Brokerage	3
	ECN	15

Appendix 2: Description of Portfolio Construction by Industrial Categories

Portfolio	Weight	SIC		
A	12.79%	D-1	D09	Manufacture of Coke, Refined Petroleum Products and Nuclear Fuel
			D10	Manufacture of Chemicals and Chemical Products
			D11	Manufacture of Rubber and Plastic Products
			D12	Manufacture of Other Non-metallic Mineral Products
			D13	Manufacture of Basic Metals
			D14	Manufacture of Fabricated Metal Products, Except Machinery and Furniture
			D23	Recycling
B	13.92%	D-2	D15	Manufacture of Other Machinery and Equipment
			D16	Manufacture of Computers and Office Machinery
			D17	Manufacture of Electrical Machinery and Apparatuseses n.e.c.
			D18	Manufacture of Electronic Components, Radio, Television and Communication Equipment and Apparatuses
			D19	Manufacture of Medical, Precision and Optical Instruments, Watches and Clocks
			D20	Manufacture of Motor Vehicles, Trailers and Semi-trailers
			D21	Manufacture of Other Transport Equipment
C	9.93%	D-3	D01	Manufacture of Food Products and Beverages
			D02	Manufacture of Tobacco Products
			D03	Manufacture of Textiles, Except Sewn Wearing apparel
			D04	Manufacture of Sewn Wearing Apparel and Fur Articles
			D05	Tanning and Dressing of Leather , Manufacture of Luggage and Footwear
			D06	Manufacture of Wood and of Products of Wood and Cork, Except Furniture; Manufacture of Articles of Straw and Plaiting Materials
			D07	Manufacture of Pulp, Paper and Paper Products
			D08	Publishing, Printing and Reproduction of Recorded Media
			D22	Manufacture of Furniture; Manufacturing of Articles n.e.c.
D	9.97%	F		CONSTRUCTION
E	16.68%	G		WHOLESALE AND RETAIL TRADE
F	14.84%	L		REAL ESTATE AND RENTING AND LEASING
G	11.25%	M		BUSINESS ACTIVITIES
		N		PUBLIC ADMINISTRATION AND DEFENCE ; COMPULSORY SOCIAL SECURITY
		O		EDUCATION
		P		HEALTH AND SOCIAL WORK
		Q		RECREATIONAL, CULTURAL AND SPORTING ACTIVITIES
		R		OTHER COMMUNITY, REPAIR AND PERSONAL SERVICE ACTIVITIES
		S		PRIVATE HOUSEHOLDS WITH EMPLOYED PERSONS
		I		TRANSPORT
		J		POST AND TELECOMMUNICATIONS

Comments on "Risks and Capital Regulations on Financial Institutions in Korea: With a special reference to measuring credit risk of SME loans"

Jeeman Jung
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This paper deals with capital regulations of Basel II. The paper constructs a multi-factor risk model and examines the relationship between the correlation of risk exposures and the size of small and medium firms (SME) in Korea. The Basel II regulation implicitly assumes the correlation of exposures is positively related to the size of the SME firms. The paper, however, reveals that the relationship is negative in Korea. Moreover, the authors find that the estimated correlations are very different from each other depending on industrial characteristics. For example, the correlation value in the construction industry is quite higher than those in other industries.

Though the empirical work of the paper is excellent, let me give some comments to improve the credibility of the results. First, we should think of the appropriateness of using the factor model. As you know, the results depend on the choice of factors. The empirical model of the paper uses factors of similar characteristics. For example, industrial production (IP), wholesale and retail index (SALE), unemployment rate (UNEMP), and GDP show quite similar time-series trend and hence some of them can be omitted in the model. Instead, I recommend adding the factors such as exchange rate, inflation rate, or aggregate money supply. Second, I pose a question on the definition of default event. The paper defined a default event when a firm cannot cover its interest payments with operating profits three years in a row. Actually it is not an accurate definition of default event. Rather, I suggest using actual number of defaults published by the statistical bureau of Korea. Third, the paper constructs the SME portfolios according to the industrial classification or asset size. The problem here is that the weight of each portfolio is not equal. At least the paper should explain why the weights are different from each other. Fourth, the paper does not report the standard error of each estimated value. As the value cannot obtain reliability without standard error, I propose the paper to calculate the standard error of each estimated value. Fifth, I would like to ask to rearrange the survey part of first fifteen pages of the paper. The authors may reduce some redundant or unimportant contents to the paper and then add the survey of past literature.

Finally, I'd like to make it clear that by all account the paper by Dr. Kim and Dr. Park is excellent in both aspects of empirical works and theoretical approaches. I expect the results of the paper provide very important implications to financial regulators in Korea before adopting Basel II capital requirement.

CHAPTER 2-4

Financial Supervisory Service, "Does Bank Structure Matter?"

by
*Bo-Eun DoH**

ABSTRACT

This paper addresses the question of whether a mega-bank or monopoly banking system can lead to a higher steady state level of capital stock. There is substantial evidence of a positive relationship between financial market development and long-term output growth. Little is known, however, about the role played by the market structure of the banking sector on growth. In addition, little work, if any, has attempted to analyze how the degree of information externality affects the relative performance of a monopoly bank and competitive banks.

This paper shows that the optimal bank structure is dependent upon the degree of information externality, associated with financial market development and the stage of economic development. In addition, this paper shows that the monopoly banking system obtains higher steady state level of capital as information externality increases.

This result suggests that not only developing countries but also industrial countries may benefit from a concentrated banking system. Hence, this provides an alternative explanation of the recent deregulation and resulting trends in mergers and acquisitions.

JEL Classification: D41, D42, D43, G21, G34

Keywords: Banking Market Structure, Information Externality, Capital Stock, Nash Equilibrium

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I. INTRODUCTION

This paper addresses the question of whether a monopolistic banking system can lead to a higher steady state level of capital stock. Specifically, this research examines factors that contribute to the promotion of economic growth that comes from a concentrated banking system.

Although several studies have recently addressed the issue of whether a monopoly banking system has better performance in terms of economic growth, there have been theoretical debates over the effects of competition on capital accumulation and real economic activities. Conventional wisdom suggests that competition promotes efficiency. In this view, a monopoly bank would exercise its monopoly power to extract rents by charging higher loan rates and/or by paying lower deposit rates. The resulting decreased supply of funds and the associated higher lending rates would lead to a slower process of capital accumulation. Smith (1998) and Guzman (2000) provide support for conventional wisdom by showing that a competitive banking system performs better in accumulating capital stock.

However, some argue that the literature on efficiency in banking does not consider how the banking industry differs from other industries.[1] For example, Allen and Gale (2000) argue that the standard competitive paradigm is not appropriate for the banking industry. One of the crucial limits of the conventional wisdom is that it is not consistent with historical evidences[2]. Petersen and Rajan (1995), Caminal and Matutes (1997) and Schnitzer (1998) show that a monopoly banking system performs better for promoting economic growth. They show that a monopoly bank can more easily overcome the problem of asymmetric information by close ties with firms.[3] They also show that a monopoly bank benefits from choosing the most profitable projects by reducing adverse selection, and making firms use funds in less risky project by preventing moral hazard.

The above studies have focused on the asymmetric information structure between banks and firms, however, little, if any, work has attempted to explore the effect of information externality[4] on relative performance of a monopoly and a competitive banking system.[5] In addition, little has been said about the policy implications of changes in information externality and market structure. For example, what is the effect of changes in government policy from anti-M&A to pro-M&A?

This paper shows that the presence of information externality together with asymmetric information would explain how an economy with a monopolistic banking system might have a higher steady state level of capital stock than an economy with a

1 See Berger and Mester (1997) for the survey of the literature.

2 Cetorelli and Gambera (2001) summarize the effect of concentrated credit market on economic development and industrialization.

3 In addition, as seen in Petersen and Rajan (1995), firms with lower credit quality such as new firms and small firms are able to obtain fund more easily as the number of banks becomes less, since banks have high probability to participate and share the potential future profit of firms. In this view, the loss from extracting rent is compensated by the gain from overcoming the problems associated with asymmetric information and from increasing loan amount to small and new firms.

4 Information externality refers to the fact that once information on firm's credit quality is created, it can be immediately transmitted to other banks.

5 Cetorelli (1997) firstly introduces the effect of the information externality on this issue. In the paper, however, he does not explain the effect of various degree of information externality since he assumes the perfect information externality.

competitive banking system. The presence of investment projects subject to a costly state verification is essential to understand how a monopoly bank performs better compared to a competitive bank. It is assumed that the state verification of investment projects (hereafter, I will state it as screening activities) is economically meaningful. That is, the benefits of screening activities exceed the cost.

This paper extends the Cetorelli's (1997) and Bernanke and Gertler (1989) by incorporating several features relevant to the current economic environments. For example, the model allows various degrees of the information externality. Information is treated as both private and public, depending on the degree of the information externality. In addition, this model is more comprehensive one in that it derives and compare the long-run equilibrium of the duopoly banking system and monopolistically competitive banking system as well as competitive banking system and a monopoly banking system. The novelty of this paper is that it provides the framework for analyzing this issue empirically. By performing comparative statics, it is found that the comparative advantage of a monopoly banking system depends on overall income level, the degree of financial market development, the types of financial market system, i.e. bank-based and capital market-based.

The major finding of this paper is that a monopoly banking system might lead to better performance in accumulating capital stock under both a low and a high degree of information externality. This is opposite result to the conventional wisdom, see e.g. Cetorelli's (1997). A monopoly bank benefits from the allocative efficiency associated with screening activities (specifically, screening activities are closely related to the relationship banking) and the absence of a free riding problem associated with information externality.

In addition, this paper shows that the comparative advantage of a monopolistic banking system depends on the degree of information externality as well as the economic development. In other words, as the degree of information externality increases, a monopoly banking system is more likely to achieve a higher level of steady-state capital stock. Moreover, a monopoly banking system may lead a higher steady state level of capital when it is both the low stage of economic development and high stage of economic development. This suggests that industrial countries as well as developing countries may benefit from a concentrated banking system. This result is not found in the existing literature, which has only shown that only developing countries may benefit from a concentrated banking system.

This analysis provides an alternative explanation of the recent deregulation and resulting trends in mergers and acquisitions, as well as an explanation for the apparent government policy changes from anti-M&A to pro M&A.

The remainder of the paper proceeds as follows. In section II, the model and its relevant factors are described. Section III analyzes the effect of bank structure on the lending strategy and derives equilibrium in each banking system. Section IV compares the long run equilibrium of capital in the competitive banking system with that in the monopoly banking system. In Section V, comparative static analysis is performed. Section VI concludes this paper and discusses policy implications.

II. The Model

This paper in general employs the model based on the Cetorelli's (1997) by making some amendment and adjustment[6]. This paper employs a standard two-period lived, overlapping generations model with production.[7] Population is assumed to be constant and each generation is composed of a continuum of agents with unit mass.[8] Time is discrete, and indexed by t = 0, 1, 2, …

Every period, there are two generations, the young and the old, and a single good is produced. Young agents are endowed with one unit of labor, which is supplied inelastically at the real wage w_t, and endowed with one indivisible investment project. The size of the investment project is assumed to be identical across firms. However, they have no endowment of capital stock or goods.

Young generations are divided into two types, depending on the quality of their endowed investment project, which we label Type 1 (the high-quality) and Type 2 (the low-quality). Young agent knows their own types. Type 1 young agents comprise a fraction $\Phi \in (0,1)$, while Type 2 a fraction $(1-\Phi)$ of the population.[9]

Young agents, both Type 1 and Type 2, are potential firms. They can access to a production technology that has a two-stage process as in Cetorelli (1997); investment and production. In the investment stage, a firm makes an investment to produce physical capitals. The size of the investment project is assumed to be identical across firms. The investment project is such that it transforms one unit of goods at the beginning of period t into one unit of capital at the end of period t.

The outcome of this stage is either success or failure. Type 1 young agents are successful in the investment with probability of $\mu > \Phi$ and unsuccessful with probability of $(1-p_I)$, while Type 2 young agents are successful with probability of $p_{II} \in [0,1]$ and unsuccessful with probability $(1-p_{II})$. Without loss of generality, it is assumed that Type 1 agents always succeed in the investment, while Type 2 agents are doomed to fail, so $p_I = 1$ and $p_{II} = 0$.

The production stage produces a single final good by using physical capital and labor. Type 2 young agent will supply their labor into production line that is owned by Type 1 young agents. K units of physical capital and (1+L) units of labor[10] produce *F(K,1+L)* units of the final good, where *F* is a constant returns to scale production function[11]. Let $f(k) = F(k,1)$ denote a standard neoclassical intensive production

6 The main differences are as follows. Firstly, this paper uses the standard model to deal with asymmetric information problem. Secondly, this model generalizes the effect of information externality on the comparative advantage of bath banking system, which explains historical evidences better. Thirdly, this model accommodates the oligopoly banking system and the monopolistically competitive banking system. Lastly, it provides the tools for analyzing this issue empirically.

7 The overlapping generations model has the advantage of providing a tractable framework for dynamic general equilibrium analysis, into which heterogeneity among borrowers and lenders is easily incorporated. See Bernanke and Gertler (1989)

8 The assumption of a unit mass of workers implies that we will generally have to handle in per capita basis rather than aggregate basis.

9 In this paper, I will use the heterogeneous agent model. We can use the homogeneous agent model alternatively to incorporate the nature of uncertainty. Both approaches have no difference in its results.

10 Type 1 young agents work for themselves (1) and hire Type 2 young agents (L).

11 Obviously, mergers among banks shows scale of economy, according to the results of previous

function[12], where $k_t = K_t/(1+L_t)$ is the capital-labor ratio. K_t is aggregate stock of physical capital, which is equivalent to successful investment. Labor market clearing requires $L_t = (1-\Phi)/\Phi$. Hence, $k_t = \Phi K_t$. To fix ideas, a Cobb-Douglas production function is employed:

$$y_t = f(k_t) \equiv k_t^{\gamma}, \; 0 < \gamma < 1 \tag{1}$$

where y_t and k_t are production per capita, capital per capita[13] at time t, respectively, and γ is the degree of capital intensity of production function.

Old agents have no endowment of either labor or good, and they have no access to the investment project. They have saving from the previous period in the form of deposits and equity capital of banks. Both instruments have identical property of risk.[14] A standard arbitrage argument requires for an interior solution that the rate of return on deposit be equal to the rate of return on equity capital, i.e. $r^d = r^e$. At the end of period, the old consume all they have before dying. It is also assumed that the initial old generations have an aggregate endowment of final goods, K_0, distributed equally among all of them.

Agents' labor supply, consumption and saving behavior are described in a simplest way. For example, labor supplies are fixed[15] and supplied unelastically, so that competitive market wage is determined by w_t. All agents are assumed to be identical with respect to their preferences, and there is no disutility of labor. Utility is derived from consuming the final good both when young and when old. They have identical utility functions of the constant relative risk aversion (CRRA) form.[16]

$$\max_{\{c_t, c_{t+1}\}} U(c_{1,t}, c_{2,t+1}) = c_{1,t}^{\alpha} + \beta c_{2,t+1}^{\alpha}, \quad \alpha < 1 \tag{2}$$

$$\text{s.t } c_{1,t} = w_t - s_t$$

$$c_{2,t+1} = s_t r_{t+1}$$

studies. However, to concentrate how the degree of information externality affects relative performance of both a competitive and a monopoly banking system, I assume a constant return to scale. When we assume increasing return to scale, we have a consistent conclusion that a monopoly bank always performs better.

12 It is assumed that $f(k)$ is a smooth, increasing, and strictly concave function with $f(0)=0$, i.e. $f_k > 0$, $f_{kk} < 0$ and Inada conditions hold.

13 Throughout the paper, "per capita" means "per member of a given generation"

14 The standard arbitrage argument holds when both instruments for savings lie same sphere of risk. In other words, When they have different property of risk, the rate of return of each instrument differ reflecting the risk premium.

15 As in Bernanke and Gertler (1989), the author focuses only on explaining investment fluctuations rather than employment fluctuations. Extensions of the results to the various employment cases are straight forward in principle.

16 Given a twice differentiable Bernoulli utility function u(.), the coefficient of relative risk aversion at c is $r_R(c,u) = -cu''(c)/u'(c)$. Models with constant relative risk aversion are encountered often in finance theory, where they lead to considerable analytical simplicity. Under this assumption, no matter how the wealth of the economy and its distribution across individuals evolves over time, the consumption and saving decisions of individuals do not vary as long as the interest rate on deposits remain same. See Mas-Colell, Whinston and Green (1995) p.194

The subscript 1 denotes young, and 2 denotes old generations. Another subscript t refers time. Hence, $c_{1,t}$ denotes the consumption of a young agent at time t, born at period t and $c_{2,t+1}$ refers the consumption of a old agent at time t+1, born at period t. Hence the combination of $c_{1,t}$ and $c_{2,t+1}$ is the lifetime consumption of a agent born at time t. $U(\cdot)$ is a twice differentiable Bernoulli utility function, and β is a discount factor. See Appendix A for derivation of the problem of agent's utility maximization

Banks are institutions owned by old agents as in Cetorelli and Peretto (2000). They intermediate resources between old agents born at t-1 and young agents born at t at the beginning of time t. At the end of time t, banks recover loans from successful young agents and repay principal and interest to old agents. Banks make profits, which are part of the resources that the old use to finance consumption.

The loan contract between a bank and a firm is assumed to follow standard single period debt contracts[17] as in Sharpe (1990). A single-period debt contract consists of a gross real interest rate on loans, R_t^L, and the corresponding repayment schedule,

$$\begin{cases} l_t R_t^L & \text{if investment is successful} \\ \nu & \text{if investment is unsuccessful} \end{cases} \qquad (3)$$

where l_t is the size of the loan, equivalent to the indivisible project size chosen by a firm at time t, and ν refers to either the residual values of a investment or the penalties levied to unsuccessful young agents. The final goods used in investment are assumed to be completely depreciated as in Bernanke and Gertler (1989). Type 2 agents, hence, will default as in Azariadis (1993).

Definition 1: Let $\theta_P^2(\nu)$ and $\theta_{NP}^2(\nu)$ be the Type 2 young agents' expected income when they start investment project and they do not engage investment project, respectively.

Proposition 1: There exists a critical level of penalty, ν^*, such that $\theta_P^2(\nu^*) = \theta_{NP}^2(\nu^*)$ for Type 2 young agents, and $\theta_P^2(\nu) \geq \theta_{NP}^2(\nu)$ for $\nu \leq \nu^*$ and $\theta_P^2(\nu) < \theta_{NP}^2(\nu)$ for $\nu > \nu^*$.

Proof : Appendix B

It is also assumed that no penalty is levied to assure that a bank plays an important role in this model economy.[18]

Banks do not know the types of an individual agent. They know, however, aggregate measure of the proportion of Type 1 agents of the population.[19] It is also assumed that banks can access the screening technology[20] that enables them to

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[17] As mentioned in Sharpe (1990), single-period debt contract does not consider the fact that rent appropriation from a monopoly bank would affect the firm's investment decision.

18 The critical level of penalty, ν^* is positively correlated with the type 2 young agents' probability of success in investment project. In the case of some penalties levied to unsuccessful agents, i.e. $\nu > \nu^*$, we have a separating equilibrium in this model. That is, Type 1 agents borrow a credit to fund an investment, while Type 2 agents do not. In this case, screening activities of banks are not important.

19 This follows the standard methodology for handling asymmetric information problem between banks and firms. We can use an alternative setting that both agents and banks do not know the probability of success of a project. Both approaches have any effect on the quality of result.

20 The screening activities consist of three functions: consulting, monitoring (ex ante) and auditing (ex post). In this economy, hence, banks play two important roles as in Diamond (1984). First, they collect savings and give a credit to firms, thus achieving diversification of idiosyncratic risk. Second, banks possess economies of scale with respect to gathering information and monitoring firms. From screening technology,

distinguish Type 1 from Type 2 agents with certainty before they provide credit. The screening technology is assumed to be economically meaningful. That is, the benefit from screening is greater than the screening cost. The screening cost is assumed to be proportional to the amount lent.[21] Note that banks lend all available funds. Hence, screening cost is proportional to savings, i.e. $b = (1-\mu)s_t$ where μ is the measure of the level of development of the screening technology.[22] The benefit of screening is to reduce investment loss from giving credit to low quality firms, i.e. $(1-\Phi)s_t$. Hence, $\mu > \Phi$.

Definition 2: Let $\eta(i) \in (H, D)$ be the perfect information of the agent's Type, where $\eta = H$ if investment is successful and $\eta = D$ if investment is failed.

Definition 3: Let $\tilde{\eta}(i) \in (\tilde{H}, \tilde{D})$ be the noisy signal of $\eta(i) \in (H, D)$.[23]

When a bank is engaged in screening (called a "screening bank"), she can observe a specific agent's Type at the cost of b, while a bank not engaged in screening (called a "outside bank"), she can observe only a noisy signal, $\tilde{\eta}(i) \in (\tilde{H}, \tilde{D})$. All "outside" banks are assumed to observe the same outcome of that signal.[24]

Suppose the conditional distribution function is given by

$$prob(\tilde{\eta} = \tilde{H} / H) = prob(\tilde{\eta} = \tilde{D} / D) = (1+\xi)/2 \qquad (4)$$
$$prob(\tilde{\eta} = \tilde{H} / D) = prob(\tilde{\eta} = \tilde{D} / H) = (1-\xi)/2$$

where $\xi \in [0,1]$ refers to degree of information externality. For example, If $\xi = 0$, i.e. no information externality, then outside banks do not have any clues to distinguish high from low quality firms. If $\xi = 1$, i.e. perfect information externality, outside banks know the firm's quality that is exactly same as a screening bank does.

The assumption of the degree of information externality, except for perfect information externality implies asymmetric outcome observability between screening banks and outside banks, and in turn, it makes banks have to expend some minimum level of resources to make sure they choose high quality projects. In the process of screening, the screening banks learn more about the success of the firm's investment than

banks produce valuable information about quality of entrepreneurs. It is used either only by screen-preformed bank or by all banks, depending on degree of information externality.

21 The advantage of this one is that it makes screening cost depend upon size of banks.

22 Screening technology reflects the developments of financial intermediary. Numerous theoretical models suggest that financial intermediaries can lower the cost of researching potential investments, exerting corporate control, managing risk, mobilizing savings, and conducting exchanges. In addition, the level of financial intermediary development influences savings and allocation decisions in ways that may alter long-run growth rates. See, for example Levine, Loayza, and Beck (2000), Greenwood and Jovanovic (1990), Bencivenga and Smith (1991).

23 The basic idea for noisy signal comes from Type I and II error in statistics. Type I error refers that bank rejects providing credit to high quality firms, i.e. $P_r(\tilde{\eta} = \tilde{D} / H)$ and Type II error implies that banks accept a loan application and give a credit to low quality firms, i.e. $P_r(\tilde{\eta} = \tilde{H} / D)$.

24 It is assumed that a firm that rejected previously by one bank will not submit a loan application to other banks. Allowing a subsequent application leads to the "Winners Curse" in that the pool of loan applicants all banks faced is systematically worsening. If a lender has a close tie with a borrower, winners curse problem will be mitigated. See Shaffer (1998)

outside banks do. How degree of information externality affects banks' optimal strategies for screening decision will be investigated in the next section.

III. EQUILIBRIUM IN THE BANKING SYSTEM

Consider an economy with N banks, where N is an exogenous number. Setting *N=1* allows us to consider a monopoly banking system, and *N>1* a competitive banking system.[25] Define $S_t = \int_0^1 s_t^i di$ be equilibrium level of aggregate saving of young agents, where s_t^i is saving of young agent *i*. Note that $S_t = s_t$ with a unit mass as every young agent chooses same amount of savings. The total saving is distributed equally among banks. Hence, a bank receives a saving of $s_{b,t}^j = S_t / N$.

Consider a bank's choices. If a bank engages in screening, he makes a safe loan regardless of what other banks do and regardless of the degree of information externality. However, if the bank does not screen, two outcomes are possible. First, in the case of a high (or perfect) information externality, a bank can learn a firm's quality and makes a safe loan without sustaining the screening cost if one of the other banks screens the firm. Second, if there is a low (or no) information externality, or if no other banks screen the firm, a bank makes a risky loan whose expected payoff depends on the unconditional distribution of high quality projects, Φ.

To get some useful insight for comparative advantage of each banking system, we need to compare the aggregate credit and physical capital between screening equilibrium and no screening equilibrium.

Definition 4: Let X_t^N, X_t^S be aggregate credits provided to all firms under no screening and under full screening, respectively. In addition, let X_t^R be aggregate credits provided to all firms when banks screen firms with probability $q_t \in (0,1)$.

Definition 5: Let x_t^N, x_t^S be credits provided to an individual firm under no screening, and under full screening, respectively. In addition, let x_t^R be credits provided to an individual firm when banks engage in screening firms with probability $q_t \in (0,1)$.

Proposition 2: For the aggregate credit to all firms by banks, $X_t^N > X_t^R > X_t^S$ holds. However, for the credit to an individual firm, $x_t^S > x_t^R > x_t^N$ holds.

Proof. See Appendix B

Proposition 2 shows that when a bank participates in screening activities, total credit to firms would be reduced because of the costs of screening, however, the credits

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25 The result of oligopoly banking system converges to that of a competitive banking system. For example, in symmetric, non-cooperative Nash equilibrium, oligopoly banks choose "no screening" as their optimal strategies in the case of high information externality, while choose "screening" in the case of low information externality. The Nash equilibrium for duopoly banks is attached in Appendix C.

supplied to firms are completely recoverable as only high quality firms are recipients of loans.

A. The Competitive Banking Industry

The competitive banks are assumed to be simultaneous-move, Nash-competitors. In other words, all banks choose strategies at the same time, which give them maximum payoffs, taking other banks' strategies given.

A bank $j \in N$ chooses a strategy z_j^m where superscript m refers to a set of strategies, and subscript j denotes a bank j. A set of strategies, m, consists of no-screening *(NS)* and screening *(S)*. Let *"NS=1"* and *"S=2"*. Hence, $m = \{1,\ 2\}$. For example, z_1^1 denotes strategy of bank 1, which is no screening, and z_2^2 denotes a strategy of bank 2, which is screening. A bank chooses its optimal strategies, either no screening (*m=1*) or screening (*m=2*) simultaneously, considering other banks' strategies and corresponding payoffs.[26]

In the Nash equilibrium, each bank has symmetric payoffs. In other words, the payoffs of a bank under a strategy bundle (z_1^1, z_2^2) equal that of other bank under a strategy bundle (z_1^2, z_2^1). The optimal strategies and payoffs for a competitive bank vary, depending upon the degree of information externality, ξ .

Definition 6: Let a competitive bank's profit be denoted by $\pi_C^S(\xi)$ under screening equilibrium, and by $\pi_C^{NS}(\xi)$ under no screening equilibrium, respectively.

Proposition 3: There exists a critical degree of information externality, ξ^* such that $\pi_C^S(\xi^*) = \pi_C^{NS}(\xi^*)$ for competitive banks, and $\pi_C^S(\xi) > \pi_C^{NS}(\xi)$ for $\xi < \xi^*$ and $\pi_C^S(\xi) < \pi_C^{NS}(\xi)$ for $\xi > \xi^*$.

Proof. See Appendix B

Proposition 4: The screening banks are getting higher payoffs as the financial market advances.

Proof. See Appendix B

Definition 7: A strategy profile $z^* = (z_1^{m^*},..., z_N^{m^*})$ constitutes a Nash equilibrium for the competitive banks if for every *j=1, 2, . ., N, , π_j = 0* and $\pi(z_j^{m^*}, z_{-j}^{m^*}) \geq \pi(z_j^{m'}, z_{-j}^{m^*})$ for all $z_j^{m'} \in Z_j$.

26 The payoffs for a bank are its profits. Profits equal the revenue minus funding and screening cost. The revenue of a bank is determined by the interest rates on lending, R_{t+1}^L , multiplied by the successful physical capital. The cost of funds for a bank is determined by the interest rates on deposit (or the return on equity capital), r_{t+1} , multiplied by total saving. The cost of screening is proportional to savings, as mentioned.

Proposition 5(No-screening Equilibrium): The unique Nash equilibrium of the competitive banks is $z_j^{\ *} = z_j^1$ for every *j=1, 2, . ., N* if $\xi > \xi^*$, i.e. no banks are engaged in screening activities.

Proof. See Appendix B

Proposition 5 shows that competitive banks have no incentive to be engaged in screening activities in the case of substantially higher degree of information externality. Instead, they want to diversify risk by lending all firms indiscriminately. In other words, competitive banks face the free riding problem in the case of high information externality and it, in turn, leads to no screening equilibrium.

When a competitive bank lends to all entrepreneurs indiscriminately, of the lending assets (s_t), lending to only high quality firms (Φ) turns out to be successful (physical capital), i.e. $K_{t+1} = \Phi s_t^j$. Hence the equilibrium capital-labor ratio is given by

$$k_{t+1} = \Phi K_{t+1} = \Phi^2 s_t^j \tag{5}$$

Rewritten (5) for the entire banking system, we can obtain following relations

$$s_t = \Phi^{-2} k_{t+1} \tag{6}$$

A bank's expected return, hence, will be $R_{t+1}^L \times \Phi s_t^j$ where Φ is the time-invariant proportion of high quality firms. In aggregate, total return of banks will be $R_{t+1}^L \times \Phi s_t$. From zero profit condition for the competitive banks,

$$R_{t+1}^L \Phi s_t = r_{t+1} s_t \tag{7}$$

where r_{t+1} is the cost of funds and R_{t+1}^L is the interest rate on loans. R_{t+1}^L and r_{t+1} are well defined demand and supply schedules of capital . Hence, the rental rate for successful physical capital, R_t^L, and real wage w_t are defined by

$$R_{t+1}^L = \gamma k_{t+1}^{\gamma-1} \tag{8}$$

$$w_{t+1} = (1-\gamma) k_{t+1}^{\gamma} \tag{9}$$

Young agents choose s_t to maximize their lifetime consumption. Plugging the optimal amount of saving at time *t*, s_t^* into CRRA utility function, we can derive r_{t+1}.

$$r_{t+1}^{C1} = (\frac{1}{\beta})^{\frac{1}{\alpha}} [\frac{w_t - s_t^*}{s_t^*}]^{\frac{\alpha-1}{\alpha}} \tag{10}$$

where superscript C1 refers to a competitive banking system with high information externality. By plugging (6) and (9) into (10), we have

$$r_{t+1}^{C1} = (\frac{1}{\beta})^{\frac{1}{\alpha}} [\Phi^2 (1-\gamma) k_t^{\gamma} k_{t+1}^{-1} - 1]^{\frac{\alpha-1}{\alpha}} \tag{10-1}$$

By substitution (6), (8), and (10-1) into (7) and rearrangement, we can derive the following relation which shows equilibrium law of motion for the per capita capital stock, k under high information externality, i.e. $\xi > \xi^*$.

$$\Phi\gamma k_{t+1}^{\gamma-1} = (\frac{1}{\beta})^{\frac{1}{\alpha}} \left(\frac{[\Phi^2(1-\gamma)k_t^{\ \gamma}k_{t+1}^{-1}-1]}{[\Phi^2(1-\gamma)k_t^{\ \gamma}k_{t+1}^{-1}-1]^{\frac{1}{\alpha}}} \right) \tag{11}$$

Proposition 6(Screening Equilibrium): The unique Nash equilibrium of the competitive banking industry is $z_j^{\ *} = z_j^2$ for every $j=1, 2, . ., N$ if $\xi < \xi^*$, i.e. all banks are engaged in screening activities.

Proof. See Appendix B

As all banks are engaged in screening activities, only high quality firms will receive loans as $p_I = 1$, $p_{II} = 0$. Then, an individual bank can lend a maximum of $\mu s_t^j (= s_t^j - b)$ and all of those credits will be turned into productive capital, i.e. $K_{t+1} = \mu s_t$ in aggregate, and the equilibrium capital-labor ratio is given by

$$k_{t+1} = \Phi\mu s_t \tag{12}$$

Similarly, we can derive deposit interest rates, r_{t+1}.

$$r_{t+1}^{\ C0} = (\frac{1}{\beta})^{\frac{1}{\alpha}} [\Phi\mu(1-\gamma)k_t^{\ \gamma}k_{t+1}^{-1}-1]^{\frac{\alpha-1}{\alpha}} \tag{13}$$

where the superscript C0 refers to a competitive banking system with low information externality.[27] Throughout the paper, the screening equilibrium in the competitive banking system is called as equilibrium in the monopolistically competitive banking system.[28] Similarly, we can derive the equilibrium law of motion for per capita capital stock, k under low information externality, i.e. $\xi < \xi^*$.

$$\mu\gamma k_{t+1}^{\gamma-1} = (\frac{1}{\beta})^{\frac{1}{\alpha}} \left(\frac{[\mu\Phi(1-\gamma)k_t^{\ \gamma}k_{t+1}^{-1}-1]}{[\mu\Phi(1-\gamma)k_t^{\ \gamma}k_{t+1}^{-1}-1]^{\frac{1}{\alpha}}} \right) \tag{14}$$

B. Monopoly Banking Industry

In this economy, there is only one bank, a monopoly bank. A monopoly bank tries to maximize her profits.

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27 Throughout the paper, the screening equilibrium in the competitive banking system is called as equilibrium in the monopolistically competitive banking system. In the economy with incomplete, asymmetric information, banks satisfy the assumption of monopolistically competitive market. For example, it has the property of monopoly market in that a bank has a monopoly power for the firms that she contacts. While it has the property of competitive market in that the number of bank is sufficiently large to assure no excess margin and it is free to enter and/or exit in the market.

28 In the economy with incomplete, asymmetric information, banks do not satisfy the assumption of competitive market. Instead, it satisfies the assumption of monopolistically competitive market. For example, it has the property of monopoly market in that a bank has a monopoly power for the firms that she contacts. While it has the property of competitive market in that the number of bank is sufficiently large to assure no excess margin and it is free to enter and/or exit in the market.

Proposition 7: The unique Nash equilibrium of a monopoly bank is "screening", regardless of the degree of information externality.

Proof. See Appendix B.

Same as the full screening equilibrium in the competitive banking system $K_{t+1} = \mu S_t$ and $k_{t+1} = \Phi \mu s_t$.

The profit maximization problem of a monopoly bank is:

$$\underset{\{s_t\}}{Max} \quad \mu R^L_{t+1} s_t - r_{t+1} s_t \tag{15}$$

where R^L_{t+1} and r_{t+1} are well defined demand and supply schedules of capital, as mentioned. This is identical to the problem of competitive market under $\xi < \xi^*$. The main difference between monopoly problem and competition with screening problem is how the deposit interest rate is determined. A monopoly bank decides it to maximize its own profit, while a competitive bank chooses it to make zero profit. Similarly, we can derive the equilibrium law of motion in the monopoly credit market

$$\gamma^2 k_{t+1}^{\gamma-1} = (\frac{1}{\beta})^{\frac{1}{\alpha}} \left(\frac{[\frac{\Phi(1-\gamma)}{\alpha} k_{t+1}^{-1} k_t^{\gamma} - \mu^{-1}]}{[\Phi\mu(1-\gamma) k_{t+1}^{-1} k_t^{\gamma} - 1]^{\frac{1}{\alpha}}} \right) \tag{16}$$

(See Appendix B)

IV. COMPARISON OF STEADY STATE LEVEL OF CAPITAL

Now, the long-run equilibrium of capital obtained in a competitive banking system and in a monopoly banking system will be compared. This comparison gives insights for the effects of the banking market structure on capital accumulation.

Definition 8: Let k_{C1}, k_{C0} and k_M be a steady state level of capital for an economy with a competitive banking system (high information externality), a monopolistically competitive banking system (low information externality) and a monopoly banking system, respectively, such that

$$\Phi\gamma k_{C1}^{\gamma-1} = (\frac{1}{\beta})^{\frac{1}{\alpha}} \left(\frac{[\Phi^2(1-\gamma) k_C{}^{\gamma-1} - 1]}{[\Phi^2(1-\gamma) k_C{}^{\gamma-1} - 1]^{\frac{1}{\alpha}}} \right) \quad (\xi > \xi^*) \tag{17}$$

$$\mu\gamma k_{C0}^{\gamma-1} = (\frac{1}{\beta})^{\frac{1}{\alpha}} \left(\frac{\Phi\mu(1-\gamma) k_{C0}{}^{\gamma-1} - 1}{[\Phi\mu(1-\gamma) k_{C0}{}^{\gamma-1} - 1]^{\frac{1}{\alpha}}} \right) \quad (\xi < \xi^*) \tag{18}$$

$$\gamma^2 k_M^{\gamma-1} = (\frac{1}{\beta})^{\frac{1}{\alpha}} \left(\frac{[\frac{\Phi(1-\gamma)}{\alpha} k_M^{\gamma-1} - \mu^{-1}]}{[\Phi\mu(1-\gamma)k_M^{\gamma-1} - 1]^{\frac{1}{\alpha}}} \right) \tag{19}$$

The left-hand side of each equation denotes the marginal revenue (MR), while the right-hand side refers to the marginal cost (MC) of lending assets for a bank. Each equation shows that in equilibrium, marginal revenue will be equal to the marginal cost.

Proposition 8: All economies converge to unique steady state levels of capital.

Proof. See Appendix B

Proposition 9: Under the competitive banking system, the steady state level of capital decreases as information externality increases, i.e. $k_{C1} < k_{C0}$ as ξ increases

Proof. See Appendix B

Proposition 9 supports the conventional wisdom in that market equilibrium in general is inefficient in the presence of externalities.[29] Hence, this result implies that the competitive equilibrium may not pareto-optimal as the information technology advances.

Proposition 10: In the case of low information externality, i.e. $\xi < \xi^*$, the steady state level of capital in the (monopolistically) competitive banking system is strictly higher than that in the monopoly banking system if $\mu > \gamma$.

Corollary 1: The steady state level of capital in the monopoly banking system is strictly higher than that in the monopolistically competitive banking system only if $\mu \square \gamma$.

Proof. See Appendix B

Intuitively, if both competitive banks and a monopoly bank are participating in screening activities, then the advantage of allocative efficiency in monopoly banking system will be washed away. In this case, the loss in output associated with typical rent extraction activities of the monopoly banks generally leads to inefficiency of economy.
Low information externality, however, implies that there is low level of financial market development and no credit pooling system to share the credit information among financial intermediaries. Considering the condition of low information externality, hence, Corollary 1 is more appropriated, which implies that given the capital intensive production technology, γ, the monopoly banking system may perform better.[30] Both the under-developed countries and developing countries might satisfy this condition.

Proposition 11: In the case of high information externality, i.e. $\xi > \xi^*$, the monopoly banking system has strictly higher steady state level of capital than the competitive banking system if $\Phi < \gamma$.

Corollary 2: The steady state level of capital in the competitive banking system is strictly higher only if $\Phi \square \gamma$.

29 When there is an information externality and if banks fail to internalize the value of externality, banks invest less, which implies "no screening" in this paper. Mergers and acquisitions are suggested as one of the solutions for the externalities problem.. For the details, see Coase (1960) and Hendricks and Porter (1996).

30 The condition $\mu \square \gamma$ is a necessary condition, not sufficient. The sufficient condition is that the marginal cost in the monopoly banking system, MC_M is strictly lower than that in the competitive banking system, MC_{C0} The economic intuition for $\mu \square \gamma$ to be necessary condition is that even if the financial sector is under-developed, there is still a room to benefit from the competitive banking structure.

Proof. See Appendix B.

Intuitively, it is clear. Given the capital intensive production technology, , the loss in output associated with lending capital to lower quality firms would be high when the proportion of high quality firms were lower, i.e. high credit risk. Then the value added by screening activities would be large enough to compensate the loss in output associated with the typical rent extraction activity of the monopoly.

V. Comparative Statics

To analyze the effect of information externality on comparative advantage of each market system, let us define $\breve{\xi}$ as a critical level of information externality, which equates the payoffs in the monopoly banking system to that in the competitive banking system.

Definition 9: Let $k_M(\xi)$, $k_C(\xi)$ be the steady state level of capital in the monopoly banking system and in the competitive banking system, respectively.

Proposition 12: There exists a critical level of information externality, $\breve{\xi}$ such that, for any $\alpha, \beta, \Phi, \gamma, \mu$ in their admissible ranges, $k_M(\breve{\xi}) = k_C(\breve{\xi})$ and $k_M(\xi) > k_C(\xi)$ for $\xi > \xi^*$ and $k_M(\xi) < k_C(\xi)$ for $\xi < \xi^*$ if and only if $\mu > \gamma > \Phi > 0$.

Proof. See Appendix B.

The condition $\mu > \gamma > \Phi > 0$ can be decomposed into $\mu > \gamma$ (advanced financial market) and $\gamma > \Phi$ (high credit risk). Hence, the condition implies that a economy has advance financial market but has high credit risk. Proposition 12 implies that in this economy, a concentrated banking system may lead to a higher output as the information externality increases. To see this, the author performs the comparative static analysis. Comparative static analysis gives us insights for how the equilibrium condition varies as the other parameters of the economy change.

1. Low Information Externality

Here we can compare equation (18) and (19) to perform comparative static. From Proposition 10 and Corollary 1, we know that the comparative advantage between the competitive and the monopoly banking system may vary as the degree of financial market developments.

Definition 10: Let μ^* be a critical value of the level of financial market developments, which equates the steady state level of capital stock in the monopoly banking system to that in the competitive banking system.

Proposition 13: There exists a μ^* such that, for any $\alpha, \beta, \Phi, \gamma, \mu$ in their admissible ranges, $k_M(\mu^*) = k_C(\mu^*)$ and $k_M(\mu) > k_C(\mu)$ for $\mu > \mu^*$ and $k_M(\mu) < k_C(\mu)$ for $\mu < \mu^*$ if and only if $\gamma > \mu^* \in (0,1)$, i.e. under-developed financial markets.

Proof. From Proposition 10 and Corollary 1, we can easily prove above Proposition.

Proposition 13 implies that as the financial markets advance, the competitive banking system may produce a higher output in the case of lower information externality. Intuitively, competitive banks can easily access information on firm's quality without screening as financial markets advance. Then, the advantage of allocative efficiency in the monopoly banking system will be diminishing. Instead, the loss in output associated with typical rent extraction activities of a monopoly bank leads to inefficiency of economy. However, if the financial markets are under-developed, a monopoly bank has a competitive advantage in acquiring and processing information on firm's quality.

To explore the effect of changes in parameters on the relative advantage between monopolistic and competitive banking system, let me define the difference function, Δ_1 as follows: $\Delta_1 = k_M - k_{C0}$ [31]. Let $k_1^* = k_M^{\gamma-1}(\mu^*) = k_{MC}^{\gamma-1}(\mu^*)$. Then, $\Delta_1(\mu^*,\ k_1^*,\ \alpha,\ \beta,\ \gamma,\ \Phi)$ can be rewritten by

$$\Delta_1(\mu^*, k_1^*, \alpha, \beta, \gamma, \Phi) = (\gamma - \mu^*)\gamma k_1^* - \left(\frac{1}{\beta}\right)^{\frac{1}{\alpha}} \left[\frac{\Phi(1-\gamma)k_1^*(\frac{1}{\alpha} - \mu^*) - (\frac{1}{\mu^*} - 1)}{(\Phi\mu^*(1-\gamma)k_1^* - 1)^{\frac{1}{\alpha}}} \right] = 0$$

(1) The Effect of Φ on μ^*

Now let us explore that how the critical level of screening technology changes as the proportion of high quality firms increases. In other words, I investigate how μ^* varies as Φ changes, i.e. $\frac{\partial \mu^*}{\partial \Phi}$. As μ^* is not written explicitly as a function of Φ, I derive the effect by applying the implicit function theorem on Δ_1. That is,

$$\frac{\partial \mu^*}{\partial \Phi} = -\frac{\partial \Delta_1 / \partial \Phi}{\partial \Delta_1 / \partial \mu^*} = -\frac{\Delta_{1\Phi}}{\Delta_{1\mu^*}}$$

The sign of $\partial \mu^* / \partial \Phi$ is strictly positive under a certain condition(See Appendix B). That is, the critical level of degree of financial markets development increases as the proportion of high quality firm increases in the case of low information externality. The economic meaning for a higher critical level of financial markets development is that an economy will benefit more from a monopolistic banking system. It is due to the inefficiency from over-investment of information system and severe competition among competitive banks.

(2) The Effect of Degree of Capital Intensity, γ on μ^*

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31 We know from Proposition 10 and Corollary 1 that $\Delta_1 > 0$ as $\mu \,\square\, \gamma$ and $\Delta_1 < 0$ as $\mu > \gamma$. In order for the difference function, Δ_1 to be continuous function in μ, hence, $\mu^* < \gamma$ must be held.

Next let us explore that how the critical level of financial markets development varies as the degree of capital intensity of technology γ changes. Note that the degree of capital intensity of technology can be interpreted by an indicator of the elasticity of capital demand. From this analysis, hence, I will answer the following question: Is a competitive banking system better for capital-intense countries (mainly industrial countries) or labor-intense countries (mainly developing countries)? Moreover, which banking system performs better if a country has a high (low) elasticity of capital demand?

To investigate how μ^* varies as γ changes, i.e. $\partial\mu^* / \partial\gamma$, I also apply the implicit function theorem on Δ_1.

$$\frac{\partial\mu^*}{\partial\gamma} = -\frac{\partial\Delta_1 / \partial\gamma}{\partial\Delta_1 / \partial\mu^*} = -\frac{\Delta_{1\gamma}}{\Delta_{1\mu^*}}$$

The sign of equation $\partial\mu^* / \partial\gamma$ is strictly negative if $\mu^* > 2\gamma$. Let us take a considering the condition of $\mu^* > 2\gamma$, which implies that a monopoly banking system is more likely to lead to higher steady state level of capital stock. Hence, it implies that the comparative advantage of the monopoly banking system will be diminishing as the economy has higher elasticity of capital demand. Intuitively, the negative repercussion on capital formation, associated with rent extraction activity in the monopolistic banking system, becomes worse as an economy has higher elasticity of capital demand. This result is consistent with historical evidence.

This is the case of the combination of the low information externality, i.e. under-developed in financial sector and high growth in real sector. The ASEAN countries might be a example of being classified to this category. Hence, those countries can promote economic growth if they set up financial system more competitively.

Countries with bank-based financial markets system such as Japan and Germany and those with market-based financial system such as United States and United Kingdom might have a different property on the elasticity of capital demand. For example, bank-based countries might have lower elasticity of capital demand than market-based countries, in general. Hence, this result gives some empirical implications about whether the effect of a concentrated banking system on real economic activities will differ among countries with different financial markets system.

2. High Information Externality

In the case of high information externality, we can compare equation (17) and (19) to perform comparative static. From Proposition 11 and Corollary 2, we know that the comparative advantage between the competitive and the monopoly banking system varies as the proportion of high quality firms in the economy changes.

Definition 11: Let Φ^* be a critical value of the proportion of high quality firms, which equate the steady state level of capital stock in the monopoly banking system to that in the competitive banking system.

Proposition 14: There exists a Φ^* such that, for any $\alpha,\ \beta,\ \gamma,\ \mu$ in their admissible ranges, $k_M(\Phi^*) = k_C(\Phi^*)$ and $k_M(\Phi) > k_C(\Phi)$ for $\Phi < \Phi^*$ and $k_M(\Phi) \le k_C(\Phi)$ for $\Phi > \Phi^*$ if and only if $\gamma < \Phi^* \in (0,\ 1)$, i.e. low credit risk.

Proof. From Proposition 11 and Corollary 2, we can easily prove the Proposition.

Proposition 14 implies that as the proportion of high quality firms increases, the competitive banking system may produce a higher output for the economy. Intuitively, the advantage of allocative efficiency in the monopoly banking system will be diminishing as high quality firm increases. In this case, the loss in output associated with typical rent extraction activities of a monopoly bank dominates the advantage of allocative efficiency. This, in turn leads to inefficiency of economy.

To explore the effect of changes in parameters on the relative advantage between monopolistic and competitive banking system, let me define the difference function, Δ_2 as follows: $\Delta_2 = k_M - k_C$.[32] Let $k_2^* = k_M^{\gamma-1}(\Phi^*) = k_C^{\gamma-1}(\Phi^*)$. Then, $\Delta_2(\Phi^*,\ k_2^*,\ \alpha,\ \beta,\ \gamma,\ \mu)$ can be rewritten by

$$\Delta_2(\Phi^*, k_2^*, \alpha, \beta, \gamma, \mu) = (\gamma - \Phi^*)\gamma k_2^* - \left(\frac{1}{\beta}\right)^{\frac{1}{\alpha}} \left[\frac{\dfrac{\Phi^*(1-\gamma)}{\alpha} k_2^* - \mu^{-1}}{(\Phi^*\mu(1-\gamma)k_2^* - 1)^{\frac{1}{\alpha}}} - \frac{\Phi^{*2}(1-\gamma)k_2^* - 1}{(\Phi^{*2}(1-\gamma)k_2^* - 1)^{\frac{1}{\alpha}}} \right] = 0$$

Similarly, we can explore that how the critical level of high quality firm's ratio changes as the financial markets advance and as production technology changes. In other words, I investigate how Φ^* varies as μ and γ changes, respectively.

As Φ^* is not written explicitly as a function of μ and γ, I derive the effect by applying the implicit function theorem on Δ_2. That is,

$$\frac{\partial \Phi^*}{\partial \mu} = -\frac{\partial \Delta_2 / \partial \mu}{\partial \Delta_2 / \partial \Phi^*} = -\frac{\Delta_{2\mu}}{\Delta_{2\Phi}} \quad \text{and} \quad \frac{\partial \Phi^*}{\partial \gamma} = -\frac{\partial \Delta_2 / \partial \gamma}{\partial \Delta_2 / \partial \Phi} = -\frac{\Delta_{2\gamma}}{\Delta_{2\Phi}}$$

The results of the comparative statics are as follows.

First, $(\partial \Phi^* / \partial \mu) > 0$ if the steady state level of capital level of capital is more than a certain level. In other words, the critical level of the ratio of high quality firms increases as the financial markets advance. The economic meaning for higher critical level of high quality firm's ratio is that the economy benefits more from a monopoly banking system. Hence, the monopoly banking system has a better performance in reaching higher steady state level of capital as the financial markets advances.

Second, $(\partial \Phi^* / \partial \gamma) > 0$ if $\Phi^* > 2\gamma$ and the steady state level of capital level of capital is more than $[\Phi^* \mu(1-\gamma)]^{-1}$. The condition of $\Phi^* > 2\gamma$ implies that the monopolistic banking system has more likely to lead to higher steady state level of capital

32 We know from Proposition 11 that Δ_2 >0 as $\Phi < \gamma$ and Δ_2 <0 as Φ □ γ. In order for the difference function, Δ_2 to be continuous function in Φ , hence, $\Phi^* > \gamma$ must be held.

stock. Hence, we can conclude that the negative repercussion on capital formation, associated with rent extraction activity in the monopolistic banking system becomes worse as an economy has a higher elasticity of capital demand. This result is consistent with historical evidences.

VI. CONCLUSION AND POLICY IMPLICATIONS

This paper explores the effect of banking market structure on capital accumulation under different degree of the information externality. Specifically, it explores how the degree of information externality affects the bank's decision on screening activities and resulting long-run equilibrium of capital stock

This paper shows that allocative efficiency from screening activity and efficient provision of screening from free riding problem are major factors for a monopoly banking system to reach a better performance in accumulating capital. In addition, it shows that a monopoly banking system might have better performance as the information technology advances and the financial markets develop

In addition, this paper suggests that there appears to be some relationship between economic development and optimal market structure in banking industry. It also suggests that there is relationship between information externality and market structure. For example, in an early stage of economic development, a monopolistic banking system might be more effective to achieve higher steady state level of capital and economic growth. In this stage, both financial market development (μ) and the proportion of high quality firms (Φ) are likely to be low. Hence, the following conditions, $\mu < \gamma$ and/or $\Phi < \gamma$ will be easily satisfied, as shown in the Proposition 11 and Corollary 1.

The competitive banking system might be better in the middle stage of economic development, where real sector starts to improve but financial sectors are still under-developed. However, as financial markets advance, information externality becomes increase, which suggests that a monopolistic banking system regains its comparative advantage for accumulating capital.

The results of comparative static also show that a monopoly banking system has a comparative advantage as financial markets advance and the credit risk is lower. However, a competitive banking system has a comparative advantage as an economy shows a high elasticity of capital demand. This result gives us empirical questions whether the effect of concentrated banking system on real economic activities will differ among countries with different financial systems and different economic conditions.

This result provides an alternative explanation for the recent deregulation and resulting trends in merger and acquisition both in the industrial countries and in the developing countries. Hence, this result can provide a theoretical foundation to support the policy change from anti-M&A to pro-M&A observed in different countries.

As we have seen from empirical evidence, banks have made a huge investment on networking and computerization to respond to the strategic uncertainty. As keeping the information technology "in-house" is a way to keep future options open and diversify across possible areas of future focus [33], a competitive banking system leads to overinvestment on information technology. Hence, a concentrated banking system through the mergers and acquisitions can be beneficial to the economy since it gives an economy of scale as well as the synergy effect from information sharing.

This paper should be considered as a first step in incorporating the level of economic development, financial markets development and information externality into the analysis of the effect of the banking market structure on the economic growth. Accordingly, there are a number of possible extensions.

First, in this model there is only a single good, there is no government sector, and banks are not regulated. Exploring the desirability of regulatory intervention, and allowing some scope for fiscal and monetary policy to affect the operation of the financial system would be important topics for further investigation. For example, in this paper, I assume that banks are owned by old agents. This assumption makes it simply to analyze. However, when we incorporate new agents, bank owner and bank regulator, into this model, we can analyze bank manager's incentive and policy implication of bank regulator.

Second, the results in this paper depend on the assumption of single-period debt contact. When we extend this model into multi-period debt contract, we can incorporate firm's incentive problem. For example, single period model may ignore the possibility that rent extraction activities associate with information monopoly have effect on reduction on firm's investment. The more distortion in firm's investment, the less capital accumulation is.

Third, this paper analyzes the equilibrium law of motion for capital stock under different banking market structures. Exploring the transitional dynamics under different banking market structure would be interesting for future project, too. Third, whereas this paper assumes that banks and firms are identical in size among themselves, it would be more realistic to introduce bank and firm size as a source of asymmetry into the model. Asymmetric bank and firm size gives the larger bank and firm a higher degree of monopoly power at the occurrence of transaction, which in turn, influences strategic interaction among banks and/or among firms. Pecorino (2001) analyzes the effect of changes in industry structure on the ability to maintain a cooperative equilibrium in a repeated game setting. He allows size difference among firms and finds the following results. When the market share of the largest firm rises holding the size distribution of firms within the "fringe", the changes in cooperation level among firms is not determined. However, when the number of identical firms in the fringe increases, cooperation becomes more difficult.

It is also interesting to model endogenous meager which depends on the degree of information externality. There is empirical evidence that the relationship between the number of banks and social welfare is an inverted U-shape. This implies that neither competitive nor monopoly banking system are not pareto-dominant. Although the result in this paper suggests that it depends on information externality, it could be interesting if the number of banks gets to be chosen depending on the degree of information externality.

33 This argument comes from the theory developed by Boot et al (1998). In this context, the enormous premia that have been paid in M&A would be rationalized in part by the large projected savings in information technology expenses by the merging banks. See Thakor (1999)

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Appendix A. Agents' Utility Maximization Problem

Young agents derive utility from consuming final goods both when they are young and when old. Let $c_{1,t}$ denote consumption of young agent at time t, and let $c_{2,t+1}$ denote consumption of old agent at time t+1. An agents is assumed to care about his lifetime consumption.

A Type 1 young agent wants to maximize his own utility. As a young agent has preference for operating his own business, a Type 1 young agent makes an investment to produce physical capital. To make investment, he borrows from banks. His investment turns out to be success and he obtains physical capital. A Type 1 young agent produces final good using physical capital and labor and then pays back loans to banks. So he has following disposable income.

$$DI_t^1 = F(l_t, 1 + L_t) - w_t L_t - R_t^L l_t \tag{A.1}$$

where superscript 1 refers to Type 1 (high productivity) young agents, $F(l_t, 1+L_t)$ is production using physical capital ($l_t = K_t$) and labor ($1+L_t$). R_t^L is the gross interest rate on loans. A young agent makes a decision how much he consumes at current period and how much he consumes at next period. Hence, $c_{1,t}^1$ and $c_{2,t+1}^1$ are given as follows.

$$c_{1,t}^1 = DI_t^1 - s_t^1 \quad , \quad c_{2,t+1}^1 = r_{t+1} s_t^1 \tag{A.2}$$

The utility maximization problem of a Type 1 young agent, hence, is as follows.

$$\max \quad U(c_{1,t}^1, c_{2,t+1}^1) = (c_{1,t}^1)^\alpha + \beta (c_{2,t+1}^1)^\alpha \tag{A.3}$$

$$s.t \quad c_{1,t}^1 = F(l_t, 1 + L_t) - R_t^L l_t - w_t L_t - s_t^1$$

$$c_{2,t}^1 = r_{t+1} s_t^1$$

As mentioned, young agents save for future consumption in the form of deposits (d_t) and equity capital of banks (e_t), i.e. $s_t = e_t + d_t$. Let r_{t+1}^d be deposit interest rates and let r_{t+1}^e be rate of returns on equity capital. No arbitrage condition guarantees that revenue from deposits is exactly same as revenue from equity capital, i.e. $r_{t+1}^d = r_{t+1}^e = r_{t+1}$.

The competitive markets for capital and labor guarantee the following demand schedules:

$$R_t^L = \frac{\partial F(l_t, 1 + L_t)}{\partial l_t} = F_1(l_t, 1 + L_t) = F_1(K_t, 1 + L_t) \tag{A.4}$$

$$w_t = F_2(K_t, 1 + L_t) \tag{A.5}$$

as $l_t = K_t$.

By applying Euler's Theorem, (A.1) can be rewritten as

$$\begin{aligned} DI_t^1 &= F(l_t, 1+L_t) - w_t L_t - R_t^L l_t \\ &= l_t F_1(l_t, 1+L_t) + (1+L_t) F_2(l_t, 1+L_t) - w_t L_t - R_t^L l_t \\ &= l_t R_t^L + (1+L_t) w_t - w_t L_t - R_t^L l_t = w_t \end{aligned} \tag{A.6}$$

Hence,

$$c_{1,t}^{1} = w_t - s_t^1 , \quad c_{2,t+1}^{1} = s_t^1 r_{t+1} \tag{A.7}$$

A Type 2 young agent also wants to maximize his own utility subject to resource constraints. As young agents have preference for operating their own business, a Type 2 young agent makes an investment to produce physical capital in the case of no penalty for default. To make investment, he also borrows credit from banks. His investment turns out to be failure, however. Thus, he is doomed to default. He will supply his labor in successful lines of production and receive competitive real wages, w_t .

Similarly, $c_{1,t}^{2}$ and $c_{2,t+1}^{2}$ are given as follows.

$$c_{1,t}^{2} = w_t - s_t^2 , \quad c_{2,t+1}^{2} = s_t^2 r_{t+1} \tag{A.8}$$

where superscript 2 refers to Type 2 (low productivity) young agents.
Hence, the utility maximization problem of a Type 2 young agent is as follows.

$$\max \quad U(c_{1,t}^{2}, c_{2,t+1}^{2}) = (c_{1,t}^{2})^{\alpha} + \beta (c_{2,t+1}^{2})^{\alpha} \tag{A.9}$$

$$s.t \quad c_{1,t}^{2} = w_t - s_t^2$$

$$c_{2,t}^{2} = r_{t+1} s_t^2$$

Note that net profits derived from borrowing and investing a physical capital is zero as loan interest rate equals marginal productivity of capital in production function. As both types of young agents have same productivity of labor, Type 1 young agents have same wage income as Type 2 young agents, which is marginal productivity of labor.

As both Type 1 and Type2 young agents have same preference, they will save same amount of real good for the next period consumption. Hence, each agent has identical bundle of consumption at time t and time t+1.

$$c_{1,t}^{1} = c_{1,t}^{2} = c_{1,t} = w_t - s_t \tag{A.10}$$

$$c_{2,t+1}^{1} = c_{2,t+1}^{2} = c_{2,t+1} = r_{t+1} s_t$$

$$s_t^1 = s_t^2 = s_t = w_t \nu(r_{t+1})$$

where $\nu(r_{t+1})$ is $\left(1 + [\beta r_{t+1}{}^{\alpha}]^{\frac{1}{\alpha-1}}\right)^{-1}$.

Appendix B. Proofs

1. Proposition 1

The expected income of Type 2 is $w_t - \nu$ when they make a investment and w_t when they do not. Hence, the critical level of penalty ν^* is zero. If there is a penalty levied on the Type 2, Type 2 young agents do not make a project, while invest a project when there is no penalty.

2. Proposition 2

First, I will show $X_t^N > X_t^R > X_t^S$.

If no banks screen, the total saving from old agents becomes loans supplied to firms, i.e. $X_t^N = S_t$. However, if all banks screen, because of the screening cost, the total credit available credit will be $X_t^S = N(s_{b,t} - (1-\mu)s_{b,t}) = \mu N s_{b,t} = \mu S_t$. Therefore $X_t^N = S_t > \mu S_t = X_t^S$ as $0 < \mu < 1$. When the probability of screening is considered, the total available credit is $X_t^R = q_t X_t^S + (1-q_t)X_t^N = q_t \mu S_t + (1-q_t)S_t = [1-q_t(1-\mu)]S_t$. Hence, $X_t^N > X_t^R > X_t^S$

Next, I will show $x_t^N < x_t^R < x_t^S$ or $x_t^N < x_t^S < x_t^R$.

To compare the size of credit for an individual firm, we need the number of firms that receive credit. If there is no screening, all the firms are credit recipients. With mass unit of entrepreneurs, $x_t^N = S_t = s_t$. If all banks screen, only high quality firms (Φ) have access to credit. Hence, $x_t^S = \dfrac{X_t^S}{\Phi} = \dfrac{\mu}{\Phi} S_t > S_t = x_t^N$ since $\mu > \Phi$ by definition. When randomizing with probability q_t, the number of firms that have access to credit is $(1-q_t) + q_t\Phi = 1 - q_t(1-\Phi)$. Therefore, the expected credit for an individual firm, x_t^R is $x_t^R = \left(\dfrac{(1-q_t(1-\mu)}{1-q_t(1-\Phi)}\right) S_t > S_t = x_t^N$ since $\mu > \Phi$ by assumption. Hence, $x_t^N < x_t^R < x_t^S$.

Table 1. Comparison of Credit and Capital

	Full Screening	Randomizing	No Screening
Total Credit	μS_t	$[1-q_t(1-\mu)]S_t$	S_t
Credit per Firms	$(\mu/\Phi)s_t$	$\left((1-q_t(1-\mu))/(1-q_t(1-\Phi))\right)s_t$	s_t
Successful Capital	μS_t	$[\mu q_t + (1-q_t)\Phi]S_t$	ΦS_t

3. Proposition 3

If a bank is engaged in the screening activity, she has to bear following screening costs, $(1-\mu)s_t$. If not, she has the expected profit, calculated as follows: The probability of accept for loan application conditioned that only noisy information is available is

$$P_r(Loan) = P_r(\tilde{\eta} = H/H) * P_r(H) + P_r(\tilde{\eta} = H/L) * P_r(L).$$

That is, $P_r(Loan) = (1+\xi)\Phi/2 + (1-\xi)(1-\Phi)/2$

As the high quality firms are able to pay back their loan with interest rate, the repayment ratio, $P_r(H/Loan)$ of no-screen banks is

$$P_r(H/Loan) = P_r(\tilde{\eta} = H/H)/P_r(Loan) = (1+\xi)\Phi/(1-\xi+2\Phi\xi).$$

Hence, the expected revenue of no-screen banks is

$$P_r(H/Loan) * s_t = (1+\xi)\Phi s_t/(1-\xi+2\Phi\xi).$$

By definition, we can derive the critical level of information externality.

$$\xi^* = (\mu-\Phi)/(\Phi+\mu-2\Phi\mu)$$

In view of positivity condition of $\xi \in (0,1)$, we can find the range of each variable: $\Phi \in (0.5,1)$ and $\mu \in (0.5,1)$. Under this range of these variables, ξ^* has a range of $0 < \xi^* < 1$.

Hence, if $\xi < \xi^*$, screening gives a bank higher payoff, and vice versa.

However, in a competitive banking system, banks will retreat from engaging in screening activities as the degree of information externality increases, shown in Proposition 2.

4. Proposition 4

By reviewing (B.1), the critical level of information externality converges to zero as the level of screening technology is close to the proportion of high quality firms. Given the proportion of high quality firms, the critical level of information externality increases as screening technology advances, suggesting that screening equilibrium has higher payoffs as financial markets advance.

5. Proposition 5

First, it is shown that $Z_j^* = Z_j^1$ for every j=1, 2,…, N is equilibrium. If all banks choose $Z_j^* = Z_j^1$ i.e., "No Screening", the total revenue will be ΦR_{t+1}^L, as they recover loans only for high quality firms. Given the zero-profit condition for the competitive banks, we can derive deposit interest rate, r_{t+1}^L, which is ΦR_{t+1}^L.

Suppose that a bank j deviates and decides to screen. Since the information about screened high quality firms is revealed to outside banks immediately, and thus outside banks make a better offer to the firms. Of course, as the screened, high quality firms want to borrow at the lowest cost, they make a contract with a bank that offers lowest lending rates. Hence, a screening bank j cannot recover screening cost and makes a loss, i.e. π_j < 0. There, thus, is no incentive for any banks to deviate from the optimal strategy, i.e. $Z_j = NS$ for every j=1,2,…,N. Therefore, $Z_j^* = NS$ is equilibrium.

Next, it is shown that $Z_j^* = NS$ is unique equilibrium. Suppose $Z_{j'} \neq Z_j^1$ is an equilibrium. Then, a bank $j \in j'$ will be subject to free riding and will suffer a net loss as shown above. If this bank decides to deviate and choose NS, it will benefit from free riding and will make at least zero profits. Therefore, $Z_{j'} \neq Z_j^1$ is not equilibrium.

6. Proposition 6

Similarly, it is shown first that $Z_j^* = Z_j^2$ i.e. "Screening", for every j=1,2,…,N is equilibrium. If all banks choose to screen, the total revenue will be $\mu R_{t+1}^L s_t$, which is greater than the payoffs of no screening, $\Phi R_{t+1}^L s_t$. Given the zero-profit condition, the deposit interest rate r_{t+1}^L is μR_{t+1}^L if screened, and ΦR_{t+1}^L if not. Therefore, $Z_j^* = Z_j^2$ is an equilibrium for every j=1,2,…,N. Similarly, $Z_j^* = Z_j^2$ is a unique equilibrium.

7. Proposition 7

The expected revenue for a monopoly bank is $\mu R_{t+1}^L s_t$ when she engages in screening activities. That is $\Phi R_{t+1}^L s_t$ when she does not engage in screening activities. By the assumption of $\mu > \Phi$, a monopoly bank screens rain or shine.

8. Profit Maximization Problem for a Monopoly Bank

Objective function: $\mu R_{t+1}^L s_t - r_{t+1}^M s_t$

Subject to: $R_{t+1}^L = \gamma k_{t+1}^{\gamma-1}$

$$r_{t+1}^M = \left(\frac{1}{\beta}\right)^{\frac{1}{\alpha}} \left[\frac{\omega_t - s_t}{s_t}\right]^{\frac{\alpha-1}{\alpha}}$$

$$w_{t+1} = (1-\gamma)k_{t+1}^{\gamma}$$
$$k_{t+1} = \Phi\mu s_t$$

Plugging constraints into objective function,

$$\underset{\{k_{t+1}\}}{\text{Max}}\ \Phi^{-1}\gamma k_{t+1}^{\gamma} - (\frac{1}{\beta})^{\frac{1}{\alpha}}[\Phi\mu(1-\gamma)k_t^{\gamma}k_{t+1}^{-1}-1]^{\frac{\alpha-1}{\alpha}}(\Phi\mu)^{-1}k_{t+1}$$

Differentiating with respect to k_{t+1},

$$\frac{\partial\pi}{\partial k_{t+1}} = \Phi^{-1}\gamma^2 k_{t+1}^{\gamma-1} - (\frac{1}{\beta})^{\frac{1}{\alpha}}\Phi^{-1}\mu^{-1}[\Phi\mu(1-\gamma)k_t^{\gamma}k_{t+1}^{-1}-1]^{\frac{\alpha-1}{\alpha}}$$
$$-(\frac{1}{\beta})^{\frac{1}{\alpha}}\Phi^{-1}\mu^{-1}k_{t+1}(\frac{\alpha-1}{\alpha})[\Phi\mu(1-\gamma)k_t^{\gamma}k_{t+1}^{-1}-1]^{\frac{-1}{\alpha}}[-\Phi\mu(1-\gamma)k_t^{\gamma}k_{t+1}^{-2}] = 0$$

By rearranging terms,

$$\gamma^2 k_{t+1}^{\gamma-1} - (\frac{1}{\beta})^{\frac{1}{\alpha}}[\frac{\Phi(1-\gamma)}{\alpha}k_t^{\gamma}k_{t+1}^{-1} - \mu^{-1}][\Phi\mu(1-\gamma)k_t^{\gamma}k_{t+1}^{-1}-1]^{\frac{-1}{\alpha}} = 0$$

Hence,

$$\gamma^2 k_{t+1}^{\gamma-1} - (\frac{1}{\beta})^{\frac{1}{\alpha}}\{\frac{[\frac{\Phi(1-\gamma)}{\alpha}k_{t+1}^{-1}k_t^{\gamma} - \mu^{-1}]}{[\Phi\mu(1-\gamma)k_{t+1}^{-1}k_t^{\gamma}-1]^{\frac{1}{\alpha}}}\} = 0$$

9. Proposition 8

The marginal revenue of each equation (17), (18) and (19) are linearly increasing in $k_{C1}^{\gamma-1}$, $k_{C0}^{\gamma-1}$, and $k_M^{\gamma-1}$, respectively. The marginal cost of (17), (18) and (19) have a vertical asymptote for $k_{C1}^{\gamma-1} = [\Phi^2(1-\gamma)]^{-1}$, $k_{C0}^{\gamma-1} = [\mu\Phi(1-\gamma)]^{-1}$ $k_M^{\gamma-1} = [\mu\Phi(1-\gamma)]^{-1}$, respectively. Those are converging to zero as $k_{C1}^{\gamma-1} \to \infty$, $k_{C0}^{\gamma-1} \to \infty$, $k_M^{\gamma-1} \to \infty$, respectively. Thus, in all cases, there is unique long run equilibrium, k_{C1}, k_{C0} and k_M.

10. Proposition 9

Figure I compares equation (17) and (18). Note that $\mu > \Phi$. Therefore, the vertical asymptote for MC_{C0} is strictly lower than that with MC_{C1}. Hence, every point of MC_{C1} is strictly to the right of MC_{C0}. The slope of $k_{C0}^{\gamma-1}$ in MR_{C0} is also steeper than that of $k_C^{\gamma-1}$ in MC_{C1}, which implies $k_{C0}^{\gamma-1} < k_{C1}^{\gamma-1}$. Note that as $\gamma < 1$, $k_{C1} < k_{C0}$.

11. Proposition 10 and Corollary 1

Figure II compares the equation (18) with equation (19). From equation (18) and (19), we know that MC_{C0} is strictly lower than MC_M. Hence, every point of MC_M is strictly to the right of MC_{C0}. If $\mu > \gamma$, the slope of $k_{C0}^{\gamma-1}$ in MR_{C0} is steeper than that of $k_M^{\gamma-1}$ in MR_M, which implies that $k_{C0}^{\gamma-1} < k_M^{\gamma-1}$. Note that since $\gamma < 1$, $k_M < k_{C0}$. However, if γ is much greater than μ, i.e. $\gamma >> \mu$, then the slope of $k_M^{\gamma-1}$ in MR_M, is much steeper than that of $k_{C0}^{\gamma-1}$ in MR_{C0}, which may obtain the result that $k_M^{\gamma-1} < k_{C0}^{\gamma-1}$. Note that since $\gamma < 1$, $k_M > k_{C0}$.

12. Proposition 11 and Corollary 2

It is straightforward. Figure III compares the equation (17) and (19). From (17) and (19). We know that every point of MC_{C1} is strictly to the right of MC_M. If $\Phi < \gamma$, the slope of $k_M^{\gamma-1}$ in MR_M is steeper than that of $k_{C1}^{\gamma-1}$ in MR_{C1}, which implies that $k_M^{\gamma-1} < k_{C1}^{\gamma-1}$. Note that as $\gamma < 1$, so $k_M > k_{C1}$.

13. Proposition 12

It is straightforward. From Proposition 10 and Proposition 11, we show that the relative performance in each banking system depends on the degree of information externality. That is, in the case of low information externality, competitive banking system has a comparative advantage in general to have high steady state level of capital stock, while monopoly banking system has a comparative advantage in the case of high information externality.

14. The Effect of on

First, let me differentiate the difference function Δ_1 with respect to Φ, then

$$\frac{\partial \Delta_1}{\partial \Phi} = -\left(\frac{1}{\beta}\right)^{\frac{1}{\alpha}} \left[\frac{(1-\frac{1}{\alpha})\mu^*(1-\gamma)k_1^* \left(\Phi(1-\gamma)k_1^*(\frac{1}{\alpha}-\mu^*)+1 \right)}{\{\Phi\mu(1-\gamma)k_1^*-1\}^{\frac{1+\alpha}{\alpha}}} \right]$$

The sign of $\partial\Delta_1 / \partial\Phi$ is positive as $\alpha \in (0,1)$. Recall that α denote the shape of saving supply schedule. For example, α =1 means horizontal supply schedule and α =0 means vertical supply schedule. It is obvious, intuitively. If the saving supply is inelastic, the negative effect of rent extraction becomes smaller. In this case, the relative advantage of a monopoly bank is enlarged as the proportion of high quality firm increases.

Next, differentiating Δ_1 with respect to μ^*, we have

$$\frac{\partial \Delta_1}{\partial \mu^*} = -\gamma k_1^* - \left(\frac{1}{\beta}\right)^{\frac{1}{\alpha}} \left[\frac{-\Phi^2(1-\gamma)^2\left(\mu^*+\frac{1}{\alpha}(\frac{1}{\alpha}-\mu^*)\right)k_1^{*2} + \Phi(1-\gamma)\left(1+\frac{1}{\mu^*}+\frac{1}{\alpha}(\frac{1}{\mu^*}-1)\right)k_1^* - \frac{1}{\mu^{*2}}}{\{\Phi\mu(1-\gamma)k_1^*-1\}^{\frac{1+\alpha}{\alpha}}} \right]$$

Let C= $\Phi(1-\gamma)(\mu^* + \alpha^{-1}(\alpha^{-1}-\mu^*))$ and F= $\Phi(1-\gamma)(1+\mu^* + \alpha^{-1}(\mu^{*-1}-1))$. Note that C>0 and F>0. Then, above equation can be rewritten as

$$\frac{\partial \Delta_1}{\partial \mu^*} = -\gamma k_1^* - \left(\frac{1}{\beta}\right)^{\frac{1}{\alpha}} \left[\frac{-C\Phi(1-\gamma)k_1^{*2} + Fk_1^* - \frac{1}{\mu^{*2}}}{\{\Phi\mu(1-\gamma)k_1^* - 1\}^{\frac{1+\alpha}{\alpha}}} \right].$$

It is strictly negative if

$$\frac{F - \sqrt{F^2 - \frac{4C\Phi(1-\gamma)}{\mu^{*2}}}}{2C\Phi(1-\gamma)} < k^* < \frac{F + \sqrt{F^2 - \frac{4C\Phi(1-\gamma)}{\mu^{*2}}}}{2C\Phi(1-\gamma)}.$$

Intuitively, it is obvious. As shown in the previous section, in the case of low information externality, the competitive advantage of monopolistic banking system is diminishing as the financial markets advance. This is consistent with historical evidences. For example, see e.g. Cetorelli (1997).

Hence, $\frac{\partial \mu^*}{\partial \Phi} > 0$ if $\frac{F - \sqrt{F^2 - \frac{4C\Phi(1-\gamma)}{\mu^{*2}}}}{2C\Phi(1-\gamma)} < k^* < \frac{F + \sqrt{F^2 - \frac{4C\Phi(1-\gamma)}{\mu^{*2}}}}{2C\Phi(1-\gamma)}$.

Appendix C. Duopoly Banking Industry

In this economy, it is assumed that there are N>1banks. Suppose N=2 (Duopoly). The duopoly (N=2) model can be extended to the oligopoly (N>2) model. The results of the duopoly model are the same in quality as that of the oligopoly model. See Cetorelli and Peretto (2000). Both banks are assumed to be Bertrand competitors. In Bertrand competition, each bank chooses its price (i.e., interest rates on deposits and loans) both simultaneously and non-cooperatively. A Nash equilibrium in prices -sometimes referred to as a Bertrand equilibrium- is a pair of prices such that each bank's price maximize that bank's profit given other bank's price. Consider a two stage game. In stage one, the banks decide whether to screen or not. In stage two, they choose the price at the market clearing loan amount. Recall that they lend all available credit.

Let R^L_{t+1} be the loan interest rates charged by bank i. By symmetry, bank i's reaction function is $\Upsilon_i(R_j^L) = R_i^{L^*}$ and bank j's reaction function is $\Upsilon_j(R_i^L) = R_j^{L^*}$. The Nash (Bertrand) equilibrium satisfies $R_i^{L^*} = \Upsilon_i(R_j^{L^*})$, and $R_j^{L^*} = \Upsilon_j(R_i^{L^*})$. Note that savings are distributed evenly between banks. This implies that both banks offer the same deposit interest rate. Hence, each bank gathers half of total savings. In this economy, banks are identical both in cost and revenue function. And they have same screening technology. Therefore, there is no incentive for saver to prefer one bank to another bank.

1. No Screening Equilibrium

No duopoly banks will be engaged in screening if the degree of information externality is greater than the critical level of information externality in the banking industry, as mentioned. Note also that high information externality implies that both banks may suffer a free riding problem. Therefore, the bank i's gross profit depends on what other bank do. The profit profile for bank i is:

Π_1 : $\pi_i^{S,S} = R^L_{t+1}(x_i - b) - r_{t+1}x_i = R^L_{t+1}(\frac{\mu s_t}{2}) - r_{t+1}\frac{s_t}{2}$ if (both) screen

Π_2 : $\pi_i^{N,S} = R^L_{t+1}x_i - r_{t+1}x_i = R^L_{t+1}\frac{s_t}{2} - r_{t+1}\frac{s_t}{2}$ if not screen but other bank screens

Π_3 : $\pi_i^{S,N} = R^L_{t+1}\Phi(x_i - b) - r_{t+1}x_i = R^L_{t+1}(\frac{\Phi\mu s_t}{2}) - r_{t+1}\frac{s_t}{2}$ if screen but others not

Π_4 : $\pi_i^{N,N} = R^L_{t+1}\Phi x_i - r_{t+1}x_i = R^L_{t+1}\frac{\Phi s_t}{2} - r_{t+1}\frac{s_t}{2}$ if both do not screen

Proposition C-1: The following relationship holds: $\Pi_2 > \Pi_1 > \Pi_4 > \Pi_3$.

Proof: First, I will show $\Pi_2 > \Pi_1$. In the case of Π_2 (No Screening, Screening), bank i does not screen, but he can recognize high quality firms because another bank screens the firms and the information about the quality of firms are publicized immediately. Hence, bank i can use his all available fund to lend to only screened high quality firms. In the case of Π_1 (Screening, Screening), bank i can recognize high quality firms with cost of screening. Therefore, the amount of loan is less than that in case . Therefore, $\Pi_2 > \Pi_1$.

Next, I will show $\Pi_4 > \Pi_3$. In the case of Π_4 (No Screening, No Screening), bank i lends to all firms indiscriminately. Hence, he can recover $\Phi s_{b,t}^i$. However, in the case of Π_3 (Screening, No Screening), bank i does screen and distinguish high quality firms but bank j lends to screened high quality firm. Instead, bank i lends to both high and low quality firms indiscriminately. Hence he can recover $\Phi \mu s_{b,t}^i$. Hence, $\Pi_4 > \Pi_3$. By assumption, we know that $\Pi_1 > \Pi_4$. Therefore $\Pi_2 > \Pi_1 > \Pi_4 > \Pi_3$ holds.

Suppose a duopoly bank is engaged in screening and hence discriminates in favor of high quality firms at the expense of paying the screening cost, b. As soon as the high quality firms are revealed, an outside bank observes the result immediately as the information externality is high. Then, an outside bank offers a lower lending rate to the screened, high quality firms. Of course, as the screened, high quality firms want to borrow at the lowest cost, they contract with the outside bank, which offers lower lending rates. Hence, the screening bank cannot recover screening cost and will have a loss.

In this situation, the optimal strategy of a duopoly bank is to wait and see the outcomes of the other bank's screening activities, just as it was in a similar situation with competitive banks. In Nash equilibrium, hence, a duopoly bank has no incentive to be engaged in screening activities, and wants to diversify risk by lending to as many firms as possible. In other words, a duopoly bank faces the free riding problem and it, in turn, leads to no screening equilibrium.

Definition C-1: A strategy profile $z^* = (z_1^{m^*}, z_2^{m^*})$ constitutes a Nash equilibrium for duopoly banks if for every j=1,2., $\pi_j = 0$ In Bertrand competition, each bank charges the competitive price, i.e. $R_{i,t+1}^{L^*} = R_{j,t+1}^{L^*} = r_t / \Phi$. Hence, in equilibrium, banks do not make profits and $\pi(z_i^{m^*}, z_{-i}^{m^*}) \geq \pi(z_i^{m'}, z_{-i}^{m^*})$ for all $z_i^{m'} \in Z_i$.

Proposition C-2: The unique Nash equilibrium of the duopoly banking industry is $z^* = (z_1^1, z_2^1)$ if $\xi > \xi^*$, i.e. no banks are engaged in screening activities.

Proof: It is straightforward. From Table C-1, we can easily find the best response for bank i is No screening regardless of bank j's strategies, and vice verse. & . Hence, Nash equilibrium is no bank screens, i.e. (NS, NS)

Table C-1 shows the payoff of bank i, j given their own stage one strategy. If both banks screen, the payoffs of both banks Π_1, If bank1 (bank2) screens but bank2 (bank1) does not screen, bank2 (bank1) benefit from information externality. Then, the payoffs of bank1 (bank2) and bank2 (bank1) are Π_3, Π_2, respectively. However, if both banks do not screen, their payoffs are same to Π_4.

Table C-1. Payoffs of Banks

		Bank 2	
		Screen	No-Screen
Bank 1	Screen	Π_1, Π_1	Π_3, Π_2
Bank 1	No-Screen	Π_2, Π_3	Π_4, Π_4

The Nash equilibrium in the duopoly banking system is identical to that in the competitive banking system. This result can be extended to the oligopoly (N>2) model.

2. Screening Equilibrium

In Nash equilibrium, all duopoly banks participate in screening activities if $\xi < \xi^*$ as the screening cost is less than the investment loss from not screening. As the payoffs of duopoly banks are higher when they engage in screening activities, the best strategy for duopoly banks is to screen all firms in the case of a low information externality. The point is that the banks do not suffer free riding problem if information externality in the banking industry is less than the critical level of the information externality.

Proposition C-3: The unique Nash equilibrium of the duopoly bank is $z^* = (z_1^2, z_2^2)$ if $\xi < \xi^*$.

Proof. It is straightforward. From Table C-2, we can easily find the best response for bank i is Screening regardless of bank j's strategies, and vice verse. & . Hence, Nash equilibrium is no bank screens, i.e. (S, S)

Table C-2 shows the payoff of bank i, j given their own stage one strategy. If a bank screens, the payoffs of the bank is , while a bank does not screen, the payoffs is . As is greater than . a bank's best strategy is screening.

Table C-2. Payoffs of Banks

		Bank 2	
		Screen	No-Screen
Bank 1	Screen	Π_1, Π_1	Π_1, Π_4
Bank 1	No-Screen	Π_4, Π_1	Π_4, Π_4

As with the no screening equilibrium, the Nash equilibrium in the duopoly banking system is identical to that in the competitive banking system. In addition, this result will be extended to the oligopoly model, too. Hence, the duopoly model converges to competitive model. In this context, setting N>1 allows us to consider a competitive banking system. Note that although the Nash equilibrium of duopoly banks is no screening, they know that full screening equilibrium is better. Hence, if they commit to coordination for getting screening equilibrium, in aggregate, their payoffs converge to full screening equilibrium. For example, if one bank deviates and is not engaged in screening activity, the payoffs of whole banking industry is $\Pi_2 + \Pi_3$, which is less than $2\Pi_1$. This result can also be extended to N>2 banks oligopoly model. For the details, see Cetorelli and Peretto (2000).

FIGURE I. Equilibrium Level of Capital - Competitive Banking System with Information Externality

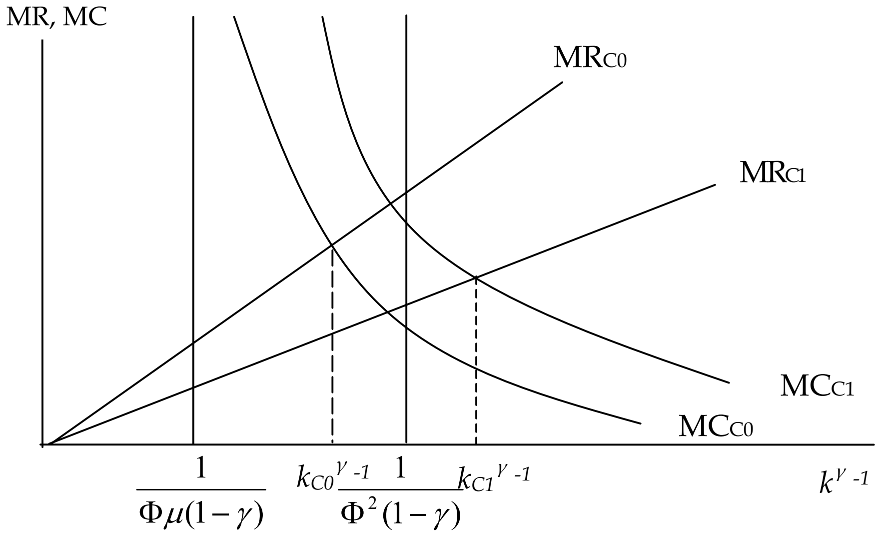
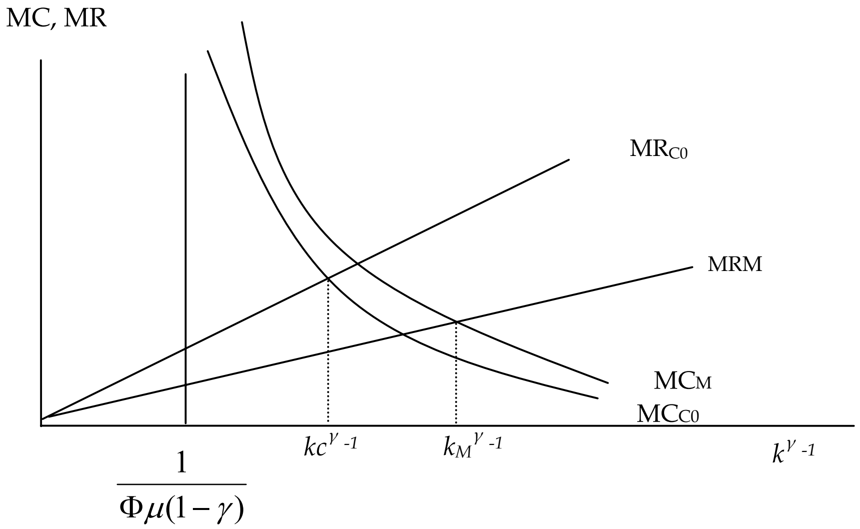


FIGURE II. Equilibrium Level of Capital – Monopoly and Competitive Banking System with Low Information Externality

① $\mu > \gamma$ (Developed Financial Markets)



② $\gamma >> \mu$ (Under-Developed Financial Market)

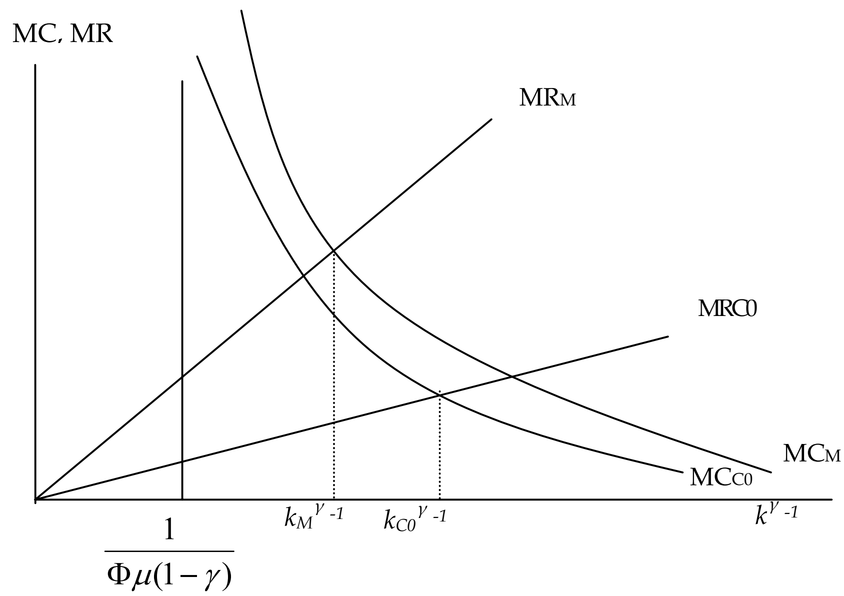
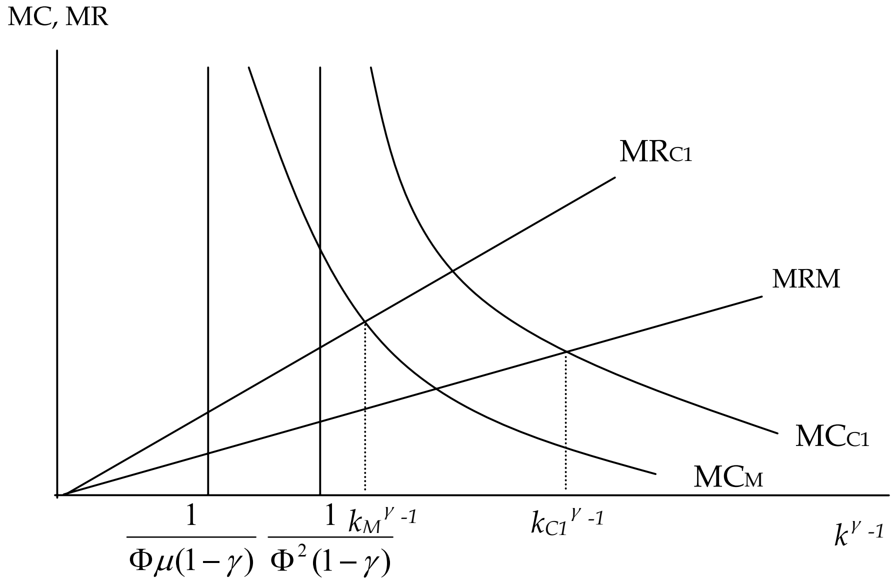
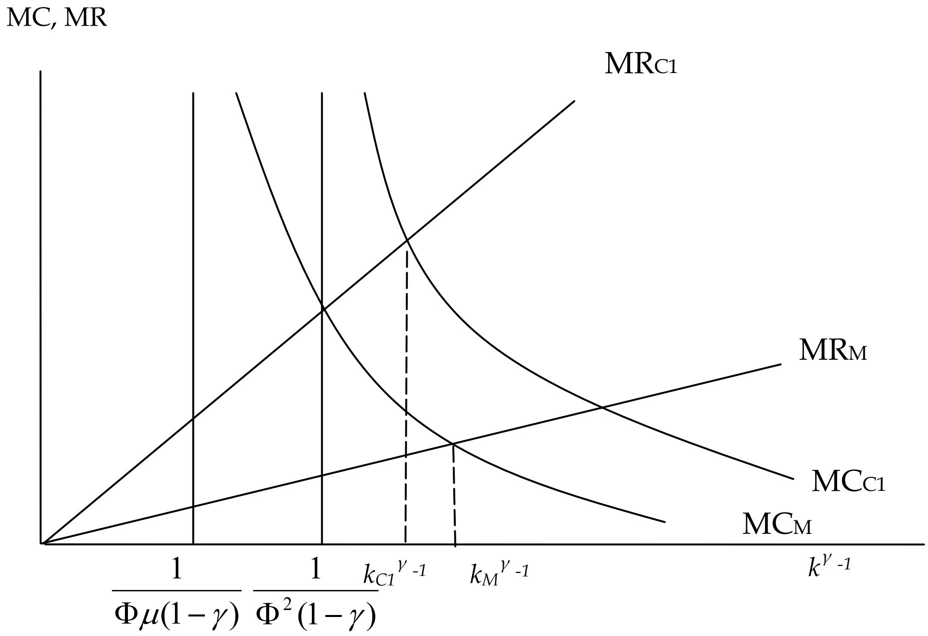


FIGURE III. Equilibrium Level of Capital – Monopoly and Competitive Banking System with High Information Externality

① $\gamma > \Phi$ (High Credit Risk)



② $\gamma << \Phi$ (Low Credit Risk)



Comments on "Financial Supervisory Service, Dones Bank Structure Matter?"

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This paper discusses the effects of banking industry structure on the steady state capital stock in an economy with possible information externality. According to the paper, in case of low information externality, i.e., the case of no screening equilibria, the steady state capital stock in the competitive banking system may be higher than the monopoly banking system. In case of high information externality, i.e., the case of screening equilibria, the steady state capital stock in the monopoly banking system may be higher than the competitive banking system.

These results are interesting. However, it is far fetched to conclude that the paper provides an explanation for the recent deregulation and resulting trends in merger and acquisition both in the industrial countries and in the developing countries and a theoretical foundation to support the policy change from anti-M&A to pro-M&A observed in different countries. I believe that the paper is better off without such discussion.

Cetorelli and Peretto (2000, FRB Chicago Working Paper) also discuss the effects of banking industry structure on the steady state capital stock in an economy with possible information externality. In fact, the major conclusions of their paper do not seem quite different from those of the current paper. I believe the author should compare his results with theirs and emphasize his contributions more clearly.

CHAPTER 2-5

Identification and Management of Systemic Risks : Macro and Micro Evidence in Korea

by
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Abstract

This study attempts to empirically identify the external shocks causing a systemic crisis and their propagation mechanisms over financial system in Korea. The measured macro aggregate shock series are found to have played a crucial role in explaining systemic crises in the past. It is also found that macro aggregate disturbances, instead of idiosyncratic factors, could affect the behaviors of individual economic agents like firms and financial institutions in a great deal. From the corporate data analysis, the credit channel effect in the course of shock amplification and propagation seems rather weak in Korea. The comovement of asset portfolios and loan loss provisions across financial institutions together with their weak correlation of individual banks' portfolios over time implies the importance of paying attention to macro risk factors in managing systemic risks.

1. Introduction

The probability of experiencing systemic crises[1] is not negligible throughout the history. Due to the inherent nature of banking business, for example, liquidity crunch takes place once in a while for fundamentally reasonable grounds [Mitchell (1941), Gorton (1988), etc.], or comes randomly from just mob psychology or self-fulfilling prophecy [Kindleberger (1978), Diamond and Dybvig (1983), Farmer (1993), etc.]. Let alone their causes, one of the foremost reasons for paying much attention to systemic crises is the astronomical amounts of their ensuing costs from both macro and micro perspectives.[2] In order to keep these probable and costly incidents from recurring,

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[1] A systemic financial crisis refers to an incident of potentially severe disruptions of financial markets that, by impairing markets' ability to function effectively, can have large adverse effects on the real economy.

[2] Hoggarth, Reis and Saporta (2001) measured the costs of banking crises in terms of two categories: direct resolution costs and welfare costs. The direct resolution costs refer to the wealth redistribution from taxpayers to the stakeholders of intevened banks, which has micro economic implications. These costs are found to be larger in lower-income countries and those with higher degrees of banking intermediation. The cumulative output losses, a proxy for welfare costs, are estimated around 15 to 20 percent of annual GDP. The

policymakers and academics have made common efforts to devise managing systemic risks, of which the examples are central banking, deposit insurance, prudential regulation, etc. Despite these instruments in hand, we are not still able to make a full stop of systemic crises.

The issue of systemic crises becomes located at the center of financial regulation, especially in the emerging market economies (EME) countries like Korea which has undergone a serious damage due to recent currency and/or financial crises. Compared with the intense interests and attention, however, empirical studies on systemic crisis and its management that policymakers could refer to are rare in such countries. That is, at least in Korea, key empirical discussions are almost lacking such as how a systemic crisis is defined quantitatively; how frequent, severe and durable it is; in what way it undermines the corporate and financial sectors, which in turn aggravates the overall situation further, etc. These curiosities motivate the current study.

The purpose of the paper (chapter) is to examine both macro and micro phenomena in the context of business fluctuations caused by external shocks. This attempt is based on the business cycle view that a systemic crisis responds to unfolding economic circumstances, so it is a natural outgrowth of the business cycle. Following a series of business cycle and financial economics literatures, the current study is to investigate, identify and measure the shocks that drive initial business flucutations in Korea. Then, it looks at how finance matters by scrutinizing amplification and propagation processes, focusing on lender-borrower relationship in the spirit of Bernanke, Gertler and Gilchrist (1999) and Kiyotaki and Moore (1997). Next, it discusses contagion mechanism via balance sheet of Korean financial institutions. To this end, it shows the similarity of asset portfolios of the financial institutions and their loan losses.

In short, this study asks how much the theories in the academic literature could explain the crises that Korea has experienced. Its agenda looks challenging and comprehensive due to the wide coverage of the issues that are not only academically but also practically debatable. Note, however, that it does not dare to provide a well organized, unifying and encompassing methodology. Rather, it is just intended to ignite further empirical analyses, based on which an appropriate system of crisis management could be established.

This study provides some prominent observations in relation to policy implications: it is macro aggregate shocks that systemic crisis managers should pay considerable attention to. A unit disturbance that hits the aggregate quantity and price variables causes very large swings of business cycles in Korea. The measured shock series using the macro variables well explain the crisis events in the past history. In addition, both borrowing firms and lending financial institutions in Korea are more vulnerable to common shocks, which seem related to macro aggregate variables, than idiosyncratic ones. It means that the credit channel through firms' balance sheet [Bernanke and Gertler (1989), Kiyotaki and Moore (1997), etc.] is not effective enough to account for Korea's business fluctuations.

This article is organized as follows. The second section overviews the academic literature on the theories and empirical analyses about systemic risks and their channels to evolve into crises. It puts more emphasis on the financial market frictions that generate the relevance of firms' financial structure, which is the case where Modigliani-Miller theorem, one of the most well known academic achievements in financial

losses are much larger in the event of a twin banking and currency crisis than in the case of a banking crisis alone. Bordo, Eichengreen, Klingebiel and Martinez-Peria (2001) also reached a simliar size of measured depth of various crises in terms of cumulative output losses: 5.9 percent losses to currency crises, 6.2% losses to banking crises, and 18.6% losses to twin crises.

economics, does not hold. The third section attempts to identify the macro aggregate shocks observed in the Korean time series data. The structural vector autoregression model is used with the long-run restriction studied by Blanchard and Quah (1989). The identified permanent and transitory shock series and their dynamic effects, not only qualitative but also quantitative, on the real quantity and financial price variables will be examined to witness the importance of the macro aggregate shocks in systemic risks. In section 4, the Credit Channel Model suggested by Bernanke, Gertler and Gilchrist (1999) will be investigated in the Korean context. Taking into account both demand and supply side of credits, it tries to infer policy implications from the empirical analyses on the determinants of corporate borrowing costs for the purpose of confirming the effectiveness of balance sheet channel and on the comparison of the asset portfolios, including loan loss provisions, among financial institutions for the purpose of seeing their vulnerability to common shocks. Summarizing the questions posed and answers found, the last section makes concluding remarks with policy implications of this study.

2. Literature Survey on Systemic Crisis

2.1. Nature of Crisis: Sunspots or Business Cycles?

Ever since banks were instituted, bank runs in which depositors attempt to withdraw their funds simultaneously have threatened not only the individual banks but also the entire financial system. Inherently, the runs on fragile banks seem inevitable at a positive probability due to the very nature of banking business that they issue short-term liquid liabilities but invest in long-term illiquid assets. More problematic is a panic, or a systemic crisis, where solvent and sound banks are forced confronted with contagious runs triggered by either the depositors' misconception or rational expectation on the possibility of their financial distress.

Economic theories that account for the causes of systemic crises have been underpinned from the two different standpoints. The first view is that the crises are just random events, unrelated to economic fundamentals. According to this tradition, financial panics may stem from mob psychology in the sprit of Kindleberger (1978) or self-fulfilling prophecies as in Diamond and Dybvig (1983) and Farmer (1993). Theoretically, there may exist multiple equilibria, of which one, or a bank run, occurs when every depositor believes that others try to unconditionally withdraw funds earlier than she does. On the other hand, if no body believes that unduly runs are about to occur except for only financially necessary withdrawals, no systemic crisis takes place. Among these two kinds of equilibria, this view says that the determinant could be economically irrelevant factors, or *sunspots*, that could affect the belief formation of depositors in a self-fulfilling manner. Then, the driving forces for systemic crises will be extraneous shocks to economy, thus being related to psychology.

The second view is that bank runs and the resulting crises are the natural results of business cycles. As an economy becomes sluggish, capital adequacy of banks deteriorates due to lower creditworthiness, and sometimes defaults, of their borrowers. Anticipating financial difficulties of trading banks, the depositors may attempt to withdraw funds prior to others, which will bring about a panic in the financial sector. In contrast to the view of random events, this school advocates that a systemic crisis is an essential part of business cycles that could be accounted for by economic fundamentals and institutions. Also, the driving forces for systemic crises could be ultimately aggregate disturbances, or exogenous shocks, that generate macroeconomic business cycles.

Conducting an empirical study as to which view better explains a systemic crisis, Gorton (1988) finds that banking panics are related to business cycles, rather than to extraneous random events. Particularly, during the National Banking Era (from the Civil War in 1864 to the Creation of the Federal Reserve System in 1914) the five worst recessions were accompanied by banking panics. Calomiris and Gorton (1991) also argue that the data do not support the *sunspot* view.

2.2. Demand Side of Credit: Financial Acceleration

Once systemic crises have some relationship with business cycles, could the phenomena during the panic situations be reconciled with standard macroeconomic theory? The canonical real business cycle model and the textbook Keynesian model echo that conditions in financial and credit markets do not affect the real economy. Thus, Modigliani-Miller (1958) theorem of the indeterminacy and irrelevance of firms' financial structure in real economic outputs is a valid proposition in both the mainstream macroeconomic theories without frictions. However, these approaches that finance is just a shadow of real economy seem to have drawbacks, for they do not well explain huge swings of business cycles, which sometimes end up with catastrophes, without somehow amplification and propagation mechanisms of external shocks. The inability of the models to replicate the movements of real aggregate quantity variables during systemic crises asks for theorizing frictions in financial and credit markets so as to enhance the explanatory power to the business cycle fluctuations in the abnormal periods.

One of the theory that incorporates financial frictions to account for large business swings is called a Credit Channel Model. Along with the standard theories, this alternative view that gives a more central role to credit market conditions in the propagation of cyclical fluctuations has a long-standing tradition.[3] Fisher (1933), for example, cautiously argued that the severity of the Great Depression was attributable in part to the heavy burden of debt and ensuing financial distress associated with the deflation of the early 1930s.[4]

Bernanke and Gertler (1989) developed this Fisher's idea of credit market frictions into a theoretic arena.[5] In order for frictions in credit markets to embed in the model, they

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[3] The deteriorating credit market conditions include sharp increase in insolvent and bankrupt firms, rising real debt burdens, collapsing asset prices, bank failures, etc.

[4] Fisher (1933) deduced the chains of over-indebtedness in the following nine links: "(1) *Debt liquidation* leads to *distress selling* and to (2) *Contraction of deposit currency*, as bank loans are paid off, and to a slowing down of velocity of circulation. This contraction of deposits and of their velocity, precipitated by distress selling, causes (3) *A fall in the level of prices*, in other words, a swelling of the dollar. Assuming, as above stated, that this fall of prices is not interfered with by reflation or otherwise, there must be (4) *A still greater fall in the net worths of business*, precipitating bankruptcies is and (5) *A like fall in profits*, which in a capitalistic, that is, a private-profit society, leads the concerns which are running at a loss to make (6) *A reduction in output, in trade and in employment* of labor. These losses, bankruptcies, and unemployment, lead to (7) *Pessimism and loss of confidence*, which in turn lead to (8) *Hoarding and slowing down still more the velocity of circulation*. The above eight changes cause (9) *Complicated disturbances in the rates of interest*, in particular, a fall in the nominal, or money, rates and a rise in the real, or commodity, rates of interest."

[5] The Fisher's "creed" as to the propagation of debt deflation and their aftermath during the Great Depression is empirically and theoretically replicated by Bernanke (1983).

introduced agency costs in the form of the "costly state verification" studied by Townsend (1979). In other words, assuming an asymmetry of information between borrowers and lenders and an existence of monitoring costs to verify the outcome of borrowers' investment projects, the model yields optimal financial arrangements entailing deadweight losses, or agency costs, relative to the first-best perfect-information equilibrium. A potential borrower with high net worth or collateralizable assets faces a small risk of bankruptcy and thus a small premium on external finance[6], whereas a borrower with less resource to invest is in an opposite position. In such an economy, an adverse shock lowering the cash flows and net worth of firms raises external finance premium, withdrawing on-going projects or at least reducing an investment in new projects. Declining investment lowers economic activities and cash flows in subsequent periods, amplifying and propagating the effects of the initial shocks. The key virtue of this model is that information asymmetry among borrowers and lenders make the Modigliani-Miller theorem inapplicable, opening up the possibility of an interaction between real and financial economies.[7]

Kiyotaki and Moore (1997) further developed the credit channel model of Bernanke and Gertler (1989) by introducing durable assets that are not only production factors but also serve as collateral for loans. To endogenize the dynamic interactions between asset prices and credit limits, they theoretically created powerful transmission mechanism by which the effects of shocks persist, amplify and spread out. Suppose that a firm is credit constrained and borrowed heavily against the value of its landholdings. When an adverse temporary shock on its productivity occurs, this credit-constrained firm becomes forced to cut back on its investment expenditure. The firm will earn less revenue, its net worth will fall, and it will further reduce investment due to even higher credit constraints. Then, the knock-on effect of a current temporary shock will persist far in the future. Furthermore, the lower cash flows of land investment in response to the shock reduce the price of land, which causes the firm's net worth to drop considerably. As a result, the firm has to make yet deeper cuts in its investment in land. This intertemporal multiplier process goes on for a long while.

The innovating component by Kiyotaki and Moore (1997) is that persistence and amplification reinforce each other.[8] With the explicit consideration of inelastically supplied assets like land, they can distinguish a dynamic multiplier from a static one. The static multiplier performs like the effect argued by Bernanke and Gertler (1989) within a period. The productivity shock reduces the net worth of the constrained firms,

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[6] External finance premium is defined as the difference between the cost of funds raised externally and the opportunity of funds internal to the firm [Bernanke, Gertler and Gilchrist (1999)].

[7] The Credit Channel Model with financial market imperfections in the sense of asymmetric information is analyzed from a different angle by Greenwald and Stiglitz (1993). Unlike Beranke and Gertler (1989) who put more emphasis on lenders' risk hedging behaviors against firms' delinquencies, Greenwald and Stiglitz focused on firms' perceptions of the risks of changes in their own net worth position which can have potentially large effects on their willingness to produce.

[8] The two-way feedback between borrowing limits and the price of assets in the context of the relevance of financial structure of firms and business cycles was discussed earlier in Shleifer and Vishny (1992). They argue that, when a financially distressed firm needs to sell assets, its industry peers that are natural purchasers are likely to be experiencing problems themselves, leading to asset sales at prices below the value in best use. The resulting fall in asset prices exacerbates the firm's financial distress by lowering the debt capacity of all firms in the industry. This is an advanced argument relative to Bernanke and Gertler (1989) in the sense that Shleifer and Vishny explicitly considered the price of tradable assets, but its incorporation has limited implication for static effects, ignoring more powerful dynamic multiplier process and the crucial interplay between amplification and persistence.

which forces them to cut back the demand for land directly and indirectly via the land price drop in the period. However, not only the land price drop in the period of the shock occurred but also subsequent drops afterwards due to the persistence of the credit shrinkage trigger the dynamic multiplier. Therefore, on top of the curtailment in investment due to the direct net worth reduction vis-à-vis an adverse shock, the cumulative impact on asset prices can be significant.[9]

The theories related to the Credit Channel Model are best summarized in Bernanke, Gertler and Gilchrist (1999), which is specifically known as a financial accelerator model. They developed a full-fledged dynamic general equilibrium model that synthesizes the various literatures mentioning the importance of credit market frictions.[10] Their framework incorporates endogenous developments in credit markets that propagate and amplify shocks to macroeconomy through the inverse linkage between external finance premium and the net worth of potential borrowers.[11] This inverse relationship arises because, when borrowers are short of funds to finance projects, lenders ask for enough compensation for taking excessive risks, or high agency costs. To the extent that borrowers' net worth is procyclical, the external finance premium will be countercyclical, widening the business cycle swings.

Empirical researches related to the credit channel model and macroeconomic effects of financial regulation have been put forth in much financial economics and policy literature. Among others, Benito and Whitley (2003) developed empirical models that relate implicit interest rates paid by firms to the measures of their financial health using both aggregate and individual company data in the United Kingdom. They concluded that both aggregate and disaggregate approaches confirm a significant influence on interest rates from changes in the financial health of companies.

2.3. Supply Side of Credits: Bank Lending Channel

Even if Bernanke, Gertler and Gilchrist (1999) demonstrated a general equilibrium approach to explain business cycle phenomena through credit market frictions, their model emphasized the balance sheet channel, or the demand side of credits because it lacks explicit introduction of financial institutions. As Hall (2001) argued, a bank lending channel, or the supply side of funds, is equally important along with the borrowers' balance sheet channel. For some reasons, like subject to a monetary tightening, banks may face difficulties in raising external funds to fund lending such as decline in deposits. If banks cannot adjust their balance sheets by reducing holdings of short-term assets, this might restrict their ability to extend new loans. Under these circumstances, while highly creditworthy borrowers may be able to substitute other forms of finance for bank lending like bonds, less creditworthy borrowers such as small firms and individuals may be unable to switch from banks to alternative finance sources. These institutional

[9] In order to understand the Credit Channel Model by Bernanke and Gertler (1989), Kiyotaki and Moore (1997) used the analogy of a well-known predator-prey model where the debts of the credit-constrained firms are predators and their landholdings are prey. Namely, a rise in these firms' landholdings means that they have more net worth with which to borrow: the prey feed the predators. A high level of debt erodes the firms' available funds and curtails their investment in land: the predators kill off the prey. Kiyotaki and Moore's model, however, is richer in that it has, in addition to the debts and landholdings, a third variable, the price of land, which is forward-looking and causes the economy to react much more to a shock.

[10] For more comprehensive general equilibrium model of the Credit Channel Model including banking sector, financial regulator, assets with secondary markets, etc., refer to Tsomocos (2003).

[11] Net worth of borrowers is defined as the borrowers' liquid assets plus collateral value of illiquid assets less outstanding obligations [Bernanke, Gertler and Gilchrist (1999)].

constraints will be associated with a rise in external finance premium and/or a tightening in non-price conditions such as covenants or collateral requirements.

In addition to monetary policy shocks, non-monetary shocks such as changes in financial health of the banking sector and prudential regulations may shift supply curve of loans. For instance, loan losses or a price fall in securities held in asset portfolios might reduce bank capital. Changes in prudential regulation such as introducing strengthened capital adequacy requirements might enable banks less easily to advance external finance. Also, banks' risk appetites and their desire for liquidity on their own balance sheet may occasionally change so that their willingness to lend to borrowers falls.[12]

This bank lending channel may be potentially significant if increases in interest rates lead to a reduction in the supply of bank loans and if the loans are imperfect substitutes for other forms of finance. Thus, a credit or capital crunch is more likely to matter in less developed economies where a substantial proportion of loans is intermediated by small and/or poorly capitalized banks. As the crunch takes place very infrequently, the potential for substantial spillovers from the financial instability to real economy, as seen in Asian crises in 1997 and earlier Latin American lending crisis in the 1980s, reminds of policymakers and regulatory authorities in the emerging market economies (EME) the need for the health of banking system.

The macroeconomic implications of financial regulation like capital adequacy requirements for banks as a shock propagation mechanism have attracted growing attention to financial architects whose aim is to maintain a fair amount of balance between financial stability and economic efficiency. Blum and Hellwig (1995), for example, studied the relationship between the US credit crunch in early 1990s and the 1988 Basle agreement. They were concerned as to whether a rigid link between bank equity capital and bank lending may act as an automatic amplifier for macroeconomic fluctuations, inducing banks to lend more when times are good and to lend less when times are bad, thus reinforcing any underlying shocks. They found that, under regular conditions, a shift from a regime of non-binding capital adequacy requirements to a regime of binding capital adequacy requirements may induce a discontinuous increase in the sensitivity of equilibrium output and price with respect to a demand disturbance.

The procycality of financial regulation is now at the heart of the "Basle II" which is supposed to replace the current formula-based bank capital adequacy requirements by the end of 2006. One of the core objectives of the Basel II is to link capital requirements more closely to risks. Accordingly, in a downturn when risks are more likely materialize, required capital requirements tend to increase. Then, economic capital requirements and output growth will move in an opposite direction. If the required capital amounts increase, however, banks should reduce their loans and the subsequent credit squeeze would exacerbate the downturn. These procyclical features embedded in the Basle II might amplify business cycle fluctuations and result in credit crunches when coupled with huge adverse shocks in an economy. Therefore, policymakers and academics should take into account the effects of the structural changes in financial regulation.

In the following two sections, this study attempts to empirically assess the fragility of Korea's financial and corporate sectors from the viewpoint of systemic risks. After identifying the external shocks that trigger business fluctuations with a certain assumption, it traces the propagation and amplification paths suggested by the credit channel model and contagious factors among financial institutions whose asset portfolios are alike in and across the financial industries in section 4. Hence, this paper tries to

[12] Credit supply shortages due to monetary shocks, capital adequacy shocks and preference shocks are often called credit crunch, capital crunch and market credit crunch, respectively [Hall (2001)].

evaluate the applicability of the business cycle view to Korea so as to draw policy inferences regarding the systemic risk management.

3. Quantitative Identification of Systemic Crisis in Korea

3.1. Measurement of External Shocks and their Responses

What is the nature of shocks that drive business fluctuations as well as economic growth? Are there purely financial shocks that do not originate from the real side of an economy but do affect the dynamics of real resource allocations? These are some of the list of the most fundamental questions that macroeconomists have tried to answer to but yet convincingly explained despite the studies for more than two centuries. Many economists have considered technology innovations, monetary policy, oil price movement, government expenditures, tax increases, financial regulation, etc., as candidates for the factors causing unexpected economic shifts. For example, Hansen and Prescott (1993) claimed technology shocks and Blanchard (1993) and Hall (1993) took consumption shocks that caused the 1990 recession in the US. These shocks are, however, not the ultimate external sources of economic fluctuations, for they are all dependent upon past history and/or future expectations.[13]

Notwithstanding the importance of the causes of business cycles in the context of policy implications, this study does not focus on the nature of shocks, but on the measurement of the shocks occurred in the economy no matter what they are. On the one hand, this research preference stems from the otherwise grandiose work scope that would make it extremely difficult and challenging. On the other, the viewpoint of policymakers, rather than of academics of intellectual curiosity, is considered that empirical findings are to be applied for policy responses to economic disturbances. In this vein, the section asks how the permanent and transitory shocks have looked like in Korea. For example, this study seeks to find out, at least in hindsight, how sizable those shocks were during the currency crisis in the late 1997 and the following financial crises, if any, relative to the overall measure of aggregate risks. Being answered to the size of the shocks and their dynamic effects, policymakers could guess an incoming path of shock evolutions and take more appropriate and timely actions once they are likely to cause a systemic crisis.

3.2. VAR with the Long-run Restriction

To look at the interaction between real and financial economy, this study considers a vector autoregression (VAR) model consisting of the variables from both sectors. Based on the premises that (i) there are multiple orthogonal shocks in the economy, and (ii) the shocks may be either transitory or permanent, the VAR answers to the following question: how and how much do the identified permanent and transitory shocks affect the cyclical variations in financial variables along with those in real aggregate ones?

There have been extensive studies about the nature of a permanent shock in the context of real business cycles theory, which is often identified as a shock from the supply side like the one affecting the balanced growth path. For example, a technological innovation to enhance labor productivity could have long-lasting favorable effects on the aggregate output level. In contrast, a transitory shock is believed somehow related to the demand side of an economy.

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[13] See Cochrane (1995) for the detailed discussions on shocks.

Let us run a two-variable VAR with the long-run restriction: the permanent shock affect the level of a real aggregate variable like the GDP growth rate in the long-run, but not that of a financial variable such as default premium. In contrast, the transitory shock does not affect either the level of the real aggregate variable nor that of the default premium. In a formal expression, the bivariate regression described above is constructed as follows:

(3.1) bivariate regression : $$\begin{bmatrix} \Delta y_t \\ f_t \end{bmatrix} = \begin{bmatrix} \phi_1 \\ \phi_2 \end{bmatrix} + A(L) \begin{bmatrix} \Delta y_{t-1} \\ f_{t-1} \end{bmatrix} + u_t ,$$

(3.2) long-run restriction : $$u_t = \Gamma_0 \varepsilon_t \ , \ \left[(I - A(1))^{-1} \Gamma_0 \right]_{1,2} = 0 \text{ and}$$

$$Var(\varepsilon_t) = \Sigma_\varepsilon \ ,$$

where Γ_0 is a (2×2) long-run restriction matrix, ε_t is a vector of the permanent and transitory disturbances, $(\varepsilon_t^P, \varepsilon_t^T)'$, and Σ_ε is a diagonal matrix. y_t and f_t stand for the GDP growth rate and default premium from the financial sector, respectively. The long-run restriction of (2.1.2) is methodologically the same as that of Blanchard and Quah (1989) and shares a similar flavor with the multivariate VAR by King, Plosser, Stock and Watson (1991) and Rotemberg and Woodford (1996).

A methodological ground for this bivariate VAR is to exactly identify the time series of both the permanent and transitory shocks. In the equation (3.2), once the variance of the shocks, Σ_ε , is normalized as an identity matrix, the condition of $\left[(I - A(1))^{-1} \Gamma_0 \right]_{1,2} = 0$ with the estimated variance of residuals, u_t , yields the numbers of Γ_0 because the four unknown elements of Γ_0 are resolved with four independent equations.[14] Then, the exact identification of the structural model enables us to quantitatively measure the shocks occurred as shown in the following subsection.

An economic motivation for the VAR with the GDP growth rate and default premium is to examine the credit channel dynamics trigged by the shocks. As aforementioned in section 2, the role of financial markets is non-trivial at least in the amplification and propagation of external shocks, though they are seldom believe to generate the shocks themselves. The credit channel model like Bernanke, Gertler and Gilchrist (1999), among others, takes into account external finance premium which is related to borrowing conditions depending on the financial health in the corporate sector. Indeed, the default premium, usually defined as a difference between the corporate bond yield and risk-free bond yield, captures a favor of the external finance premium. Thus, the simultaneous

[14] Three equations come from the regression and the remaining one equation comes from the long-run restriction. The multivariate VAR as in King, Plosser, Stock and Watson (1991) and Rotemberg and Woodford (1996) with the long-run restriction of the same kind this paper, however, assumed identifies the permanent shock only. The transitory shocks could not be identified without further assumptions on the nature of the shocks.

effects of the real output and bond market premium could reveal some clues on the role of finance.[15]

The data used in the regression are as follows: the time period of consideration is between 1987 to 2003 at a quarterly frequency due to availability of the bond yields data set. As for the output, seasonally adjusted real GDP growth rate (relative to previous quarter) is used. The default premium is measured as the difference between yields of the investment grade corporate bond in the over-the-count (OTC) market and of the first type National Housing Bond (NHB). Obviously, this is a poor measure for the default premium since the maturity of the two bonds is not identical, three and five years, respectively, and NHB is not at all a benchmark risk-free rate. Despite the unsatisfactory characteristics of this measurement, the premium could hardly be improved.[16]

3.3. Results

3.3.1. Dynamic Responses to External Shocks

The impulse response functions shown in Figure 3-1 and 3-2 summarize the dynamic effects of the permanent and transitory shocks on the GDP growth rate and default premium in Korea. They represent percentage deviations from the steady state values due to 1% shocks in a period and no shocks afterwards. As assumed by the long-run restriction, the GDP growth rate increases permanently in response to the permanent shock and the default premium will return to the steady state level eventually due to the same shock in Figure 3-1. In contrast, the permanent effects of both the variables vis-à-vis the transitory shock phase out as seen in Figure 3-2.

[Figure 3-1 and 3-2 Here]

There are some noticeable features of the impulse response results. Firstly and foremost importantly, the default premium due to favorable shocks, either permanent or transitory, declines initially for a while. In response to a 1% unexpectedly good permanent signal, the premium declines by 0.2% away from the steady state for two quarters after the shock. This means that the corporate bond yield relative to the risk-free bond one decreases by 0.2% more. It is interpreted that such a good economic condition due to the positive shock makes the corporate default probability lower. The measured response of the default premium vis-à-vis a good temporary shock looks similar only with the difference of magnitude and persistence. This result is consistent to the argument made by the credit channel model. According to Bernanke, Getler and Gilchrist (1999), during the downturn of business activities the frictions on the borrowing conditions straitjacket the amounts of firms' credit available. For example, lower values of collateral and increasing likelihood of bankruptcy render firms to be able to borrow

[15] The empirical work is not pursued to scrutinize the direct implications of the Credit Channel Model because it does not contain any information on the corporate finance structure. These implications will be assessed with micro firm-level data in section 4. Here the purpose of this job is to examine the dynamic interaction between the real side of an economy and the credit markets in the context of macro aggregate risks.

[16] In Korea, the Government Treasury Bond (GTB) yield data are available only after 1995 and they did not reflect on market supply and demand until the outbreak of financial crisis due to the feature of compulsory underwriting practices by banks. That is to say, the appreciated price of the then GTB over the market price was treated as a quasi-tax. Thus, GTB had not functioned as a benchmark risk-free bond nor reflected on the market conditions.

less and/or to pay more interests in recessions. Thus, the impulse response results reconfirm that the story by the credit channel model survives in Korea.

Secondly and as expected, the GDP growth rate increases due to both the permanent and transitory shocks. In particular, the response of the real aggregate quantity is quite brisk to the permanent shock in the sense that a unit increase in the permanently positive shock drives the GDP growth rate upward by twice. This magnitude of the response in Korea is much greater than that in the US, which means that Korea is much more responsive to permanent aggregate shocks. In contrast, the response of the GDP growth rate due to the temporary shock is quite modest.

Thirdly and summarizing the first and second points, the effects of the permanent shock on the real aggregate quantities are greater, whereas the financial price variables due the transitory shock are much more resilient. This observation implies that a small disturbance in leading the GDP level change permanently makes the level of bond yields lower quite uniformly, regardless of the level of default risks. In addition, it also implies that the one in leading the GDP level to change only temporarily drives much larger swings in the differences of borrowers' capability to mobilize external finances via the varying fluctuations in corporate bankruptcy rate and collateral values of their fixed assets and securities held.

3.3.2. Identified Shock Series

Figure 3-3 displays the identified time series of the permanent and transitory shocks from the third quarter of 1988 to the fourth quarter of 2003.[17] By the assumption, they are normalized with mean zero and standard deviation one, so that the series swing around zero. One of the most interesting features is observed around the 1997 currency crisis and ensuing financial crisis in the following years. Over the entire sample periods, the measured permanent and transitory shocks are the largest in the first quarter of 1998 and the forth quarter of 1997, respectively. Furthermore, the size of the shocks is by far larger than that in all other periods. The transitory shock in the last quarter of 1997 is measured to be - 5.19%, which means a huge temporary hit rarely occurring in the statistical sense took place. Also the permanent shock in the next quarter is - 3.6%, which could hardly occur as well.

[Figure 3-3 Here]

Regarding the crisis, a next relevant question is why the transitory shock preceded the permanent shock. One of the answers refers to earlier reaction of price variables in the financial markets than real aggregate quantities to the outbreak of unanticipated disturbances,[18] for the former contains forward looking expectations influenced by the disturbances while the latter reflects on backward looking performances of economic activities. Since the currency crisis broke out in the late November, the growth rate of GDP during the fourth quarter partly captured the performances after the crisis. That is to say, the October and November activities cancel out the contraction after crisis. However, the default premium measured in this study is the difference of the bond yields at the end of quarter. Thus, the bond prices captured the full story of the crisis and the

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[17] The lags used in the regression of (3.1) is six. Therefore, the first six observations of the shocks are not measured.

[18] Of course, there exist a number of endogeous factors that caused the 1997 crisis [Claessens (2003)] but this empirical model assumes shocks to be exogeously given.

future expectations as of the end of 1997. This data description partly accounts for the huge negative transitory shock preceded by the ensuing permanent shock.

Figure 3-3 also demonstrates the Daewoo moratorium in the third quarter of 1999. Contrary to the economists' and policymakers' consensus that the insolvency of the Daewoo group, a second largest business conglomerate in Korea, might and, some may argue that it did, lead a crisis, the measured shocks in that quarter are negligible. As for this observation, there could be several interpretations. One is that the time series of the bond yields were severely distorted at that time. As a matter of fact, the Bond Stabilization Fund had been run to respond to massive fund withdrawals from the Investment Trusts and to control the interest rate swings in the corporate bond markets from the August of 1999 to the February of 2000. More importantly, the aggregate performances in 1999 were extremely good partly because of an unprecedented deep trough in 1998 and the subsequent rebounds in 1999 and also partly because of the high foreign demands due to world economic booms in 1999.

Figure 3-3 also shows the depth of the liquidity crisis of credit card industry in the second quarter of 2003. The economic slowdown since 2002 led the GDP growth rate sluggish around the early 2003. Additionally, the liquidity and solvency problem of the SK group ignited by auditing embellishments and frauds hit the corporate bond markets hard, especially around the liabilities issued by the highly levered credit card companies which had advanced enormous amounts of credits to millions of delinquent consumers. This event seems to be very serious statistically. The size of the permanent shock in the second quarter of 2003 was actually the largest since the first quarter of 1998 and fourth ranked over the entire time span from 1988 to 2003. However, the bond market crash in terms of price was not so problematic, despite the shrunk trading volume. In fact, the regulatory actions such as intervention in the bond markets through credit ratings, funding and coordination among stakeholders alleviated the widespread contagion of the problem. Thus, the permanent shock that is more or less related to real economy seems to have played greater roles in the overall performances than the transitory shock that reflects presumably more on financial economy.

Table 3-4 and 3-5 show the histograms of the permanent and transitory shocks measured, respectively, which is overlapped with the standardized normal distribution with mean zero and standard deviation one. As seen in the figures, both shocks are more concentrated around the mean than the normal distribution. In the case of the permanent shock, the histogram of Figure 3-4 is quite balanced with one negative outlier at the time of the crisis. The histogram of Figure 3-4 displays more favorable events with also a far outreaching and improbable transitory shock.

[Figure 3-4 and 3-5 Here]

4. Vulnerability of the Korean Economy to External Shocks

4.1. Two Contagion Paths

Suppose that external shocks be occurred as measured in the previous section. Then we could ask ourselves how the shocks propagate over time and in what fashion. This section tries to answer to these questions by looking at the microeconomic financial conditions of corporate firms and financial institutions in Korea.

As argued in section 2, we could imagine two channels of propagation and amplification of shocks into a crisis. The first one is through the financial statements of borrowers. Once a shock causes a shift in real aggregate quantities such as GDP drops, the consequences on the corporate balance sheets are about to exacerbate the corporate creditworthiness by way of lowing profitability. Also, the asset price decline would lead the collateral value, which in turn constrains the borrowing conditions and terms. If these credit channel effects begin to activate, the real economy would otherwise hurt more seriously and persistently. This financial acceleration is the story mentioned by Kiyotaki and Moore (1997) and Bernanke, Gertler and Gilchrist (1999). The following subsection attempts to find out the determinants of corporate funding rates by considering macro and micro variables together.

The second channel of propagation, amplification and contagion of shocks is through asset portfolios of financial institutions. Banking crises generally stem from the assets side of banks' balance sheets – from a protracted deterioration in asset quality. For example, banks' asset holdings are very similar across banks and one of the highly concentrated assets become sour like the bonds issued by the credit card companies in 2003. Since most of the banks hold considerable amounts of their bonds relative to their capital position, the credit card companies problem triggered banks' capital inadequacy. In order to avoid regulatory punishments like the prompt corrective action, banks should reduce the amount of loanable funds and withdraw investments early. The supply side response to a shock from the lenders' point of view exaggerates the depth of credit crunch, potentially ending up with a systemic crisis. This episode let us put more emphasis on the financial health of banks and assimilation of their asset portfolios. This channel is reviewed with relevant statistics in subsection 4.3.

4.2. Capital Gearing and External Finance Premium

This subsection tests the effect of the credit channel in shock propagation and amplification suggested by Bernanke and Gertler (1989), Kiyotaki and Moore (1997), Bernanke, Gertler, Gilchrist (1999), etc. The hypothesis posed here is whether a capital structure of a firm, or capital gearing measured by the ratio of debts to equities, affects the corporate borrowing rates. The importance of capital gearing has been argued in many credit channel model literatures in the context that deterioration (improvement) in borrowers' net worth increases (decreases) the cost of finance.

In the following regression analysis using firm level data set, we consider many controls for the firms like profitability, liquidity, size of firms, credit ratings, and macroeconomic conditions in order to incorporate fixed effects and year effects. For instance, profitability of a firm's certain projects executed in the specific year may affect borrowing rates regardless of its debt-to-equity ratio. In the similar reasoning the firm's borrowing condition depends on its liquidity level and other macroeconomic performances like a GDP growth rate and monetary policy measured by call rates. Because of asymmetric accessibility of bond markets, the size of firms, either large companies or small and medium sized enterprises (SMEs) could also determine the borrowing terms.

Before running regressions, we briefly overview the relationship between the borrowing interest rates and other explanatory variables under study. Figure 4-1 demonstrates the relationship between capital gearing and borrowing rate. At first glance, nice positive correlation is observed except for the periods around the 1997 crisis. Figure 4-2 displays inverse relationship between interest coverage ratio and borrowing rate. Figure 4-3 and 4-4 show the relationship between the GDP growth rate and borrowing rates by the large companies and SMEs, which is also negatively correlated. Finally, Figure 4-5 provides the hierarchy of borrowing rates by credit ratings: the poorer a credit rating, the higher the corresponding borrowing rate. In sum, all of the figures conform to a conventional wisdom.

[Figure 4-1 to 4-5 Here]

With this information on the basic statistics, let us run the following unbalanced panel regression over the periods between 1991 and 2003:

$$log(ABR_t^i) = \alpha_0 + \alpha_1 log(CG_{t-1}^i) + \alpha_2 log(ICR_t^i) + \alpha_3 log(CFT_t^i)$$

$$+\alpha_4 Size_t^i + \alpha_5 log(CR_t^i) + \alpha_6 log(RGDP_t) + \alpha_7 log(CALL_t) + \xi_t^i .$$

Here, the dependent variable, ABR_t^i, is the average borrowing rate of a firm i in period t. The explanatory variables consist of firm i 's capital gearing (or debt-to-equity ratio) at the end of previous period, CG_{t-1}^i; interest coverage ratio (or operating profits divided by interest expenses), ICR_t^i; ratio of annual cash flows relative to turnovers, CFT_t^i; size dummy, $Size_t^i$; credit rating, CR_t^i; and two macro variables such as annual real GDP growth rate, $RGDP_t^i$, and one-day call rate averaged out over period t, $CALL_t^i$. The companies of interest are the externally audited ones that have issued bonds or commercial papers so as to get credit ratings.[19]

The results over the entire sample are summarized in Table 4-1. Without controlling other variables, the capital gearing is positively and significantly correlated to borrowing rates in the column (1). Even if profitability relative to debt burdens, or interest coverage ratio, and liquidity relative to business activities, or cash flows to turnover, are additionally considered, the positive correlation between capital gearing and borrowing rates, or the negative correlation between borrowers' net worth and borrowing rates, survives in the column (2) and (3). Also, higher profitability and liquidity reduce the borrowing interest rates, other things being equal. All of these results in Korea are consistent to the prediction by the credit channel model.

If we control other factors that could presumably affect the interest rates, the results become different. The columns of (4), (5) and (6) in Table 4-1 show the relative insignificance of the capital gearing in determining the borrowers' funding costs, while all other control variables are reasonably significant. For example, the firm size does affect the borrowing costs in favor of large companies and higher credit rated companies spend less in mobilizing external finances. The aggregate factors like overall GDP growth rate and call rate, a proxy for monetary policies, also significantly affect the firms' unit interest costs. The capital gearing, however, becomes insignificant, especially in the columns of (5) and (6). From Table 4-1 we could also infer the fact that the aggregate factors are dominant over idiosyncratic and firm-specific financial structure and business performances in determining the interest costs. This implies that, at least in Korea, macro factors, rather than the credit cannel, could be more important in accounting for corporate risks, hence reaching a conclusion that credit channel effect is rather minor in systemic risks and that macroeconomic shocks attract more attention. This result is consistent to Hall (2001) that pointed out less importance of the balance sheet channel effects in underdeveloped or developing countries than in the developed countries.

[19] The data used in this subsection is described in the Appendix A.

[Table 4-1 Here]

Table 4-2 and 4-3 shows the results of bifurcated sampling into two groups: large companies and SMEs. There are many observations that differentiate the SMEs from large companies. One of the differences between the two groups is that the capital gearing affects the borrowing costs by firm size in an unidentical way, while the effects are not at all significant in both cases. While the large companies are less subject to financial health in borrowing, the SMEs look more or less desperate in making their financial structure sound so as to reduce external financing costs. The second difference is the effectiveness of credit ratings. As for the large companies, a good credit rating is crucial because they borrow much from capital markets. To the contrary, the SMEs' major funding sources are financial institutions, rather than bond markets. Thus, official credit ratings become relatively secondary components for borrowing decisions. Third, as seen in Table 4-2 and 4-3, both the real GDP growth rate and call rate have significantly positive relationship with the firms' borrowing costs. Among macro variables, however, the SMEs are more severely affected by monetary policies, while the large companies by the real shocks leading changes in the GDP growth rate. According to the regression with all explanatory variables (column (6) of Table 4-2 and 4-3), the elasticity of the borrowing interest rates of the large companies with respect to the real GDP growth rate is 0.12, while it is 0.04 for the SMEs. The elasticity with respect to the call rate for the SMEs (0.31) is greater than that for the large companies (0.14). These estimates are quite plausible, recalled that the SMEs' liabilities are concentrated in short maturity claims so that the borrowing costs are more in tandem with short-term nominal interest rates. Also, the high explanatory power of real GDP for the large firms' borrowing costs is easily reconciled with the relatively large contributing share of their outputs to GDP.[20]

[Table 4-2 and 4-3 Here]

4.3. Risk Contagion through Balance Sheet of Financial Institutions

A bank collapse multiplies the harmful effects of an initial shock, as credit squeezes and costly liquidation of investment projects cause drops in real output and collapses in asset prices. It is even more harmful that a certain bank's risks are contagious over other financial institutions, which means a systemic crisis. Massive and simultaneous distresses of many financial institutions originate from the interrelated asset positions among these institutions. Since financial institutions face liquidity needs due to uncertain withdrawals by their customers, the credit lines among financial institutions allow them to cope with liquidity shocks and to save the cost of maintaining reserves. However, as Freixas, Parigi and Rochet (1999) argued, the interbank market exposes the system to a coordination failure even if all banks are solvent.[21]

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[20] That is, the high correlation between the large firms' borrowing costs and real GDP growth rate has a reverse causality relationship.

[21] Freixas, Parigi and Rochet (1999) model inter-regional financial connections for the premise that depositors face uncertainty about the location where they need to consume. The financial connections arise, in contrast, in Allen and Gale as a form of insurance: when liquidity preference shocks are imperfectly correlated across regions, cross holdings of deposits by banks redistribute the liquidity in the economy. Then, these links expose the system to the possibility that a small liquidity shock in one location spread to the rest of the economy.

There are roughly three sources of contagion in the balance sheets of financial institutions: payment systems, interbank market, and derivatives. In order to understand entire picture of payment systems, we might need overall fund flow charts that summarize the issuers and underwriters of claims by financial sectors and institutions. This is not only a huge but also infeasible task outside financial regulatory authorities. Thus, this study tries to do a shortcut analysis by examining the portfolios of Korean financial institutions, putting more emphasis on the commercial banks. More specifically, we will investigate the balance sheets of the banks and figure out their assimilation and vulnerability to common shocks. This approach shares the spirit of de Bandt and Hartmann (1998) and Kaufman (1994) in that pure panic contagion is rare; far more common is contagion through perceived correlations in the asset returns of financial institutions. Next, the derivative trading and outstanding balance of the financial institutions that are recently becoming increasingly important in credit and market risk management will be taken into account from the viewpoint of systemic risk management.

4.3.1. Assimilation of Banks' Balance Sheets

In order to check whether systemic risks in the type of contagion of financial distress among banks, the asset portfolios are scrutinized across banks and over time. Figure 4-6 and 4-7 demonstrate the movement of the asset holdings by the four major Korean commercial banks: Kookmin Bank, Shinhan Bank, Woori Bank and Hana Bank. One of the most striking facts is that asset portfolios are quite different over time, but similar among the banks at a given time. This means that banks may be subject to common risk factors or at least keep track of the same trends in the strategically similar manner. In addition, the assimilation of the banks' balance sheets becomes strengthened due to a recent trend of financial conglomeration [Hahm and Hong (2003)]. With these observations combined, Korea's banking sector now seems exposed, in the *ex ante* sense, to systemic risks in ever greater deal than in the past.

[Figure 4-6 and 4-7 Here]

The common credit risks among Korean banks can be reconfirmed in the pattern of the loan loss provisions and loan write-offs. In principle loan loss provisions should relate future expected losses on loans, but in practice accounting conventions are set in a backward rather than forward-looking manner. Particularly, specific provisions can only be made once the debts are impaired. Also general provisions that should cover losses which have not yet been identified do cover the losses that currently lie latent in the book. That is to say, the provisions reflect actual, rather than expected losses. These practices render us to read the loan loss provisions as the proxy for actual losses occurred for whatever reasons.

What are the shocks that push the banks to raise the provisions? Figure 4-8 and 4-9 displaying the loan loss provisions and loan write-offs relative to total assets in the four major commercial banks partly answer to the question. These graphs imply that the variation in provisions across banks is lower than that over time. This seems to suggest that over time the major banks in Korea would hit from the common shocks than from idiosyncratic shocks.[22] Therefore, policymakers and financial regulators should pay more attention to aggregate shocks and their influences on bank capital adequacy in order to prevent and manage systemic risks.[23] [24]

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[22] The similar observation is found in the UK banks by Pain (2003).

[23] Davis (1993) measured the determinants of the loan loss provisions. He found that a sustained 1 %

[from Figure 4-8 to 4-11 Here]

4.3.2. Risk Exposure to Derivative Holdings

Financial innovations have brought about a host of techniques with which financial institutions can manage various risks, but also provided tools that could drive them to take excessive risks. One of the most significant devices for hedging and taking risks is derivative securities such as forward, future, option, swap, etc., so that monitoring the derivative positions of financial institutions should be a key task for systemic crisis management as well.

In Korea, the origin of derivatives went back to the 1980s when exchange rate forwards began to be traded for the purpose of hedging exchange risks due to the heavy volume of imports and exports. Recently, the derivatives become one of the major sources of non-interest revenues among financial institutions, especially banks and security companies. Table 4-4 and 4-5 show the derivatives trading by types and financial sectors in 2003. Since most of derivatives trading is assumed by security houses that deal with short-term contingent claims, the trading volume is astronomical, but the outstanding balance as of the end of 2003 is relatively smaller, albeit not at all negligible in view of total assets. For instance, banks held KRW 979 trillion, which is about 90% of their total assets (see Table 4-7). Because of the huge long balances by foreign branches rather than domestic commercial banks, the risks are more concentrated in foreign banks. However, the short-fall risks in the domestic banking industry are quite worrisome. According to Table 4-8, the credit risk exposure by the domestic banks reaches to 13%, while the US counterpart is only 6%. Why do financial institutions get fierce to trade derivative securities? As for the answer, Table 4-9 provides a clue that it could contribute to profits considerably. But, recalling that financial incidents always start with excessive risk taking behaviors in order to exploit seemingly arbitrage opportunities and that derivatives are related to market aggregate risks to which Korean financial system is especially vulnerable, Korea's financial regulatory authorities should thoroughly examine the risk exposure to derivative holdings of the banks and security companies from the viewpoint of systemic risk management.

5. Summary and Conclusion

This study is designed to provide policymakers and financial regulatory authorities with empirical references to systemic risk management. To this end, it tries to answer to the following questions. First, how and how much do macro aggregate shocks affect both the real and financial economies in Korea? Second, how do we identify the shocks to the extent that could have quantitative implications to policymakers? Third, does

fall in the GDP growth raises the long-run rate of provisioning by 14%; a 1% rise in the level of the bankruptcy rate raises provisioning by 1.7%; a 1% rise in corporate capital gearing (= gross debt/capital stock) raises provisioning by 0.73% and a 1%p rise in real rates from an initial level of 4% raises provisioning by 8%.

[24] Gonzalez-Hermosillo (1999) stressed the importance of the aggregate risks: banks do not fail because they have a large portion of troubled loans, but they fail because of their earlier investment decision whose outcomes may be also influenced by changed economic conditions – a high level of non-performing loans are the result of those same fundamental causes.

Korean firms' financial structure matter in the course of propagation and amplification of external shocks into a crisis? Fourth, how vulnerable are Korean financial institutions to contagious systemic risks through their asset portfolios?

To these questions, this study answers as follows. First, macro aggregate shocks do matter in the sense that they could multiply disturbances and have quite persistent effects on the real economy. Especially, the permanent shock that affects the level of real aggregate quantities, for instance, the one shifting labor productivity, disturbs the real side of an economy a lot, while it brings about temporary disorder in the financial side. In contrast, the influences of transitory shock seem limited to the financial markets.

Second, the size of the identified shocks with the long-run restriction could well explain the depth of the 1997-98 financial crisis. The identification also enables us to compare the shocks occurred over the time periods of interest. This explanation is particularly well understood in the *ex post* sense, but the *ex ante* application of the methodology for policy references asks for additional researches.

Third, capital gearing seems positively related to firms' borrowing costs. However, after considering other factors that could presumably affect the costs of external finance, we could find only a weak correlation between the firms' financial structure and borrowing costs. Rather, macro variables like real GDP growth rate and short-term nominal interest rates better explain the variations in unit corporate borrowing costs. This result could be interpreted that, on average, the Korean firms are more vulnerable to macro aggregate risk factors rather than idiosyncratic risks.

Fourth, the asset portfolios of the Korean financial institutions have moved together in a similar fashion over time. And the assimilation of their asset portfolios has been strengthened. These imply that the Korean financial institutions are also subject more to common risk factors than idiosyncratic risks like the non-financial firms.

All of the aforementioned results are uniformly stressing the importance of macro aggregate risks in managing a systemic crisis. In this context, it recommends to policymakers and financial regulatory authorities that they should call more attention to unveiling the characteristics of macro risk factors, of which the quantity is measured here but the nature remains unanswered.

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Appendix A. Corporate Data used in Section 4

The corporate data set used in the analysis is based on the National Information & Credit Evaluation, Inc. (NICE). Out of the externally audited companies from 1991 to 2003, we select the companies that have credit ratings and the number of employees in order to measure the fixed effect of credit ratings and firm size effect. In Korea, the classification for the small and medium sized enterprises (SMEs) follows the amount of paid-in capital less than KRW 80 million or the number of employees less than 300. In order to exclude the contamination of the results, the firms whose liabilities exceed their assets are not captured in the sample. The number of sample firms that satisfy the existence of data is 7,051, which counts the same firm in different years separately.

The variables are constructed in the following way:

(1) Average Borrowing rate) = Interest Expense / Total borrowing;
(2) Total Borrowing = Short-term Borrowings + Current Portion of Long-term Liabilities + Bonds + Long-term Borrowings + Long-term Trade Payables + Long-term Payable-Lease;
(3) Debt-equity Ratio = Total Liabilities / Total Stockholders' Equity;
(4) Interest Coverage Ratio = Operating Income / Interest Expense; and,
(5) Cash Flows from Operating Activities = Net Income + Depreciation + Amortization of Intangible Assets/Deferred Charges + Provision for Liabilities + Other Expenses without Cash Outflows + Other Revenues without Cash Inflows.

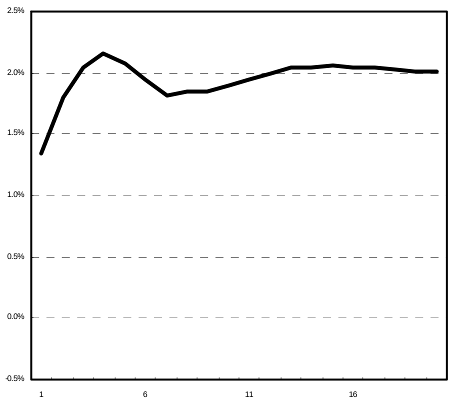
Credit ratings by year are constructed in the following manner: when a new credit rating is issued for bond issuance on a certain date, we take the credit rating of the firm to the very first date of the year. Thus, a credit rating in a particular year used in the analysis is the one during the year. If no new credit rating is given in a particular year, the pre-existing credit rating is counted as valid. When long-term bond ratings are not available, credit ratings for short-term commercial papers are used with comparison table between bonds and commercial papers.

The remaining macro variables are real GDP growth rates and call rates. It is very simple and standard to use real GDP growth rates. As for the call rates, we use the average of monthly call rates for one-day maturity without collateral. The average of monthly time series is used on the premise that corporate borrowings occur uniformly for a given year.

Figure 3-1. Impulse Response Functions due to 1% Permanent Shock: VAR with Lag 6

a. GDP Growth

b. Default Premium



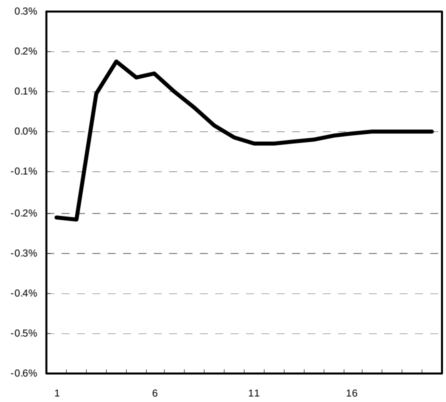
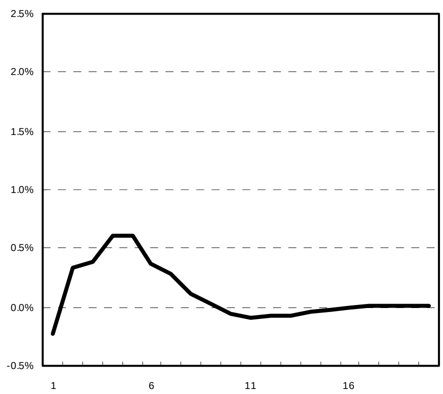


Figure 3-2. Impulse Response Functions due to 1% Transitory Shock: VAR with Lag 6

a. GDP Growth

b. Default Premium



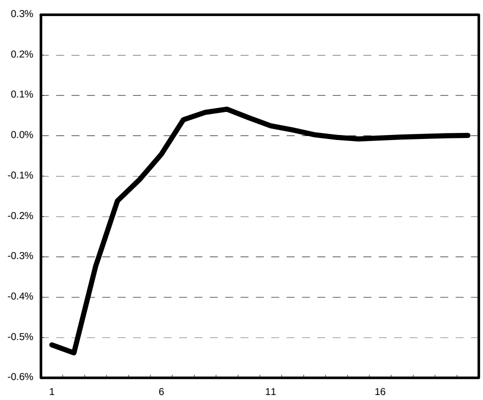


Figure 3-3. Identified Shock Series from 1988:3 to 2003:4

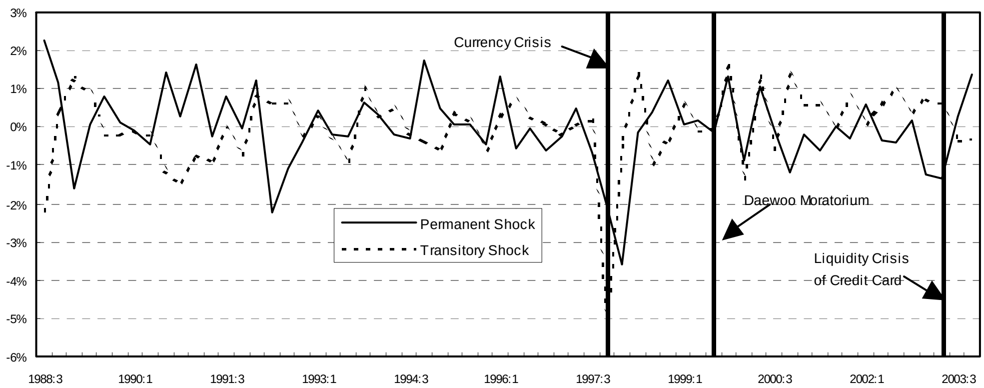


Figure 3-4. Histogram of the Permanent Shocks

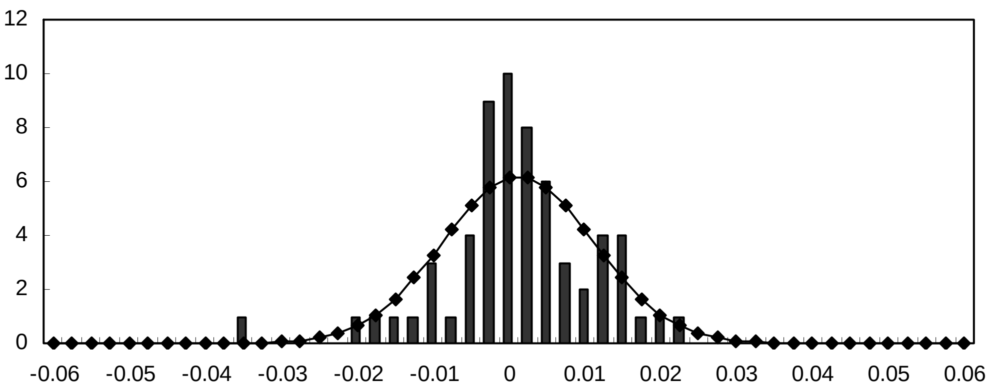


Figure 3-5. Histogram of the Transitory Shocks

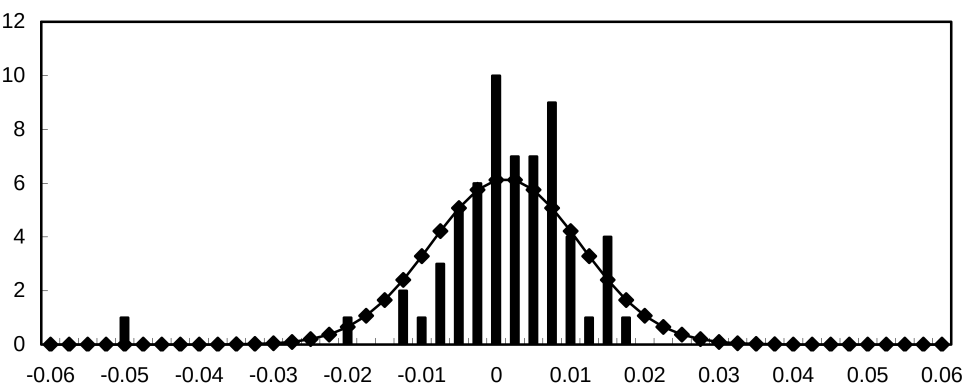


Table 4-1. Determinants of Average Borrowing Rate: the Entire Sample

$$\log(ABR_t^i) = \alpha_0 + \alpha_1 \log(CG_{t-1}^i) + \alpha_2 \log(ICR_t^i) + \alpha_3 \log(CFT_t^i) + \alpha_4 Size_t^i + \alpha_5 \log(CR_t^i) + \alpha_6 \log(RGDP_t) + \alpha_7 \log(CALL_t) + \xi_t^i$$

	(1)	(2)	(3)	(4)	(5)	(6)
$Log(CG_{t-1})$	0.09295***	0.06851***	0.06343***	0.2209**	0.00995	0.0036
	(0.01093)	(0.00857)	(0.00928)	(0.00934)	(0.00985)	(0.01057)
$Log(ICR_t)$		-0.05508***	-0.0506***		-0.03252***	-0.02897***
		(0.00750)	(0.00946)		(0.00804)	(0.00993)
$Log(CFT_t)$			-0.04843***			-0.04184***
			(0.01001)			(0.01039)
Size Dummy				-0.03012*	-0.04515***	-0.04396**
				(0.01631)	(0.01696)	(0.01786)
$Log(CR_t)$				-0.23542***	-0.20772	-0.21347***
				(0.02941)	(0.03304)	(0.03570)
$log(RGDP_t)$				0.10134***	0.10237***	0.1009***
				(0.02091)	(0.02168)	(0.02273)
$log(Call_t)$				0.18556***	0.16964***	0.17364***
				(0.01801)	(0.01905)	(0.02017)
No, of Observations	5611	5131	4800	5159	4739	4466
Adjusted R^2	0.0245	0.0332	0.0392	0.0601	0.0645	0.0707

Note: ABR = Average Borrowing rate
CG = Capital gearing or Debt-to-equity ratio
ICR = Interest coverage ratio
CFT = Cash flow / Turnovers
Size Dummy = 0 for SME, 1 for Large Company
CR = Credit rating
RGDP = Annualized real GDP
Call = Annualized average Call interest rate

Table 4-2. Determinants of Average Borrowing Rate: Large Companies

$$log(ABR_t^i) = \alpha_0 + \alpha_1 \, log(CG_{t-1}^i) + \alpha_2 \, log(ICR_t^i) + \alpha_3 \, log(CFT_t^i) + \alpha_4 \, log(CR_t^i) + \alpha_5 \, log(RGDP_t) + \alpha_6 \, log(CALL_t) + \xi_t^i$$

	(1)	(2)	(3)	(4)	(5)	(6)
	0.07699***	0.04062***	0.02984**	0.01123	-0.00869	-0.02080
log(CG_{t-1})	(0.01180)	(0.01331)	(0.01426)	(0.01423)	(0.01522)	(0.01606)
		-0.06547***	-0.04535***		-0.02893**	-0.00470
log(ICR_t)		(0.01046)	(0.01296)		(0.01170)	(0.01415)
			-0.08023***			-0.08741***
log(CFT_t)			(0.01350)			(0.01432)
				-0.31971***	-0.31618***	-0.32677***
log(CR_t)				(0.04215)	(0.04752)	(0.04998)
				0.11487***	0.11892***	0.12194***
log($RGDP_t$)				(0.02690)	(0.02811)	(0.02917)
				0.12633***	0.12723***	0.13761***
log($Call_t$)				(0.02428)	(0.02645)	(0.02757)
No, of Observations	2973	2760	2602	2714	2528	2407
Adjusted R^2	0.0138	0.0252	0.0363	0.0421	0.0472	0.0619

Note: ABR = Average Borrowing rate
CG = Capital gearing or Debt-to-equity ratio
ICR = Interest coverage ratio
CFT = Cash flow / Turnovers
CR = Credit rating
RGDP = Annualized real GDP
Call = Annualized average Call interest rate

Table 4-3. Determinants of Average Borrowing Rate: SMEs

$$\begin{aligned} log(ABR_t^i) = \alpha_0 + \alpha_1 log(CG_{t-1}^i) + \alpha_2 log(ICR_t^i) + \alpha_3 log(CFT_t^i) \\ + \alpha_4 log(CR_t^i) + \alpha_5 log(RGDP_t) + \alpha_6 log(CALL_t) + \xi_t^i \end{aligned}$$

	(1)	(2)	(3)	(4)	(5)	(6)
log(CG_{t-1})	0.09172***	0.06938***	0.07429***	0.01988*	0.01193	0.01474
	(0.01049)	(0.01117)	(0.01223)	(0.01201)	(0.01238)	(0.01346)
log(ICR_t)		-0.06048***	-0.08645***		-0.05552***	-0.08012***
		(0.01055)	(0.01347)		(0.01068)	(0.01330)
log(CFT_t)			-0.00786***			0.01637
			(0.01443)			(0.01424)
log(CR_t)				-0.10334***	-0.03187	-0.04288
				(0.04000)	(0.04436)	(0.04927)
log($RGDP_t$)				0.06739**	0.05004	0.04248
				(0.03264)	(0.03347)	(0.03527)
log($Call_t$)				0.33130***	0.30477***	0.31042***
				(0.02723)	(0.02822)	(0.03002)
No, of Observations	2411	2174	2012	2241	2033	1889
Adjusted R^2	0.0303	0.0454	0.0552	0.0911	0.1004	0.1095

Note: ABR = Average Borrowing rate
CG = Capital gearing or Debt-to-equity ratio
ICR = Interest coverage ratio
CFT = Cash flow / Turnovers
CR = Credit rating
RGDP = Annualized real GDP
Call = Annualized average Call interest rate

Figure 4-1. Capital Gearing and Borrowing Rate

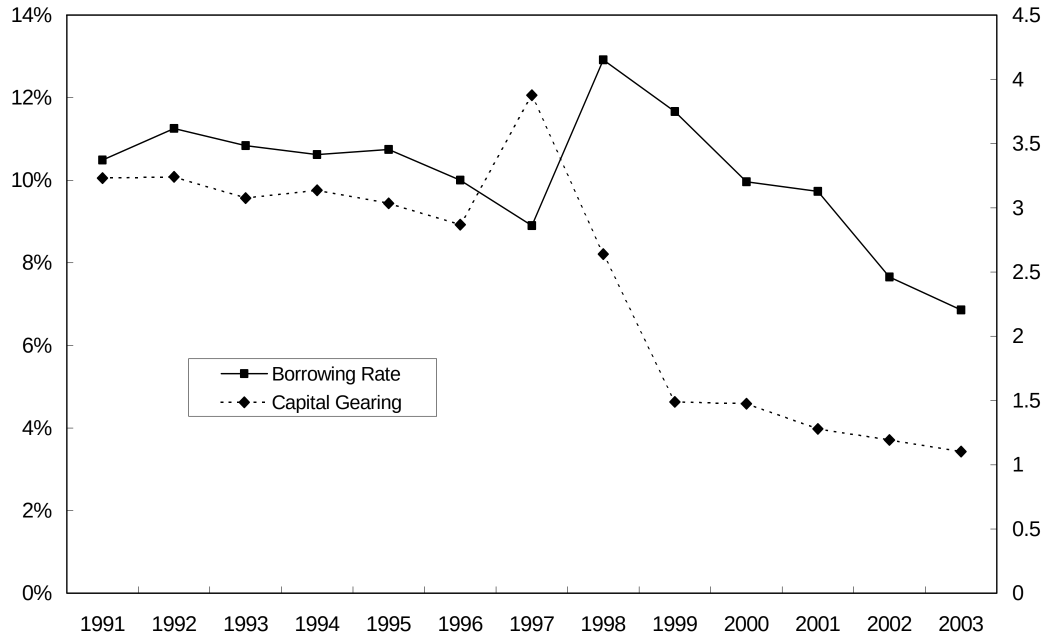


Figure 4-2. Interest Coverage Ratio and Borrowing Rate

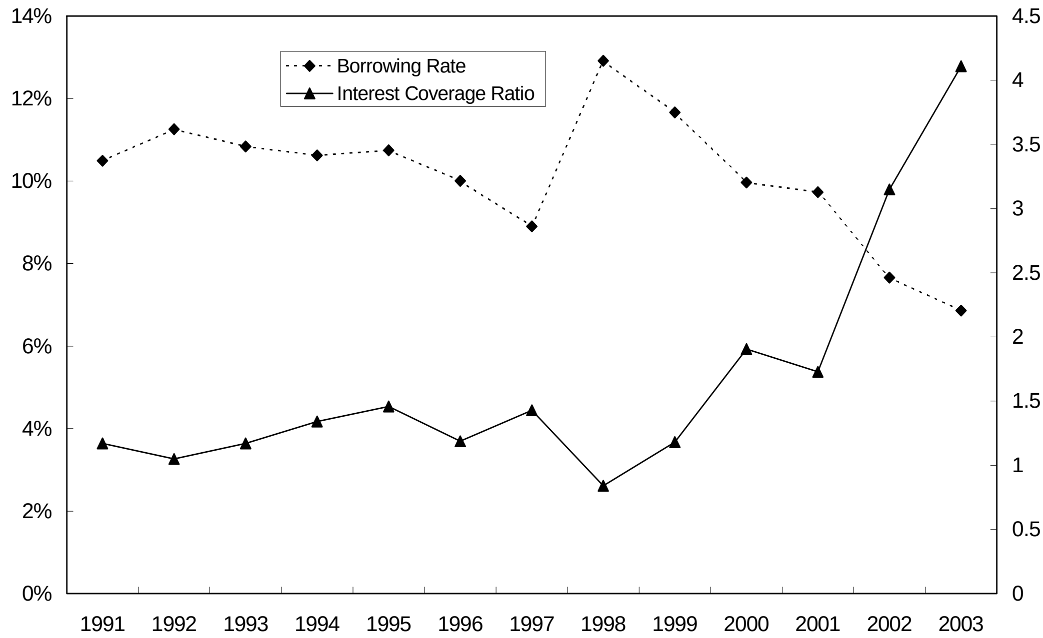


Figure 4-3. GDP Growth Rate and Borrowing Rate by Firm Size

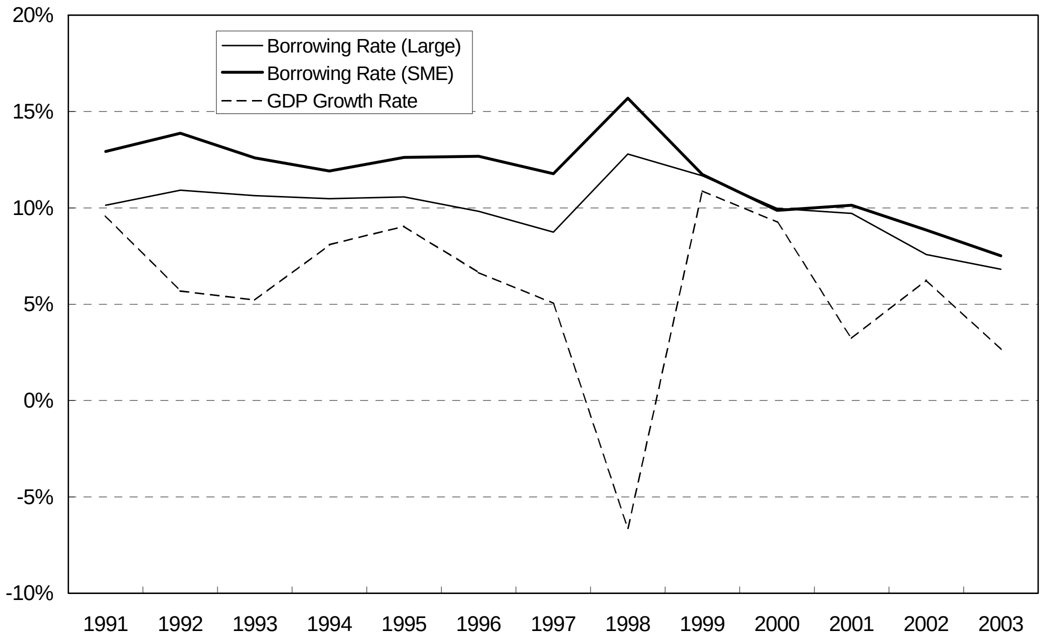


Figure 4-4. Call Rate and Borrowing Rate by Firm Size

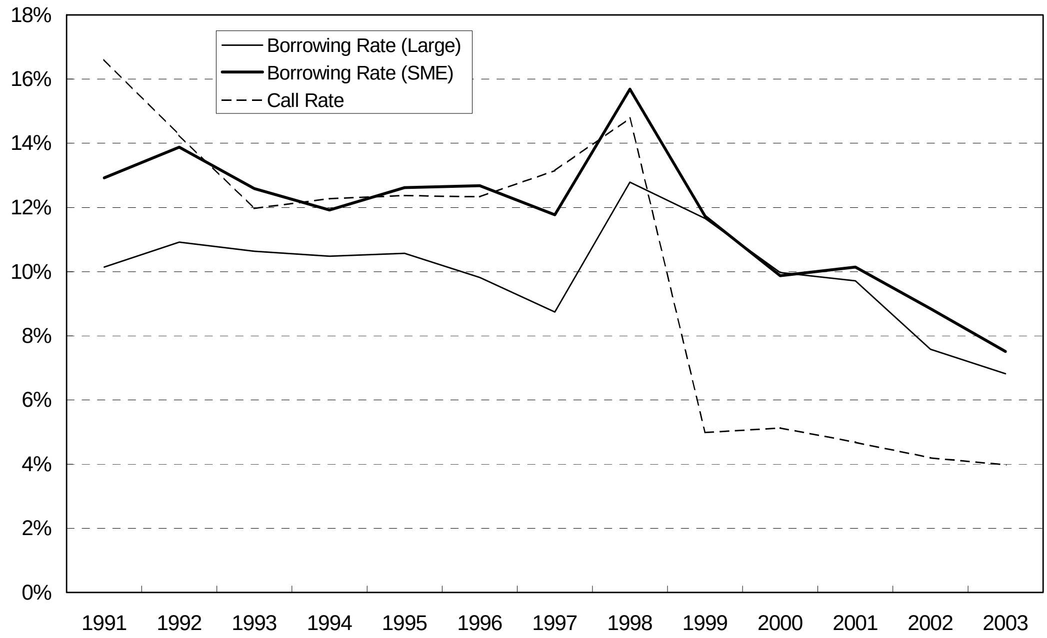


Figure 4-5. Borrowing Rate by Credit Rating

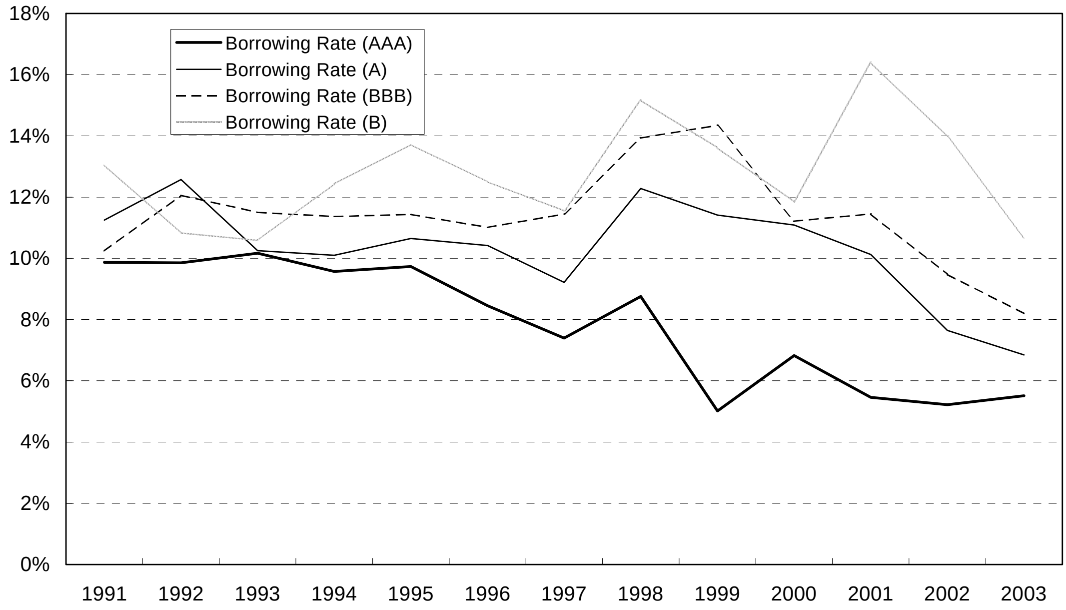


Figure 4-6. Ratio of Securities to Assets by the Major Commercial Banks

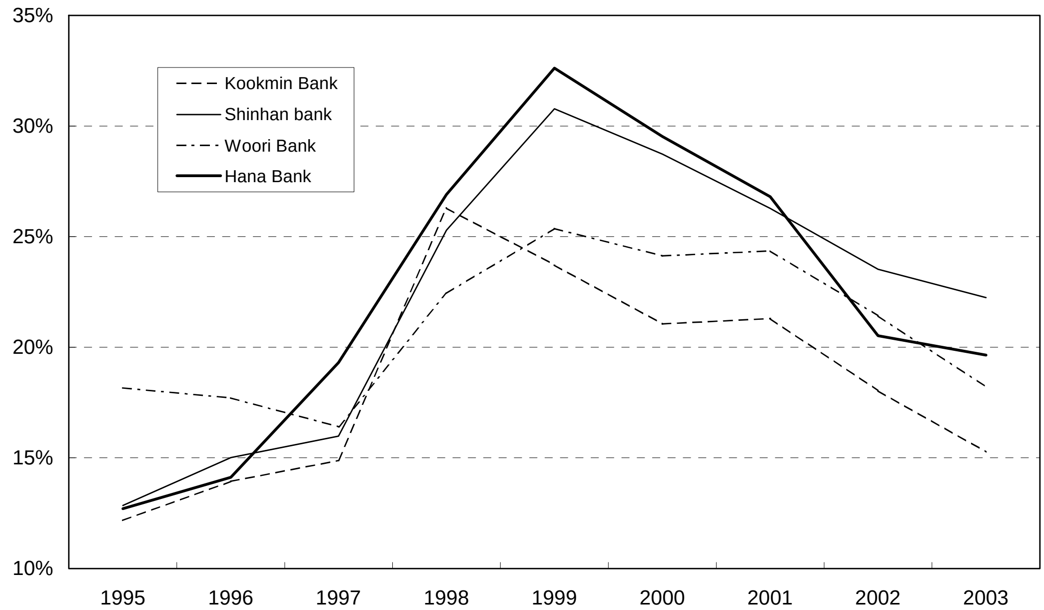


Figure 4-7. Ratio of Loans to Assets by the Major Commercial Banks

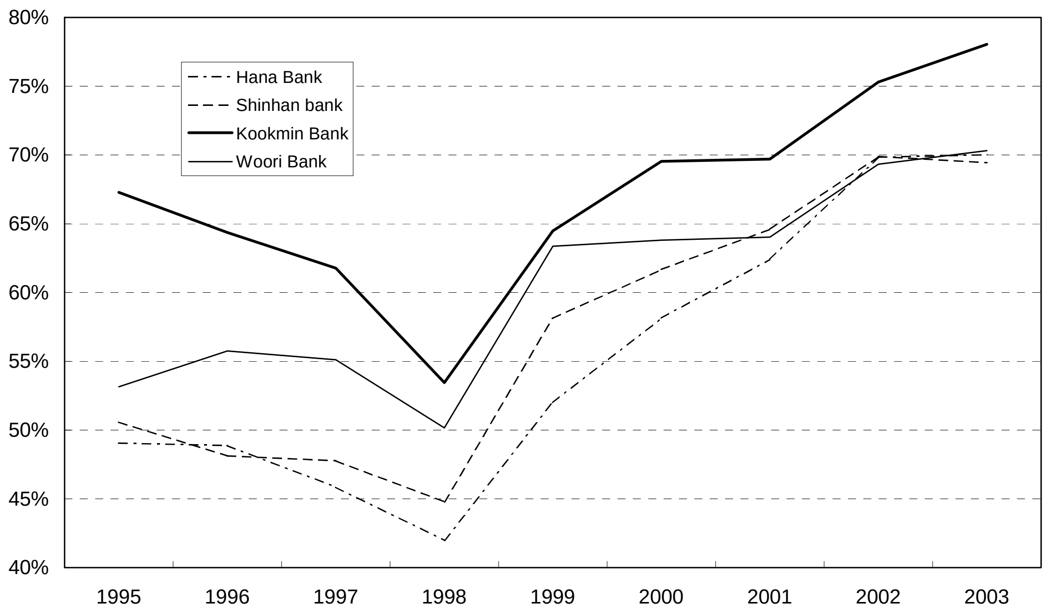


Figure 4-8. Loan Loss Provisions of the Major Commercial Banks

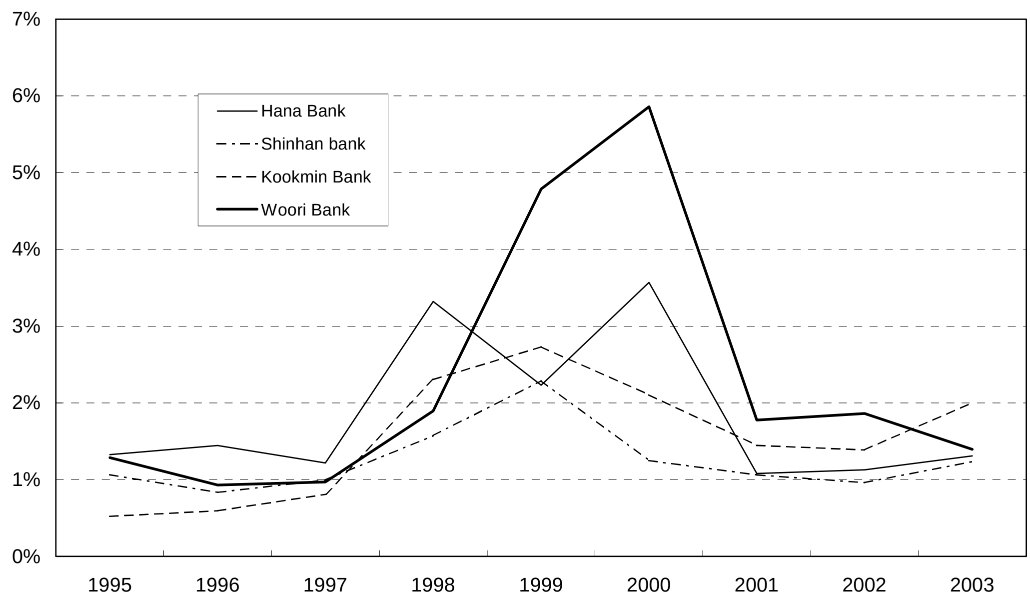


Figure 4-9. Loan Write-offs of the Major Commercial Banks

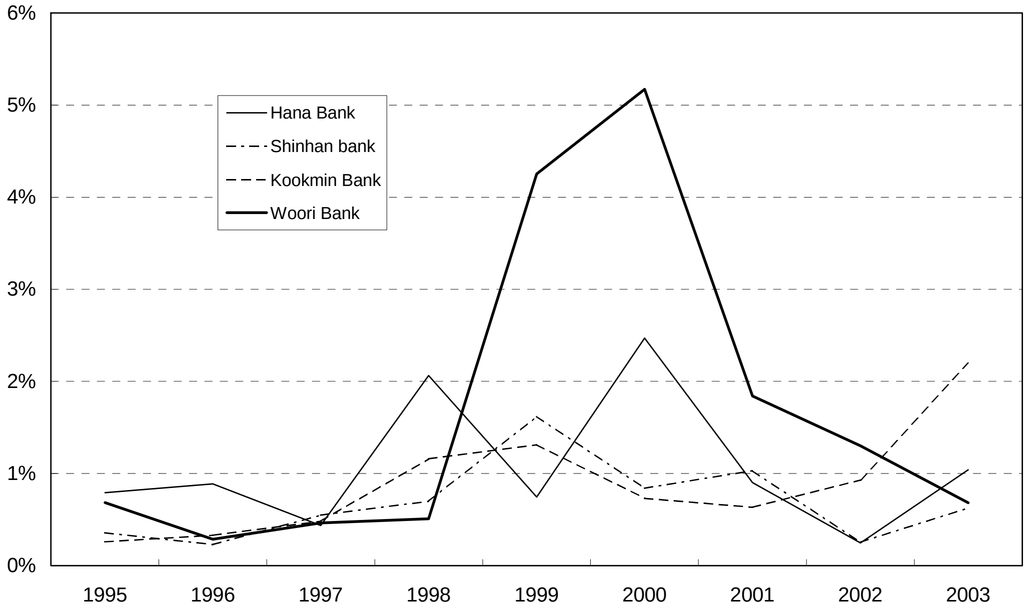


Figure 4-10. Net Increase in Loan Loss Provisions of the Major Commercial Banks

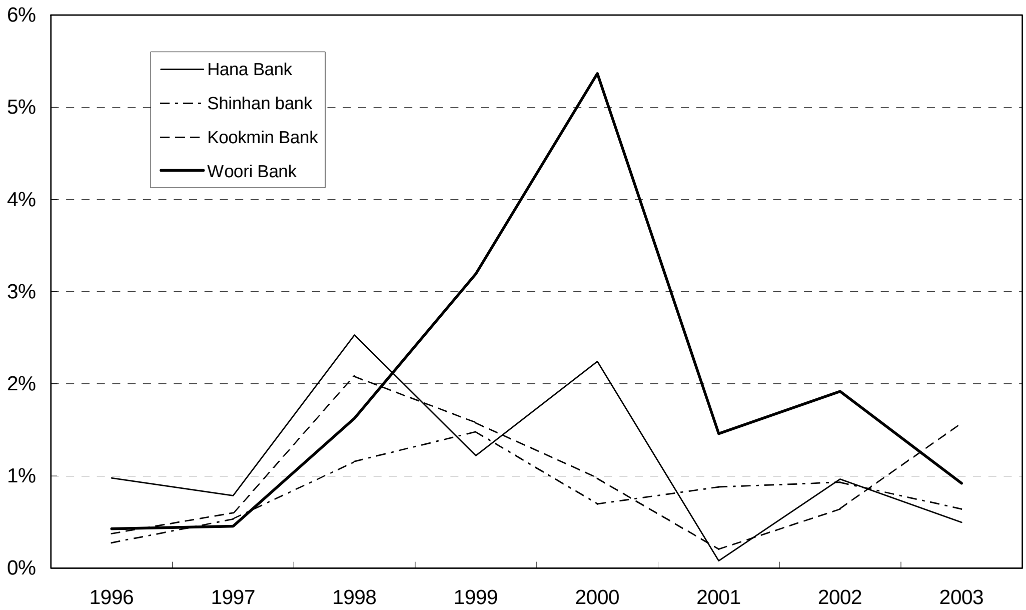


Table 4-4. Derivatives Trading by Types

(unit: trillion won, %)

	Trading Amount				Outstanding Balance			
	Stock	Interest Rate	Exchange Rate	Total	Stock	Interest Rate	Exchange Rate	Total
Forward	0.3	30	1,583	1,613 (7.5)	0.0	4	344	348 (34.1)
Future	1,314	1,803	120	3,237 (15.0)	2	16	2	20 (2.0)
Swap	0.1	240	113	353 (1.6)	0.1	389	166	555 (54.3)
Option	16,244	29	72	16,345 (75.9)	25	35	39	99 (9.6)
Total	17,588	2,102	1,888	21,548 (100)	27	444	552	1,022 (100)

Table 4-5. Derivatives Trading by Financial Sectors

(unit: trillion won, %)

	Trading Amount		Outstanding Balance	
Bank	2,941	(13.6)	979	(95.7)
Security	17,405	(80.8)	15	(1.5)
Insurance	54	(0.3)	20	(1.9)
Trust*	647	(3.0)	7	(0.7)
Others**	501	(2.3)	1	(0.2)
Total	21,548	(100.0)	1,022	(100.0)

* Trust = Bank Trust + Investment Trust

** Others= Credit Card + Future + Merchant Bank

Table 4-6. Derivatives Trading in the Exchange and Over-the-Counter(OTC)

(unit: trillion won, %)

		Stock	Interest Rate	Exchange Rate	Others	Total
Trading Amount	Exchange	17,540 (90.1)	1,804 (9.3)	119 (0.6)	2 (0.01)	19,465 (100.0)
	OTC	17 (0.8)	298 (14.3)	1,767 (84.9)	- -	2,083 (100.0)
Outstanding Balance	Exchange	10 (34.4)	17 (57.7)	2 (7.9)	- -	30 (100.0)
	OTC	16 (1.6)	426 (43.0)	550 (55.4)	- -	992 (100.0)

* Source: Financial Supervisory Service

Table 4-7. Ratio of Derivatives Outstanding Balance to Total Assets

(unit: trillion won, %)

	Bank	Domestic Bank	*Foreign Branch*	Security	Insurance	Total	Commercial Bank in the US
Total Assets	1,089	1,000	89	56	221	1,366	5,902
Nominal Balance of Derivatives	*979*	*380*	598	15	20	1,013	70,005
Ratio	0.90	0.38	6.72	0.27	0.09	0.74	11.86

Source: Financial Supervisory Service, Office of the Comptroller of the Currency

Table 4-8. Credit Risk Exposure by Financial Sectors

(unit: trillion won)

	Bank	Domestic Bank	Foreign Branch	Security	Insurance	Total	US Commercial Bank
Adjusted Capital (A)	81	76	6	5	25	111	-
Credit Conversion (B)	25	10	15	0.4	2	27	-
Credit Risk Exposure (A/B)	0.31	0.13	2.52	0.07	0.06	0.24	0.06

* Source: Financial Supervisory Service, Office of the Comptroller of the Currency
* add on: (nominal balance × conversion rate by commodity and maturity)

Table 4-9. Profits from Derivatives Trading

(unit: 100 million won)

	Bank	Domestic Bank	Foreign Branch	Security	Insurance	Total
Profits from Derivatives Trading (A)	5,260	1,430	3,830	2,340	45	7,645
Operating Profits (B)	38,130	32,200	5,930	12,560	39,170	89,860
Ratio (A/B)	13.8	4.4	64.6	18.6	0.1	8.5

* Source: Financial Supervisory Service

Comments on " Identification and Management of Systemic Risks : Macro and Micro Evidence in Korea"

Joon-Hwan Im,
Professor,
Sogang Unversity

This paper attempts to employ an empirical method to identify and manage systemic risks in Korea, using macro and micro data. The empirical findings are two-fold:(1) macro aggregate shock are important in explaining the evolution of systemic risk in Korea, whereas (2) the micro-data approach is not enough to account for the onset of systemic risk.

I found this paper interesting in that it tries to empirically model "systemic risk". Often the concept, systemic risk is often abused in policy circle without giving a precise operational meaning on it. However, the attempt to explain systemic risk on an empirical framework seems to incomplete for the following reasons. First, in the model, there is no economic rational for the breakdown of shocks in two parts: permanent and transitory shock. In other words, it is not clear to show how the two variable VAR with the long-run restriction is closely linked to the generation of systemic risk from the viewpoint of economic reasoning, not from statistical approach.

Secondly, it seems to be unfair to argue that the macro data approach is better than the micro-data approach in explaining the nature of economic crisis in Korea by comparing the empirical validity between the two different approaches. What the paper tries to argue in a more valid context should have bee done on the same dependent variables between the two models.

It would be like comparing an apple with an orange to argue that the macro shock is more important in explaining economic crisis in Korea.

Thirdly, there is some doubt about the empirical measure of default premium to be defined a difference between the corporate bond yield and risk-free bond yield. Before the onset of the crisis, the corporate bond yield was de-facto risk-free yield since it was fully guaranteed by commercial banks which maintained almost same credit rating with the risk-free bond. So Before the crisis, the use of corporate bond yield as a proxy measure of default would be problematic. Lastly, there is some

confusion on the interactive use of systemic risk, shock, and crisis. Those concepts need to be clarified by giving different operating definitions.

CHAPTER 3-1

On the Insider Trades of SK Chaebol

by
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Abstract

This paper concerns the insider trades between affiliates of the SK group. Before the IMF crisis, this group was one of the top five *Chaebols*, which was in relatively sound financial statements and kept less diversified business structure. Moreover SK group has rapidly grown under the Kim Dai-Jung administration, and has since a far-reaching influences upon the Korean economy. But, after the exposure of the 2002 window-dressings made by the SK Global Co., many economists and financial analysts debate again over the merits and demerits of the *Chaebols*.

Obviously, the insider trades between group affiliates are one of the key points concerning the *Chaebol* problems. It has an effect on the structures of business systems like the *Chaebol* and it also indicates the outcomes of business restructuring. Insider trades are classified as trades of goods and services; trades of capitals such as investment into the stocks of other affiliates, debt guarantees; and dispatching manpower to other affiliates.

The main focus of this paper is on the topics related to the insider trades of goods and services. Those insider trades of goods and services will be specified in detail by subcategories such as 1) insider sales (gains), 2) insider purchases (expenses), 3) insider account receivables, and 4) insider trade account payables.

In section Ⅱ, we briefly reviews the historical growth paths of the SK *Chaebol,* by looking at total assets, capital stocks, debts and sales. In Section Ⅲ, we demonstrate the resources, scales and rates of the insider trades of the SK group in general by including their individual affiliates. Based on these findings, some hypothetical analyses are suggested, for example, a comparative analysis on the results of before and after the IMF crisis, and on the rates of insider trades between listed and unlisted companies. Also we focus on the insider trades between Information & Telecommunications (IT) companies and non-IT companies. The supporting effects of insider trades on the IT companies, especially incorporated after the financial crisis (1997), will be discussed in this section. And lastly but not least, we investigate the relationships of the insider trades with stock shareholdings. In section Ⅳ we conclude by presenting some hypothetical suggestions on the transformation of business structures and the evolution of the *Chaebol* organization.

Section Ⅰ Introduction

The financial crisis that occurred in late 1997 has struck the entire Korean society unprecedentedly. In the process of many reforms, there were no such entities as *Chaebol*, which has attracted so much attention. If it wouldn't be for the reform pressures following the economic crisis, the serious and rapid changes in economic circumstances, so called 'globalization', would have compelled the transformation of the C*haebol*-systems. *Chaebols* had no choices but to reform to survive. Nevertheless the professedly self-directed reforms initiated at the beginning of the administration of Kim Dai-Jung (1998-2002; so called "peoples' government") now resulted as a failure. The government was unable to touch the commanding or controlling powers of the chief of the *Chaebol* group. The Korean economic system got a lesson from the reforms. There are many insuperable limits in the self-directed reforms. The reforms of the *Chaebol* have influenced all aspects of Korean society. Moreover, the SK group's entangles which accidentally happened at the beginning of the 'Participatory Government' were fully informed of the difficulties in the *Chaebol* reforms.

Our interest here is not in addressing specially the *Chaebol* reforms in-itself. It rather concerns the insider trades between affiliates of the SK group. Before the IMF crisis, SK group was well known as one of the top five big *Chaebols*, it was in relatively sound financial statements and they kept up less diversified business structures. Moreover the SK group has rapidly grown under the Kim Dai-Jung administration, and has since had a far-reaching influences upon the Korean economy. But after the exposure of the 2002 window-dressings made by the SK Global Co. financial analysts and economists debate again over the merits and demerits of the *Chaebol*.

Obviously the insider trades between group affiliates are one of the points concerning the *Chaebol* problems. It had an effect on the structures of business systems like the *Chaebol,* and it also indicates the outcomes of business restructuring. Insider trades are classified as trades of goods and services; trades of capitals such as investment into the stocks of other affiliates; debt guarantees; and dispatching manpower to other affiliates.

The main focus of this paper is about the changes appeared over a period of several years into the insider trades of goods and services Those insider trades of goods and services will be specified in detail by subcategories such as 1) insider sales (gains), 2) insider purchases (expenses), 3) insider account receivables, and 4) insider trade account payables.

In section Ⅱ, we will briefly reviews the historical growth paths of the SK *Chaebol* by looking at total assets, capital stocks, debts and sales. In section Ⅲ, we demonstrate the resources and the scales of the insider trades of the SK group in general by including their individual affiliates. Based on these findings, some hypothetical analyses are suggested, for example, a comparative analysis on the volumes and the rate of the insider trades before and after the IMF crisis, and on the rates of insider trades between listed and unlisted companies. Also we focus on the insider trades between Information & Telecommunication (IT) companies and non-IT companies. The supporting effects of insider trades on the IT companies, especially incorporated after the financial crisis (1997), will be discussed in this section. And lastly but not the least, we investigate the relationships of the insider trades with stock shareholdings. In section Ⅳ, we conclude by presenting some hypothetical suggestions on the transformation of business structures and the evolution of the *Chaebol* organization.

Section Ⅱ The growth of the SK *Chaebol* after the financial crisis of 1997

Before the IMF crisis, SK group was known as one of the top five big *Chaebols*, they were in relatively sound financial statements and they kept up less diversified business structures. Moreover, this group has rapidly grown under the Kim Dai-Jung administration. Their total assets ranked 5th in 1994. At that time, the scale of assets represents a half of the 4th LG group. But in 1999, SK had 40,147 billion won assets; it had grown by 7,381 billion won per a year. This growth rate was without parallel in any other large *Chaebols*. In a way the total debts increased from 23,910 billion won in 1997 to 29,721 billion won in 2002. Capital stocks are three times larger than those of the financial year 1997. In 2002, total sales were recorded up to 53,415 billion won. It increased rapidly like any other group did before. A better picture of this impressive growth from 1997 to 2002 of the SK *Chaebol* is shown on the following table 1.

During these years, we have to take into consideration the rapid increasing number of affiliates. From thirty-two affiliates in April 1996, it raised to sixty in May 2003. At that time they ranked second behind the Samsung *Chaebol* (sixty-three affiliates) in respects of number of group affiliates. Among these sixty affiliates, eleven companies are listed (in KSE and KOSDAQ), ten companies are enrolled in Financial Supervisory Services (hereafter FSS), and twenty-six companies are statutory audited companies.

Table 1. The growth of the SK *Chaebol* (1997-2002)

(End of the year, Billion Won)

Year	Non-financial companies					Total companies				
						Total assets		Stockholder's Equity	Capital Stocks	Sales
	Asset	Stockholder's Equity	Debts	Capital stocks	Sales	Official Assets	General Assets			
1997	29,019	5,109	23,910	1,102	30,167	29,267	30,431	5,243	1,327	30,691
1998	32,045	9,418	22,627	1,849	36,829	32,766	34,185	9,503	2,562	37,449
1999	39,581	16,959	22,622	2,391	37,347	40,147	41,447	16,908	2,949	38,039
2000	45,891	18,301	27,590	3,392	45,380	47,379	49,570	18,377	4,870	47,596
2001	45,603	18,972	26,631	3,214	48,561	46,754	49,345	19,247	4,353	50,319
2002	46,315	16,594	29,721	3,371	51,801	47,463	50,511	16,876	4,510	53,415

Source: FTC

By industry, eight companies (including SK Corporation Ltd.) are participating in chemical industries, sixteen companies are in electronic/gas/energy, another sixteen companies are in information & telecommunication industries, and the remaining eleven companies are in engineering & construction including logistics business (see table 2).

Table 2. Business categories and Affiliates of SK *Chaebol* (2003.2.28)

Business category	Listed or not	Affiliates
Chemicals (8)	Listed	SK Corporation, SK Chemicals, SKC, DongSin Pharma
	Not-Listed	Daehan Oil Pipeline, SK NJC, SK UCB, SK Pharma,
Electronics/Gas/ Energy (16)	Listed	SK Gas, Daehan City Gas, Pusan City Gas
	Not-Listed	SK-Enron, Chungju City Gas, Pohang City Gas, Kumi City Gas, Chonnam City Gas , Kangwon City Gas , Iksan City Gas, Daehan City Engineering, Pusan City Gas Development, SK Electric Power, Iksan Energy, Chungnam City Gas, Eunkwang Gas Industrial Co.
Information & Telecommunications (16)	Listed	SK Telecom
	Not-Listed	SK C&C, SK Teletech, SK Telink, SK IMT, IWingz, Infosek, WiderThan.Com, The Contents Company, SK Telesys, Innoace, Paxnet Inc., Air Cross, Entro E&M, Smartic, SK Communications
Engineering & Construction/ Logistics (11)	Listed	SK Global, SeGye Corporation
	Not-Listed	SK Engineering & Construction, SK Shipping, SK Forest, SK DtoD, Stella Shipping, MRO Korea, IACC, Benex International, Oil Chain
Financials (5)	Listed	SK Securities
	Not-Listed	SK Life Insurance, SK Investment Trust Management, SK Capitals, Global Credit & Information
Others (4)	Not-Listed	Walkerhill Hotels, ENCar Networks CO. JungJiWon, SK Wyverns

Source: SK Corporation's Annual Audit Report(2002).

In table 3, a comparative scale of five financial companies is shown. SK *Chaebol* entered into the financial business in March 1988 with the SK Life Insurance Co. and SK Investment Trust Management Co. In 1991, SK *Chaebol* incorporated Pacific Securities Co. and renamed it SK Securities Co. Moreover SK Capitals Co. was established by investments of the SK Telecom in 1995. The entrance of the SK *Chaebol* into financial was relatively late compared with the other top four *Chaebols*. Therefore the share of the financial business in assets and sales was smaller than any other else.

Four financial companies excluding Global Credit & Information Co. are sharing about 8.3 percent of assets and 8.7 percent of workers to the group totals at May 2003. But notice the share of the capital stocks is very high, it is 25 percent of the group totals compared with the 3 percent of total sales (which is a usual practice for the top five *Chaebol*.)

Table 3. Comparative scale of Financial and Non-Financial companies (2003. 5)

(Million won, %)

	Total Assets	Capital Stocks	Sales	Net-Incomes	Workers
Non-Financials	46,190,266	3,336,822	51,586,961	1,371,531	25,896
Financials (B)	4,187,786	1,136,349	1,586,656	5,512	2,478
Total (A)	50,378,052	4,473,171	53,173,617	1,377,043	28,374
Shares (B/A)	8.3	25.4	3.0	0.4	8.7

In respects of sales for each business divisions, petroleum & chemical companies shared 50 percent and more during the late 80's and it decreased by 20 percent in the financial year of 2001. By adding distribution & logistics division to these companies, two divisions' share became over 70 percent. After the IMF crisis, the distribution division outran the petroleum & chemicals. Followed by the information & telecommunications division which had grown rapidly in 1990's, they were then ranked 3rd in the group. By excluding the information & telecommunications division, we notice that the changes in ranking of each division within the group have been relatively stable since 1987.

On the other hand, the study of total assets brings us to other results concerning the growth of the *Chaebol*: During the FY2001 the petroleum & chemicals is evaluated to approximately 17 billion won (34.7 percent), the information & telecommunications division represents 13.7 billion won (27.8 percent), and the distribution divisions totalize 7.6 billion won (15.5 percent). In the 1990's, it is noticeable that the shares of textiles & clothing division have declined and those of the information & telecommunications, electronics & gas, and the financials divisions have increased markedly their assets as in the case of gross sales. But the fluctuation of the share of each division was more violent in assets than in sales.

Section Ⅲ The insider trades of the SK *Chaebol*

3.1 Definitions on the Insider Trade

The insider trades includes trades of goods and services, capital trade such as investment into the stocks of other affiliates, debt guarantees and manpower. Our analysis is concentrating on one specific aspect of the inside trades i.e. the trades of goods and services. Insider trades of goods and service are divided into several sections: insider sales including gains (hereafter IS), insider purchases including expenses (hereafter IP), insider account receivables (hereafter IAR), and the insider trade account payables (hereafter ITAP) among affiliates.

The insider trades of goods and services are usually done between vertically diversified affiliates by purchasing and selling intermediate goods and materials. But these trades are also done between companies indirectly related in the lines of manufacturing. For example, an engineering & construction company included in the group can sell his products and services to another affiliates. Also a system integration company in the group is allowed to sell various computer-related services to the other affiliates.

Therefore, the amount of "insider sale" is measured by company's total sums of sales of goods and services (recorded as business incomes in the Financial Statements), which were sold to other group affiliates, this including the rents. Also the "*rate of insider sales*" is defined by the ratio of insider sales to total sales of relevant company. "Insider purchases" represents a total amount of goods (intermediate goods and plants and other fixed assets etc.) and services purchasing from other affiliates. In the case of purchasing the services, it is recorded as purchasing costs (i.e. bills for computing services, communication expenses etc.) in F/S (i.e. income statement) including leasing fees. In case of missing data in cost of sales, it will be filled up by the "purchase of raw materials" in F/S (i.e. statement of costs of goods manufactured). With the same manner, the "*rate of insider purchases*" is defined by the ratio of insider purchases to total "cost of sales" in income statement or total "purchase of raw materials". On the other hand, "*insider account receivables*" are claims in exchange for payments including accrued incomes, leasing guarantees existing between affiliates. The "*insider trade account payables*" are liabilities on which a company owe to other group affiliates by including other liabilities such as account payables, guarantees in advance from other affiliates at rental contract (Song, 2001a; 2001b).

At a group level, the *rate of insider sales* is defined by the ratio of insider sales of all the affiliates to total sales of all the affiliate companies. In case of the rate of the insider purchases, considering that total amount of insider purchases exercised by all the affiliates is equal to total amount of insider sales of all the affiliates within the group by definition. Therefore, to get more accurate data on the rate of insider purchases at a group level, we can define the "*rate of insider purchases*" by the ratio of insider sales of all the affiliates to total "cost of sales" of all the affiliate companies.

3.2 The rate of insider trades of SK group after 1987

The facts we can find on the changes of various rates concerning insider trades after 1987 are as follows; First, the numbers of affiliates being related to the insider trades have been increase for 16 years except during three years from 1997 to 1999. Second, the rate of insider sales of the SK group total (insider sales of all affiliates to the sales of group total) has declined from 27 percent in FY1987 to 15 percent in FY1994 and inclined to 37.5 percent in FY 1999, and thereafter it declined again slightly. Third, the rate of credit sales or purchases to the insider trades has increased progressively after 1987 and scored 25 percent in 1998. Fourth, the rate of insider account receivables among group affiliates has increased rapidly after 1997 and kept up the level about 37 to 38 percent during the following two years. And lastly, the rate of trade account payables among group affiliates to the total trade account payables has recorded over 50% after FY1997 and declined to 34.6 percent in FY2002.

From these trends, we can present hypothetical assumption. After the IMF crisis in 1997, the growth of the SK *Chaebol* could happen via the expansion of new affiliates into the same lines of business. This growth effects happened because the insider trades was developing among group affiliates. Before the crisis, the rate of insider trades of SK is the lowest among the other top five *Chaebols*, but after the crisis it has increased rapidly especially from the end of 1998 and to the end of 1999.[1)] During this period, the government regulations on investments in the stocks of group affiliates were nullified. Thereafter for 3 years (2000,2001,2002) it recorded respectively 30.3 percent, 32.4 percent, and 31.8 percent. All these records are higher than those compiled before the crisis by 10 percent and some times even more.

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[1] According to our calculation, the rate of insider trades of the 17 affiliates is 40.1 percent at the end of FY1998 and it differs from the 21.6 percent in table 4. This difference came from the SK Telecom Co. Ltd. of which the rate of insider sales was about 162 percent. The reason why the rate of insider sale is over 100 percent is that the insider sale also includes income for telecommunication services to insiders.

Table 4. Changes of rates concerning insider trades of SK after 1987

(%, Number of companies)

Year	Rate of insider sales	Rate of IAR	Rate of ITAP	Number of relevant affiliates
1987	26.9	0.0	12.5	14
1988	25.5	7.6	10.9	16
1989	19.0	15.1	22.8	20
1990	24.5	14.8	20.5	21
1991	18.4	12.6	16.4	21
1992	22.7	12.7	23.4	24
1993	16.5	12.7	30.0	24
1994	15.0	12.8	25.2	25
1995	18.4	5.9	29.8	25
1996	16.2	7.4	23.7	35
1997	21.5	37.0	61.3	31
1998	21.6	38.6	61.4	29
1999	37.5	38.5	52.2	29
2000	30.3	31.8	52.3	41
2001	32.4	15.4	43.1	44
2002	31.8	12.2	34.6	47

Source: Kisline, Song (2000: 99-105)

3.3 Insider Trades before and after the IMF Crisis: Comparing with other top three *Chaebols*

According to the Financial Supervisory Services (FSS) analysis, which was based on the consolidated F/S (FY1999) of each group, the average rate of the insider sales of 16 *Chaebols* was 34.9 percent. By excluding the top four *Chaebols*, the average rate of the twelve remaining groups was 13.5 percent in 1999. It shows that the rates of the insider trades of the top four *Chaebols* are higher than all the other 12 *Chaebols*. The FSS investigation revealed an average rate of insider sales of the top 4 *Chaebols* (excluding Daewoo group) was 39.2 percent.[2)] Especially, the rates of insider sales dedicated to the domestic affiliates of the top three *Chaebols* (excluding SK group) exceeded up to 40 percent. In the case of the rates of insider sales to overseas, Samsung and SK group exceeded up to 40 percent of total sales to overseas. On the other hand, Hyundai and LG group concentrated their insider sales relatively in domestic affiliates. Comparing the rate of the insider sales dedicated to the domestic affiliates with the rate of insider sales for the overseas in the SK group, the latter was twice higher than the former group.

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[2] As a reference, the rate of insider sales of Daewoo group was 32.7 percent in FY1997 and 32.0 percent in FY1998.

Table 5. Amounts of insider sales of top 4 ***Chaebols*** **(**FY1999)

(Billion Won, %)

Name	Total Sales[1)]			Insider Sales[2)]		
	Total	Domestics	Overseas	Total	Domestics	Overseas
Hyundai	112.98	83.33	29.65	43.04 (38.1%)	41.27 (49.5%)	1.78 (6.0%)
Samsung	148.17	111.21	36.96	61.73 (41.7%)	46.56 (41.9%)	15.17 (41.1%)
LG	83.48	62.28	21.20	31.76 (38.0%)	25.96 (41.7%)	5.80 (27.3%)
SK	51.72	38.39	13.34	18.68 (36.1%)	11.46 (29.8%)	7.22 (54.1%)
Sub-total	396.36	295.21	101.15	155.21 (39.2%)	125.24 (42.4%)	29.97 (29.6%)
Other *Chaebols*	77.89	71.17	6.72	10.43 (13.4%)	9.48 (13.3%)	0.95 (14.2%)
Total	474.25	366.38	107.87	165.64 (34.9%)	134.72 (36.8%)	30.92 (28.7%)

Note: 1) Total sales before offsetting the insider sales.
2) Numbers in the ( ) are rate of insider sales to total sales of each *Chaebol*.
Data: FSS (2000)

Based on the FSS investigations, we compare the rates of insider trades of the major *Chaebols* before and after the IMF crisis in table 6. Remarkable fact can be notified in this table; the rates of insider sales of all the top four *Chaebols* are increased after the IMF crisis. But in other *Chaebols* excluding Hanjin, Hanhwa and Hansol group, their rates of insider sales to total sums of sales were declining after the IMF crisis.[3)] As the FSS (2000) points out, the increasing rate of insider sales could be considered as a results of the corporate restructurings or reforms by selling and merging of non-profitable affiliates and business departments. Therefore, the degree of vertical integration among the independent affiliates is higher than ever before. But at the same time, we believe that the increasing rate of insider sales could also be interpreted as a consolidation of *Chaebol*-like organization. High degrees of dependency among the group affiliates were rather results of increasing investment to the stocks of affiliates after the IMF crisis.

[3] A study estimated that the average rate of insider trades of the thirty groups was 26 percent and 8.74 percent when excluding the amounts of general trading companies (in case of top 5 *Chaebols*, it was 7.33 percent). It suggested that this average rate is similar to that of Japanese group (*Keiretzu*)(Lee, 2000). But this may be the effect of an underestimation.

Table 6. Changes of the rate of insider sales of major *Chaebols* before and after the IMF crisis (%)

		Hyun dai	Sam sung	LG	SK	Han jin	Lotte	Han hwa	Ssang yong	Han sol	Du san	Dong yang
Before IMF Crisis	87-96 Avr.	20.0	24.1	24.2	20.3	4.7	9.1	12.4	17.4	23.2	13.3	9.0
	1997(A)	31.6	30.3	24.5	21.5	5.8	11.6	4.7	38.6	24.1	16.7	18.0
After IMF Crisis	1998	28.4	24.6	24.3	21.6	4.3	10.7	11.7	41.8	25.3	12.3	22.0
	1999(B)	38.1	41.7	38.0	36.1	6.8	10.8	10.7	8.6	25.2	8.3	6.6
B-A		6.5	11.4	13.5	14.6	1.0	▽0.8	6.0	▽30.0	1.1	▽8.4	▽11.4

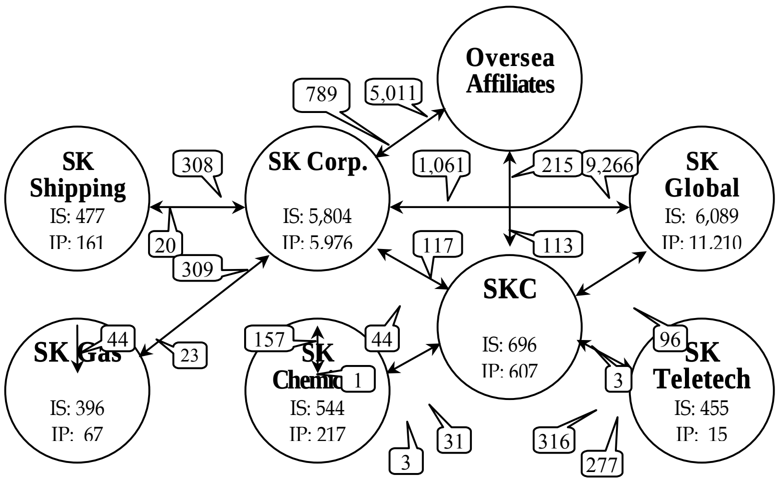
Note: 1) Daewoo and Saehan group are excluded because of missing data
2) Data before the FY1999 is from the sums of individual companies
3) 87-96 average rate of Hansol group is made by data from FY 1996 alone.
Source: FSS (2000), Song (2000: 99)

3.4 Insider trades of major affiliates of SK *Chaebol*

A remarkable aspect to notify concerning the insider trades among affiliates in the SK group is an unbalanced distribution in the degrees of insider sales. At the end of the FY2002, total amounts of the insider sales are 16,586 billion won of which 71.7 percent (11,893 billion won) are done by two major affiliates, i.e. SK Corporation Ltd. and the SK Global Co. Ltd. On the rates of insider trades of other individual companies, it exceeded up to 80 percent in the SK NJC Co. Ltd., the Innoace Co.Ltd., the SK Teletech Co. Ltd. and the SK Telesys Co. Ltd. Figure 1 shows the flowcharts of the insider trades among major affiliates in FY2002.

Figure 1. Flowcharts of the insider trades among major affiliates

(End of FY2002, Billion Won)



3.4.1 SK Corporation Ltd.

The insider trades of SK Corporation Ltd. happen towards the process of purchasing raw petroleum and supplying refined oil products. For four years the amounts of insider sales and purchases to group affiliates are respectively of about six billion won. The degree of insider trades is higher than other affiliates because some company has a high degree of vertical integration among business related group affiliates. The rate of insider sales of the SK Corporation has kept up the ranges from 35 percent to 49 percent of total sales.

Table 7. Insider trades of SK Corporation Ltd.

(Yearly, Million Won, %)

Year	Insider Sales	(%)	Insider Purchase	(%)	Insider Account Receivables	(%)	Insider Trade Account Payables	(%)*
1999	5,207,697	**43.4**	5,060,156	**41.8**	1,223,559	65.2	36,579	10.1
2000	4,885,304	**48.7**	5,937,342	**46.6**	842,942	79.1	213,665	50.1
2001	6,870,014	**34.8**	6,826,591	**55.3**	661,424	41.7	146,087	28.7
2002	5,803,785	**46.0**	5,975,513	**61.1**	988,418	47.4	299,368	121.9

Note: * ratio of trade account payables to costs of sales.
Data: SK Corporation Ltd.(Annual Audit Report)

At the same time, the rate of insider purchases has been increased from 42 percent in 1999 to 61 percent in 2002. On the other hand, the rate of insider AR to the total AR is declined by 31.7 percent from 79.1 percent in FY2000 to 47.4 percent in FY2002. But high rate in itself means high ratio of credit sales for other affiliates. We notice that the rate of insider TAP is increasing rapidly recently (1999-2002).

3.4.2 SK Engineering & Construction Co. Ltd.

Actually, the insider sales of SK Engineering & Construction Co. Ltd. have been substantial by the construction of oil refinery establishments of SK Corporation Ltd. and the installation of telecommunication bases of SK Telecom Co. Ltd. But after the mid-90s, the rate of insider sales was declined because of the decreases in the facility investments and in construction orders from the SK Corporation Ltd. The economic depressions after the 1997 crisis did aggravate construction demands. As a result, the rate of insider trades continued to decline. Nonetheless, it restarted to increase in the year of 2001(9.0 percent) and later in FY2002 it recorded a significant high of 27.8 percent.

Table 8. Trading affiliates with SK Engineering & Construction

(Yearly, Million Won, %)

Purchasing companies	1995	1996	1998	1999	2000	2001	2002
SK Corporation	356,801	591,936	91,967	76,131	21,742	31,826	30,378
SK Telecom			105,190	96,189	95,440	82,071	281,191
SK Global	26,535	45,989	7,320	66,264		2,395	
SK Chemicals	2,309	6,661	671	6,841	570		217
SKC	13,785	12,527	651	1,565	666	9,120	115
SK Gas	263	5,130	34,440	17,393	165	0	
SK C&C	-	-	17	251		20,565	2
SK Evertec	2,558	24,237	21,796		3,052	201	26
Shinsegi Telecom	-	-			359		
Walkerhill Hotels	-	25	34		7,674	29,520	23,564
Pohang City Gas	-	105	586	1,841	2,199		
SK NJC	-	-		266,475	8,417		
Daegu Electricity	-	-				158	56,016
SK Forest	-	-			67	445	114
Others	36,742	29,387	3,531	1,686	555	13	380
Total (A)	438,993	715,997	266,203	268,161	140,906	176,314	392,003
Sales (B)	1,244,532	1,625,389	1,818,513	2,066,574	2,066,070	1,950,676	1,408,334
A/B	**35.3**	**44.1**	**14.6**	**13.0**	**6.8**	**9.0**	**27.8**

3.4.3 SK Chemical Co. Ltd.

The SK Chemical established in July 1969 as Sunkyung Synthetic Fiber Co. Ltd. and was renamed in 1988 as Sunkyung Industry Co. Today SK Chemical Co. purchase from such companies as SK Pharma, SK Engineering & Construction Co. Ltd. Recently it enlarged to SK Corporation Co. Ltd. and SK C&C. Major insider sale partners are SK Global, SK Telecom, SKC, SK Corporation, Walkerhill Hotels, SK Evertec, Pohang City Gas, SK KERIS, SK Pharma, SK UCB, SK NJC etc. (see table 2) The rate of insider sales was under 20 percent from FY1987 until FY1993, and increased from 25 to 35 percent during the mid-90s. After the FY2000 it spread to a 40 percent and reached to a 70 percent at the end of FY2002.

Table 9. Insider trades of SK Chemicals Co. Ltd.

(Yearly, Million Won, %)

	Purchasing from Affiliates	Shares to Costs of Sales	Sales to Affiliates	Shares to Total Sales
1987	15,258	8.5	32,362	15.3
1988	33,310	14.3	23,542	8.6
1989	26,263	8.5	46,757	13.5
1990	56,152	17.3	84,005	21.8
1991	62,917	17.6	92,997	21.1
1992	n.a.	n.a.	n.a.	n.a.
1993	73,388	16.1	99,136	17.6
1994	120,111	22.2	187,336	28.1
1995	218,208	31.4	311,143	36.3
1996	142,474	25.4	193,992	28.8
1997	164,944	28.7	223,734	30.0
1998	160,607	25.2	216,179	25.4
1999	140,098	24.2	138,499	18.7
2000	182,615	25.6	352,179	42.3
2001	189,798	31.3	367,061	49.1
2002	216,898	34.2	544,058	69.6

On the other hand, the rates of insider purchases had kept up below 20 percent until FY1993. But from the FY1995 now on, it have shown the stable movement between the level 25 percent and 35 percent.

3.4.4 SKC Co. Ltd.

Founded in July 1973, the SKC Co. Ltd. was known as Sunkyung Chemicals. This company got listed in 1997 and merged with the SK Evertec Co. Ltd. in 2001.[4)] The dominant shareholder of the SKC was Choi Tai-Won (who owned 12.1 percent of total stock of the company) at the end of FY2002.

Concerning the insider trades, all of insider sales were mostly happening around the SK Global Co. Ltd. in the late 80's. The scale of insider sales was 53.4 percent of total sales of the company, but since FY1995 insider sale partners in the group have extended by including SK Corporation Ltd., SK Chemicals Co. Ltd. and SKM Co. Ltd. Among these companies, the SK Chemicals Co. Ltd. has become an important purchasing company in the group. During these last four years the rate of insider sales has been unchanged, it

[4] Before the merger, SK Evertec (former YuKong Arco Chemicals Co. Ltd.) purchased ethylene, benzene, and propylene from SK Corp. Ltd and the rate of insider purchases was reached 81%. On the other hand, SK Evertec sold to SK Corp. Ltd. via SM manufacturing contract and the rate of insider sales to total sales was 52 percent in FY1999.

maintains around 50 percent, but the shares of insider purchases to costs of sales have grown rapidly from 27 percent in FY1999 to 63 percent in FY2002.

Table 10. Insider trades of SKC Co. Ltd.

(Yearly, Million Won, %)

	Insider Sales	(%)	Insider Purchases	(%)	Insider Account Receivables	(%)	Insider Trade Account Payables	(%)
1999	301,906	**50.9**	135,906	**27.4**	106,729	**136.4**	30,254	**46.1**
2000	295,965	**50.6**	125,596	**27.7**	106,404	**112.3**	30,296	**49.3**
2001	343,627	**50.9**	212,341	**39.7**	120,370	**111.1**	60,831	**67.7**
2002	684,625	**58.3**	607,399	**63.0**	107,008	**96.5**	130,866	**80.4**

The facts attracting our attentions here are the rates of insider account receivables, they were over 100 percent and the rates of insider trade account payables were around 80 percent. These mean that almost all the volumes of total credit sales and purchases are originated from group affiliates and the degree of company's dependency on group was higher than any other affiliates.

3.4.5 SK Gas Co. Ltd.

The SK Gas Co. Ltd., which was founded in 1985 as Yukong Gas Co. Ltd has grown by merging Kukil Energy Co. Ltd. in 1999, and added the Eunkwang Gas Industrial Co. as a subsidiary company. Their main business areas are import, storage and sales of liquidated petroleum gas (LPG). The SK Enron Co. Ltd. as a holding company it owns 45.53 percent from the total stocks, and now it is controlling shareholder of SK Gas Co. Ltd. In table 11, we can see the various rates concerning the insider trades of SK Gas Co. Ltd.

Table 11. Insider trades of SK Gas Co. Ltd.

(Yearly, Million Won, %)

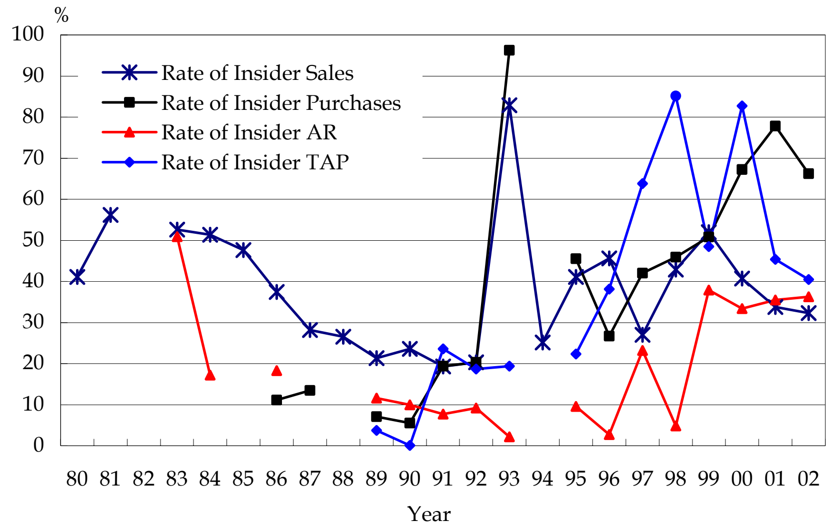
	Insider Sales	(%)	Insider Purchases	(%)	Insider Account Receivables	(%)	Insider Trade Account Payables	(%)
1999	409,439	**34.6**	97,171	9.2	42,321	**54.9**	5,456	21.6
2000	589,796	**33.4**	66,601	4.2	49,178	**38.2**	3,464	3.7
2001	614,583	**33.4**	68,868	4.2	55,349	**30.2**	6,576	6.8
2002	416,647	**22.8**	72,619	4.3	38,551	**14.8**	25,376	18.7

3. 5 Purchasing affiliates in the group

Previously, we outlined insider trades of SK *Chaebol* in general and also those of major constituting independent affiliates. From these discernible facts we are now able to separate purchasing affiliate from the group. We can define the "purchasing affiliate" as an affiliate whose share of the insider sales is low (tentatively under the 10 percent of total costs of sale) and their share of insider purchases is high. For example, most sales of general trading company (hereafter GTC) in the group usually are occurred towards the outsider companies and consumers. In this case, the rate of insider sales will become lower. On the other hand, the shares of insider purchases must be very high when this GTC is willing to buy commodities from the other affiliates in the same group.

When the SK Global Co. Ltd. has taken the role of exporting window within the group, it was a typical example. It's rates of insider sales and insider purchases have kept up the levels of 40 to 50 percent respectively. Recently, the rate of insider sales is lower and lower down to about 30 percent (FY1999: 52.0, FY2000: 40.7, FY2001: 33.8, FY2000: 32.3). But the rate of insider purchases has continued to increase after FY1996 and has recorded a high of 77.8 percent in FY2001 and 66.2 percent in FY2002.[5)]

Figure 2. Trends in the Rate of Insider Trades of SK Global Co. (End of the Year)



[5] As an additional information, the rate of insider purchases for export of the general trading company (GTC) in the group was 55.4 percent on the average and the rate of insider sales of commodities imported by GTC to the group affiliates was 37.5 percent on the average. In case of the top five *Chaebols'* GTC (excluding SK Corp. Ltd.), the above-mentioned two rates are over 60 percent. Especially in the case of Hyundai *Chaebol*, it reached 89 percent (Federation of GTC, 1989: 199). These trends are maintained until the early 1990's. In 1997 the average rate of insider purchases of top 5 *Chaebols* recorded 42.85 percent and the average rate of insider sales recorded 28.13 percent (Chamyoyondai, 1999:126-133; Song, 2000).

This means that the scale of SK *Chaebol* was smaller than other *Chaebols* (for example Samsung) and therefore SK Global had small volumes of sales and purchases from other affiliates in the group. Thereafter, the SK *Chaebol* found some new affiliates. And the SK Global Co. merged SK Energy Sales Co. Ltd. and SK Distributions Co. Ltd. at the end of the 1999. This breakthrough contributes to the enlargement of insider trades of SK Global. Besides, the SK Global continued to try to reform the business structure, which was biased by the exporting. This also represents the weakening role of the GTC within the group, caused by the enlargement of domestic demands and the direct sales of other affiliates. Therefore, entering in 1990's, the role of GTC was transformed to holding company in the group via investment to group affiliates and debt guaranteeing.

By comparing the rate of insider purchases of SK Global with other GTCs such as Samsung Corporation Ltd. and LG International Corp.; the Samsung Corporation Ltd. (of which the rates of insider sales are under 3 percent) recorded more than 70 percent in the rate of insider purchases for the last three years. In the case of LG International Corp. the rates of insider sales just remained the level of 10 percent to 13 percent, but its rates of insider purchases were ranged from 16 percent to 26 percent. Concerning the rates of insider purchases, SK Global were much higher than LG International Corp., but those of these two companies had declined by 10 percent between FY2001 and FY2002.

Table 12. The rates of insider purchases of Samsung Corp. & LG International Corp.

(Billion Won, %)

	Samsung Corporation Ltd.					LG International Corp.			
	1994	1996	2000	2001	2002	1999	2000	2001	2002
Insider purchases	5,610	7,584	27,379	22,242	27,651	3,299	4,984	3,746	2,943
Costs of Sales	15,167	23,241	39,577	31,883	36,070	17,688	19,343	17,828	19,029
(%)	**37.0**	**32.6**	**69.2**	**69.8**	**76.7**	**18.7**	**25.8**	**21.0**	**15.5**

Besides, manufacturing companies of which the rates of insider sales are low and the rates of insider purchases are high concern the SK Telink Co. Ltd. and the SK UCB Co. Ltd. In this way, we can recalculate the rate of insider sales at a group level by summing the insider sales of affiliates of which the rate of insider sales were over 10 percent. It was higher than the records by including all the affiliates (in table 4) by 7.2% on the average for last four years

3.6 Insider Trades of Listed and Non-listed affiliates

When grouped by listed and non-listed companies, the average rate of insider sales of the eight listed companies (excluding Daehan City Gas, Pusan City Gas) was respectively 31.2 percent, 33.7 percent, and 31.4 percent for the last three years. These records were similar to those of the group total for each year. Specified by individual listed companies, the rate of insider sales in SKC Co. Ltd. and SK Chemicals Co. Ltd., are higher than other listed companies. But that of SK Global is declining slowly for the last three years as above mentioned. Otherwise, the level of insider sales of SK Telecom was quite low (around 5 percent) but continued to increase during these last three years (See table 13).

Also the rate of insider sales of all the enrolled companies in KOSDAQ market and FSS had increased slowly by 4.3 percent for three years from 1999 to 2001, but rapidly increased to 49.0 percent in FY2002. The SK Engineering & Construction Co. Ltd. had recorded to have the largest volumes of sales among other enrolled companies. They kept up the level around 10 percent until FY2001 and increased up to 27.8 percent in FY2002. For two other companies, SK C&C Co. Ltd.[6] and SK Telesys Co. Ltd.,[7] their rate of insider sales are 76 percent and 87 percent respectively in FY2002.

Table 13. The rate of insider sales of listed companies in SK *Chaebol*

(Billion Won, %)

Selling Affiliates	FY2000			FY2001			FY2002		
	Insider Sales	Sales	(%)	Insider Sales	Sales	(%)	Insider Sales	Sales	(%)
SK Corp.	4,885	14,022	34.8	6,870	14,115	48.7	5,804	13,388	43.4
SK Gas	590	1,768	33.4	615	1,841	33.4	417	1,827	22.8
SK Evertec	194	363	53.3						
SKC	296	585	50.6	344	675	50.9	685	1,174	58.3
SK Global	5,699	14,021	40.7	6,102	18,036	33.8	6,089	18,822	32.3
SK Chemicals	352	833	42.3	367	747	49.1	544	782	69.6
SK Telecom	208	5,761	3.6	284	6,227	4.6	489	8,634	5.7
Shinsegi Telecom	82	2,056	4.0	123	2,007	6.1			
Total	12,306	39,410	**31.2**	14,704	43,649	**33.7**	14,027	44,627	**31.4**

Note: SK Evertec merged into SKC, Shinsegi Telecom merged into SK Telecom

Concerning the statutory audited companies, it included thirteen companies in FY2002,[8] their rates of insider sales were declining from 39.3% in FY1999 to 30.6% in FY2001, but it rose up to 35.3% in FY2002.[9] This percentage is higher than the group totals by 5% and sometimes more. The companies whose rate of insider sales is relatively high are SK Shipping Co. Ltd. and SK Teletech Co. Ltd. On the other hand, SK Telink Co. Ltd. and SK UCB Co. Ltd. are classified as purchasing companies where the rate of insider sales is respectively estimated fewer than 10 percent as mentioned above section 3.5. By excluding these two purchasing companies, the average rate of insider sales of statutory audited companies is 36.5 percent.

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[6] Computer system design, S/W development and supply and consulting business

[7] Its former name was NSI Technology Co., Ltd. Manufacture of communication apparatuses without any line connection and radio or television broadcasting apparatuses

[8] Statutory audited company is non-listed company of which the total assets are over 7 billion won.

[9] Among statutory audited companies Pohang City Gas is excluded and among enrolled companies Chongju City Gas and Walkerhill Co. Ltd. are excluded.

According to the types of companies, we found that the average rate of listed companies was the highest, followed by the statutory audited companies and the enrolled companies.[10)] They were consistent from FY1999 to FY2001. But the average rate of the listed companies has declined from 39.5 percent in FY1999 to 31.4 percent in FY2002. Also, if we exclude the purchasing companies such as SK Telelink Co. and SK UCB Co., the rates of statutory audited companies are higher than any other types of companies except FY2001. In FY2002, the rate of insider sales of the enrolled companies ranked first. Moreover we can see that the significant rises in the average rate of those enrolled companies from FY1999 to FY2002. Considering that the most of IT (Information and Telecommunication) affiliates are statutory audited companies and the enrolled companies except the several Gas distribution affiliates. Then we can interpret this as it is closely related to the higher rates of insider sales of IT companies in the group.

Table 14. Comparing the rate of insider sales by types of companies

(Million Won, %)

Types	FY1999		FY2000		FY2001		FY2002	
	Insider Sales	(%)	Insider Sales	(%)	Insider Sales	(%)	Insider Sales	(%)
Listed	11,015,741	39.5	12,306,492	31.2	14,703,988	33.7	14,026,503	31.4
Enrolled	607,651	**24.3**	724,813	**26.6**	826,557	**28.6**	1,273,863	**49.0**
Statutory 1	761,869	**39.3**	1,044,194	**31.3**	1,080,388	**30.6**	1,270,018	**35.3**
Statutory 2*	757,806	**40.4**	1,040,188	**32.0**	1,075,383	**31.5**	1,264,033	**36.5**

*: Excluding SK Telelink Co. Ltd. and SK UCB Co. Ltd.

Arise a comparison of the rankings of each type of companies in SK group with the other *Chaebols*. First, in the case of Samsung *Chaebol*, the rates of insider sales of listed companies were 12.4, 13.6, and 13.8 percent for the last three years. These figures are lower than the average rate of group totals. But those of the statutory audited companies were 34.1, 49.7, 50.5 percent at the same period, and those of enrolled companies (excluding financial companies and Carecamp.com, CV Net, HTH) recorded 61.6 percent on the average for these same last three years.

Second, the rate of insider sales of the listed companies in LG *Chaebol* was 26 percent on the average for two years (FY2000, FY2001) and it was higher than the group totals. In 2002, it recorded 17.5 percent and was below the level of group total. The rate of insider sales of enrolled and statutory companies recorded 20.7 percent and 19.8 percent respectively (on the average FY2000 and FY2001) which is under the level of group average, but in 2002 it outran the group average. These observations brings us to assume that until FY2001 the insider sales in LG *Chaebol* has been done mainly by large listed companies and thereafter by non-listed companies. It contrasts with the Samsung *Chaebol* whose rates of insider sales of non-listed companies doubled a to the listed companies during that same period FY2000 to FY2003 (Song, 2003a).

[10] SK Engineering & Construction, SK Enron, SK C&C, SK Telesys

3.7 Insider trades of affiliates in IT Sector

One of the remarkable features in the growth of the SK *Chaebol* is its rapid expansion of IT sector in the group business. In this paper, the IT sector includes such industries as D322 (Manufacture of Communication Apparatuses Without Any Line Connection and Radio or Television Broadcasting), J64 (Mobile Telephone Services), and M72 (Data Processing and Consultancy) according to the Korean Standard Industry Classifications (KSIC). The total sum of assets of these three IT sector is 13,709 billion won**,** it ranked 2nd in the group and the total volumes of sales reached 712 billion won. The IT sector covers 16 companies including SK Telecom Co. Ltd., which is the largest company in the group.

The SK *Chaebol* entered into the IT business by founding the company named Sunkyung Information System Co. Ltd. in May 1990 and YC&C Co. Ltd. in October 1990. At once in April 1991 was founded Sunkyung Telecom Co. Ltd. (now SK C&C). In 1994 the SK *Chaebol* was participating as a dominant shareholder in the management of Korean Mobile Telecommunication Co. Ltd. Then in 1996, Sunkyung Information System Co. Ltd. and YC&C Co. Ltd. merged as new company named SK C&C. The Korean Mobile Telecommunication Co. Ltd. was included as a group-affiliate and was renamed SK Telecom Co. Ltd. in 1997. The following year of 1998 was founded SK Telink Co. Ltd. As a result, there was 3 affiliates in the IT sector until 1999. The venture bubbles start from the year 2000, SK *Chaebol* founded Infosek Korea Co. Ltd. (Jul.), The Contents Company Ltd. (Aug.), Letsgo Co. Ltd. (Sep.), and incorporated WiderThan.Com (Sep.), SK Telesys (Sep.), Innoace (Nov.) by stocks acquisition. In the next year 2001 SK IMT and Wizwith Korea was founded by SK *Chaebol* and Shinsegi Telecom merged into SK Telecom. The SK *Chaebol* incorporated SK Communications Co. Ltd. as a dominant shareholder in 2002 and Paxnet Inc. in 2003.

The average rate of insider sales of all the companies included in the IT sector is 18.7 percent during FY2002 (See table 15). Compared with that of FY1999, it increased by 6 percent on the average. Concerning the Mobile Telephone Services industry (J64) including the SK Telecom Co. Ltd. and SK Telink Co. Ltd., the rate of insider sales is rating at 5.6 percent. It is the lowest one in 2002 among the three sub-categories, this is because these two affiliates belong to this category are large selling companies. The rate of insider sales of companies belonging to industry like M72 is 75.3 percent. And lastly in case of the industry D322, it increased rapidly from 66.6 percent in FY1999 to 95.1 percent in FY2000 and recorded 92.3 percent at the end of FY2002.

Table 15. The insider sales of IT sectors in the SK ***Chaebol***

(Billion Won, %)

By Industry	FY1999			FY2000			FY2001			FY2002		
	IS	Sales	(%)	IS	Sales	(%)	IS	Sales	(%)	IS	Sales	(%)
J64	839	6,185	13.6(3)	292	7,876	3.7 (3)	410	8,322	4.9(5)	493	8,736	5.6(2)
M72	332	366	90.7(1)	516	574	89.9(2)	585	785	74.6(3)	732	972	75.3(4)
D322	122	183	66.6(2)	308	324	95.1(2)	377	442	85.4(3)	746	808	92.3(3)
Total	1,293	6,734	19.2(6)	1,116	8,774	12.7(7)	1,372	9,549	14.4(9)	1,971	10,516	18.7(9)

Note: 1) D322: Manufacture of Communication Apparatuses Without Any Line Connection and Radio or Television Broadcasting), J64: Mobile Telephone Services, M72: Data Processing and Consultancy on the Korean Standard Industry Classifications (KSIC).

2) The numbers in ( ) are companies summed up.

In table 16, we can see the rate of insider sales of each individual companies belonged to the IT sectors. It is the SK C&C that the volumes of the insider sales to other affiliates are largest. The rate of insider sales to the total sales is 75.6 percent at the end of FY2002. Started from a team within the SK group targeting business development in mobile telecommunication services, SK C&C have traditionally sold system integration services to group affiliates. The major trading partners are SK Telecom Co. and other eleven affiliates. The rate of insider sale of SK C&C was highly 90.7 percent at the end of the FY1999 and it was declined to 75.6 percent in FY2002. The high level of the rate of insider sales has reflected in the high rate of insider account receivables: 80 percent in FY2002. On the other hand the rate of insider purchases of the company was fewer than 10 percent, and we can say this company as typical selling company in the group. In case of the other IT companies such as SK Telesys, WiderThan.Com, and Innoace, the rates of insider sales are over 70 percent and even 90 percent in FY2002.

Table 16. The rate of insider sales of IT companies in SK *Chaebol*

(Million Won, %)

Affiliates	Types of firms	FY2001			FY2002		
		IS	Sales	(%)	IS	Sales	(%)
SK C&C	Enrolled	555,830	754,305	**73.7**	668,053	884,251	**75.6**
WiderThan.Com	Statutory audited	24,966	25,271	**98.8**	42,153	56,125	**75.1**
Infosek Korea	Statutory audited	4,683	5,107	**91.7**	6,921	9,060	**76.4**
SK Communications	Statutory audited				14,730	22,788	**64.6**
Innoace	Statutory audited	10,141	12,029	**84.3**	51,431	53,943	**95.3**
IWings*	With F/S	654	1,058	**61.8**			
SK Telesys	Enrolled	72,331	91,230	**79.3**	189,114	216,023	**87.4**

Note: * end of FY2000

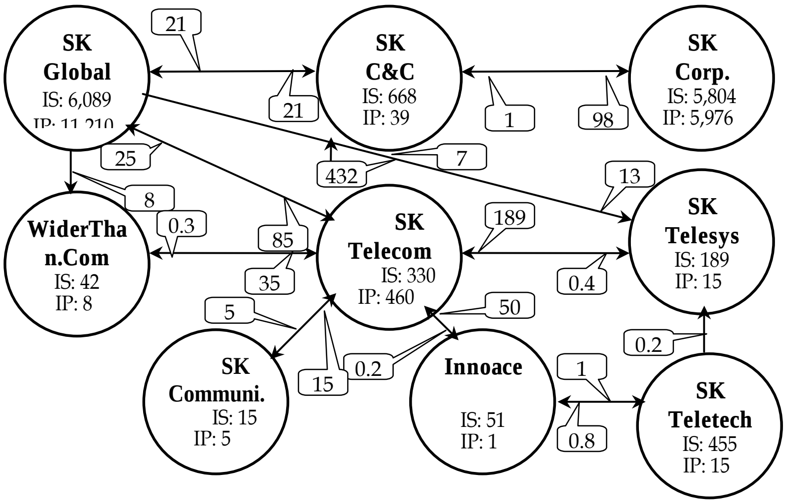
Figure 3 shows the flowcharts of insider trades among IT affiliates. The pivot company of the insider trades among the IT companies is the SK Telecom Co. The function of the SK Telecom within the SK group is buying the products and services of other IT affiliates, i.e. SK C&C, SK Telesys, WiderThan.Com, Innoace, and the SK Communications.

3.8 Relationships between insider trades and stock shareholdings

Following our analysis, it can be assumed that the increase of rates of insider sales between 1998 and 1999 is related to the growth of investments with other affiliates after the abolition of government regulations on the total investment to group affiliates. This assumption can be ascertained by investigations over the relations between the insider trades and the stock shareholdings. The reason is it is the shareholding structures that determine the volumes and the rates of insider trades.

Figure 3. Flowcharts of insider trades among IT affiliates

(End of FY2002, Billion Won)



On the other hand the relationship between insider trade and share ownership is depending on each group-affiliate who can have one or more relationship with other affiliates among the following nine categorical types of relations. (1) First, one company can invest and sell to the other affiliates. In this case insider sales may be mediated by the share ownership. (2) Second, this firm can be invested from other affiliates and also can sell to the same affiliates. These companies are named "supported firms". (3) Third, there is no direct investment relation but it is possible to sell to other affiliates. This way of doing may be called simple "selling relation". (4) Fourth, one company can invest to other affiliates and purchase from the same affiliates. These firms are considered "supporting companies" (5) Fifth, one company can be invested from other affiliates and therefore purchase from the same companies. The affiliates having this relation belong to the counter-traders of first relation. (6) Sixth, it can be possible to purchase from other affiliates without any direct investment relations. This relation may be called simple "purchasing relation". (7)(8) Seventh and Eighth, these types of relations are come into being when there are no trade relations but only investment relations exist. (9) Lastly it can be possible that there are no direct investment or trade relations at all.

Table 17 Categorical types of relations between insider trade and share ownership

	Investment to	Investment from	No insider investment
Sell to	(1)	(2) supported	(3) selling
Purchase from	(4)supporting	(5)	(6) purchasing
No insider Trade	(7)dominate	(8)dominated	(9)no direct relations

To investigate the relationship between insider sale and share ownership, we try to overlap two matrices of insider sale and share ownership by specifying each affiliate company according to the above-mentioned types of relations (in table 18 and table 19). For example, the SK Corporation Co. Ltd. had relations with thirteen other affiliates in FY2002, among these firms, some four of its trading relations concurred with the shareholding relation. In case of the SK Global Co. Ltd. and SK Telecom, there were 2 and 3 overlapping relations respectively. The relationships of insider sales in SK Chemicals Co. Ltd. towards other affiliates are relatively based on share ownerships. Those related companies are SK Corp., SK Global, SK Eng. & Con., SK Pharma, SK UCB, SK NJC. The SKC has no relationship with SK Teletech but sells and purchases from SK Teletech, therefore two relations exist concurrently (i.e. #3, #6 relation in table 17).

[Table 18 and Table 19, here]

The SK Shipping invested in SK Eng. & Con, SK Forest and Stella Shipping but it purchased from the companies such as SK Corp., SK Gas and SK Global. The SK Gas Co. of which SK Enron owns largely 45.88 percent of shares sells to other group-affiliates such as SK Corp., SK Global, and SK Shipping. Based on these overviews, we suggest that trade relations are not always consistent with the share ownership relations. This is one of the general features of the Korean *Chaebol*-like organizations.

Next, we try to sum up the insider sales and investments by calculating the rate of insider trades of each major investor companies in FY2001. In table 20, numbers standing in the upper line are rates of insider investments and those standing in the lower line are rate of insider trades. For example, SK Corp. Ltd. invested to other affiliates 16.09 percent of their total stockholder's equity (i.e. total asset minus total debt) and sold 48.7 percent of their total sales. On the other hand, the SK Corp. of which 15.92 percent of total shares were owned by other affiliates purchased 18.08 percent of total purchases from other affiliates.

Table 20. Rate of Insider trades of major investor companies in SK *Chaebol*

(End of FY2001, %)

	SK Corp.	SK Global	SK Telecom	SK Chemi.	SKC	SK E&C	SK Ship.	Walker Hill	SK Gas	SK C&C	SK Enron	The Contents Com.	Wider Than	Group Total
Invest/	16.09	3.77	5.7	1.95	1.64	1.3	0.68		0.49	3.23	2.27			37.92
Sell To	48.7	33.8	4.6	49.1	50.9	9.0	39.7	0.5	33.4	73.7	24.7		98.8	33.1
Be Invested/	15.92	49.07	32.57	6.2	49.6	73.66	99.53	10.18	45.88	40.5	50.0	15.0	20.0	
Buy From	18.08	43.84	22864.5	1.65	13.71	1.26	2.39	48.21	3.50	11.49			97.7	

The company whose rate of insider investment was low and the rate of insider sale was relatively high (i.e. over the group average) includes SK Global Co. SK Chemicals, SKC, SK Shipping, SK Gas, and SK C&C. The companies whose rate of subordination was high but the rate of insider purchases was low cover the SK Eng. & Con., SK Shipping, and SK Gas. By putting together the two results, it was made clear that there existed "supported affiliates" such as SK Shipping, and SK Gas. In this case SK Chemicals is the typical case of a low rate of subordination and a low rate of insider purchases. We can call this company as typical selling company with a weak invest relationship.

Section Ⅳ Conclusions

The insider trades between group-affiliates has the most sophisticated dilemma; whether it was legal or illegal. In fact, supporting the insolvent affiliates, the counter competition activity and the illegal heritage of wealth was happening through the insider trades. To say without mentioning, the investment to affiliates and acquisition of other affiliates' stocks, roundabout support via financial affiliate companies and the reciprocal debt guarantees between affiliates are ubiquitous. Up till now, the illegality of insider trades have not been proved and traced thoroughly.

In this article, we reviews the insider trades of SK *Chaebol* restricting the sales and purchases between group-affiliates and we find out some stylized facts. In the following paragraph, we will reveal some hypothetical suggestions on the transformations of business structure and on the evolutions of the *Chaebol*-like organization.

Initially, the rates of insider sales in the SK *Chaebol* have been recorded around 30% for the last three or four years. By comparing with the levels registered before the IMF crisis, it increased by 10% and more. This could be considered as the results of the corporate restructurings or reforms by the selling and the merging of non-profitable affiliates and business departments. Therefore, the degree of vertical integration among the independent affiliates is higher than ever before as the FSS points out. But this interpretation isn't applicable to SK group because the insider purchases of SK Global (which is purchasing companies in the group) have continued to decrease and those of SK Corporation Ltd. and SK Telecom Co. Ltd. have stayed stable (at the level 40%) since the IMF crisis. Therefore the 10 % increases were due to the expansion of firms in IT sector and growth of their insider sales to non-IT affiliates.

Secondly, by comparing the rates of insider sales of listed firms with those of non-listed companies, we find that the volume of the insider sales in the former was larger than that in the latter. But in case of the rate of insider sales, the latter was higher than the former. Also, if we exclude the purchasing companies, the rates of statutory audited companies are higher than any other types of companies except FY2001. In FY2002, the rate of insider sales of the enrolled companies ranked first. Moreover we can see that the significant rises in the average rate of those enrolled companies from FY1999 to FY2002. Considering that the most of IT (Information and Telecommunication) affiliates are statutory audited companies and the enrolled companies except the several Gas distribution affiliates. Then we can interpret this as it is closely related to the higher rates of insider sales of IT companies in the group.

Among the four enrolled companies, the volumes of insider sales of SK C&C Co. Ltd. totalize two-thirds of the total insider sales of enrolled companies. Almost all the statutory audited companies are companies in IT sector. Therefore, these findings are closely related to the high rates of insider sales of IT related companies. This assertion is to be backed by more data and some detailed findings. Nevertheless, we can assume that tunneling of wealth is happening from the listed companies to the statutory companies, especially to the IT-related companies whose shares of the families during the second generations are high.

Third, the hypothesis i.e. the growth of the IT-related companies was the results of supports of many other affiliates become more forceful. Entering into the IT business may represent a kind of venture investments. Unfortunately it was lead by successors from the second or the third generations of group founders. These successors use new IT-related venture firms to try to expand their commanding or controlling powers within the group. It is completely different from the general purposes such as business diversification and management strategy (Song, 2003b).

Fourth, it can be assumed that the increases of rates of insider sales between 1998 and 1999 would be related to the growth of investments from other affiliates after the abolition of government regulations on the total investment from the group affiliates. This assumption expected to be ascertained by investigations over the relation between the insider trades and the stock shareholdings. Contrary to the general recognitions, the research results are being pessimistic; the volumes and rates of insider trades are not related to the shareholding structures and its changes. It is to say; that the main purpose of shareholding is not to improve vertical integration between the business-related group affiliates but to sustain controlling powers of a chief or his successors within the group.

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Table 18. Overlapped Matrix of Insider Sales and Share Ownership

(End of FY2002, %)

Invest(sell) / dominated(buy)	SK Corp	SK Glo.	SK Tele	SK Che	SKC	SK E&C	SK Ship.	SK Gas	SK C&C	Wider Than	R. of Insider Share/ R. of IPs
SK Corp.		5.64	0.04	2.26 / 4.03	7.56	2.37 / 2.16	30.35	16.84	8.63 / 11.05		13.26 / 16.49
SK Global	38.68 / 42		4.44	2.51 / 15.62	3.29 / 8.20	3.55	2.83	1.50	6.67		48.03 / 37.85
SK Telecom	20.85 / 0.22	3.55 / 0.45		0.00	0.02	19.97			48.88	67.61	24.4 / 2466.22
SK Chemicals					6.2 / 0.07	0.02					6.2 / 2.45
SKC	47.66 / 0.87			3.78		0.01			1.08		47.66 / 24.52
SK Eng. & Con.			0.01	40.67 / 0.00			30.99		1.71		74.12 / 1.56
SK Shipping	47.81 / 0.15	33.17			19.02			0.01			100 / 1.96
SK Gas		0.35					3.95				45.88 / 2.64
SK C&C		10.5 / 0.11	30 / 0.08	0.00		0.00				1.72	45 / 5.15
SK Pharma	20			80 / 2.11							100 / 78.07
SK Forest		0.41				23.74 / 0.01	18.21				42.36 / 0.57
SK-UCB				50 / 0.16							50 / 6.31
SK NJC				60 / 0.81							60 / 51.22
SK Teletech			61.66		23.53						61.66 / 70.18
SK Telink			90.77								90.77
SK Telesys			0.00		77.13						77.13 / 0.15
SK Elec.	100					3.98					100
SK Communi.			90.4 / 0.05							5.58	90.4 / 175.74
Innoace			13.13 / 0.00							7.5	28.13 / 0.49
Aircross			40							45 / 0.20	85 / 2.08
ENCar Net.	50										50
Stella Shipping							70				70
IWings	66.15		12.15								78.3
Infosek					20.68				48.28		68.96
MRO Korea		51									51
IACC	100										100
SK IMT			61.34								61.34

Global Cre. & Info			50								90
Entro E&M	50										50
Oil Chain	38.1										38.1
Smartic	75										75
Benex Int.l		66.67									100
SK D to D		90.94									90.94
Daehan Oil Pipe.	29.43	4.61									34.04
Segye Tradings		30.09									30.09
Dongshin Pharma.				7.92							30.66
Paxnet			67.1								67.1
JungJiWon						40					40
SK Evertec				0.00		0.00					52
SK Keris				5.57							43,585
Nexcel					0.59						6,892
Huvis				19.07							149,110
Others		26.15	0.76	18.43	18.38	0.03	5.96	3.25	2.77		5,583,106
Rate of IS	43.4	32.3	5.7	69.6	58.3	27.8	43.1	22.8	75.6	75.1	32.5

Table 19. Overlapped Matrix of Insider Sales and Share Ownership

(End of FY2001, %)

Invest(sell) dominated(buy)	SK Corp.	SK Global	SK Tele-com	SK Chemi.	SKC	SKE &C	SK Ship.	Walker-hill	SK Gas	SK C&C	SK Enron	The Contents Com.	Wider Than	R. of insider Share/RIPs
SK Corp.		20.99	0.67	2.26 0.47	0.46 [1] 2.66	2.37 18.05	69.84		66.90	10.83 [2] 19.16				15.92 18.08
SK Global	38.68 48.30		0.05	3.55 17.49	3.29 9.04	3.55 0.12	3.47	0.01	3.25	6.26				49.07 43.84
SK Telecom	26.81 0.14	5.76 0.17			0.00	4.21		0.35		41.70			97.70	32.57 22863.45
SK Chemicals					6.20 0.13									6.20 1.65
SKC	47.66			3.98		0.47	1.94			1.70				49.60 13.71
SK Eng.&Con.			0.01	40.21			30.99	2.46 0.06		1.56				73.66 1.26
SK Shipping	47.59 0.23	33.01			18.93				0.01					99.53 2.39
Walkerhill		2.18		0.25	7.50	1.51								10.18 48.21
SK Gas		0.35				0.00	3.79				45.53			45.88 3.50
SK C&C		10.50 0.14	30.00 0.11			1.05								40.50 11.49
SK Forest		0.41				23.74 0.02	18.21							42.36 2.21
SK Pharma.	49.00			51.00 1.43										100.00 68.40
SK Teletech		(80.43)	61.66 (0.31)		6.43									61.66 16.47
SK Telink			90.77 (1.89)											90.77 2.51 [3]
SK Telesys					54.63									54.63

			(77.48)		1.40									12.20
Shinsegi Tele.			2.47											48.25
SK UCB				50.00 0.26(1.23)										50.00 9.04
SK NJC				60.00 (87.58)										60.00 0
Innoace			14.00 (78.27)									8.00	8.00	30.00 1.09
SK Life Ins.	(12.43)	71.72 (0.65)	(0.61)		16.10 (1.23)	(0.68)		0.04		3.12				97.37 1.73
SKSecurity		14.47			12.41 0.24	14.49 0.00		0.001		0.69				41.37 3.16
SK Capital			100.00											100.00
SK Inv. Trust														35.00
Iridum Korea			100.00											100.00
Pusan City Devl.														51.00
Stella Ship.							70.00							70.00
SK Enron	50.00													50.00
The Contents Com.			15.00											15.00
WiderThan.Com			20.00 (97.7)											20.00
Daehan Pipe	29.43	4.61												34.04
Daehan City Eng.														100.00
Infosek					25.85					60.34				86.19
Global			50.00											90.00
MRO Korea		51.00												51.00
IWings	66.15		12.15											78.30
Netsgo			96.82											96.82
Bill Plus	20.00		80.00											100.00
Jungjiwon						40.00								40.00
Madnet			40.00										60.00	100.00
ENCar Net.	50.00													50.00
CareBest		52.69												52.69
IACC	100.00													100.00
SK IMT			61.58											61.58
Mobiya										60.00				60.00
Bescare										100.00				100.00
SK Media	40.00		40.00							20.00				100.00
Oil Chain	38.10													38.10
Smartic	75.00													75.00
Benex Int'l.		66.67					33.33							100.00
Wizwith Korea		94.00												94.00
R. of Insider Invest	16.09	3.77	5.7	1.95	1.64	1.3	0.68		0.49	3.23	2.27			37.92 4)
R. of Insider Sales	48.7	33.8	4.6	49.1	50.9	9.0	39.7	0.5	33.4	73.7	24.7		98.8	33.1

Note. : 1) At 2002. 3, SKC 0.26%,
2) SK C&C 3.54%,
3) Rate of Insider Purchases to selling & general admin. Expense
4) Rate of stocks of affiliates to stockholder's equity. Rate of stocks of affiliates to total assets is 15.73%
5) Numbers in the ( ) are the rate of insider purchases to total purchases(manufacture).

Comments on "On the Insider Trades of SK Chaebol"

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This paper analyzes an interesting issue of the insider trades of SK Group, which was one of the top five *chaebols* and known to maintain sound financial status and less diversified business structure, but suffered from the 2002 window dressing of the SK global corporation and faced the take-over threat recently. The issue of inside trades is one of the key points in the *chaebol* structure, in the sense that it is meaningful to figure out whether the inside trades reflects just corporate interests, industrial structure, and lowering transaction costs, or they are major tunnels for controlling shareholders to seek their private interests. Thus, this paper is studying an important issue with his endeavor. However, in order to connect the insider trade pattern with the main point in insider-trade research, there are several points to be clarified in this paper.

In his paper "On the Insider Trades of SK *Chaebol*," he describes the overall change in the rate of insider trades of SK group. For example, the rate of insider sales of the SK group total has declined from 27% in 1987 to 15% in 1994, and then it increased to 37.5% in 1999. In particular, by reporting the year 1999 recorded the highest ratio in the insider trade rates, he argues this phenomenon is related to the weakened government regulation on "Restriction on total amount of share holding of other affiliates." However, in order to interpret this phenomenon as a result of the weakened restriction, the author needs to provide further evidence. If that is the result of the weakened restriction, it would be meaningful to examine what happened to other groups. Furthermore, to support his interpretation, it is also needed to present the change clearly in the total amount of share holding of other affiliates.

Table 8 reports the "Changes of the Rate of Insider Sales of Major *Chaebols* before and after." Based on the table, it is not easy to isolate the noteworthy differences of SK group from the other major groups such as Hyundai, Samsung, LG, and SK. Furthermore, if we see Figure 2, "Trends in the Rate of Insider Trades of SK Global Cooperation," they appear to be quite unstable over time. Thus, it is not so easy to provide a stable connection with other meaningful economic variables, unless a sophisticated empirical work is accompanied. Additionally, his paper describes the trend of insider trades for SK corporation, SK engineering and construction, SK chemical, SKC, and SK gas. Although the description is a good explanation as each company's history, it is hard to figure out the implication of the trends.

In data, this paper reports that the rate of statutory audited companies are higher than any other types of companies by at least 3% to 15%. And then he argues that this is closely related to the higher rates of insider sales of IT companies in the group. In the data pattern, it seems to be true. However, in order to make this connection over a description of data pattern, it is also needed to examine whether it reflects a industrial feature of IT industry, or related to group controlling system.

He is arguing the relationship between insider sales and stock shareholdings as the evidence of the weakened restriction on the total amount of share holding of other affiliates. However, the matrix is based on the data of 2001 and 2002. Whether the timing of the ownership data is appropriate to explain the relationship is arguable. Furthermore, the matrix itself does not guarantee the relationship between insider sales and stock shareholdings. Thus, more rigorous examination is invited.

CHAPTER 3-2

The Grand Unified Theory of the Firm and Corporate Strategy Measures to Build Corporate Competitiveness

by
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Abstract

A good understanding of the nature of the firm is essential in developing corporate strategies, building corporate competitiveness, and establishing sound economic policy. Several theories have emerged on the nature of the firm: the neoclassical theory of the firm, the principal agency theory, the transaction cost theory, the property rights theory, the resource-based theory and the evolutionary theory. Each of these theories identify some elements that describe the nature of the firm, but no single theory is comprehensive enough to include all elements of the nature of the firm.

Economists began to seek a theory capable of describing the nature of the firm within a single, all-encompassing coherent framework. We propose a unified theory of the firm, which encompasses all elements of the firm. We then evaluate performances of Korean firms from the unified theory of the firm perspective. Empirical evidences are promising in support of the unified theory of the firm.

I. Introduction

A good understanding of the nature of the firm is essential in developing corporate strategies and building corporate competitiveness. Several theories have emerged on the nature of the firm: The neoclassical theory of the firm, the principal agency theory, the transaction cost theory, the property rights theory, the resource-based theory and the evolutionary theory. Each of these theories identifies some elements that contribute to the success of the firm, but no single theory is comprehensive enough to include all elements for the success of the firm.

Economists are beginning to realize the need for unifying these theories. Bolton and Scharfstein (1988) indicate what we lack and what we need is a more unified theory of the firm based on the insights of Coase (transaction cost theory, 1937) and Bearl and Means (agency theory, 1932). We propose to unify all of the theories mentioned above. We refer this new theory, "the grand unified theory" of the firm. We borrowed the term, "grand unified theory" from physics (Feynman, 1965; Yun; 1984, Weinberg, 1992; Green, 1999). Physicists studied the forces determining high energy separately until Feynman proposed to unify them. Physicists call the theory "grand unified theory" or "final theory." The final theory in physics is not fully confirmed and they are still working on the theory and experimental evidence.

The grand unified theory of the firm can offer a comprehensive view of the firm and may provide better insights on corporate strategies. The neoclassical theory offers insights on corporate mergers because it defines the economies and diseconomies of scale and scope. Benefits and costs of hierarchies and markets (transaction cost theory), ownership structure of assets (property rights approach), separation of ownership and control (agent theory), development of resources and capabilities (resource-based theory), or an environmental change and firm's adaptation to the change (evolutionary theory of the firm) can explain the relative cost and profit positions of the firm.

The environmental changes experienced by Korean firms and corporate transformation after facing the environmental changes present a unique opportunity for scholars to study factors contributing to success and failure of the firm. As Porter (1991) indicates the reason why firms succeed or fail is the central question in strategy and any effort to understand success must rest on an underlying theory of the firm and an associated theory of strategy.

We developed a comprehensive theory of the firm and associated strategy. In discussion of firm success, we must define a clear definition of what success means. For purposes of our study, we follow the Porter's (1991) definition of success: "Firm success is manifested in attaining a competitive position or series of competitive positions that lead to superior and sustainable financial performance" (P. 96). Financial performance can be measured with profitability of the firm. Profit is defined as follows:

Profit = Total Revenue !Total Cost

or Profit = (Price ! Average Cost) x Quantity

In our study we will examine the nature of the Korean economic crisis and apply the grand unified theory of the firm to our empirical examination of success and failure of Korean firms. Like "the grand unified theory" in modern day physics, the grand unified theory of the firm may define the universal model for corporate strategy in Korean firms.

II. The Grand Unified Theory of the Firm

Each of the theories mentioned above identifies some elements that define the nature of the firm. However, no single theory is comprehensive enough to include all elements in defining the success of the firm. As Bolton and Scharfstein (1998) also indicate what we lack and what we need is a more unified theory of the firm based on the insights of Coase and Berle and Means. We need to link together all theories that explain the success of the firm because each theory contributes some relevant elements for defining the success of the firm.

We may call this "the grand unified theory of the firm." We have borrowed the term "grand unified theory" from physics (Feynman, 1965; Yun, 1984; Weinberg, 1992; Green, 1999). Physicists studied the forces determining the naturae of the universe separately until Feynman purported to identify the force linking the strong and electroweak forces of atoms. Feynman (1965) indicated that all matter is the same.

> "The matter of which the stars are made known to be the same as the matter on the earth. The character of the light that is emitted by those stars gives a kind of fingerprint by which we can tell that there are the same kinds of atoms there as on the earth. The same kinds of atoms appear to be in living creatures as in non-living creatures; frogs are made of the same 'group' as rocks, only in different arrangements. So that makes our problem simpler; we have nothing but atoms, all the same, everywhere (Feynman, 1965, p. 150)."

In physics, the superstring theory has emerged as a single theory that, in principle, is capable of describing all phenomena of the universe (Green, 1999).

We may find a similar analogy in economics. Factors of production in the firm are the same in different organizations/labor, land and raw materials, capital and entrepreneurship, but organizations produce a variety of goods and services by arranging input factors differently. We have nothing but production factors, all the same in every organization. The various theories purport to explain the nature of the organization and each theory offers differing vantage points of the organization. The grand unified theory of the firm is a framework for stitching these theories into a seamless whole, as the superstring theory in physics.

The firm in the neoclassical theory produces a large variety of outputs using various combinations of inputs. The firm maximizes the profit by accomplishing technical efficiency of inputs, and every economic agent has perfect information. Information is distributed symmetrically. The boundaries of the firm can be defined by the economies and diseconomies of the scale and scope. In principal-agency theory information is asymmetric and moral hazard and adverse selection problems may lead to less than optimal outcomes in the firm. Costs of mitigating these problems can be very high. The transaction cost theory introduced by Coase (1937) offers explanations and identifies the nature and sources of transaction cost in different circumstances. Williamson (1985) identifies three transaction characteristics that are critical to adoption of governance structure: frequency, uncertainty and asset specificity. Each of those characteristics is claimed to be positively related to hierarchical organization. The design of efficient governance structure is aimed at matching these characteristics with governance structure: hierarchy, varying degree of hybrid and market. Grossman and Hart (1986) and Hart and Moore (1990) advocated a fourth approach, the modern property rights approach to the nature of the firm. A major strength of their property rights approach is that they clearly identify the costs and benefits of integration without relying on the presence of an impersonal market. A firm is a set of assets under common ownership according to their theory. Nelson and Winter (1982) explore the evolutionary and dynamic aspects of the firm. The firms are complex, adaptive systems and this theory focuses on the organization's core competency, structure and strategy. Firms are able to survive and prosper if they change in response to changing input and output markets, and technologies. Firms must find new productive and valuable outlets for their core competency (the things they do well). Determining factors of the success of the firm are the firm's learning about its costs and abilities relative to other firms.

The differences among these theories can be viewed from many different perspectives. However, Acs and Gerlowski (1996) summarize them into three areas: unit of analysis, availability of information and the operational environment assumed. Acs and Gerlowski point out that the unit of analysis in the neoclassical theory, the principal agent theory, the transaction cost theory and the evolutionary theory of the firm is exchange, the firm in relation to itself, the individual transaction between parties and the firm and its productive processes, respectively. The unit of analysis is the property rights theory is ownership of assets.

The availability of information assumed differs among theories. The neoclassicial theory assumes that the economic agent has perfect information. The principal-agent theory introduces asymmetric information into the analysis and asymmetric information leads to the moral hazard and adverse selection problems which result in less than optimal outcomes of the organization. The transaction cost theory assumes that economic agents act with the bounded rationality ("intendedly rational, only limitedly so," Simon, 1961, p. XXIV) and opportunism ("self-interest seeking with guile," Williamson, 1985, p. 47). The transaction cost theory is concerned with the hold up problems of incomplete contracts. The property rights theory recognizes the problems associated with the ownership of assets and post contractual investment in plants and assets. Theevolutionary theory of the firm regards firms as complex adaptive systems. Information regarding market and technology changes is important to organizational changes which are critical for the firms to survive.

A summary of the definition of each theory of the firm, the unit of analysis, assumptions on information and behavior and the principle that each theory is offering for profit maximizing and a stitching link of all theories is presented in Figure 1.

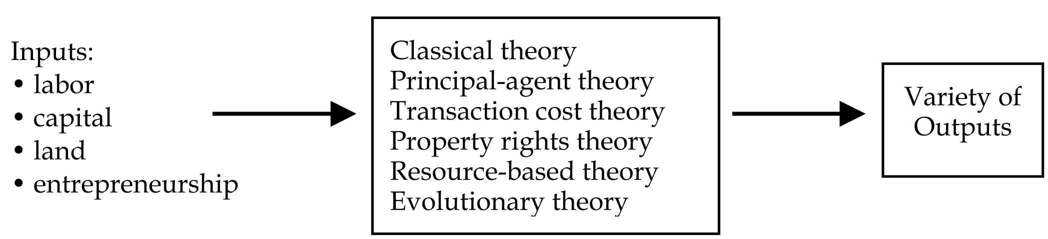
Figure 1: A Summary of the Theory of the Firm

Theory of the Firm	Definition of the Firm	Unit of Analysis and Major Issues for Explanation	Assumptions on Information and Behavioral Principles	Action Principles of Profit Maximizing and Links
neoclassical theory	a device for resource allocation	-exchange -technical efficiency	-perfect information -symmetric information -rational behavior	-set the ratio or factor price over marginal -production cost minimizing
agency theory	a nexus of contract	-the contractual relationship between agent and principal -work incentives	-imperfect information -asymmetric information -bounded rationality	-design of contract to deal with risks sharing, work incentives -economize agency cost

property rights theory	a team of resource owners	-assignment of property right and ownership of the firm	-imperfect information -asymmetric information -bounded rationality -pursuit of self-interest	-incentive compatible assignment of property rights -economize property right costs
transaction cost theory	a collection of transaction	-transaction/contract -holdup costs problem -make or buy	-imperfect information -information asymmetry -bounded rationality -opportunistic behavior	-aligning governance structure with transaction characteristics -economize transaction costs
resource-based theory	a collection of resources and capabilities	-resources -continue to create excess profit	-imperfect information -bounded rationality	-develop strategic assets -economize resource development cost
Evolutionary theory	-a collection of routines -complex adaptive system	-routine -product and process innovation	bounded rationality	-adapt to changes in selection environment -economize innovation cost and adaption cost

The grand unified theory of the firm recognizes issues raised by the above theories and purports to identify a link among theories as physicists try to identify linking factors among elements of defining the nature of the universe. A firm is the essential basic unit of the economy. When we study the firm from a comprehensive viewpoint, we should have a better understanding of the nature of the firm and the economy. The firm involves all aspects of the extant theories: the scale and scope of the economy, technical efficiency, agency efficiency, transaction cost economization, ownership structure and assignment, procurement, development and maintenance of corporate resources and adaptation to changing input and output markets.

Figure 2: The Grand Unified Theory (GUT) of the Firm



In Figure 2, we can see that the grand unified theory of the firm includes all elements of the extant theories of the firm. Candidates of linking factors can be profits, sales, market share, growth or economizing. Behavioral assumptions can be optimization or satisfying and there are interactions among theories in optimizing profits. The grand unified theory (GUT) of the firm lays ground for comprehensive corporate strategy.

III. Corporate Strategy

There has been an increasing trend integrating the theory of the firm and corporate strategy (Rumelt, 1984; Shapiro, 1989; Spulber, 1993, 1994; Spence, 1979; Porter, 1980, 1991; Wernfelt, 1984; Reve 1990; Williamson, 1991; Nelson and Winter, 1982; Nelson, 1991; Rubin, 1973; Teece, 1985, 1987). Porter (1991) indicates that the earlier strategy literature offers a theory that sought to explain part of phenomena, but which left out important elements that precluded the offering of credible guidance for individual companies. He then asserts that the earlier efforts to formulate a theory of strategy raises profound challenges for research because the complexity, situation specificity, and changing nature of the firm and its environment strain conventional approaches to theory building and hypothesis testing. He attempts to suggest what we know and what we need to know to develop a theory of firm performance linked to managerial choice, initial conditions and environmental choice. His answer to the question why some management makes the right choices in selecting products, industries, and activity configurations are luck and local environment. He, however, points out that an important role for the local environment in competitive success does not eliminate the role of strategy nor the need for competitive analysis. Industry structure, positioning, activities, resources, and commitment remain important.

From the above review of the strategy literature, we can see linkages between the theory of the firm and corporate strategy. Lately, more scholars attempt to integrate economic theories with management strategy. Spulber's survey paper on economic analysis and management strategy (1993) evaluates economic theories on the basis of their potential application to problems of management decision making. Management strategy involves decisions in production inputs, production processes and product markets. Decision levels are routines, tactics and strategies.

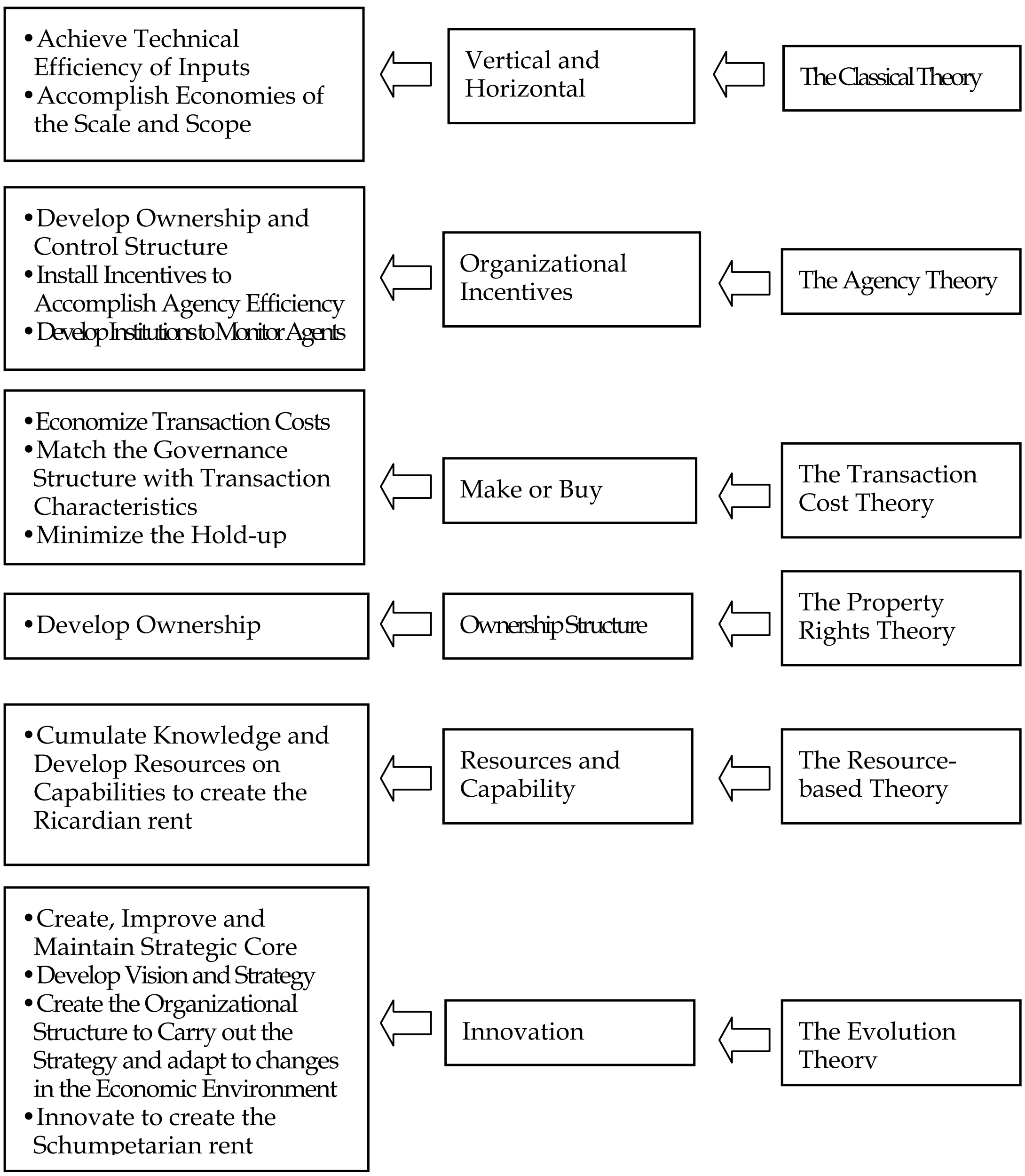
Wernerfelt (1984) explicitly explores the usefulness of analyzing firms from the resource side (input side) and use a resource-based view of the firm to highlight the new strategic options. Reve (1990) argues that a theory of the firm capturing the questions of strategic management can be developed drawing on transaction cost economics. Reve applies ideas of transaction cost economics to develop an integrated model of strategic management.

IV. Integration of the Grand Unified Theory of the Firm and Strategy

Factors determining success or failure can be analyzed from costs of production and sales of the product. Therefore, any effort to understand success must rest on underlying theory of the firm and an associated theory of strategy as Porter (1991) indicated in the dynamic theory of strategy. The grand unified theory of the firm (GUTOF) offers frameworks for the corporate strategy.

See Figure 3 below:

Figure 3. Integrated Model of the Strategy Based on the Grand Unified Theory of the Firm
Strategic Goals Strategies Grand Unified Theory



The firm that economizes transaction costs, achieves technical and agency efficiency, accomplishes the economies of scale and scope; creates, improves and maintains a strategic core, can amass more resources and expand the boundaries of its organization, according to "this unified theory of the firm." The operational or strategic aspects of the grand unified theory of the firm are presented in Figure 3.

Hypotheses

Hypotheses are formulated based on the grand unified theory of the firm, market structure and organizational characteristics of the firm.
H1: The market share of the firm (X1) enhances corporate performances.
H2: There is a positive relationship between the size of the firm (X2) and corporate performances.
H3: The tangible asset intensity (X14), machinery and equipment per employee (X5) and debt to equity ratio (X4) of the firm affect the performances of the firm.
H4: The bonus, stock option and sales commission intensity of the firm (X6) positively affect the performances of the firm.
H5: The share (X7) and participation (X8) of major stock holders in a firm play an important role in the performances of the firm.
H6: There is a positive relationship between the purchase intensity (X9) of intermediate parts and the performances of the firm.
H7: The difference (X10) between productivity per employee and labor cost per employee positively affect the performance of the firm.
H8: The educational and training expenditure intensity (X11) of the firm has a positive effect on the performances of the firm.
H9: The R & D expenditure intensity (X12) has a positive effect on the performances of the firm.
H10: The marketing expenditure intensity (X13) of the firm affect the performances of the firm.
H11: The sales growth rate (X15) of the firm has a positive effect on the performances of the firm.
H12: The age of the firm (X3) affects the performances of the firm.
H13: There is a difference in performances of chaebol and non-chaebol firms (X16).

Model and Data

To test hypotheses we used multiple regression models. The model in our study is specified as follows:

$$Y = \forall + \exists X + ,$$

where Y: performance of the firm measured by return on invested capital (ROIC), return on asset (ROA) and return on equity (ROE).
X: a vector of corporate strategic variables, industry structure and organizational characteristics of the firm:
Detailed strategic variables are as follows:
X1 = market share
X2 = ln (number of employees)
X3 = age of the firm
X4 = debt/equity ratio

X5 = machine and equipment per employee
X6 = bonus, option and sales commission intensity
X7 = share of large shareholders
X8 = management participation of large shareholders
X9 = parts purchase intensity
X10= productivity per employee — labor cost per employee
X11= education and training expenditure intensity
X12= R & D expenditure intensity
X13= marketing expenditure intensity
X14= tangible asset intensity
X15= sales growth rate
X16= 30 large chaebol (Yes=1, No=1)

Intensity variables in the model are measured by the ratio of each expenditure over sales. Data used in the model are obtained from the Korea Information Service (KIS) and the Korea Economic Research Institute (KERI). They are cross-section data and consist of detailed accounting data for the firms listed in Korean stock exchange. We used data for manufacturing firms. We also conducted a survey and 203 firms responded to our survey questionnaire.

Hypotheses are derived from the industry conduct (strategy) performance model, the grand unified theory of the firm and the organizational characteristics of the firm. An integrative summary of theories of the firm and corporate strategies are presented in Figure 4.

Figure 4. A Summary of Hypotheses Derived from the Strategic Model, and an Integration of the Grand Unified Theory of the Firm and Corporation Strategy

Industry Structure-Conduct (Strategy) Performance (SCP) Model			
market share	market structure	X1	H1
Strategy-Structure-Performance (SSP) Model			
Theories of the firm	**Strategies**	**Strategic Variables**	**Hypotheses**
neoclassical theory	efficient combination of resources	X2, X4, X5, X15	H2, H3
agency theory	improve incentive compatibility	X6	H4
property rights theory	proper assignments of property rights	X7, X8	H5
transaction cost theory	make or buy	X9	H6
resource-based theory	create and appropriate Ricardian rent	X10	H7
evolutionary theory	innovate and create Schumpoterian rent	X11, X12, X13	H8, H9, H10, H11
Organizational Characteristics			
age of the firm		X3	H12
30 large chaebols	develop a proper organizational structure	X16	H13

Empirical Results

Empirical results of the regression model are shown in Table 1 and findings of the study are summarized in Table 2.

Table 1: Empirical results

	ROIC (Y1)	ROA (Y2)	ROE (Y3)
Independent Variables (X)	Regression coefficient (P-value)	Regression Coefficient (P-value)	Regression Coefficient (P-value)
constant	-27.7573 (0.00)	-18.2309 (0.00)	-22.1981 (0.00)
market share	0.0103 (0.68)	0.0080 (0.66)	0.0115 (0.53)
ln (employee)	1.6799 (0.00)	1.1612 (0.00)	1.2576 (0.00)
debt/equity ratio	-0.2385 (0.00)	-0.2449 (0.00)	-0.1815 (0.00)
machine and equipment per employee	-0.4646 (0.03)	-0.5142 (0.00)	-0.3987 (0.00)
tangible asset intensity	-0.00879 (0.28)	-0.0169 (0.00)	-0.0158 (0.01)
bonus, option intensity	0.00897 (0.79)	0.00126 (0.96)	0.00024 (0.99)
parts purchase intensity	0.0387 (0.12)	0.0362 (0.05)	0.0231 (0.21)
(productivity–labor cost)/ per employee	3.8321 (0.00)	3.1928 (0.00)	3.3066 (0.00)
education and training intensity	-3.5089 (0.34)	-0.2766 (0.92)	-0.0259 (0.99)
R & D intensity	-0.5429 (0.12)	-0.4355 (0.09)	-0.4473 (0.08)
advertising, sales commission and A/S intensity	-0.0519 (0.64)	-0.0099 (0.90)	-0.0170 (0.83)
Sales growth rate	-0.0000272 (0.96)	0.000934 (0.85)	-0.0000148(0.97)
age of the firm	-0.1142 (0.00)	-0.1635 (0.00)	-0.1429 (0.00)
30 chaebol	-6.9362 (0.00)	-4.8073 (0.01)	-5.2072 (0.00)
N	1773	1773	1773
R^2	0.17	0.29	0.20
Adj R^2	0.16	0.28	0.19
F	25.68	50.14	31.10

Table 2: Findings of the regression model

Strategic Model Based on Industrial Organization (IO)			
market share		H1	the market share variable has a positive relationship with corporate performances, but not statistically significant.
Strategic Model Based on The Grand Unified Theory of the Firm			
Theories of the Firm	**Strategic Variables**	**Hypotheses**	**Results of Regression Model**
neoclassical theory	economy of scale and scope	H2	a positive relationship between corporate performances and the economy of scale.
	technical efficiency	H3	an inverse relationship between corporate performances and technical efficiency variables: debt equity ratio, tangible asset intensity and machine and equipment per employee.
agency theory	agency cost economizing	H4	a positive relationship between corporate performances and agency cost variable, but not statistically significant.
property rights theory	assignment of property rights	H5	not on Table 1, but we found that there is a positive relationship between corporate performances and shares of large stockholders, and an inverse relationship between corporate performances and large shareholders' participation in management. Both variables are not statistically significant.
transaction cost theory	make or buy	H6	a positive relationship between corporate performances and parts purchase intensity.
	Theories of the Firm	**Strategic Variables**	**Hypotheses Results of Regression Model**
resource-based theory	creating Ricardian rent	H7	Differences in productivity and labor cost per employee have a positive relationship with corporate performances and consistently significant.
		H8	an inverse relationship between corporate performances and educational and training expenditure intensity, but not statistically significant.

Strategic Model Based on The Grand Unified Theory of the Firm			
evolutionary theory	creating Schumpeterian rent	H9	an inverse relationship between corporate performances and R & D intensity.
		H10	an inverse relationship between corporate performances and advertising, sales commission and after service intensity.
		H11	a mixed relationship between corporate performances and sales growth rate, but not statically significant.
Organizational Characteristics			
age of the firm		H12	an inverse relationship between corporate performance and the age of the firm.
30 large chaebol	organizational structure	H13	a statistically significant difference in corporate performances between the large chaebol firms and other firms.

V. Conclusion

The empirical results in general support the grand unified theory of the firm. Korean firms can improve their performances and competitiveness by applying the grand unified theory of the firm to their cost and benefit drivers. In other words they can reduce costs by accomplishing technical efficiency and the economy of the scale, economizing agency and transaction costs, and obtaining, developing and maintaining strategic resources (assets). They can improve benefit drivers by innovating production processes and products. We also found that the survey results show that successful business practices in Korean firms follow the framework of the grand unified theory of the firm. Therefore, we can conclude that the grand unified theory of the firm offers a good framework for improvement in business practices, corporate performances and competitiveness.

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Comments on "The Grand Unified Theory of the Firm and Corporate Strategy Measures to Build Corporate Competitiveness"

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Various theories of the firm identify conditions under which vertical or horizontal integration occurs or ownership structure is determined and so on. The literature on management strategy mainly concerns competitive success. So there has been a gap between the theories of the firm and corporate strategy. And we lack unifying framework to combine these.

This paper tries to unify the theory of firms with corporate strategy and fill the gap. Moreover, the paper tests various hypotheses based on several theories. As far as I know, not much is known about synthesized theory of the firm and empirical studies are very few, if any, as compared to theoretical ones. Therefore, it is more than welcome to have a paper that combines the theories of firm with corporate strategy and tests a unified framework. Nevertheless, I would like to make a few points that seem not to be fully discussed in the paper.

First of all, the paper assumes the existence of the firm. So what makes a firm different from market transactions is unclear, which should be clarified. In order to have a grand unified theory of the firm, distinguishing characteristics of a firm needs to be identified in advance of the discussion of corporate strategy.

Secondly, I think that the classification of theories is a bit too simplified. Pursuit of self-interest and opportunistic behavior, which are the basic assumption in economics, are common to all theories. And bounded rationality is not the essential element of agency theory and property right theory. Transaction cost theory, *ȁ la* Williamson, does not rely on the bounded rationality assumption *per se.*

Moreover, in explaining the nature of the firm, each theory is not mutually exclusive but complementary to one another to some extent. But in unifying theories and formulating hypotheses, this aspect seems to be ignored. For instance, debt to equity ratio is used not only for grabbing competitive edge in neoclassical theory but also for controlling empire-state taste of the managers in agency theory. So formulating hypothesis, H3, as a neoclassical theory seems too much simplification.

With regard to hypotheses, 13 hypotheses are formulated and tested. Some are easily understandable but the others are not. So it is better to explain what the underlying theory is in formulating hypothesis. For example, H9 states, "The R&D expenditure intensity has a positive effect on the performances of the firm." Recent theoretical and empirical studies show that there exists a non-monotonic relationship between innovation and degree of competition and between the firm performances and product market competition. This suggests that the relationship between R&D expenditure intensity and performance of firms be non-monotonic, assuming that innovation is positively related to R&D expenditure intensity. So it is hard to understand where H9 comes from. So it is better to explain the underlying theory for each hypothesis.

With regard to regression, there seems endogeneity problem. Almost all variables of interest are endogenous. So treating endogenous variable as exogenous one results in spurious correlation. For example, H1 states, "The market share of the firm enhances corporate performances." But causality may go the other way around. That is, a well performing firm gets greater market share. The same is true for H2, which is about the relationship between size of the firm and corporate performance. Due to endogeneity problem, the relationship seems out-of equilibrium explanation in that causality goes from strategies to firm performance. To explain equilibrium phenomenon, it may be necessary to consider other exogenous factors.

Needless to say, different organizations have different characteristics. For example, in law firms and consulting firms, hierarchy is relatively flat and partnership is a prevalent mode of organization. In many manufacturing firms, hierarchy is tall and assignment of ownership to workers is not of great concern. Without knowing different characteristics that lead to different organizational structure, it is hard to understand the nature of the firm and its corporate strategy. So it would be better to incorporate firm specific and/or industry specific factors in empirical analysis, in addition to Chaebol factor. This would enable us to have a better view on corporate strategy in relation to organizational structure.

Last but not the least, for better understanding of the functioning of a firm and its connection to market, I would like to see dynamics of a firm. This issue is touched in the paper by considering the age of the firm. But to make a one more step and to see how birth, growth, and death of a firm are related to corporate strategy and market conditions would enhance our understanding of the nature of the firms and its competitive edge.

To conclude, to have a paper about the grand unified theory of the firm and corporate strategy is very much welcome. Incorporating a few points, however, would enrich the analysis and make it possible to apply the theory to various aspects of organizations.

CHAPTER 3-3

The Market for Liars: Reputation and Auditor Honesty*

By

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"The National Association, representing the majority of its members' views, always has held firmly to the belief that all human nature is weak at best, and that that weakness extends even to Public Accountants, certified or otherwise."
W.R. Anderson, "The Surety Bond," *The Certified Public Accountant Bulletin*, IV-4, 1925.

Abstract

In the model there are two types of financial auditors with identical technology, one of which is endowed with a prior reputation for honesty. We characterize conditions under which there exists a "two-tier equilibrium" in which "reputable" auditors refuse bribes offered by clients for fear of losing reputation, while "disreputable" auditors accept bribes because even persistent refusal does not create a good reputation. The main findings are: (a) honest auditors charge higher fees, and have economic profits accruing to reputation; (b) as the fraction of auditors who are honest increases, the premium charged by reputable auditors eventually decreases, which diminishes the incentive to refuse bribes; (c) if the fraction of honest auditors exceeds an upper bound, there does not exist a two-tier equilibrium; (d) thus the reputation mechanism may be undermined by entry into the honest segment of the industry, if it is possible; (e) increasing auditor independence increases the upper bound. (*JEL* M41, D82, G14)

Keywords: auditing, reputation, adverse selection, auditor independence.

During the first three decades of the twentieth century the auditing industry grew rapidly, and several audit firms opened branches in multiple cities.[1] Since that period most observers have recognized a clear distinction between a small number of large firms, described as the Big Eight, the Big Six, the Big Five, or the Big Four, depending on the era,

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[1] This process in described in Edwards (1960).

who are generally acknowledged to have a special status within the industry. (Herein these will usually be described as the Big *n* firms.) Various studies suggest that smaller audit firms charge lower fees and their clients received less favorable treatment from financial markets in connection with IPOs and perhaps other transactions.[2] The membership of this group seems to be very stable: two bilateral mergers in 1989 reduced the number from eight to six, and a merger in 1998 reduced the number to five.[3] Although the collapse of Arthur Andersen provides an example of departure from this group, it seems to be very hard to enter the Big *n*[4]: all of its current members are descended from the firms that expanded on a national scale during the early part of the last century. These firms have also undergone considerable internal expansion in recent decades.

This paper presents a model in which there are two types of audit firms, which we describe as "reputable" and "disreputable." These firms have identical technology, but behave differently in equilibrium. The reputable audit firms are more fearful of losing their reputation and less easily induced to misreport the condition of the client. As a result their reports are, in fact, more credible, and more valuable because of the impact on the client firms' valuations on asset markets, or because they allow new financing to be secured on more favorable terms. For this reason reputable firms are able to charge higher fees, and the capitalized value of expected future fees is what makes them more reluctant to jeopardize their reputations.

In contrast to earlier theoretical studies (DeAngelo (1981) and Dye (1993)) we find that this form of reputation depends on an entry barrier to the reputable segment of the audit industry that prevents competition from eroding the profits of the reputable auditors. Perhaps the most important conclusion is that the value of reputation, and thus the ability to obtain a credible audit, can be jeopardized if the size of the reputable segment of the industry grows beyond a certain point. Some data suggests that the market share of the top audit firms has, indeed, increased substantially during recent decades. Reforms aimed at strengthening "auditor independence" may postpone the collapse of the reputation mechanism, but we know of no proposed reform that would arrest the internal expansion of the Big *n* firms. Events such as the collapse of Arthur Andersen probably diminish the size of this segment, even though many former Arthur Andersen employees have found employment at other Big *n* firms, but such exits from the Big *n* also create antitrust concerns.

In another paper (McLennan and Park (2003)) we present a quite general model that describes conditions under which market forces lead to full disclosure of relevant information by parties to financial contracts. Applied to this paper's model, the import is that in any equilibrium in which reputable and disreputable auditors coexist, the reputable auditors are providing a more valuable service, so they must be charging higher fees, since otherwise the demand for the services of disreputable audit firms would dry up. Concretely, the audit reports of disreputable auditors are uninformative, so that the firms hiring such auditors are "pooled." The "best" client firms in this pool receive worse treatment from financial markets, on average, than they would if they hired a reputable auditor, so they would switch if the two types of auditors charged identical fees. An important finding of McLennan and Park (2003) is that, although this

[2] See, for example, Beatty (1989), Balvers et. al. (1988), Chan et. al. (1993), Craswell et. al. (1995), Ettredge and Greenberg (1990), Francis (1984), Francis and Simon (1987), Francis and Stokes (1986), Ireland and Lennox (2002), Palmrose (1986), Pong and Whittington (1994), Simon and Francis (1988).

[3] Arthur Andersen, Deloitte & Touche, Ernst & Young, KPMG, and Pricewaterhouse Coopers constituted the Big 5 in 1999.

[4] E.g., "Too Few Accountants," *The Economist*, January 31, 1998.

conclusion depends on well functioning markets, it is very robust with respect to the nature and details of the financial arrangements being pursued by the client firms.

We regard this work as a contribution to the theoretical literature on reputation in industrial organization and game theory. In contrast with some other models of reputation (e.g., Kreps and Wilson (1982), Milgrom and Roberts (1982), Rogerson (1983)) there is no hidden state variable, e.g., a "commitment type" or capital suitable for making products of a particular quality, that persists across periods. In this sense ours is a model of "pure" reputation: agents of different reputation do not differ in other ways, so that the desire to preserve one's reputation is the only motivation for behaving in the manner one's reputation predicts. Klein and Leffler (1981), Shapiro (1983), and Allen (1984) are also models of pure reputation in this sense. Unlike those papers (but like Rogerson (1983)) in our model behavior is monitored infrequently and imperfectly.

The remainder has the following structure. The next section, which is introductory in nature, provides an overview of the model and the findings and contrasts them with related research on the auditing profession. Sections II and III present and analyze the formal model of financial auditing. Section IV contains some concluding remarks.

I. Auditor Reputation and Auditor Honesty

The wave of financial scandals beginning with the announcement of bankruptcy by Enron in October 2001 and the subsequent revelation of document shredding, and perhaps other improprieties, at Arthur Andersen, have focused public concern on issues related to the financial auditing of the accounts of major corporations. Should regulations be reformed in the direction of requiring more extensive disclosure of financial information? Would it be desirable (in spite of the substantial switching costs that would result) to require corporations to change their audit firm, or at least the auditor in charge, periodically? Should auditors be prohibited from selling consulting services to audit clients? Is the supply of audit services by leading firms, whose reports have much greater credibility in financial markets, becoming excessively concentrated in a dwindling number of firms?

Implicit in this discussion is the concern that the forces underlying the credibility of leading auditors are fragile, perhaps increasingly so. This paper presents a simple model of how the desire to preserve a reputation for reliability leads audit firms to behave honestly: since exposure of dishonesty results in expulsion from the industry, auditing firms behave honestly rather than jeopardize the capitalized value of their reputation, goodwill, existing clientele, etc. In contrast with other models of reputation for quality (e.g., Klein and Leffler (1981), Shapiro (1983), Allen (1984)) quality is not observed in each period, but instead only when the earlier accounting of bankrupt firms is investigated, nor is it embodied in physical or institutional capital. This creates the possibility that an auditor may gamble, hoping that dishonest behavior will never be revealed.

We compare our model to two other models, due to DeAngelo (1981) and Dye (1993), of how the Big *n* auditors might be different, in equilibrium, from other auditors. DeAngelo was responding to industry critics who argued that large audit firms benefited unfairly and unjustifiably from discrimination by underwriters and other actors in financial markets. Those critics maintained that large and small audit firms provided essentially the same service, and that the preference of customers for large audit firms was the result of discriminatory practices unrelated to any underlying difference in quality. She countered by arguing that large firms had more to lose in the event that they were found to have failed to honestly report the condition of one of their clients, and that this made their reports more reliable. Thus large and small audit firms were selling different products which could reasonably be expected to be regarded as distinct by customers and those who might be influenced by auditors' reports.

DeAngelo describes a world in which large and small audit firms use identical technology, and competition in the market for new clients drives expected profits, at the time of first audit, to zero for both large and small auditors. In general this can happen in two ways. First one might imagine that on average (over the life of a relationship with a particular client) large and small firms charge identical fees.

Since the costs of performing an audit for a new client are greater than the costs of auditing a client one has audited before, audit firms can extract quasi-rents from existing clients who would incur costs if they switched auditors. Since these quasi-rents are anticipated, competition leads auditors to offer a fee for the initial audit that is below cost. This practice, which is known as *lowballing*, implies that relationships with existing clients are valuable to the audit firm, and the value of these relationships is placed at risk whenever the audit firm behaves dishonestly. Large firms have more clients, hence more to lose.

Our results suggest that one should not expect to observe both large and small audit firms if the capitalized value of existing accounts is the only force motivating differential honesty and there is free entry into the high quality tier of the auditing industry. In equilibrium the firms that choose disreputable auditors must be precisely those who prefer to do so, given the signal to financial markets that results from this choice. Our general model of full disclosure suggests that this is quite unlikely if the two types of firms charge equal fees over the life of the relationship.

There is an alternative hypothesis under which Big *n* firm charge higher fees because their costs are higher. Dye (1993) develops a model in which wealthier audit firms are more strongly motivated to be diligent in their investigations of client firms because their greater wealth makes them more vulnerable to lawsuits. Even if both large and small auditors are incorporated, hence protected by limited liability[5], smaller firms may be presumed to have much less wealth, so that a favorable verdict in a lawsuit might be a hollow victory. This is known as the *deep pockets* hypothesis. One significant point emerges from Dye's model: if the deep pockets hypothesis was the only important factor, large auditors would dominate small ones, and drive them out of the market, unless small auditors enjoyed a cost advantage. Dye (1993, p. 890) mentions that liability can arise out of failure to follow proper procedures, and that such failure can result in lower costs. For example, Generally Accepted Auditing Standards require that auditors inspect warehoused inventories. But one might expect (we have no specific information) that to a large and increasing extent the relevant data is already available to the auditor in electronic form, and can be manipulated with no more effort than is required to modify a spreadsheet. In addition, the hypothesis that wealthy firms use more expensive procedures is counter to the usual presumption of scale economies. On the other hand, even prior to the Enron affair there was substantial anecdotal evidence (e.g. Grout et. al. (1994)) concerning the importance of pressure to give a favorable presentation of the client firm's accounts. In the contemporary popular press there is little discussion of costs of diligence. We do not know of formal studies supporting the view that such cost differentials are substantial, but possibly this is due to difficulty in obtaining data.

In our model Big *n* firms charge higher fees in spite of having the same technology and costs as smaller firms, thereby making positive profits. Their clients are willing to pay the higher fees because the reliability of Big *n* audit reports results in better treatment in financial markets. The audit reports of Big *n* firms are, in fact, more reliable. Specifically, these firms are unwilling to accept bribes from clients who would like to

[5] In fact Arthur Andersen was a partnership.

have their situation misrepresented, precisely because the capitalized value of future fees in excess of cost is large. In order for such an equilibrium to persist it must be the case that the profits of Big *n* firms are not competed away, at least in the short run, because reputation acts as an entry barrier: potential entrants who would like to acquire a reputation for honesty are powerless to do so. The essence of reputation is a coordination of intentions and inclinations on the part of the audit firm and expectations on the part of the financial markets. In general one can try to create a reputation, in the sense of inducing desired expectations concerning one's behavior, by taking steps to make honest behavior attractive and dishonest behavior risky or irrational. The implicit hypothesis of our model is that creating "a Big *n* reputation" from scratch is either infeasible or excessively costly.

We now describe the main features of our formal model of auditing. In each period firms seeking financing hire auditors to certify their accounts. The firms are heterogeneous insofar as they are privately informed about the probability that the state of the firm will be good. After the audit firm completes its work, both it and the client firm know the actual state of the firm which, in our model, is either "good" or "bad." If the state of the firm is good, this is stated publicly by the audit firm[6]. If the state is found to be bad, the audit firm may state this (in the terminology of the industry, the audit firm "qualifies the accounts") but there is also the possibility that the client may offer inducements to the audit firm to not qualify the accounts. In reality these inducements take many forms including the prospect of continued patronage and purchase of consulting services. In our model we describe them simply as a "bribe."

We assume that there is an exogenously given supply of "reputable" audit firms that have acquired a reputation for refusing bribes. Other auditors may enter the industry by paying a certain entry cost, but our model includes no mechanism by which these auditors might acquire a positive reputation, and in equilibrium they always accept bribes. The financial markets regard the reports of such auditors as uninformative, and provide financing to their clients on terms that reflect the average probability of a good state for such firms. In contrast, firms that receive an unqualified audit from a reputable auditor receive financing on terms reflecting the belief that the state is good. Consequently firms with a high prior probability of a good state will be willing to pay more for the services of reputable auditors. Our concern is with delineating the conditions under which the rents accruing to reputable auditors are valuable enough to deter them from accepting bribes, thereby justifying their reputation.

A natural intuition is that as the supply of reputable auditors increased, the premium that they could charge in equilibrium would decrease, and at some point the premium would be insufficient to deter them from accepting bribes. That is, one might expect that the set of exogenously given supplies of reputable auditors supporting an equilibrium of this type is an interval with zero as one endpoint. However, our model admits two reasons that this simple picture might not pertain.

First, there is the possibility that the distribution of firm types is extremely favorable, so much so that if all firms received disreputable audits, the probability of a good state would be so high that the loan would be advanced on terms almost as favorable as those resulting from a credible certification that the state is good. If the differential of repayment terms was insufficient to justify a premium for reputable auditors that

[6] Here we are assuming that audit firms cannot engage in extortion by threatening to report that the state of the firm is bad when, in fact, it is good. In practice this would be a matter of creative accounting in a negative direction, but in fact the relationship is an ongoing negotiation between the auditor and the client, and it seems reasonable to suppose that the client has greater bargaining power insofar as the value of the account, due to the lowballing phenomenon described above, serves as a sort of hostage.

deterred acceptance of bribes, the set of supplies of reputable auditors supporting an equilibrium in which reputable and disreputable auditors coexist would not include zero. Of course this theoretical possibility does not seem at all realistic.

The second complication is that the set of supplies allowing an equilibrium of this type might not be an interval. As the supply of reputable auditors increases, the type of the marginal firm hiring such an auditor decreases, so that if one held the repayment terms resulting from a disreputable audit fixed, the premium that that firm would be willing to pay would also decrease. But as the supply of reputable auditors increases, the distribution of firms receiving unfavorable audits worsens, so that the repayment terms resulting from a disreputable audit become less favorable, and it can happen that this effect dominates in certain intervals. Consequently it is possible that, as one increases the supply of reputable auditors, one first reaches a point at which the premium is insufficient to deter acceptance of bribes, but if the supply is increased further, one enters another region in which bribes are no longer accepted, so that the set of supplies of reputable auditors supporting an equilibrium in which they do not accept bribes has multiple intervals.

These two caveats do not fundamentally undermine the message of the model concerning the fragility of reputation as a mechanism for enforcing honest auditing. If (contrary to our assumption) the supply of reputable auditors can be increased, market forces may undermine the reputation mechanism that underlies auditor credibility. We argued before that both historical experience and common sense suggest that it should be extremely difficult to create new Big *n* audit firms, but this does *not* imply that the supply of reputable auditors is fixed in practice. Quite to the contrary, each of the Big *n* firms has expanded substantially during the last several decades. This suggests a picture in which the supply of reputable audit services does not adjust instantaneously, but is to some extent flexible, and responsive to market forces, over the course of years and decades.

Of course the collapse of Arthur Andersen has reduced the supply of reputable auditors. But the overall picture is not one of a dynamic steady state in which creation of reputable audit services by existing firms is balanced by their destruction through loss of reputation. Rather, we see a diminishing number of reputable audit firms that initially acquired their reputations in a bygone era, each of which can increase profits in the near term by expanding, with the collective consequence being the creation of circumstances in which the value of reputation is insufficient to deter acceptance of bribes that risk another implosive exit from the Big *n*.

"Auditor independence" is the phrase commonly used to express the various incentives making auditors reluctant to accept bribes. Many of the reforms that have been proposed are motivated by the desire to strengthen independence. Specific proposals of this type include limitations on auditors supplying consulting services and schemes that would require firms to change audit firm, or at least the identity of the lead auditor within the firm, periodically. In large audit firms there is the possibility that the interests of the auditor in charge of a particular account may diverge from the interests of the firm as a whole, especially if auditors are presented with incentives that reward aggressive pursuit of clients. While this aspect is less likely to be subjected to government regulation, it is possible that the industry's sense of "best practices" concerning auditor incentives may change. Auditor independence may also be affected by changes in standard accounting practices. In particular, independence may be increased by reforms that restrict the auditor to reporting objective conditions and do not allow the exercise of subjective judgment. (Grout et. al. (1994) provide a sophisticated discussion of the likely consequences of some of the proposed reforms.)

Essentially auditor independence may be viewed as a matter of the difficulty of inducing an audit firm to falsely report that the client firm's condition is good. In our model independence is inversely proportional to the fraction of an auditor's business represented by a single account. Formally this is represented using a standard discounting framework, so that the bribe offered in the current period is weighed against a future stream of fees. But in fact the assumption that each auditor audits one firm in each period could easily be modified to allow auditors to have multiple clients, so we regard the discount factor in our model as a parameter characterizing the degree of independence that is only loosely related to the rate at which future revenue is discounted.

In connection with this parameter, our results are simple and unambiguous: decreasing the discount factor (i.e., weakening auditor independence) diminishes the set of supplies of reputable auditors that support an equilibrium in which reputable auditors do not accept bribes. That is, our model presents no reason to doubt that policies that increase auditor independence may strengthen the credibility of auditing in the short run. But, as we stressed earlier, our model suggests that while such policies can postpone the collapse of the reputation mechanism, they will not prevent it if the internal expansion of the Big *n* firms continues.

II. The Model

In each period there is a continuum of client firms with total measure one. A client firm cannot stay in business unless it succeeds in obtaining financing in the form of a loan whose amount ` is fixed and exogenous. The firm has an unknown *state*, which may be either "good" or "bad," so the set of possible states is $S := \{G, B\}$. The firm hires an auditor who investigates the firm's condition, and this investigation reveals the state of the firm to both the firm and the auditor, but not to the financial market. The auditor then publicly states whether the firm is good or bad. The auditor must state that the condition of the firm is good when that is in fact the case. When the actual state of the firm is bad there is the possibility that the auditor may be induced to make a false report. Thus, when the auditor reports that the firm's state is bad, that is certainly the case, but in response to a favorable report the financial market must assess the probability that the state is, in fact, good.

After the auditor issues her report, the repayment promise *r* required for the firm's loan is determined in the financial market. (It may happen that there is no repayment promise sufficient to induce lenders to make the loan.) If the firm obtains financing, it either succeeds or fails. The probability of success is either p_G or p_B, according to whether the firm's state is *G* or *B*. (The state is a sufficient statistic for the probability of success in the sense that, conditional on it, the firm's type is uninformative.) We assume that $p_B < p_G$. In the event that the firm succeeds its value is *h* (which is fixed and exogenous) so that the profits resulting from the attempt at survival, net of the audit fee *f* and the loan repayment, are

$$h - f - r.$$

If it fails, then its value is zero and it makes no repayment of the loan[7]. Regardless of the outcome, we assume that the firm and the auditor have no dealings in later period.

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7 That is, we are assuming that f is treated as an operating expenses, hence is paid regardless of

In the event that the firm fails, there is an investigation that reveals whether the state was actually *G* or *B*. The auditor is forced to leave the industry if she is revealed to have failed to qualify the accounts when the state was bad.

There is a continuum of auditors with total measure *m*. Although, in the equilibria we emphasize, different auditors will have different reputations, all auditors have the same cost of performing an audit, which is assumed to be zero for the sake of notational simplicity. Each auditor is capable of auditing one firm in each period.

The interaction between the auditor and the client firm is assumed to be governed by a contract, specifying a payment prior to the audit, and there is also the possibility of a renegotiation leading to a bribe once the actual state has been revealed. Since the auditor is bound to report that the state is good when the actual state is good, there is no possibility of renegotiation in this circumstance.

There is a measure $m_R < m$ of *reputable auditors*. In the equilibria we focus on these auditors cannot be bribed because the maximum bribe a firm in a bad state would be willing to pay is insufficient to compensate for the risk to a reputable auditor's reputation. The prior reputation for honesty of reputable auditors is a exogenously given (i.e., historically determined) fact: reputable auditors retain their reputation unless they are caught, and the model does not permit an auditor to acquire a reputation for honesty. Thus the quantity m_R is given and fixed, instead of being determined by equilibration. We should stress that the reputable auditor's behavior is an equilibrium phenomenon, not a matter of inherent honesty; an incentive compatibility condition will state that she declines bribes only because they are insufficient to compensate for the risk to her reputation. The constant fee charged by reputable auditors is denoted by f_R.

The other auditors are described as *disreputable*. Prior to each period new auditors can enter the disreputable segment of the industry by paying a fixed cost *C*. The fee actually paid to the disreputable auditor will be f_{DG} or f_{DB} according to the state. Here f_{DG} is the contractual fee, and the difference

$$b := f_{DB} - f_{DG}$$

is the amount of the bribe. (In practice such payments are difficult to identify as such, since they are embedded in the continuing relationship between the firm and the auditor.) Our definition of equilibrium specifies that the bribe should be the minimum amount that is acceptable to the auditor as compensation for the risk of getting caught[8].

We assume that the contractual fee cannot depend on the reported state. An agreement to pay a higher fee when the state is bad amounts to a vehicle for shifting a greater fraction of the expected fee onto the firm's creditors when the firm is bankrupt, so it is natural to expect that such an arrangement would be disallowed by the bankruptcy court.

On the other hand an agreement to pay a higher fee when the state is good is disadvantageous from at least two points of view. First, in practice, though not in the model due to the assumption of rational expectations, if the financial markets can observe the terms of such a contract, they will tend to have doubts about the auditor's

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whether the firm succeeds, but in the bankruptcy proceedings of a failed firm the assets are insufficient to repay all debt more senior than the loan under consideration.

[8] This assumption can be justified by the following bargaining protocol. Prior to performing the audit, the firm pays the auditor a sum that is necessarily independent of the state. After the audit, if the state is *B*, the firm may make a take-it-or-leave-it offer of a bribe to the auditor. Naturally, other bargaining protocols imply different outcomes. It may be of interest to investigate other possibilities along these lines.

independence. Second, the effect of such a contract is to shift some of the auditor's expected payments into events in which the firm does not declare bankruptcy, which is unnecessarily generous to the firm's creditors. A disreputably audited firm always receives financing. The creditors end up paying the audit fee when the firm fails, and the equity holders pay when the firm succeeds. Under a contract in which a reputable auditor's fee was lower in the bad state, and the expected fee was equilibrated, hence higher in the good state, the expected payment of the creditors would be less, and the expected payment of the equity holders would be more, to the extent that the probability of success was lower in the bad state.

If $m > 1$, competition should drive the expectation of the sum of the fee and the bribe of a disreputable auditor to zero. This case is implausible and not otherwise of great interest, so henceforth we assume that $m \leq 1$. For both reputable and disreputable auditors, expected audit fees and bribes in future periods are valued by applying the discount factor $\delta \in (0,1)$. The value of a disreputable auditor's business is equal in equilibrium to the cost C of entry into the industry, and a client firm whose state has been found to be bad is willing to pay a bribe that is sufficient to compensate a disreputable auditor for the risk of being forced to leave the industry. The value of being an undiscredited disreputable auditor is the discounted value of the entry cost C, so $b + p_B \delta C = \delta C$, i.e,

$$b = (1 - p_B)\delta C$$

Therefore free entry implies that the value of receiving f_{DG} in every subsequent period is C, so

$$f_{DG} = (1-\delta)C \text{ and } f_{DB} = (1 - p_B\delta)C.$$

The type of the auditor is the only information available to the financial market at the time the financial contract is negotiated. The financial market is competitive and risk neutral, so that the firm will receive a loan if there is a repayment amount that does not exceed the value of the firm in the event of success (net of the audit fee and bribe) such that the expected repayment is equal to ℓ. Let r_R and r_D be the repayment amounts for firms who receive unqualified reports from reputable and disreputable auditors respectively. Since reputable auditors always report truthfully, in equilibrium $p_G r_R = \ell$ so that $r_R = \ell / p_G$. We assume that $p_G h > \ell$, so that a firm that is known to be good is a worthwhile gamble[9].

The repayment amount for a firm receiving an unqualified audit from a disreputable auditor (in equilibria where this happens) is r_D. Equilibrium requires that

$$\Pr ob(G \mid D) p_G + \Pr ob(B \mid D) p_B) r_D = \ell, \quad (1)$$

where Prob(G|D) and Prob(B|D) are the probabilities of the good and bad state conditional on receiving an unqualified audit from a disreputable auditor. We assume that, regardless of the audit fee, there is no repayment amount satisfying this condition

[9] Since (1-δ)C is the minimum audit fee that could be observed in equilibrium, it would be natural to assume that $p_G(h-(1-\delta)C) > \ell$, but this strengthening of the assumption would not simplify the analysis by ruling out obnoxious and irrelevant special cases.

when the state is known to be bad. That is, $p_B h < \ell$, i.e., the expected revenues from continued operation are less than the loan amount.

A firm that is audited by a disreputable auditor and is found to be bad must decide whether it is worthwhile to pay the bribe. Since, in our model, all firms who have been found to be in a bad state are, at that point in time, identical, either all firms bribe or none do. If firms choose not to bribe, then firms who are audited by disreputable auditors and receive an unqualified report are viewed by the financial market as having a good state with probability one, so that r_D and r_R would be equal. But then the ability of reputable auditors to charge higher fees would collapse. Put another way, all auditors are, in effect, reputable, and since there is free entry into the industry, the fees of all auditors are driven by competition to the level at which a new entrant expects to recover the entry cost C. Such equilibria are possible, for instance if p_B is very close to zero, but they are simple and unproblematic. For the most part we will focus on equilibria in which firms are willing to bribe disreputable auditors:

$$h - f_{DB} - r_D > 0. \quad (2)$$

Prior to choosing which auditor to hire, the firm is privately informed of its *type*, which is the probability $t \in T := [0,1]$ that the state will be good. If the firm hires a reputable auditor its expected payoff. Is

$$tp_G(h - f_R - r_R) = t(p_G(h - f_R) - \ell). \quad (3)$$

The expected payoff. resulting from hiring a disreputable auditor is

$$tp_G(h - f_{DG} - r_D) + (1-t)p_B(h - f_{DB} - r_D). \quad (4)$$

Comparing the results of hiring the two sorts of auditors, we find that the reputable auditors are hired by firms with favorable types.

Lemma 1: *Suppose there is a probability $\tilde{t}$ such that a firm of type $\tilde{t}$ is indifferent between hiring a reputable auditor and hiring a disreputable auditor. Then firms of type $t > \tilde{t}$ strictly prefer hiring a reputable auditor to hiring a disreputable auditor, and the opposite is the case for firms of type $t > \tilde{t}$.*

Proof: Since $h - f_{DB} - r_D > 0,$ the equality

$$\tilde{t}p_G(h - f_R - r_R) = \tilde{t}p_G(h - f_{DG} - r_D) + (1-\tilde{t})p_B(h - f_{DB} - r_D)$$

implies that $h - f_R - r_R > h - f_{DG} - r_D.$

Let t^* be the number such that $\mu([t^*,1]) = 1.$ Since μ is atomless and has full support there is a unique such number. Lemma 1 implies that, in equilibrium, all types in $[0,t^*)$ hire disreputable auditors and all types in $(t^*,1]$ hire reputable auditors. We now determine the repayment terms of clients of disreputable auditors and the fees of reputable auditors.

Under the assumption that the relation between the firm's type and the probability of hiring a reputable auditor is known, we can compute that when a firm hires a disreputable auditor, the financial market's beliefs about its probability. $\tau(t^*)$ of being good will be the average type of firms with types in $[0,t^*]$: set

$$\tau(t^*) := \frac{\int_0^{t^*} t \, d\mu}{\mu([0,t^*])}.$$

The equilibrium value of r_D is now determined by (1):

$$r_D = \rho D(\tau(t^*)),$$

where, for $0 \le \alpha \le 1$

$$\rho D(\alpha) = \frac{\ell}{a p_G + (1-\alpha) p_B}.$$

is the equilibrium repayment amount when the probability of a good state is α .

It may happen that the value of r_D given by this equation is so high that continued operation of the firm is not worthwhile. In this case the disreputable auditors will have no clients. The fee of reputable auditors will rise to the point where all firms are indifferent between immediate bankruptcy and hiring a reputable auditor. Consider a firm of type *t* choosing between hiring a reputable auditor and not hiring an auditor, i.e., going out of business. If it hires a reputable auditor its expected payoff is given by (3). If $p_G(h - f_R) - \ell$ is positive, then all firms wish to hire reputable auditors, and if it is negative, then no firm wishes to do so. The market for auditing services will not clear unless the audit fees rise at least to $h - r_R$, and it cannot rise higher. At this fee all firms are indifferent as to whether to hire a reputable auditor, and which firms actually hire auditors is indeterminate. Moreover, a firm whose state has been found to be bad is unwilling to pay any bribe, since all the surplus has already gone into the audit fee. Such equilibria are quite extreme, with very high audit fees and bankruptcy of many firms for which it would be worth the expense of an audit if there could be a credible report in the event that the state was found to be good, so they might be regarded as unrealistic in the sense that there would be pressure for institutional reforms that would undermine the features of the model leading to this outcome. In any event we will not discuss them further.

If firms with types in $[0,t^*]$ hire disreputable auditors, the fee of reputable auditors will be determined by the condition that a firm of type t^* is indifferent between the two types of auditors. Equating (3) and (4) and isolating f_R yields:

$$f_R = f_{DG} + r_D - r_R - \frac{(1-t^*) p_B (h - f_{DB} - r_D)}{t^* p_G}. \quad (5)$$

At this point we have shown how to determine the equilibrated variables— f_R, f_{DG}, f_{DB}, r_D and r_D —in equilibria in which reputable and disreputable auditors coexist.

III. Equilibrium Analysis

This section presents the analysis of parameter values for which there are equilibria in which disreputable auditors accept bribes and reputable auditors do not, which we refer to as a *two-tier equilibrium.*

In such an equilibrium a disreputably audited firm must be willing to pay the bribe *b*, which will be the case if $0 \leq h - r_D - f_{DG} - b$. Note that $\tau(t^*)$ is an increasing function of t^*, and $\rho_D(\tau(t^*))$ is a decreasing function of $\tau(t^*)$, so there is a unique number $\underline{t} > 0$ such that

$$\rho_D(\tau(\underline{t})) = h - f_{DG} - b = h - f_{DB} = h - (1 - p_B\delta)C. \quad (6)$$

Disreputably audited firms will be able to obtain financing that justifies paying a bribe when $t^* \geq \underline{t}$ and not otherwise. If $t^* < \underline{t}$, i.e., $m_R > \mu([\underline{t},\ 1])$ the (unique) equilibrium will have only reputable auditors, as described above.

We now examine the incentive compatibility condition under which reputable auditors cannot be bribed. A firm whose state has been found to be bad by a reputable auditor would be willing to pay up to $h - f_R - r_R$ to obtain an unqualified audit report. Thus the maximum bribe plus the probability of success in the bad state times the value of the stream of future audit fees must be less than the value of having the future audit fees with certainty:

$$h - f_R - r_R + p_B \frac{\delta}{1-\delta} f_R < \frac{\delta}{1-\delta} f_R,$$

or $f_R \geq f_R^{\min}$ where

$$f_R^{\min} := \frac{h - r_R}{1 + (1 - p_B)\dfrac{\delta}{1-\delta}}.$$

Comparing this with (5), an equilibrium in which reputable auditors do not accept bribes exists if and only if $t^* \geq \underline{t}$, and

$$f_{DG} + \rho_D(\tau(t^*)) - r_R - \frac{(1-t^*)p_B(h - f_{DB} - \rho_D(\tau(t^*)))}{t^* p_G} \geq f_R^{\min}.$$

Isolating $\rho_D(\tau(t^*))$, this inequality is equivalent to $\rho_D(\tau(t^*)) \geq \overline{\rho}(t^*)$ where

$$\overline{\rho}(t^*) := \frac{f_R^{\min} - f_{DG} + r_R - (h - f_{DB})}{1 + \dfrac{(1-t^*)p_B}{t^* p_G}} + h - f_{DB}. \qquad (7)$$

is the repayment amount for disreputably audited firms that results in a fee for the reputable auditor that makes her indifferent between accepting a bribe or not.

Lemma 2: $f_R^{\min} - f_{DG} + r_R < h - f_{DB}$, *so that* $\overline{\rho}$ *is a decreasing function.*

Proof: Above we assumed the existence of $\underline{t}$ satisfying (6), so that $h - f_{DG} - r_R > h - f_{DG} - \rho_D(\tau(\underline{t})) = b$. Thus $h - r_R - b > f_{DG}$. Since b is just sufficient to compensate an auditor for the risk of losing a stream of revenues of f_{DG} in each future period, b is not sufficient to induce acceptance by an auditor who could receive a fee of $h - r_R - b$ in each future period. Since b would be the maximum possible bribe if $f_R = h - r_R - b$, this implies that $f_R^{\min} < h - r_R - b = h - r_R + f_{DG} - f_{DB}$.

Note that $\overline{\rho}(t^*)$ decreases from $h - f_{DB}$ to $f_R^{\min} - f_{DG} + r_R$ as t^* increases from 0 to 1, and that $\rho_D(\alpha) = \ell/(\alpha p_G + (1-\alpha)p_B)$ decreases monotonically from ℓ / p_B to ℓ / p_G as α increases from 0 to 1. We claim that

$$\frac{\ell}{p_G} < h - f_{DB} < \frac{\ell}{p_B} \text{ and } \frac{\ell}{p_G} < f_R^{\min} - f_{DG} + r_R < \frac{\ell}{p_B},$$

so that the image of $\overline{\rho}$ is contained in the interior of the image of ρ_D, which means that we may define $\tau : [0, 1] \to (0, 1)$ by $\tau(t^*) := \rho_D^{-1}(\overline{\rho}(t^*))$. Of the four asserted inequalities, the first follows from (2) and $r_D > r_R = \ell / p_G$, while the second follows from $h < \ell / p_B$. The third follows from $\ell / p_G = r_R$ and $f_R^{\min} \geq f_{DG}$, while the fourth follows from $f_R^{\min} < h - r_R$ and $h < \ell / p_B$. Since ρ_D and ρ are both decreasing functions, we have:

Lemma 3: $\overline{\tau}$ *is an increasing function.*

Summarizing the discussion above:

Theorem 1: *There exists an equilibrium in which disreputable auditors accept bribes and reputable auditors do not if and only if* $t^* \geq \underline{t}$ *and* $\rho_D(\tau(t^*)) \geq \overline{\rho}(t^*)$ *i.e.,* $\tau(t^*) \leq \overline{\tau}(t^*)$.

The inequality $\tau(t^*) \le \bar{\tau}(t^*)$ holds whenever $\bar{\tau}(t^*) \ge t^*$, since $t^* \ge \tau(t^*)$. The case $\bar{\tau}(t^*) < \tau(t^*) \le t^*$ corresponds to an exotic possibility: the distribution of firm types is so heavily concentrated near t^*, and t^* is so close to one, that the financial markets extend loans to disreputably audited firms at terms that are only slightly worse than the repayment terms for reputably audited firms, with reputable auditors receiving a premium that is insufficient to dissuade them from accepting a bribe from a firm that is revealed to be bad. Assuming that the reputation mechanism collapsed, the distribution of types of disreputably audited firms would become even more favorable. The parameter values leading to this outcome are extreme, and this aspect of the model seems both unrealistic and unproblematic. Diagrammatically, the graphs of $\bar{\tau}$ and τ are both increasing, but the former starts from a strictly positive value whereas the latter starts from 0 as illustrated in Figure 1. For the latter graph to catch up the initial difference and cross over the other one at some point, the latter must rise very sharply (as illustrated at the upper end in Figure 1). This is impossible unless the distribution of firm types is unusually concentrated on a small interval.

In the sequel, therefore, we focus on the cases that this unlikely event does not arise. Then, a two-tier equilibrium exists precisely when $t^* \ge \underline{t}$ according to Theorem 1. Hence, comparative statics on the set of the sustainable sizes of reputable auditors, is reduced to checking the movement of $\underline{t}$. We are interested in the effects of δ. Although we treat δ as a discount factor, it can be construed more generally as a measure of auditor independence, insofar as its function in the model is primarily to measure the relative importance of the auditor's expected fees from other clients in comparison with the temptations offered by the current client. Note that the definition of τ is independent of δ.

Proposition 1: *$\underline{t}$ is a decreasing function of δ.*

Proof: From (6) we have

$$\underline{t} = \tau^{-1}(\rho_D^{-1}(h-(1-p_B\delta)C)).$$

Since τ is an increasing function, ρ_D is a decreasing function, and neither function changes when δ varies, this quantity decreases when δ increases. This means that increasing δ pushes down the lower bound of t^* for which a two-tier equilibrium exists. So long as the aforementioned exotic case ($i.e.$, $\bar{\tau}(t^*) < \tau(t^*)$) does not arise, therefore, the comparative statics is unambiguous: a larger set of reputable auditors can be sustained when the auditor independence is enhanced.

IV. Conclusion

This paper develops a model in which the audit firms previously endowed with a reputation for honesty do, in fact, behave honestly, because they are afraid to jeopardize their reputation. The value of reputation is proportional to the difference between the fees charged by reputable auditors and those charged by auditors without prior reputation. In equilibrium this fee differential leaves the marginal client firm indifferent between the two types of auditors. High quality client firms have a stronger preference for reputable auditors, so that expansion of the reputable segment of the market leads to a marginal client firm with lower willingness to pay for a high quality audit. Lowering the quality of the marginal firm also results in a lower average quality, and less favorable financing, for disreputably audited firms. We find that the former effect is dominant, except in unusual and unrealistic circumstances, so that expansion of the supply of high quality auditing leads to a reduction of the fee differential. If the supply of high quality auditing passes a certain threshold, the fee differential will be so small that the value of reputation is insufficient to motivate honest behavior.

Our model shares various features with the models of DeAngelo (1981) and Dye (1993). Unlike those models, our model has equilibria in which reputable and disreputable auditors coexist in spite of the disreputable auditors having equal or greater costs. One of our important theoretical findings is that incentives to maintain reputation will diminish if the Big *n* premium is eroded as a result of competition. While entry into the Big *n* seems to be very difficult, all these firms are now very different creatures from the firms that opened branches in multiple cities during the first quarter of the twentieth century. (See Edwards (1960) for a description of the evolution of the auditing industry during this period.) In particular, there is the possibility that internal expansion of these firms could erode the Big *n* premium, and for this reason it is interesting to examine the evolution of their market share over time. We know of two studies that are explicitly focused on the evolution of market share in the US. Using a sample of 299 S&P firms drawn from a selection of industries chosen to include both regulated and unregulated industries, and industries with both high and low propensity to use Big *n* auditors, Danos and Eichenseher (1986) find that the Big 8 market share increased from 51.8% in 1965 to 58.2% in 1972 and then to 66.6% in 1980. For all audit clients listed in the NYSE, NASDAQ, or AMEX (excluding those that were acquired, went private, or for which there was inadequate information) Wolk, Michelson and Wootton (2001) find that the Big *n* market share was well over 80% in the years 1988, 1991, 1996, and 1999.

Our comparative statics result may be viewed as supportive of policy reforms (e.g., prohibitions on auditors supplying consulting services or periodic mandatory rotation of auditors) that enhance auditor independence by diminishing anticipated revenues from the client firm, as a fraction of the auditor's current and future business. But such reforms are a stop gap response to the erosion of the value of reputation that results from an increase in the market share of the top firms. This suggests giving consideration to more drastic reforms, such as requiring publicly traded firms to purchase audit insurance, with the auditor hired by the insurer, in order to align the auditor's incentives with its true "customers," namely those who base financial decisions on audit reports.

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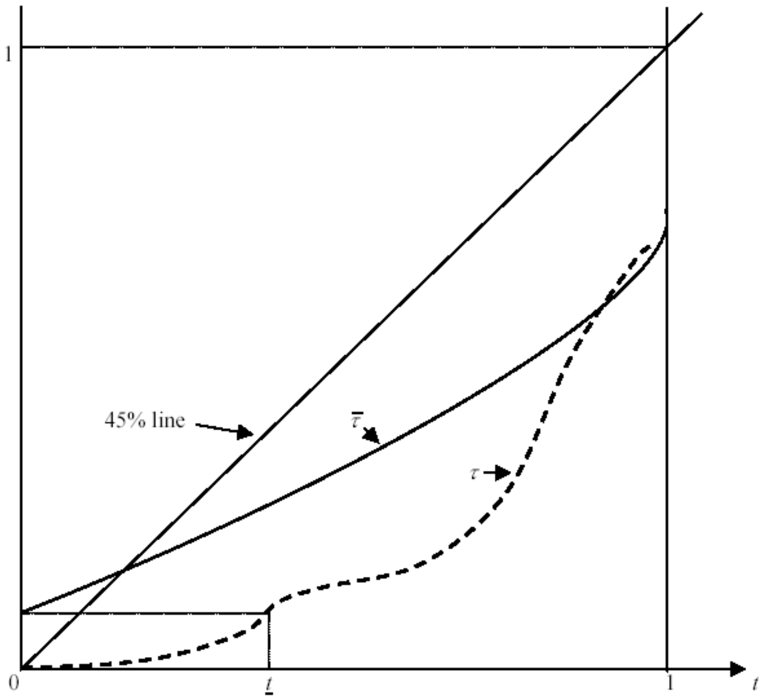
Figure 1. Region of t^* that supports two-tier equilibrium



Comments on "The Market for liars: Reputation and Auditor Honesty"

Kiho Yoon
Professor, Korea University

This paper deals with reputation when there are two distinct types of audtiors, reputable and disreputable.

The reputable auditors are given exogenously, and no auditor can become a new reputable auditor.

On the other hand, a reputable auditor becomes a disreputable auditor if it is found to misreport.

The paper is well-written and conveys the main idea clearly.

Compared to other reasons advanced in the literature why reputable auditors might be different from others (large client base by DeAngelo (1981) or the deep pocket hypothesis by Dye (1993)), this paper seeks the reason from the desire to keep reputation.

Intuitively, the value of reputable auditors is high if there are less of them. The paper confirms this intuition by the main proposition that there cannot exist *two-tier equilibrium* (where reputable auditors behave honestly, and disreputable auditors do not) if the faction of reputable auditors are high.

This is a model on reputation keeping, not reputation building in the sense that reputation cannot be acquired by new entrant.

The conclusions of the paper fit well with the empirical facts, and the paper proposes some policy suggestions.

I think the basic intuition of the paper regarding *reputation*-keeping is quite well known, or at least straightforward. On the other hand, I think the interesting contribution seems to lie in the fact that the paper rather deals a *repeated game* framework with unknown types.

Contents

Table of contents

Figure of Contents

CHAPTER 4-1

Enhancing Productivity through Innovation: Korea's Response to Competitiveness Challenges

by
Joonghae Suh, Korea Development Institute

1. Introduction

The production systems in the East Asia that have prevailed over the past years are dissolving rapidly. The factors underlying these changes seem to be different from those in the past. Multinational enterprises are apparently a driver of the change as in the past; but there are differences in today's changes. The world economic environment is changing rapidly. Hot debates on the architecture of the new international economic order are undergoing as well observed in WTO and DDA round tables. Globalization becomes a catchword or cliché nowadays, but there appear some countervailing movements against it; and there remain many issues to be resolved for a new international economic order to be settled. The rapid advances of information technology are enabling to overcome the limitations of physical distances and thereby to organize the production activities more effectively through the global supply chains. In line with the forces of globalization and IT revolution, the integration of low-cost economies to the world economy raises new challenges to national economies, in particular to Korea, forcing them to move towards knowledge-based innovative economies.

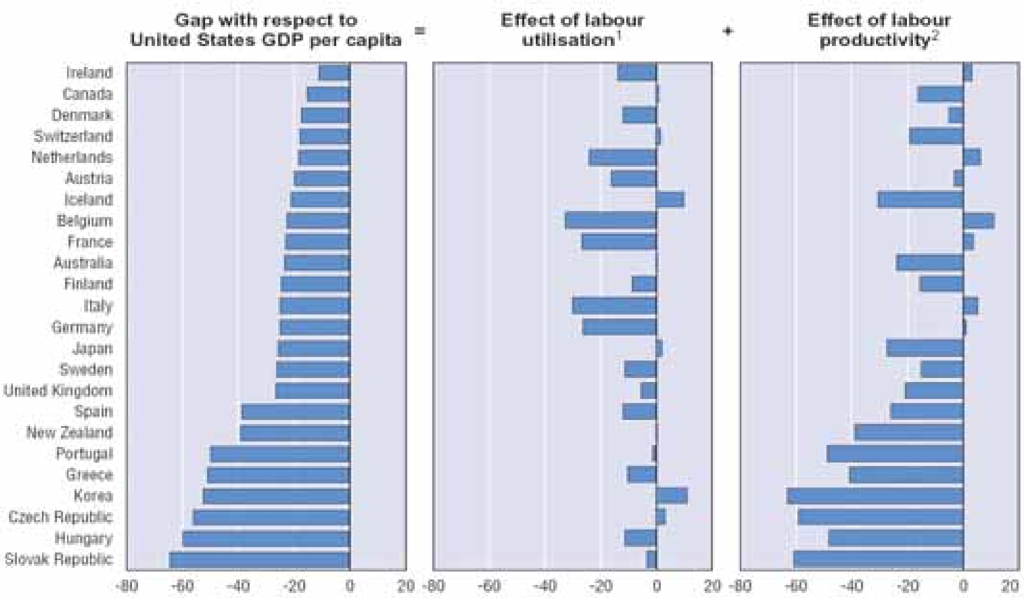
The changes describe above raise several questions. Theoretically, can the conventional theories of industrial development and international trade be maintained as the framework of explaining these changes? To what extent, and what aspect of the phenomenon? If not, quoting Gerschenkron, "how can we know if we knew what we would know"? From a policy point of view, is the rise of these low-cost economies a threat? Under what conditions is it an opportunity? Is "industrial hollowing-out" a revelation or result of structural adjustment responding to the changes in economic environment? Or, is there something more fundamental? Is "the China Fear" in Japan and Korea justified, or exaggerated reaction from the losing businesses? What are the policy framework and options to make these changes an opportunity for further growth?

It is not sure how long Korea can maintain international competitiveness in her flagship exporting products such as textile, automobile and IT products. What we have found from the first-year research, though preliminary to make a clear conclusion and definitive interpretations, is that the basis of international competitiveness of the Korean exporting products is not so strong and Korea needs to find out new engines of growth. The challenges faced by today's Korean economy would be termed as, in need of better words, the transition from the catch-up model to a knowledge-based economy. What are the requirements for a successful transition?

In terms of productivity of the economy as a whole, Korea is far behind other OECD economies. Against the existing productivity gap, we have seen a worrying sign in Korea's investment trend. It is worth reminding that Korea has shown very high machinery and equipment (M&E) investment ratio in the past years, but recent years we have seen rapid decreases. Compared two period between 1993-1997 and 1998-2002, OECD economies on the average has increased M&E investment from 9.4% to 10.8%, in terms of percentage average as of GDP. In contrast, Korea has shown decreases from 13.8% to 11.2%, yet still above the OECD average. It is noticeable to see that US and Japan has increased their M&E investment. Concerning business R&D investment, OECD countries have shown increasing trend, and Korea as well.

What does the trend imply? Is it the sign that Korea is transforming her economy from input-driven economy to one that is knowledge based? There are lots of issues to be investigated more rigorously and in-detail. We will do further research this year. For a moment, I will show some of the first-year research results of KDI project and focus on two issues – to make innovation system more effective and the current status of SME.

Figure 1: Income and productivity levels of OECD countries, 2002
Percentage point differences with respect to the United States



Note: 1. Based on hours worked per capita. 2. GDP per hour worked.

Source: OECD, *Science, Technology and Industry Scoreboard*, 2003.

Figure 2-1: GDP per capita and GDP per hour worked (US = 100)

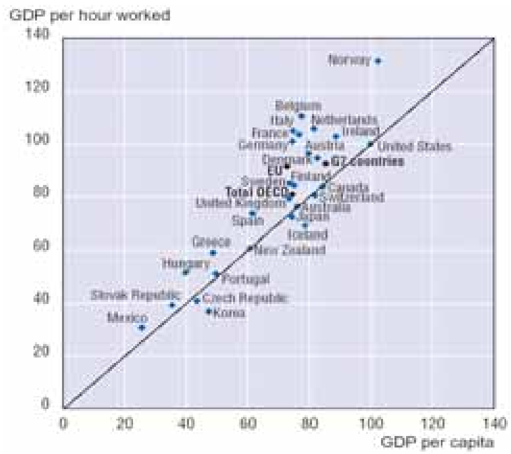
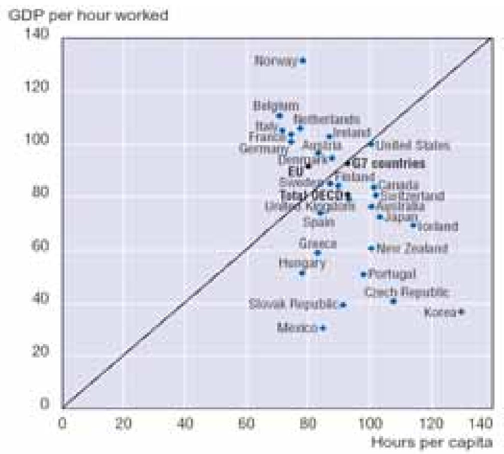


Figure 2-2: GDP per hour worked and hours per capita (US = 100)



Note: Total OECD excludes Poland and Turkey.

Source: OECD, *Science, Technology and Industry Scoreboard*, 2003.

Table 1: Investment Trend of OECD Countries

(Unit: period average, % as of GDP)

	Machinery and equipment		Business R&D	
	(1993-1997)	(1998-2002)	(1993-1997)	(1998-2002)
Korea	13.8	11.2	1.81	1.94
Sweden	8.9	11.4	2.50	3.03
Netherlands	9.3	10.8	1.05	1.10
Germany	8.2	9.5	1.52	1.71
Japan	12.6	13.5	1.95	2.14
USA	9.3	12.3	1.81	2.02
OECD average	9.4	10.8	1.16	1.34

Source: OECD.

2. Structural Changes in Korean Industry[1]

The Korean economy has experienced gradual changes in its industrial structure since the 1980s, where, as the industrialization process matured, the share of manufacturing became saturated while service sectors as a whole tended to take more portion in gross economic activities. The manufacturing sector has started to account for smaller shares in the late 1980s. However, its shares have recovered to the previous level after starting to increase in the second half of the 1990s: the manufacturing sector has shown the high growth rate since the mid-1990s. And productivity in the manufacturing sector has been greatly improved; particularly, high productivity increase is found in manufacturing firms that survived the financial crisis with successful restructuring.

Over the long-term period, the manufacturing sector maintained a stable level, whereas the service sector has been stagnant. Above all, productivity in the service industry is lower than that of manufacturing. In this regard, even though the service industry takes a larger share in terms of employment, its share is constant in terms of added value. This fact implies that enhancing productivity in the service sector is the crux of raising the overall economic growth rate.

Within the manufacturing industry, intervals of business scales widen both in inter- and intra-sectors. Its expanding gaps in inter-sectors are the most evident in inter-sectoral differences in terms of growth rate and total factor productivity (TFP) growth. The electronics and automobile sectors lead a large part of the growth rate of the manufacturing industry and TFP growth. Especially, these growth rates are ascribable to the rapid productivity increase mainly by large conglomerates since the 1990s. Furthermore, according to findings of productivity analysis of manufacturing by sub-sectors and by five groups of firm-scale, the higher growth rates are found in electronics and automobiles, with the larger share led by conglomerates. And these conglomerate firms make a higher contribution to the growth rate of productivity and increasing productivity. These analysis results show that large conglomerates are expected to maintain the leading role in the growth of the manufacturing industry for the time being. In contrast, except for the smallest firm-cohort with less than 10 employees, smaller firms show poor records in productivity growth. The productivity improvement of smaller firms is an important task for sustainable growth and improvement of the competitiveness in manufacturing in general.

The phenomenon of widening gaps among inter-sectors and inter-firms which we call bifurcation or polarization is also identified in the analysis of financial structure. According to the results analyzing financial stability and profitability from 1990 to 2002, while both total assets and tangible asset investments have been on a downwards trend since the financial crisis, the gaps widen between large conglomerates and SMEs. In addition to this deepening polarization, signs of a decrease in increasing rate of tangible assets give rise to apprehension in light of an expansion of growth potential. However, as KDI study noted in the chapter reviewing R & D activities of firms, we have found a positive sign of the possibility that the Korean economy is in the process of transforming into an innovation-driven economy as the number of technology-intensive SMEs dramatically increases after the financial crisis.

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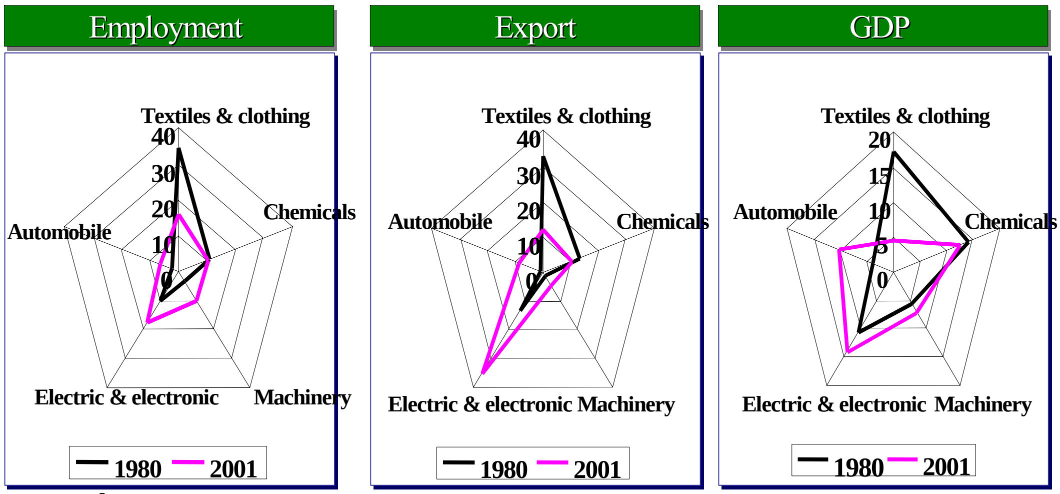
1 This section reports the findings of KDI project on Korea's industrial competitiveness. For more details, see KDI (2003).

Figure 3: Changes in Shares of Five Major Manufacturing Sectors



Productivity

We used the plant-level manufacturing survey data for 1984-2001 compiled by the National Statistical Office. The data were re-compiled according to the 29-sector classification system of the KDI Multi-Sector Model, and, for five major industries, the data were rearranged into sub-industries according to the supply chain in each industry. The plants were classified into five categories according to the number of workers, and the analysis was performed for three sub-periods; 1985-89, 1989-97 and 1998-2001. We estimated both single-factor productivity, such as labor productivity and capital productivity, and total factor productivity (TFP), which was estimated by both the growth accounting method and multi-lateral method.

(1) Labor Productivity: Huge gaps of labor productivity were observed among industries and among size groups. The basic metals and electronics industries showed high labor productivity while textiles and garments, metal products, precision instruments industries showed a low level. We could also find that larger plants recorded higher labor productivity for the entire period, and that the gaps are widening. Analysis on the growth rate of labor productivity also showed a similar pattern. Specifically, the electronics industry showed an overwhelmingly high growth rate, and machinery and transportation equipment industries showed comparably high growth rates, while textiles and garments, paper products and publishing, and metal products industries recorded extremely low growth rates. Overall growth rate has persistently risen, with an exceptionally low growth rate right after the economic crisis. Analysis on the growth rate of labor productivity by plant size reveals an important result. We found that, over the entire period, larger plants recorded higher growth rates. However, we found, in addition, that smaller plants showed higher growth rates in the first sub-period (1985-89), that this trend reversed in the second sub-period (1989-97), and that the gaps widened in the third sub-period (1998-2001) when productivity growth was led mostly by large firms.

(2) Capital Productivity: Capital productivity shows a relatively stable time-series, and the gaps among industries and among firm sizes are reducing, except for several industries. Capital productivity by plant size shows an "inverted U" shape, i.e., the plants with medium size show the highest capital productivity.

(3) Total Factor Productivity (TFP): Annual average growth rate of TFP for 1985-2001, computed by the growth accounting method, for the entire manufacturing sector was estimated to be 4.33 percent. It was estimated slightly higher than 4 percent until the late 1990s, but rose sharply up to 11.68 percent after the economic crisis. The food and beverage, textiles and garments, and precision instrument industries showed slow TFP growth for the entire period, while the electronics industry showed an extremely high TFP growth rate, high enough to lead the TFP growth of entire manufacturing sector. The machinery and transportation equipment industries, in addition to electronics industry, also recorded high TFP growth rates, and these industries recorded remarkably high TFP growth in late 1990s. Growth pattern of TFP by plant size shows a trend highly similar to that of labor productivity. That is, smaller firms revealed higher TFP growth rates in the first sub-period, but the trend reversed in the second sub-period, and the gaps widened in the third sub-period. Estimation by multilateral index method showed almost the same results.

In conclusion, it can be said that the growth and technological progress of the manufacturing sector has been led by the electronics and automobile industries, and, in particular, by the fast productivity growth of large firms in the 1990s. This can be explained by the fact that the shares of large firms are relatively big in the industries with fast productivity growth.

It is expected that the growth of the manufacturing sector led mostly by large firms will persist for the time being. At the same time, however, it is necessary to pay special attention to the increasing share of smallest firms and to the slow productivity growth of medium-size firms (with 100 to 300 workers), since it would be impossible to sustain a high growth rate and improved competitiveness in the manufacturing sector without sufficient productivity growth of small- and medium-size firms.

Figure 4: Labor Productivity by Industry and Firm-size

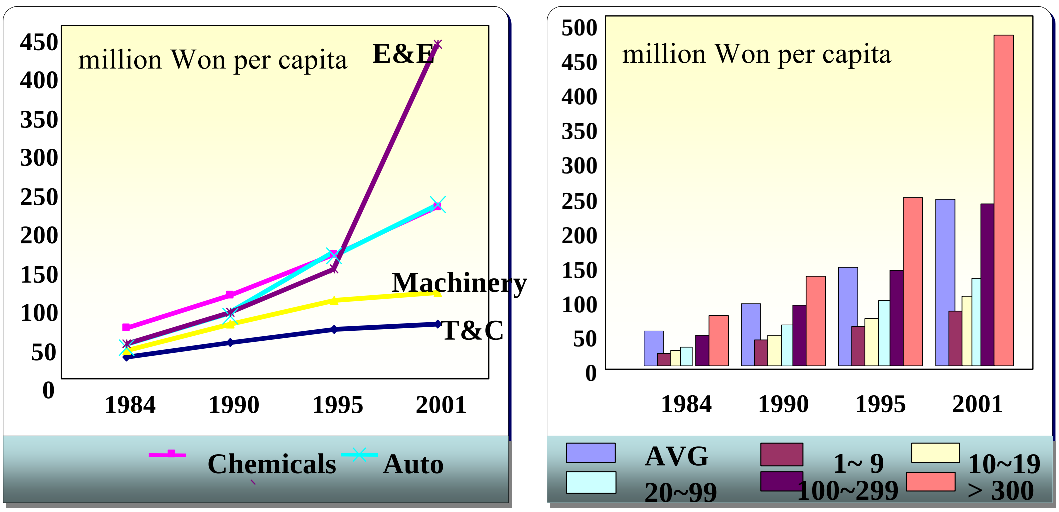
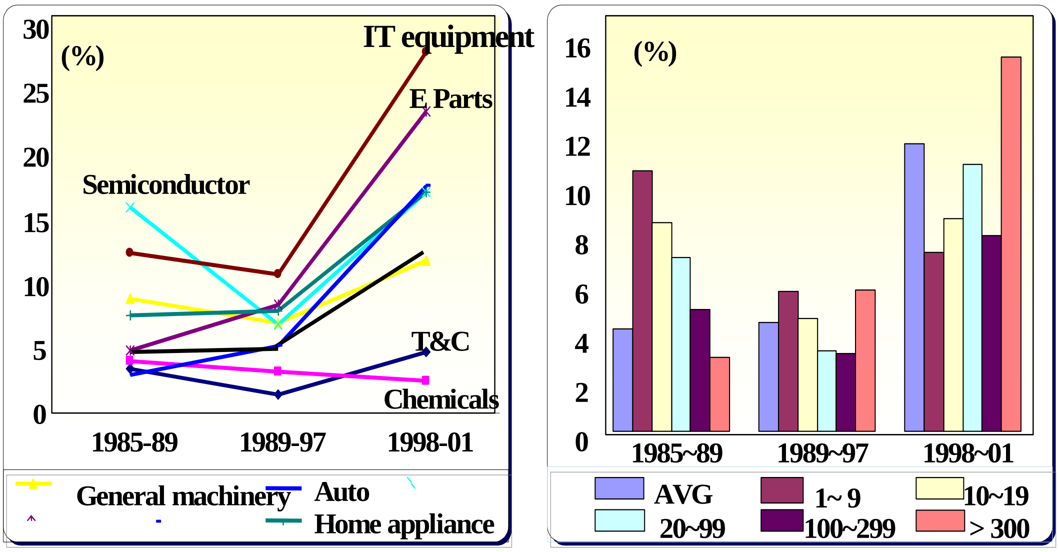


Figure 5: Total Factor Productivity Growth by Industry and Firm-size



Trade Performance

We analyzed the trade pattern of Korea through various indices such as market share, export similarity (ES) index, revealed comparative advantage (RCA) index, and trade specialization (TS) index at industry and sub-industry levels. The UN's trade data for the period 1992-2000 were used for this purpose, which, originally compiled by SITC, were re-compiled under the 29-sector classification system of the KDI Multi-Sector Model. The trade performance of Korea and the degree of competition among three countries - Korea, Japan and China - were evaluated by market shares and ES indices, while RCA and TS indices were used to analyze the current state of comparative advantage and the dynamics of trade pattern of the above three countries. In addition, we also analyzed intra-industry trade (IIT), i.e., the trade of "similar" goods, based on the UN's trade data for the period 1989-2002.

Estimation results clearly revealed the complementary and substitutive relations of the major industries among the above three countries. Korea recorded high export and market shares in IT equipment, semiconductors, textiles and apparel, and chemical products, while China in textiles and apparel and IT equipment's, and Japan in automobile, general machinery, IT equipment's and chemical products. In case of Korea and China, the shares of textiles and apparel were decreasing, while those of IT equipment's were increasing. Korea showed high and increasing export and market shares of semiconductors. On the other hand, Japan showed a relatively stable export structure, with high shares of automobiles, general machinery, electronics and chemical products. Japan's trade pattern revealed a comparative disadvantage in textiles and apparel, and electric appliances, while Korea in food products and beverages, precision and general machinery, and metal products, and China in automobiles, semiconductors, precision and general machinery, and chemical products.

All three countries showed high market shares and export similarity in the field of electronics, which seems to stem from the activities of the multinational companies that started establishing production bases in China since the 1990s and increasing exports. In recent years, China has overtaken Korea rapidly in the export of electronics (except semiconductors), and the competition between the two countries has also risen in the trade of precision instruments and metal products. Between Korea and Japan, export similarity in the field of automobiles was at the highest level, while competition between Japan and China was rising in shipbuilding as well as electronics.

Reviewing the TS indices, we could find that China was gaining competitiveness in almost every industry, that Japan was losing competitiveness in most industries except chemical products, and that Korea was enhancing competitiveness in more industries. China's competitiveness was improving in the trade of products with positive TSI such as electric appliances, miscellaneous manufactured products and metal products. In addition, IT equipment's, automobiles, and shipbuilding, previously net-imported (i.e., negative TSI), became net-exported, and the TSI's of chemical products, semiconductors, electronic components, general and precision machinery, and basic metals, though negative, have been improving recently. In case of Japan, on the other hand, only chemical products showed positive and improving TSI, while the TSI's of other products are falling. Korea's competitiveness was improving in the trade of metal products, electric appliances, automobiles and shipbuilding (goods with positive TSI) and of chemical products, petroleum and coal products, and electronic components (from negative to positive TSI). On the other hand, Korea was losing competitiveness in the trade of textiles and apparel, semiconductors, IT equipment's, and miscellaneous manufactured products (goods with positive but declining TSI) and of food and beverage, and basic metals (goods with declining negative TSI).

We performed the analysis of industrial competitiveness through IIT indices in addition to the study of inter-industry trade. Trade between Korea and Japan and between Korea and the US showed a pattern such that vertical IIT dominates horizontal IIT, which implied that Korea could produce and export "similar" products to the US or Japan, but with lower quality and price. We could not detect any evidence that the gaps were narrowing. On the other hand, we found increasing horizontal IIT between Korea and China, which implied that the quality and price of China's products were approaching those of Korea's. We also found that IIT with ASEAN, unlike IIT with China, was not increasing fast.

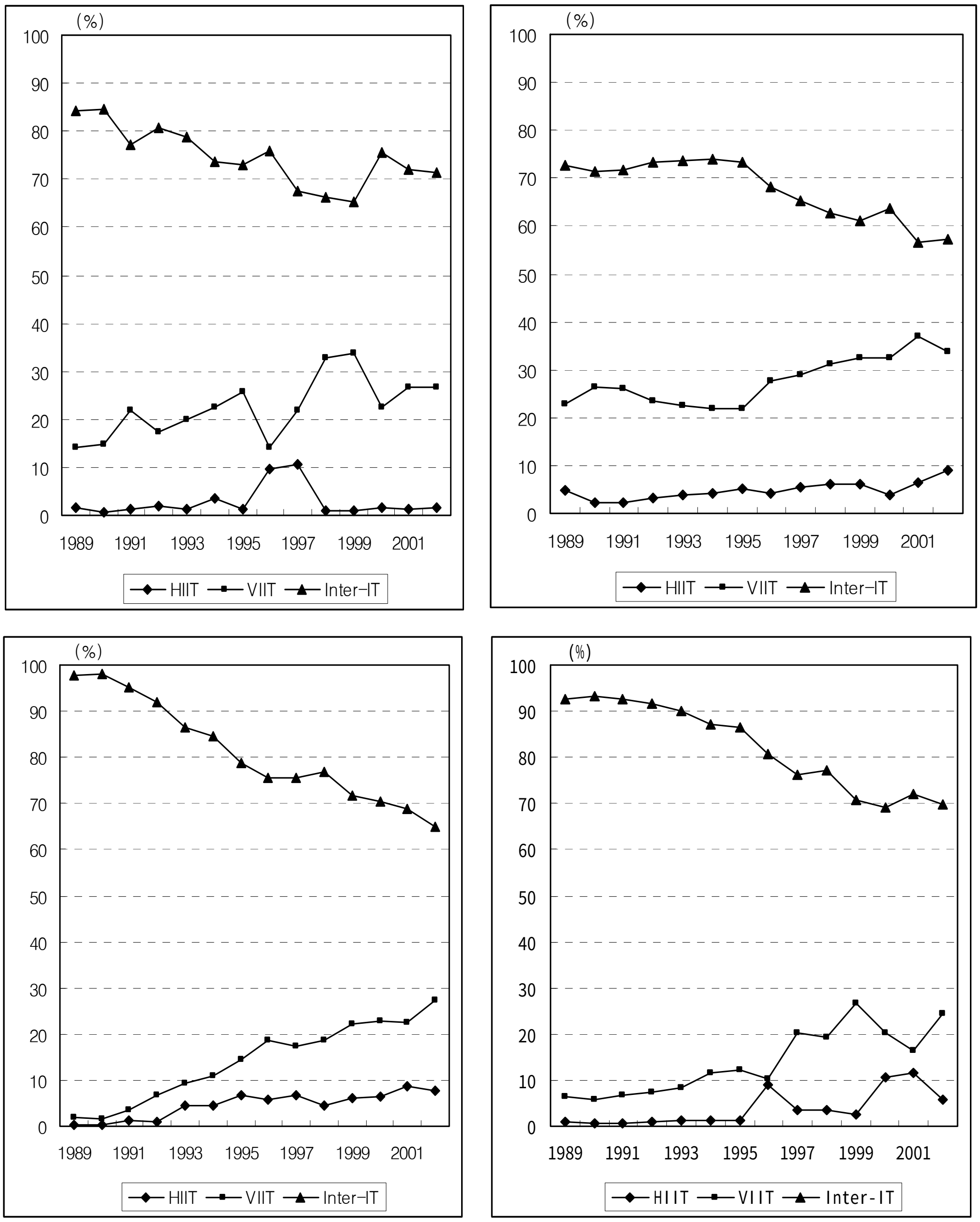
Table 2: Trade Specialization Pattern in East Asian Economies

	Korea	China	Japan
Group I	Automobile and parts, Shipbuilding, IT home appliances, Metal products	Textile & clothing, IT home appliances, Other manufacturing	Chemicals
Group II	Textile & clothing, Semiconductors, IT equipment, Other manufacturing	Food & beverage, Non-metallic mineral products	Automobile and parts, Shipbuilding, IT equipment, Electronic parts, Semiconductors, Machinery, Metal products
Group III	Chemicals, Petroleum & coal products, Electronic parts	IT equipment, Automobile and parts, Shipbuilding	IT home appliances
Group IV	General machinery, Precision instruments	Semiconductors, Electronic parts, Primary metal products, General machinery, Chemicals, Petroleum & coal products, Precision instruments	Food & beverage, Textile and clothing, Petroleum & coal products

Note: Group I = Highly competitive, TSI is positive and increasing,
Group II = Competitive, TSI is positive but decreasing,
Group III = New exporting industries, TSI changes from negative to positive,
Group IV = Weak industries, TSI has been negative.
Source: KDI, 2003.

Figure 6: Patterns of Intra-Industry Trade in Manufacturing Products

Korea-US Korea-Japan



Note: HIIT denotes horizontal inter-industry trade and VIIT denotes vertical inter-industry trade.
Source: KDI, 2003.

Profitability and Financial Performance

We analyzed financial performance measures for each categorized firm-size of major manufacturing industries with the data of National Information & Credit Evaluation Inc. over a thirteen year period (1990-2002). In the analysis, we investigate empirically not only the various financial performance measures but also the value-based performance measures, EVA (economic value added).

Major empirical findings for the thirteen-year period are as follows; First, The profitability of domestic manufacturing companies in general displays an improving trend after the 1997 financial crisis even though there were significant differences between large enterprises and SMEs (small and medium-sized enterprises). For instance, ordinary income to sales of large enterprise and SME were 2.4% and 0.2%, respectively between 1990-1997, and these trends continued after the financial crisis as well as for ordinary income to total assets and interest expenses and ordinary income to total assets.

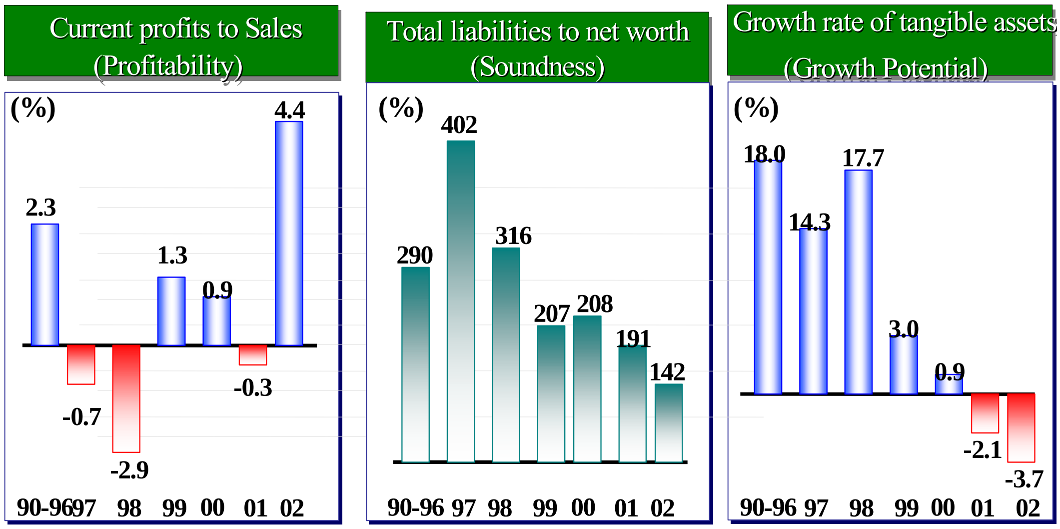
Second, the difference in the growth rate of sales between large enterprises and SMEs, one of the indicators concerning growth, became larger than those before the financial crisis. Especially, the growth rate of tangible assets of both of large enterprises and SMEs, which is the prior index of investment, has a declining trend after the financial crisis due to companies dormant facilities investment. Furthermore, the ratio of decline of SMEs is larger than that of large enterprises.

Third, the capital structure of companies was significantly improved. The debt-to-equity ratio fell to 213% during 1998-2002 compared to the 290% during 1990-1996. However, the average debt-to-equity ratio was 269% during the period of analysis. Meanwhile, their profitability gradually improved thanks to the decline in the cost of capital and results from the restructuring efforts.

EVA (economic value added) is a measure of a firm's profit after subtracting the cost of all capital employed. It is defined as operating profits after taxes minus cost of capital. The average growth ratio of EVA was 22.3% for 1991-1996 but was 1.8 trillion in 1998 that is almost -40% of the preceding year. However, after recording a fall in 2001 there was a remarkable increase (79.8p%) in 2002. Major empirical results of EVA for each industry recorded almost positive values that means firms produced economic value. But SMEs experienced significant declines after the financial crisis.

The conclusion to be drawn from this analysis is that the results are mixed. In other words, we could not find the financial performance characteristic in the major industry, meaning that firm size is more important than each industrial characteristic in producing financial performance. Korean manufacturing companies have shifted their economic management goals from being a growth-based strategy to inward building for profit following the financial crisis in 1997. Therefore, the difference of financial performance between the Korean firms and the advanced countries is gradually reducing. While the average debt-to-equity ratio of the companies was reduced, it was not led by the efforts of companies but mainly by the government's restructuring efforts and financial agents. Therefore, it is imperative that domestic companies sharpen their competitive edge so that they can produce stable profits regardless of outside situations with efficient and continuous investment and gradual reduction of the debt-to-equity ratio.

Figure 7: Financial Indicators



Foreign Direct Investment

Since 2000, Korea has experienced a sudden downturn in the amount of FDI (Foreign Direct Investment) inflow which has continued ever since. In addition, most of the FDI have been gravitated toward Seoul and Gyeonggi Province, and this gravitation has intensified even more since the crisis. The FDI into China, on the other hand, has reached a record high, making the gap between the growth rate of FDI amount into Korea and China bigger than ever.

According to the analysis performed to examine the effect of inbound FDI on productivity, the productivity of firms with FDI is higher than that of non FDI domestic firms with other things being equal. When the intra- and inter-industry productivity spillovers are examined, the coefficients of intra-industry and downstream industry FDI share are both found to be positive and significant. The backward productivity spillovers are especially bigger and more significant among all the variables, and are not affected by the model specification and share calculation method employed. The forward productivity spillover effect, on the contrary, appears to be unstable in terms of sign and significance. Depending on the model specification and share calculation method, it even appeared to be negative and significant in some cases. The existence of such effects, regardless of their direction, provide evidence on the public good aspects of FDI and thereby can be a rationale for governmental intervention in the course of attracting FDI.

In the case of outbound FDI, the size decreased drastically after the crisis, though lately it is showing some signs of recovery. While there has been sharp increase in the amount of outbound FDI into China, especially in the small and medium enterprise sector, it is uncertain whether this trend can last considering there is only a limited number of domestic firms that have capacity to penetrate Chinese market.

In general, FDI is known to raise productivity and to promote industrial restructuring through the transfer of advanced production and management technologies, not to mention increase in investment and employment. FDI would thereby raise the level of production and technological innovation in Korea.

While the world FDI market is also suffering from stagnation, there is a very high possibility that this market could revitalize in the near future. If it does, there will be a rapid expansion of M&A and strategic alliances among advanced countries and developing countries. Korea still possesses an advantage over China in terms of high value-added activities and industries. As long as we manage to innovate the strategy and propulsion system of attracting FDI, we can expect a turnaround that could take Korea out of recent stagnation in investment and the gravitation of FDI into China. This must be preceded by building a strategic FDI-attraction-system, improving the investment incentive system and M&A related laws and regulations, lifting the entry barrier of a national R&D system to FDI firms, etc.

Table 3: Korea's Foreign Direct Investment

(Unit: billion dollars)

	1997	1998	1999	2000	2001	2002
Inbound	7.0	8.9	15.5	15.2	11.3	9.1
	(117.6)	(27.0)	(75.6)	(1.0)	(-25.8)	(-19.4)
Outbound	5.9	5.8	5.1	5.9	6.3	6.2
	(-10.9)	(-2.0)	(-12.9)	(17.6)	(5.7)	(-1.4)

Note: Registration basis; numbers in parenthesis are year-on-year growth rates.
Source: Inbound FDI = MOCIE, outbound FDI = MOFE.

2.2 Competitiveness of Major Industries

Electronics

The Korean electronics industry is characterized as a dual structure or an unbalanced structure. It is comprised of large conglomerates that play a leading role both in domestic and global markets and the remaining groups of companies that are weak in their technological competence. Considering the electronics industry in general, competition with China is fierce in such sectors as computers and home appliances where price plays a key role in competitive advantage. The Chinese competition is relatively low in such sectors as memory chips particularly semiconductors and display units where non-price factors, for example technological leadership, are more important. Of particular interests is the dramatic increase of global market share by Chinese firms in communication equipment, rising as one of Koreas major competitors, presumably due to the roles of MNEs in China. The obstacles to further development of the electronics industry will be found in its dual structure, such as gaps between conglomerates and SMEs in both inter and intra-sectors. While leading conglomerates that have global business strategies can maintain their competitiveness through procurement of parts all over the world; the development of industries in general cannot be sustained without improving competitiveness of firms at a lower level. This conclusion implies that the government should make more efforts to rectify the dual structure, which indicates the importance of nurturing smaller technologically agile firms.

Automobile

The dual structure is found also in the automobile industry - the bifurcation of industry into the two groups of companies: final auto assemblers, led by conglomerates, and component suppliers made of SMEs at the lower level. While the final assembly sector is assessed to have a competitive advantage that enables them to penetrate into overseas markets, the persistent weaknesses of parts suppliers is expected to be a vulnerable element to the competitiveness of the automobile industry in general. Whilst modularization has become important in securing competitiveness in the parts industry, it is currently being implemented as a way of reducing costs for automobile components in order to compensate for wage differentials between final auto assemblers and parts suppliers. As R&D becomes the most critical strategic element in sharpening competitive edge, first-tier companies as well as many second and third-tier ones expand their R&D investment. Still, one of the biggest obstacles for the parts suppliers is the shortage of high-skilled labor in the production line due to their wage differentials compared to final assemblers. Owing to business restructuring after the financial crisis and the progress of market opening and the IT revolution, parent companies' global sourcing is strengthened. In this circumstance, conglomerates dealing with component suppliers have faced a turning point, changing from the previous vertical relationship. Competence of parts suppliers is weak in such areas as independent technological development, purchasing & sales, and capabilities of collecting information on global market trends, mostly relying on the parent companies. Whereas Chinese enterprises have higher price competitiveness, they lag behind Korea in terms of the level of technology, which delays the rise of Chinese firms as threatening competitors to Korean firms. However, building up firms' core competence requires accumulation of long-term experience. Taking into account that Korean parts makers do not have a considerably higher capability of developing technologies compared to Chinese firms, it is expected that Chinese firms would catch up to Korean firms in the near future. An upgrade in the quality of work force is needed to strengthen innovation capabilities and to expand the production capability of parts suppliers to the level where scale-economies is realized.

Machinery

The machinery industry faces a challenge to transform its current production system to one that is based on generic technologies, which enables to the production of differentiated products. In general Korea's machinery producers show dexterity in manufacturing and assembly, where company competitiveness originates. On the other hand, competitiveness is found to be low in the specialized machinery sector, which requires integration and application of new technology. This characteristic is largely due to the industrial structure of the machinery industry that is composed of, mostly, SMEs. The efficient and competitive production structure can be idealized as one where, when SMEs specialized in core parts and materials strongly support industrial base and conglomerates perform large-scale projects as well as lead the machinery industry. Ninety-eight percent of the Korean machinery industry is composed of SMEs based on the number of enterprises. As the majority of them are small scaled with the sales composition made mostly of single products, they lack sufficient competence to function as the bedrock of the machinery industry due to poor motivations for technology development. In contrast, big companies do not in general reach such stages as they can lead the development of the overall machinery industry, even though they achieved business rationalization through restructuring processes after the financial crisis. Therefore, a pressing task is to consolidate the system-base of the industry, a system where specialized firms are closely linked through supply chains and innovation networks. It is also urgent to improve technological capability in machinery design and generic technologies, where Korea has big gaps compared to advanced countries. To accomplish this task, it is necessary to promote the inward investment of foreign companies, who are leading the global industry, as well as reinforce industry-academia linkages.

Chemicals

The chemical industry includes such diverse industries as petrochemicals, fine chemicals, and rubber and plastic. While it is linked with a series of production chains, obvious differences are found in each sub-sector in terms of production structure, required technologies and others. While there has been a slight decrease in value of production, the amount of export, and share of value-added just after the financial crisis, the chemical industry has recently experienced a recovery trend and some products meet global standards in light of production scale. There are contrasts between capital-intensive industries as petrochemicals and rubber and plastic and technology-intensive fine chemicals. Whereas the petrochemical sector, led by large conglomerates, has an export to production ratio of over 40%, with a high comparative advantage index, the fine chemical sector mostly remains oriented toward domestic demands with a lower competitiveness index in the global market. In terms of productivity, the petrochemical industry generally attains a high level of productivity due to the high capital intensity, while that of the fine chemical industry is low. However, a high level of competitiveness does not necessarily relate to a higher level of productivity in petrochemicals compared to fine chemicals. Without adjustment of the excess facilities and R&D efforts for new products, its current competitiveness cannot be maintained. In the chemical industry in general, prerequisites for sustained growth are, among others, development of new businesses and innovation of production process. Especially, the industry in general should re-orient its growth strategy to explore new markets through the development of differentiated products thus changing the current strategy of focusing on standardized products. More large companies are to be induced to enter into the fine chemical sector which is currently comprised of mostly small companies, and thus playing a leading role in the development of the industry as a whole. In tandem, the government should make more efforts to rationalize the industrial structure by inducing autonomous restructuring of over-capacity in petrochemicals and enhancing cooperation between large firms and smaller firms.

Textiles and Garments

The textiles and garment industry has been gradually taking smaller shares since the 1980s. However, they still occupy a key position with 15% of total employment in the manufacturing sector as of 2001. They took larger shares in exports in spite of a slowdown in their exports with 13.9 billion dollars in the black in 2000. As domestic textiles and garment industries have tended to lose their competitive edge in general, the long-term trend of industrial decline is expected to continue. Considering the textiles and garment industries in general, recovering to the levels of their heydays is difficult to expect. Yet, the textiles and garments sectors still have potential for further development, with strategic specialization in the sectors of synthesis yarn and synthesis fabrics, where

Korea has a high degree of competitiveness and strengthening design and brand marketing which enables to climb up a higher ladder of quality. For instance, developing super-functional textile materials and their commercialization is important for preventing a radical decline in the domestic textiles industries, as well as upgrading industrial structures. Reactivating the fiber and textiles sectors requires a creation of demand in the garment industry. It is also essential to create a demand of apparel with fashionability and marketability. Furthermore, innovation of a distribution system in the garment industry is critical for overcoming limitations of market size and creating further demand. Additionally, an initial generation of market environment is also required for domestic textiles businesses to convert into various kinds of small lots through formulating a distribution network of fashion clothes with low and medium price levels.

3. China Factor

China is becoming a major player in the world economy. It has shown astonishing performances in economic and export growth. For the period from 1985 to 2002, the Chinese economy grew at an average annual rate of 8.9% and China's share of the world economy increased from 1.2% to 3.8% (Table 4). Meanwhile, China's share of world exports has rapidly increased from 1.3% in 1985 to 5.2% in 2002, which is equivalent to 15.1% average annual growth rate. China's export growth rate surpasses its two neighboring countries; during the same period, average growth rates of exports from Korea and Japan were 11.0% and 6.0%, respectively. China has also successfully diversified its export markets. In particular, China's penetration into US, Japan and EU markets, the most advanced ones in the world, is remarkable. In 1985, China's exports claimed only 1.1% of those three markets; but, in 1999, had 4.9% of the total.

Table 4: China in the World Economy

(Unit: billion dollars)

	1985			**2002**			**1985-2002 avg. annual growth %**	
	China	**World**	**China/ World %**	**China**	**World**	**China/ World %**	**China**	**World**
GDP	274	22,710	1.2	1,237	32,227	3.8	8.9	2.1
Exports	25	1,886	1.3	326	6,272	5.2	15.1	7.1

Note: GDP in constant terms; exports in current terms.

Source: UNCTAD, *World Investment Report*, 2003; WTO, *International Trade Statistics*, 2003.

Several factors explain China's rapid economic growth. Following Japan and other newly industrializing economies in East Asia, China adopted export-oriented development strategies. Backed by the country's large size, export markets enable China to realize economies of scale, one of the main sources of economic growth. In addition to these factors, which are frequently jointly referred to as the success factors of Asian economic growth, China's economic development process also has a unique aspect that is not all common to other Asian peers' earlier stages of economic development: that is its strong technological base. China's shift from technological nationalism to a more pragmatic strategy of developing national capabilities in conjunction with multinational corporations has also contributed to transform its economy.

China has transformed its economy on the foundation of a large science and technology base with technological capacities well beyond those of most developing countries (Kraemer and Dedrick, 2002). As part of its economic transition, China transformed its science and technology system to spur economic development. It did so partly by creating state-owned but market-oriented enterprises linked to commercializing the technologies developed in state-owned research institutions. For example, the four largest Chinese PC makers—Legend, Founder, Stone, and Great Wall—emerged from this background. The growth of indigenous firms with high technological competence even in earlier stages of economic development distinguishes China's economic development process from that of other Asian peers.

Conventionally, the process of economic development in developing or less developed countries is postulated on a linear model. Industrialization starts in technologically less demanding low-skilled industries; in the meantime, through experiences in low-skilled production, the economy and indigenous firms accumulate technological capabilities; and, then at the later stages of development, the economy and firms enter into technologically more demanding high-tech industries. The industrialization processes in Japan and in Asia's newly industrializing economies such as Korea and Taiwan were in most cases not exceptional to the linear stage model. But, in contrast, taking a cross-section of China's industrial composition, however, observers would find that almost every industrial sector exists in significant scale. Leapfrogging, particularly in high-tech industries, is taking place in China's economy. (See Box 1 for an example on China's communications equipment industry) China's computer industry and communications sector are good examples to show how a late-industrializing economy would take advantage of new technological opportunities through the interplay of the government and markets.

Box 1 The Growth of China's Communications Equipment Industry

While most countries, including Taiwan, presently are deciding to postpone the actual introduction of the 3G mobile telecommunications service, Mainland China is endeavoring to developits own 3G system. The key to this daunting venture into new technology-based industry is the government's initiatives to promote the mobile Internet through a low tariff policy, to give opportunities for growth for indigenous companies, and to induce foreign investment. Three Chinese companies, DATANG Telecom, Huawei Technologies, and Chungxing, are concentrating on the development of relevant facilities such as base stations, and other mobile handset producers, including PTIC, Wavecom, Eastcom, and Chungxing, are working to upgrade their technologies in developing the 3G mobile handsets. MIC forecasts that by 2005, China will become the biggest market and production base for mobile communications, with the number of mobile telephony subscribers forecast to reach 245 million in 2005 from 117 million in 2001.

Source: http//www.ntc.no:8080/files/ntc/rapporter/taiwaninternet.doc.

Box 2: Huawei (華爲) Technologies Co. Ltd.

Established in 1988 by an army wireless communication engineer, Huawei Technologies is a high-tech enterprise that specializes in research and development, production and marketing of communications equipment. Taking 40% share in the Chinese market. Huawei's competitive strength is to produce high-tech products with lower costs, which enables it to compete with foreign suppliers both in domestic and overseas markets. It has succeeded in wining the competition in supplying communication equipment projects in Vietnam, Thailand, Indonesia, South Korea and Brazil. Sixty percent of its 16,000 workers hold MA degrees, and more than 2,000 are Ph.D.s. Huawei spends more than 10% of its sales in research and development – US$342 million in 2001. With a headquarters in Shenzhen, Huawei has 11 R&D centers, among which are five overseas research institutes in Silicon Valley, Texas, Stockholm, Bangalore, and Moscow. It has numerous collaborative R&D projects with domestic and US universities. With its state-of-art design technologies, Huawei designs ASIC in-house and out-sources production to a US foundry company on an OEM basis.

Source: A. Kuroda, *Made in China*, tr. Park Jung Dong, 2002, p. 38 and http://www.huawei.com.

Impacts of China's development on East Asian trade structure

Overall, the rapid expansion of the Chinese economy creates a new growth opportunity for the East Asian countries and the world. As is shown in Table 4, the scale of China's economy has grown 4.5 times from 1985 to 2002; and China's entry into the WTO creates additional momentum for her trading partners for a bigger market with eased trade barriers. The question is, then, who will benefit relatively more from China's development. The answer is not straightforward, since the effect of increased trade depends on several factors.

The following figures show China's trade specialization pattern and the comparative advantages of China and her trading partners in Asia. Index for comparative advantages of international trade is calculated; and the manufacturing industry is disaggregated into 22 sub-sectors, and these sub-sectors are classified into four groups according to OECD standard of R&D intensities.[2] The KDI study of trade specialization patterns and comparative advantages of China and her trading partners in Asia, changes in China's trade specialization pattern are more apparent in bilateral trade with some Asian countries.

- With ASEAN:
  In high-tech industries, China has comparative advantages in precision instruments, pharmaceuticals. In all mid-high tech industries, China has

[2] CTB in the figures represents for contributions to trade balances that are calculated by OECD method in percentage of manufacturing total. Positive CTB means structural surplus or comparative advantage; whereas negative CTB structural deficit or comparative disadvantage. For industry classification according to R&D intensity and the method to calculate comparative advantage, see OECD, Science, Technology and Industry Scoreboard, 2001.

comparative advantages. China has structural surplus in most of mid-low tech industries except petroleum refining and rubber and plastic. In low-tech industries, China has comparative advantages in paper and textile.

- With Korea:

  Trade between China and Korea had begun in full scale in 1991 when two countries restored diplomatic relationships. It is very interesting to notice that in high-tech industries China has comparative advantages except communications equipment including semiconductor, though the margin is narrow. In mid-high tech industries, China has comparative advantage in electrical machinery including home electronics; and, Korea shows comparative advantages in the remaining mid-high tech industries. In mid-low tech industries, Korea has strong comparative advantages in rubber & plastic and petroleum-refining; and, expect these two, China has comparative advantages. In low-tech industries, China has comparative advantages expect food.

- With Japan:

  China's trade with Japan shows very stable specialization patterns in high tech and mid-high tech industries, where Japan has mostly strong comparative advantages. In contrast, in mid-low tech industries China is gaining her comparative advantages; and, in low-tech industries, China has comparative advantages except food.

<<<Figure 8>>>

China's international trade shows an overall specialization pattern that is strong structural surplus in low-tech industries whereas structural deficits in the remaining manufacturing industries. But it is noteworthy that China's pattern of trade specialization is changing rapidly. For example, computer and office equipment in the high-tech sector and electrical machinery in the medium-high tech sector are rapidly changing from structural deficit to structural surplus.

China's changing pattern of trade specialization exemplifies how comparative advantages can be *created*. The rise of China's computer and communications equipment industries, as illustrated above, is a case in point. Coupled with the strategies of multinational corporations to capitalize on the growth potential of a country with a population of 1.2 billion, the Chinese government has introduced deliberate industrial policies to commercialize strong technological base. Indigenous firms are growing and accumulating technological capabilities that are comparable to those of foreign competitors. Technologically dynamic firms such as Huawei, (Box 2), are not prevalent in most developing countries; but, in fact, numerous Huawei's are growing in China. These factors interacting with others not mentioned here give positive feedback in the form of high economic growth and enhanced international comparative advantage.

China's trade relationships with other Asian economies show where its economy is moving. Currently, China's economy has strong comparative advantages in low-tech industries; but, at the same time, it is gaining comparative advantage in more technology-intensive sectors. Already, China has strong comparative advantages over ASEAN in some high-tech and most mid-high tech industries. China even shows comparative advantages over Korea in some high-tech industries, albeit with a small margin. But with

Japan, there exists wide gap in high-tech and mid-high tech industries. Therefore, it is to be expected that competition between China and ASEAN and Korea will intensify in the near future; but China will not be an immediate threat to Japan in world markets for high- and mid-high tech products.

Prospects for the International Division of Labor between China and other Asian Economies

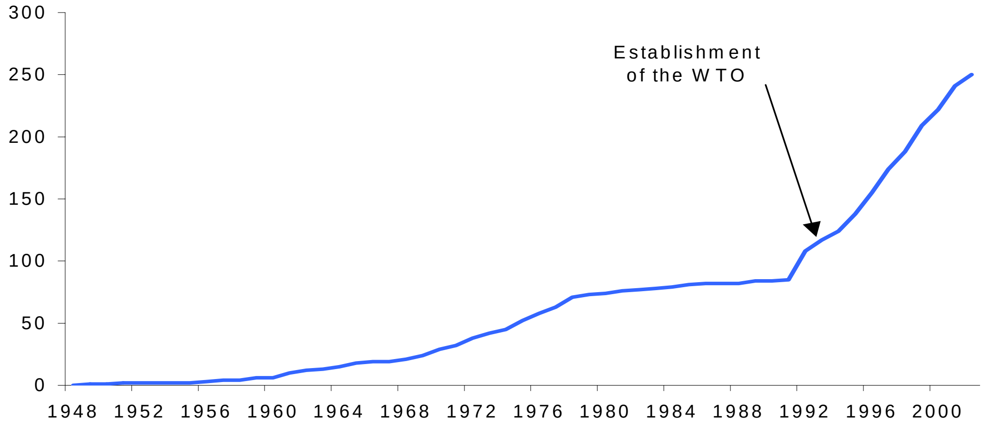
In discussing international division of labor in Asia, the flying geese model has gained wide audiences not only in academia but also in policy circles. The model was coined by Kaname Akamatsu in the 1930s and more rigorously developed by Kiyoshi Kojima later in the 1960s. Explaining the catching-up process of industrialization in latecomer economies, Kojima's model is based on two assumptions: (a) An economy's industrial structure is diversified and upgraded in a sequence from labor-intensive industries to capital-intensive industries and further to more capital-and knowledge-intensive industries. (b) The flying geese pattern of industrialization is transmitted through FDI from the lead country to follower countries according to industrialization stage or per capita income level.

As Kojima (2002) acknowledged, the sequential process of industrialization characterized as the flying geese model does not fit the current status of the East Asian economies. First, Japan, as a lead country, has so far been unsuccessful in establishing a big new industrial sector needed to enlarge the scope of the regional division of labor. Second, in the 1980s, the Asian NIEs and some ASEAN countries (Thailand and Malaysia) graduated from the catching-up phase and became sub-leaders in exports and FDI to other Asian economies, and went ahead of Japan in certain other activities. The regional transmission of development in a manner consistent with the model has thus developed dual or triple paths. Third, since the 1990s, China became the largest Asian recipient of FDI and this contributed to the development of many technology-intensive industries. China's economic development does not fit well to the model in that its economy has leapfrogged in some technology-intensive sectors.

Accordingly, the international division of labor in the East Asia, and particularly that between China and other Asian economies, will be more diverse and different from the past. It will not be a sequential movement or a vertical division of labor as in the past; rather, the future shape of the international division of labor in East Asia will be more complicated, with multiple relationships between economies. Several factors will affect the shape of the international division of labor; some of significant importance will be briefly discussed in the following.

First, globalization with regionalism: The world economy is being rapidly integrated in various ways. Backed by the liberalization movements where GATT and WTO had made great efforts, international trade and foreign direct investment have rapidly increased. In addition to these traditional mediators of globalization, mergers and acquisitions are also proceeding internationally on an unprecedented scale. Literally, globalization is proceeding in full scale. Along with the globalization trend, however, there also happen international movements to integrate economies on a regional basis, particularly since the mid-1990s. According to Boonekamp (2002), the number of regional trade agreements (RTA) notified to the WTO has rapidly increased and accelerated during the 1990s. For example, the 125 regional free trade zones agreed since the WTO system was established in 1992, is the same as the total number of cases agreed during the entire life of the GATT system since 1948 (Figure 9). Regionalism alongside globalization is indeed becoming a new trend in the world economy; and, the new trend gives a hint to the future shape of the international division of labor in the East Asian region.

Figure 9: Cumulative Number of RTAs notified to the GATT/WTO , 1948-2002



Source: Boonekamp (2002).

Second, increasing importance of developing countries in the world economy and regional economic integration: As many developing countries adopted export-led development strategies since the 1980s, not only has the volume of world trade increased rapidly but also the share of developing countries in world manufacturing product trade has greatly expanded. For example, for the period between 1980 and 1998, those developing countries that pursued export-led growth strategies realized about 5% average annual economic growth rates, which is far higher than the 2% rates achieved by advanced countries. And, the share of manufacturing products in developing countries' trade increased from less than 25% in 1980 to more than 80% in 1998. The successful industrialization of developing countries and their increased share in world trade imply that the role of developing countries in the world economy will be more important than in the past and that international trade relationships will be more diversified. As, in the East Asian region, China and the first and the second tier NIEs will play a more important role in trade and investment than before, while Japan's role as a lead country will be diminished.

Third, as economic activities of multinational corporations (MNC) are taking a larger share in the world economy (Table 5), the global strategies of MNCs in their choice of content and location of foreign investment are becoming more crucial in the economic development of host countries. UNCTAD reports that as of 2000 there are about 60,000 MNCs with 800,000 foreign affiliates and the number of MNCs coming from developing countries is increasing. In the freer trade and investment environment of today's world, countries are competing to attract more FDI and MNCs; and they are competing in creating more favorable conditions for this.

Table 5: Multinational Corporations' Activities in the World Economy

	1982		1990		2002	
	US$ billions	**% world GDP**	**US$ billions**	**% world GDP**	**US$ billions**	**% world GDP**
MNC foreign affiliates						
Sales	2,737	25.3	5,675	26.2	17,685	54.8
Value added	640	5.9	1,458	6.7	3,437	10.6
Exports	722	6.7	1,197	5.5	2,613	8.1
World GDP	10,805	100.0	21,672	100.0	32,227	100.0

Source: UNCTAD, World Investment Report, 2003

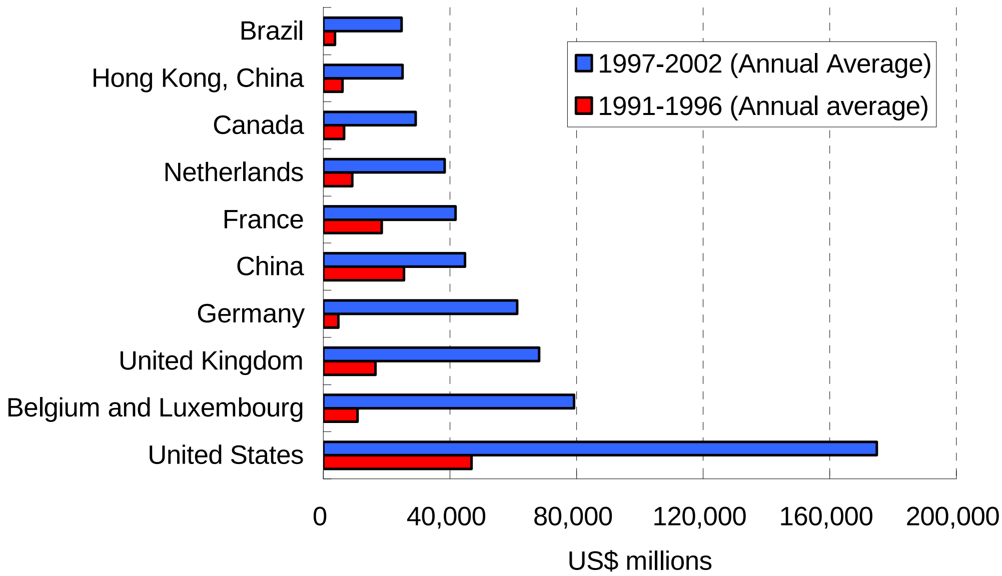
Despite the increasing role of developing countries in the world economy, the flows of FDI are concentrated on advanced countries and a handful of developing countries. During the period between 1990 and 2002, world FDI grew 9.5% on an annual average rate, which is far higher than the rates of world GDP growth (3.3 %) and world exports growth (5.0%) (Table 6). But the destinations of FDI are mostly confined to advanced countries (Figure 6): China is the only developing country among the top 10 recipient countries during the period between 1991 and 2002. According to the *World Investment Report*, 79% of US$1,271 billion world FDI flows into advanced countries and 91% of FDI comes from advanced countries.

Table 6: Trade and Investment in the World Economy

	Value (in current $US billion)		Average Annual Growth Rate (%)
	1990	**2002**	**1990-2002**
FDI inflows	209	651	9.5
FDI stock	1,954	7,123	10.8
International M&A	151	370	7.5
World GDP	21,672	32,227	3.3
World Exports	3,442	6,272	5.0

Source: UNCTAD, *World Investment Report*, 2001; 2003; WTO, I*nternational Trade Statistics, 2003.*

Figure 10: Top 10 FDI Recipient Countries



Source: UNCTAD, World Investment Report, 2003.

China is expected to become the manufacturing base of the world economy. China's industrialization will continue for the foreseeable future, and the pace of China's industrialization will be dependent upon, among other things, its success in reforming to a more market-oriented economic structure. China's rapid growth will in general give new growth opportunities for other countries; but there will be keen competition over the Chinese and world markets. In the process, the Asian economies will experience a structural adjustment much different from the past. In the past, as the flying geese model tells, upgrading of industrial structures of the Asian economies occurred sequentially and vertically. But as China is leapfrogging in its industrialization process, the industrial restructuring in the Asian economies will proceed across almost all industrial sectors. In sum, *intra-industrial restructuring* across the Asian economies will be prevalent.

The future shape of the international division of labor in the East Asian region will be more complicated that in the past. Any single country will not be able to dominate in an industry; rather, many firms of different nationalities will compete in the varied segments of a product market. Over the course, many more Asian firms will go multinational following their Japanese predecessors.[3] Those MNCs will play a mediator role in promoting economic integration in the East Asian region. MNCs will relocate according to the strategic value of the host countries, so the challenge for national governments will be to create a more business-friendly, market-oriented socio-economic environment.

[3] UNCTAD (2001) reports that among the largest 50 MNCs from developing economies 33 are from the East Asia—10 from Hong Kong, 9 from Korea, 7 from Singapore, 4 from Malaysia, 2 from Taiwan, and 1 from Philippines

4. Korea's Innovation System

4.1 The Evolutionary Process[4]

Although Korea, as a late-industrialising country, has depended heavily on foreign technologies, it has also made efforts to accumulate technological capabilities. At the initial launch of its economy-wide economic development plan, Korea was poorly endowed with factors necessary for industrialisation except for a plentiful labour force. Furthermore, the technological competence of Korean firms was far below world standards. Consequently, it was inevitable or natural to look toward foreign sources for technologies. After the industrialisation process launched in 1962, there was remarkable growth in imports of foreign. The process of technological capability building in Korea is characterised as a dynamic process of the interplay between imported technologies and indigenous R&D efforts.

Reviewing the process of industrialisation since the 1960s, there appears a general pattern of technological development across industries with some industry-specific variations. Table 7 presents the pattern in Korea's machinery industry. The table shows that technology transfer and in-house R&D are two principal modes of building technological capability in the machinery sector and other industries in general.

During the early stages of industrialisation, technologies are imported in packaged forms. Turn-key based plant imports were most common during those years, and assembling technologies were imported for the purpose of knock-down production and/or OEM. Then, afterwards, self-sufficiency in technology was enthusiastically pursued, although it was not achieved in a short period. Localisation of some technologies was one of the main goals both for government and private firms. In this period, imported technologies changed to un-packaged ones and the importation of operation technology increased in order to enhance productivity. After achieving, to some extent, the goal of promoting self-reliant technologies, the next step was to get Korean products into world markets. In order to do this, it was necessary to expand domestic markets. In this period, imported technologies were relatively more sophisticated and advanced, involving material-related technologies and control and design technologies. Throughout all periods, the ratio of OEM to own brand name (OBN) has steadily decreased.

Table 7: The technological capability building process in Korea's machinery sector

	The process of development	*Technology imports*	*Production and R&D*
1960s – 1970s	Policy goal: establishment of production base Characteristics: heavy dependence on imported technologies	Packaged technology: turn-key based plants Assembling technology	Knock-down type production system OEM-dominated Almost no in-house R&D
	Policy goal: promotion of	Unpackaged technology:	OEM/own brand:

[4] For more detailed discussion on Korea's innovation system, see Suh (2000).

Early 1980s	self-reliance Characteristics: Import-substitution, Localisation of parts/components Production	parts/components-related technology Operation technology	high ratio Product development In-house R&D begons
Late 1980s – 1990s	Policy goal: export-promotion by Means of expansion of Domestic market Characteristics: beginning of plant Exports, learning advanced and core technologies	Materials-related technology Control technology Design technology High-quality product tech.	OEM/own brand: low ratio Product innovation Process improvement

The pattern of technology transfer differs slightly across industries, particularly in the early years. Unit production industries, such as shipbuilding and machinery, relied mainly on formal transfer in the form of licensing and consultancy for the initial erection of production facilities and product design. Mass production industries, such as electronics and automobiles, also depended on formal transfer but to lesser extent. Instead, more emphasis was placed on engineering efforts for implementation. Continuous process industries, such as chemicals, cement, paper, and steel, were established on a turn-key basis.

Since the early stages and throughout the 1970s and 1980s, technology imports prevailed, and are still an important source of technological innovation. Recently, however, the outsourcing of foreign technologies has become more sophisticated, and the modes of technology transfer have become diversified and complex. Exchanges or alliances, for the mutual benefit of both parties, are beginning to take the place of unilateral technology imports. Furthermore, interest in foreign technologies is shifting towards more high-tech areas and/or design technologies, and the scope of foreign partners has widened considerably.

The growth of R&D activities in the private sector shows a similar pattern. During the earlier period of industrialisation, systematic in-house R&D efforts were hard to find out. It was not until the 1980s that Korean firms endeavoured to build in-house technological capability by institutionalising R&D activities. In the early 1980s, the R&D activities of private firms focused on the adaptation and assimilation of imported technologies. Product development was the main feature of R&D in those years. Since then, with a base of accumulated experiences and knowledge, a number of firms in some specific industries have been able to make some product innovations. Throughout these years, efforts to improve the production process have continued.

The pattern outlined above is clearly illustrated in Figure 11, which plots the trend of the relationship between technology imports noted as payment for foreign technology licensing fees and indigenous R&D efforts noted in terms of R&D expenditures over industrial production from 1976 to 2002. The trend changed substantially over the years.

Indigenous R&D efforts remained at an insignificant level until the early 1980s, but since then R&D intensities have increased considerably. Consequently, the overall relationships between imported technologies and indigenous R&D efforts have changed from substitution to being complementary. Figure 5 shows that the trend of relationships changed around 1982. The turning is not accidental; this year marks the launch of NRDP, when private enterprises began to establish in-house R&D laboratories.

<<<Figure 11>>>

The changing relationship between royalty payments and R&D originated mainly from two sources: increased R&D efforts in the private sector, and governmental policy changes. Throughout the 1980s TI increased steadily and maintained its pace. At the same time, however, systematic in-house R&D efforts in the private sector have begun to prevail. Underlying this change, three driving forces, inter alia, have been influential. First, as the Korean economy moved to technology-intensive industries, foreign sourcing of technology could not meet the required technological standards. As foreign firms become more reluctant to release their technologies, it becomes harder to acquire advanced technologies by depending solely on the conventional means of technology imports. Second, the cost advantage of cheap skilled labor was exhausted after the early 1980s. Therefore, Korean firms felt the need to develop their own technological capabilities.

Underlying the changing relationships, both the private sector and the government have made concerted efforts to develop technological capabilities. First, there has been a fundamental shift in business strategy. In earlier years, international competitiveness relied mostly on such cost factors as low wages and scale economies based on mass production. And as imported technologies were of a kind that required simple assimilation and adaptation, there was no need to organise R&D activities. In later years, in contrast, as the cost advantage of cheap skilled labour was exhausted and the economic structure was transformed into more technology-intensive sectors, there was a pressing need for institutionalised R&D activities. The private sector met this need by establishing in-house R&D laboratories. Accordingly, the pattern of international technology transfer has changed substantially, towards more sophisticated and complex forms.

In accordance with the stages of economic development, the Korean government has successively changed the orientation of S&T policy. In the earlier years, more emphasis was put on building the infrastructure for technological development, whereas in later years the emphasis shifted towards more specific targeted technological development. In the early years of launching full-scale economic development plans, the Korean government recognised very clearly that science and technology would play important roles in the coming years. In the 1960s, two noteworthy policy measures were initiated in this regard: the establishment of KIST (1966) and of MOST (1967). These two institutions, together with KAIS, which was established in 1971, have exerted powerful influences over the S&T community in Korea. MOST has been the main designer of Korea's overall S&T policy; KIST has played the role of technological functionary in responding to industrial demands for rapid economic growth; and, KAIS (later KAIST) first implemented the concept of the research-oriented university into the Korean higher education system. Subsequently, several important policies have been successively enacted; among others, the establishment of specialized GRIs since the 1970s, and, since the early 1980s, full-scale national R&D programmes.

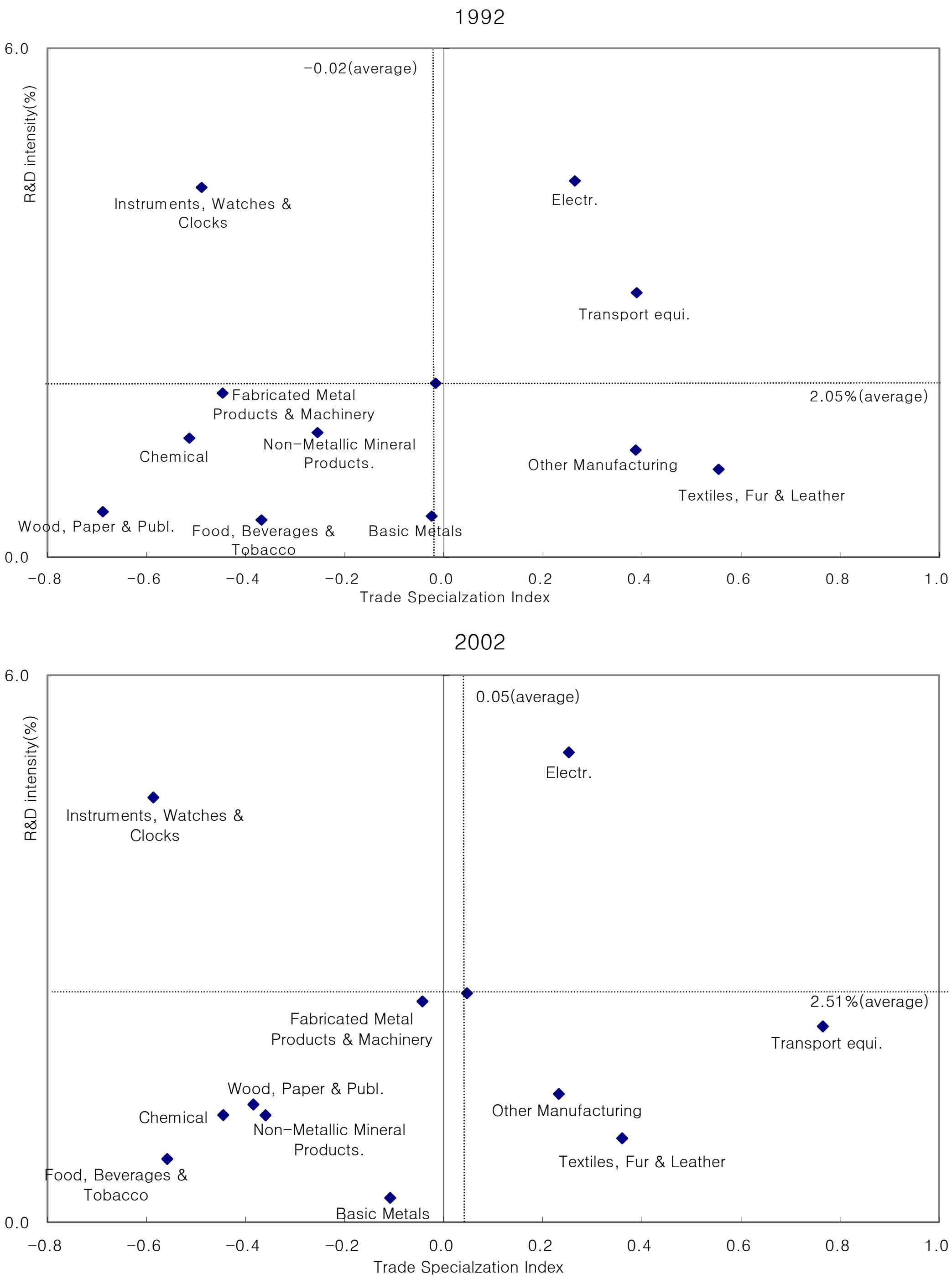
The process of building technological capability is best considered from the aspect of the choice of technology. The fact that most imported technologies are in a mature stage of development shows that products are already standardized in the world market. Moreover, in order to compete with foreign firms in world markets, i.e. produce standardized products without having technological superiority, cost advantage has to be achieved by economies of scale. Consequently, technologies that render economies of scale in production have been preferred. Large plants in petro-chemicals, semi-conductors, shipbuilding, steel, and the automotive industry exemplify the choice of technologies of this kind. Most of these industries demonstrate economies of scale in production as well as large plant size. In looking at industrial linkages, Korean industries in general show vulnerable backward and forward linkages when starting a new venture. For instance, when the semi-conductor industry was launched, there were neither adequate backward linkages to the equipment and raw materials sector nor forward linkages to the computer sector. The strategy of development for both government and private firms has been to assume that such lacked elements as components and raw materials will come from foreign sources. Combining imported technologies with cheap labor in the earlier period and fully exploiting human factors in the later period has enabled Korean firms to compete in foreign markets. In general, Korean firms have shown adroit movement in the operation of imported plants and the absorption of imported technologies. The choice for big technology is also closely related to the government's aggressive export-promotion policy and to large firm oriented industrial policy.

R&D Activities and Industrial Competitiveness

Korea's industrial R&D spending is highly concentrated within a small number of industries. ICT sectors (communications equipment, semiconductors, computers, and electrical and electronic products) account for 57.6% of the total manufacturing R&D expenditure, followed by the automotive sector (19.6%), chemicals (9.8%), machinery (3.9%), and iron and steel (3.8%). All of these industries, except for chemicals and machinery, make a positive contribution to the trade balance. Furthermore, Korea is one of the major exporters of high-tech products, although the value content of Korea's exports, including high-tech products, is still low. For instance, Korea's up-market share in EU-15 countries is below the OECD average, while its down-market share is one of the highest, exceeded only by that of Turkey, the Czech Republic, and Poland.[5] Korean industries, despite their high R&D intensity, have not yet been successful in harnessing R&D potential to added value in their products.

[5] For more information, see OECD *STI Scoreboard* 1999.

Figure 12: R&D intensity and TSI in Korean Manufacturing Sectors



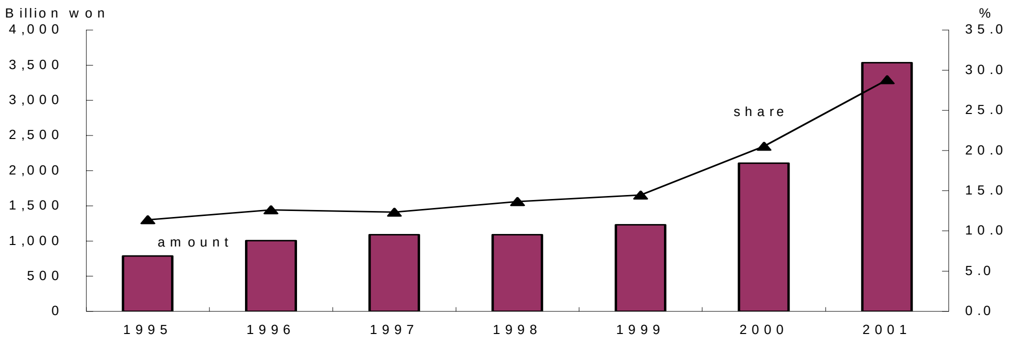
4.2 Changes since the Financial Crisis[6]

Business R&D Activities

In the past years, large firms played a leading role in industrial R&D activities. Since the early 1980s, private enterprises began to establish in-house R&D centers, and large firms established most of them at that time. For example, the *Directory of Korean Technology Centers* published by Korea Industrial Research Institutes in 1985 listed 141 industrial R&D centers, out of which only 15 centers belonged to SMEs. Another characteristic of industrial R&D activities in past years is their mostly adaptive nature. This was mainly because R&D activities were to assist the production of mature products. Technologies invented elsewhere were transferred by licensing contracts or other means of technology transfer, and adapting those transferred technologies to the requirements of the production process was the major goal of industrial R&D activities.

The trend has changed, particularly since the financial crisis in 1997. As shown in Figure 13 although SMEs are still responsible than less than one third of total R&D expenditures, their spending is increasing more rapidly than that of large enterprises (LEs), which results in an increase in SMEs' share. During the period 1995 and 2000, SMEs' share of total industrial R&D expenditures has doubled. Do the increased R&D spending by SMEs and their increased R&D share imply that SMEs' role in industrial innovation activities is also increasing.

Figure 13: R&D Expenditure by SMEs and its Share of Total R&D Expenditure



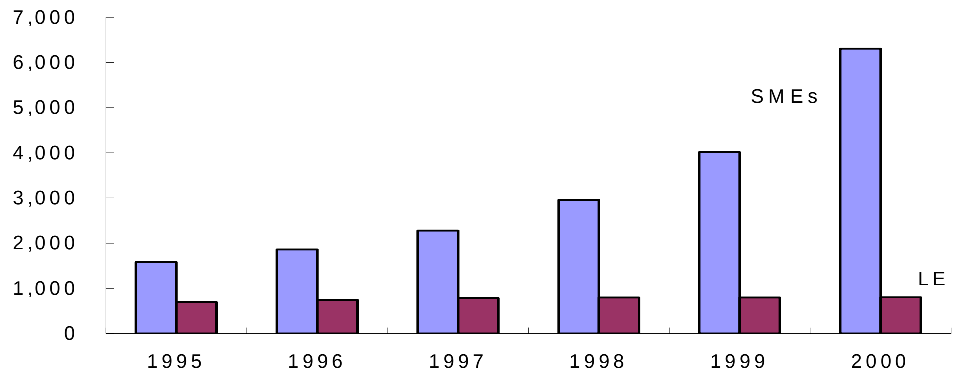
Source: Ministry of Science & Technology, *Report on the Survey of Research and Development in Science and Technology*, each year.

The financial crisis in 1997 and the restructuring efforts afterwards had an unexpected effect on Korean business. Profitability came to be recognized as more important than market expansion. Firms' spending for technological development is no exception. Companies, particularly large firms, have endeavored to downsize and streamline their R&D laboratories in line with business restructuring. Downsizing s forced many R&D personnel to leave large firms; and many of these displaced professionals have

[6] This section is based on Suh (2003).

established small-scale, specialized R&D laboratories or technology-based small firms. As shown in Figure 14, the number of corporate R&D centers increased very rapidly since the financial crisis, and most of the newly established corporate R&D centers are small in size.[7]

Figure 14: Number of Corporate R&D Centers



Source: Korea Industrial Technology Association

The increasing number of small-scale, specialized R&D centers or technology-based small firms will change the industry's landscape. First, a direct effect is the increases in R&D expenditure and intensity by SMEs. Second, the existence of technologically agile small firms will lead to changes in business relationships, particularly between large and small firms. Supporting statistics are following.

Total R&D expenditures by SMEs doubled between 1997 and 2000, whereas expenditures by large enterprises increased by only 5.1%. The increases in total R&D expenditures by SMEs is partly due to the sharp increase in the number of SMEs that spend on R&D activities, as manifest by the sharp rise in the number of SME R&D centers. But the R&D intensity of SMEs, defined as the ratio of R&D expenditures over sales, also increased, from 2.8% in 1997 to 3.1% in 2000. In contrast, the R&D intensity of large enterprises decreased from 2.1% in 1997 to 1.8% in 2000. In sum, not only is the number of SMEs that spend on R&D increasing, but also SMEs areintensifying their R&D activities since the financial crisis. The same observation and conclusion apply to the case of researchers. From 1997 to 2000, SMEs strengthened their R&D activities by sharply increasing the number of researchers they employed, whereas the number of researchers at large enterprises remained almost during this period.

The effects of the financial crisis on the R&D activities of SMEs vary across industrial sectors. R&D expenditures have increased in almost all of sectors, except ships and boats, railroad equipment, and communication services. In terms of R&D intensity, chemicals, including medicine and pharmaceuticals, electrical products, transportation equipment, including automobiles and parts, ships and boats, railroad equipment and aerospace, and services in electricity, gas and water and communication show decreases. Note that R&D

[7] In addition to the restructuring of large firms, other factors contribute to the increase in small-sized corporate R&D centers. The government's drive to create "venture" companies and changed capital market conditions for start-up companies are among them.

intensities of SMEs in Korea's 'flagship industries,' such as chemicals and transportation equipment, have all decreased by a big magnitude. In contrast, IT related sectors such as computer & office equipment, semiconductor & electronic parts, and communication & media equipment have all showed big increases in R&D expenditures or intensities. The different pattern in R&D expenditures across industrial sectors is also to be found in the pattern of changes in the number of researchers in different industrial sectors. Particularly striking are the semiconductors and electronic parts, communication and media equipment, and the business services sectors, where the number of researchers including Ph.D.s and R&D expenditures increased more than three times. These are sectors in which specialized, small R&D centers are burgeoning; and therefore, networking and collaboration could be expected to be more prevalent than other sectors.

The Emergence of Innovation Networks

Based on cross-shareholding, subsidiary companies in a Chaebol are mostly vertically integrated. Vertical integration can be seen in that subsidiary companies in a Chaebol take part in various stages of a supply chain. Diversified business structures of Chaebols might allow to developing horizontal division of labor among subsidiary companies of a Chaebol; but, horizontal relationships between Chaebols or subsidiary companies of different Chaebols are less prevalent. The expansion strategy of Chaebols, which aims to widen business areas as possible, results in more diversified business structures for Chaebols; but, it obstructs the development of horizontal relationships between companies, in particular those between Chaebols and SMEs.

The business relationships that were prevalent in the past years have been changing after the financial crisis. Chaebols could no more pursue as aggressively as in the past the expansion strategy based on debt financing and cross-shareholding. Instead, they had to substantially lower their debt-ratios and to rationalize their diversified business structures. The new strategy was to concentrate on core businesses and to sell out or spin off unprofitable businesses. As is shown in the TABLE 8, 442 business branches that had employed 67,863 people had been spun off to independent companies. *Samsung* has rendered 161 spin-off companies, followed by *Hyundai* with 98 companies, *LG* with 94 companies and *SK* with 45 companies. Spinn-off companies from these four Chaebols account for 398 companies, more than 90% out of total. The number of spin-off companies peaked at the year of 1998, when the repercussions of the financial crisis on the corporate restructuring were also at its highest.

Table 8: Spin-offs from Chaebols

	No. of mother co.	No. of spin-off companies						No. of employees
		1997	1998	1999	2000	2001	Total	
Samsung	16	0	115	29	5	12	161	17,235
Hyundai	12	36	27	18	8	9	98	16,937
LG	15	5	18	51	14	6	94	21,443
SK	11	3	11	11	13	7	45	3,650
Hanjin	5	0	0	4	1	0	5	2,866
POSCO	1	0	0	0	1	0	1	40
Hanwha	2	0	0	4	0	0	4	2,636
Doosan	1	0	0	0	3	1	4	103
Ssangyong	1	0	0	0	2	0	2	880
Dongbu	1	2	5	1	1	0	9	144

Dongyang	2	0	0	2	1	0	3	227
Hyosung	1	0	2	0	0	0	2	52
CJ	3	1	0	0	1	4	6	643
Kolon	3	0	0	0	3	0	3	289
Hyundai	1	0	0	0	0	1	1	658
Dept. Daewoo E.	1	0	0	4	0	0	4	60
Total	76	47 (10.6)	178 (40.3)	124 (28.1)	53 (12.0)	40 (9.0)	442 (100.0)	67,863

Note: Spin-off is confined to the cases of MBO (management buy-out) and EBO (employee buy-out).
Source: Federation of Korean Industry, 2001.

The increasing tendency of large enterprises to make strategic alliances with venture companies is another new trend that has occurred since the financial crisis. Strategic alliances had been more prevalent between large enterprises; but it was hard to find those between large enterprises and SMEs before the financial crisis. Two factors, among others, are worth to note. First, backed by the expansion strategy, large enterprises, particularly Chaebols, usually set up their own business branches or subsidiaries when new opportunities arose or found. In other words, large enterprises preferred to internalize new business opportunities rather than to externalize them. The second factor was that since the number of technologically advanced SMEs had been few, the number of partners for alliances with LEs was also few. Under these circumstances, strategic alliances between firms, particularly between LEs and SMEs, will not be well developed.

The situations described above have also been changed since the financial crisis. Because of the more stringent financial constraint, LEs should concentrate on core businesses. Spinning-off, as is explained above, is other side of the concentration. And there come a large number of technologically agile smaller companies. These changes have rendered a new trend of increasing strategic alliances between LEs and SMEs.

TABLE 9 shows some examples of strategic alliances between LEs and new technology based firms, or venture companies in the Korean parlance. *Samsung Electronics*' strategic alliances with about 100 venture companies focus on non-memory chips where it has the strong necessity to enter into and needs business partners. *LG Electronics* runs what they call LG Venture Club composed of venture companies founded by retirees from *LG Electronics* or other *LG* companies. (See below for details on LG Venture Club.) *LG Chemical* has made strategic alliance with four venture companies and plans to increase the number of partners. *SK* and *CJ* are collaborating with venture companies for R&D projects for entering into new businesses where they do not have competence.

Table 9: Strategic Alliances between LE and Venture Company

Samsung Electronics	Strategic alliance with about 100 venture companies. Focusing on non-memory chips
LG Electronics	LG Venture Club
LG Chemical	Made alliances with 2 domestic and 2 overseas venture companies
SK	Project for developing pharmaceutical products with 11 venture companies
CJ	Project for developing pharmaceutical products with 2 venture companies. Plan to make alliances with 20 venture companies

Source: Dong-A Ilbo, March 27, 2002.

Although there is no complete information on the new business relationships between LEs and SMEs such as in TABLE 4, we can further assume that strategic alliances and other kinds of business relationships between LEs and SMEs are rapidly increasing. There are, at least, two grounds for the assumption. First, the necessity of strategic alliances is stronger than before the financial crisis. When LEs need to enter into new businesses, partnership with NTBF(new technology-based firms) will be less costly and risky than total internalization. Second, smaller NTBF will have an incentive to make alliances with LEs that have advantages of scale economies. Partnership with LEs will allow NTBF to safeguard their growth by utilizing LEs', for example, capital and marketing advantages.

The financial crisis of 1997 has brought many, some fundamental, changes to the Korean economy. As North (1990) notes, institutions structure incentives in economic action. Apparently, the financial crisis has rendered an institutional change that will give different incentives to economic agent and, consequently, result in different modes of inter-firm relations. Structural changes after the financial crisis have rendered new constraints and incentives. The government and the bank will no long offer Chaebols preferential policy loans. Chaebols will face tougher financial constraints, so they will not be able to pursue the aggressive expansion strategy as before. Diversified business structures are already undergoing streamlining that focuses on more competent areas. On the other hand, the number of technologically agile small firms is rapidly growing. These new technology based firms will have much more eased business environment in that they will have more chances to get financial resources than before. Majority of those SMEs that are trying to enhance their technological capabilities and to move up to higher ladder of value chain will also face a different business environment where they will no longer have safe umbrellas from the contractors. Those relationships are fading away. Instead, they have to compete with other suppliers globally. This new environment will act as either a new opportunity or a new threat. It depends on how these SMEs in transition would prepare for it. The increasing number of foreign owned companies is a new phenomenon to the Korean economy. Still small in numbers, but they will make a difference to the Korean economy in any ways. There are some positive signs that these firms are strengthening their technological activities in Korea, but the linkage of these firms with the other Korean firms and Korea's innovation system are still in the stage of early development.

5. Discussion

The Korean economy is facing a new environment. There are new technologies in such fields as ICT, biotechnology and new materials. As economic activities will be more knowledge-intensive, so the transition to the knowledge-based economy requires significant changes in work and production organizations, industrial relations and in the structures of governance. The world economy is becoming more integrated in both trade and investment; this fosters (and is caused by) freer movement of capital and production activities across national borders. The trend toward globalization emphasizes the importance of the global integration of national economic activities. That the Korean economy has matured and developed at a level comparable to advanced economies implies that the available stock of technologies drawn on through conventional technology transfer is exhausted. How well are Korean firms responding to these changes? Can the Korean economy achieve sustainable economic growth in the future?

Making Innovation System more effective

Under the new economic setting, both domestically and internationally, the conventional ways of technological development will not be as effective as they have been in the past. Standing at the crossroads, faced with new challenges, private firms need a new strategy. The task for Korean private enterprises is to make the transition from borrower to innovator. This presents several issues for discussion.

First, the industrial structure shows the weakness of upstream sectors, particularly in the capital goods industry. This weakness is closely related to the predominance of large firms, notably Chaebols, and the government's industrial policy. In accordance with the aggressive export-promotion policy that complements the tiny domestic market, the imported technologies are both mature in life cycle, and able to render economies of scale in production. Consequently, a few large firms have made large-scale investment, with the aid of favourable government support. The production structure has centred on end products, and ignoring support firms and industries has resulted in heavy dependence on the foreign sourcing of materials, parts, and components. This chronic phenomenon renders the Korean economy vulnerable to external changes in the foreign market. Accordingly, strengthening upstream industrial linkages is one of the most urgent tasks for the Korean economy.

Second, related to the first issue, a small number of Chaebols and research institutions are dominating innovation activities. The dominance of Chaebols, per se, is not an evil. The problem lies in the diffusion of innovation. The internal diffusion of technological innovation is not so active in Korea. The lack of domestic diffusion among firms is well demonstrated by the fact that repetitive importation of foreign technologies is common. Furthermore, the diffusion from research institutions to private firms is not as effective as expected. More organic co-operation between domestic firms, particularly between large firms and SMEs, and more active collaboration between research institutions and private firms are imminent. In this regard, we have observed a positive sign of change, for example, the emergence of innovation networks between conglomerates and SME. It is needed to sustain this trend.

Third, technological co-operation between domestic firms and foreign firms should be promoted. In the past, the Korean economy has benefited from the inflow of advanced foreign technologies. Now, new modes of co-operation such as cross-licensing and strategic alliances need to be utilised more. Facing rapid changes in technological opportunities and the expansion of globalisation, private enterprises need to strengthen the development of human resources and international R&D networks.

SMEs in transition

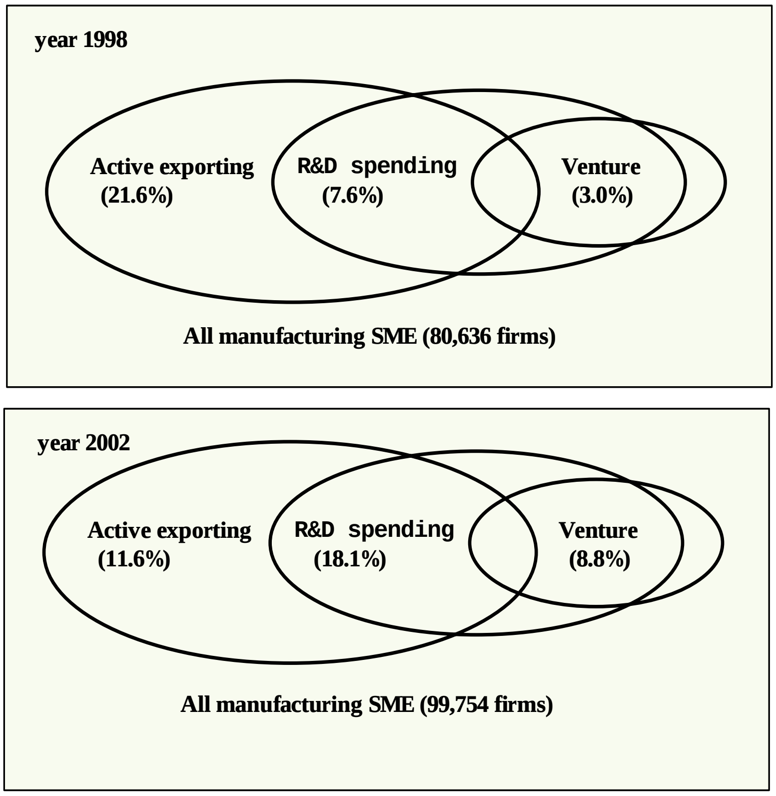
Today's SME in Korea face a challenge to strengthen their technological capabilities and thereby to move up to higher ladder of value chains. Unlike the new technology-based firms (NTBF) or those small numbers of firms that can make partnership relations with chaebols or other firms, however, the prospect for the rest of SME is not necessarily positive.

Figure 9 below[8] gives a snapshot on the current status of manufacturing SME in Korea. The figure classifies manufacturing SME into three: those that are actively exporting, those that are spending money for R&D, and those are certified as "venture". Exporting can be interpreted a measure to indicate firm's overall competitiveness; R&D spending as a measure of firm's technological capability; and venture certification as an entrepreneurial capability to enter into a new business. Intuitive conclusions can be drawn from the figure. Most of Korean SME are home market-oriented that only about 12% manufacturing SME are actively engaged in exporting, which might imply that they are vulnerable to market opening. Notice that the share of those active SMEs in exporting decreased by 10 percentage-point from 1998 to 2002. In terms of technological capability, about 18% SME have ever spent money for R&D purpose – an increase by 10 percentage point from 1998. This implies that majorities of SMEs are weak in their technological capabilities; but there is a positive sign of increase. In contrast, the fact that 9 % of manufacturing SME get the certification of "venture"- a significant increase from 3% in 1998 - might be a promising indicator for the prospect of Korea's SME in the future[9].

[8] The data are from Korea Federation of Small and Medium Business, and as of 1998. "Active exporting" firms are those that exporting more than 30% of total sales.

[9] Despite the debate on the nature of "venture" in Korea, it is evident that venture activities in Korea are very active. An indicator is the investment in venture capital as a percentage of GDP. OECD (2003) shows that Korea is one of countries above OECD average.

Figure 15: Classification of SME by Activities



Source: Korea Federation of Small and Medium Business

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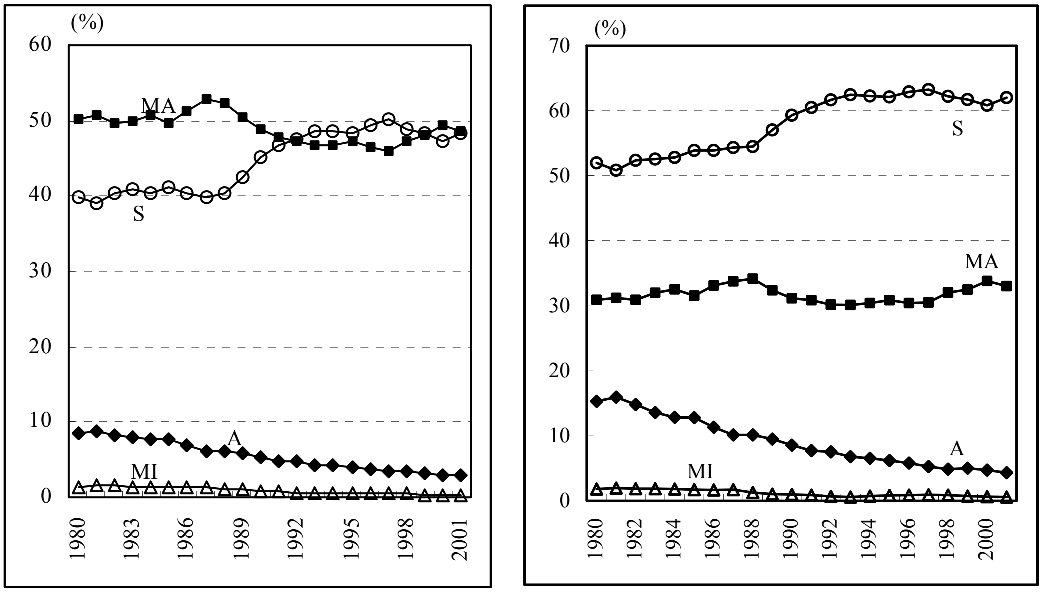
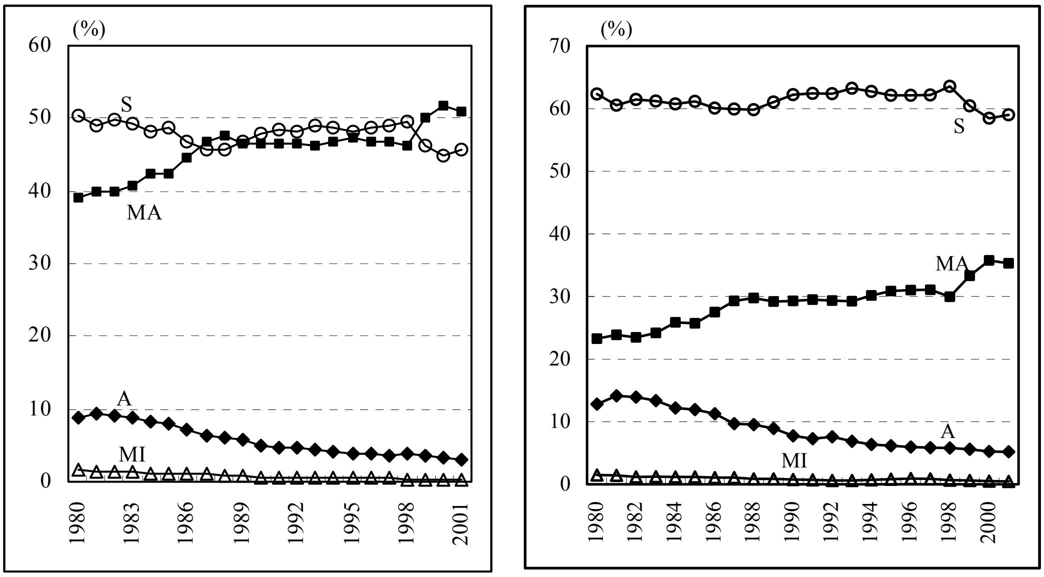
Figure A1: Gross Output and GDP by Sector (current price, percentage share)



(Gross output) (GDP)

Figure A2: Gross Output and GDP by Sector (1995 price, percentage share)



(Gross output) (GDP)

A = Agriculture, Forestry and Fishing, MI = Mining and Quarrying, MA = Manufacturing, S = Service
E = Electric and Electronic Products, A = Vehicles and Parts, T = Textile and Apparel

Figure 11: Changing Relationship between Royalty Payment and R&D (1976-2002)

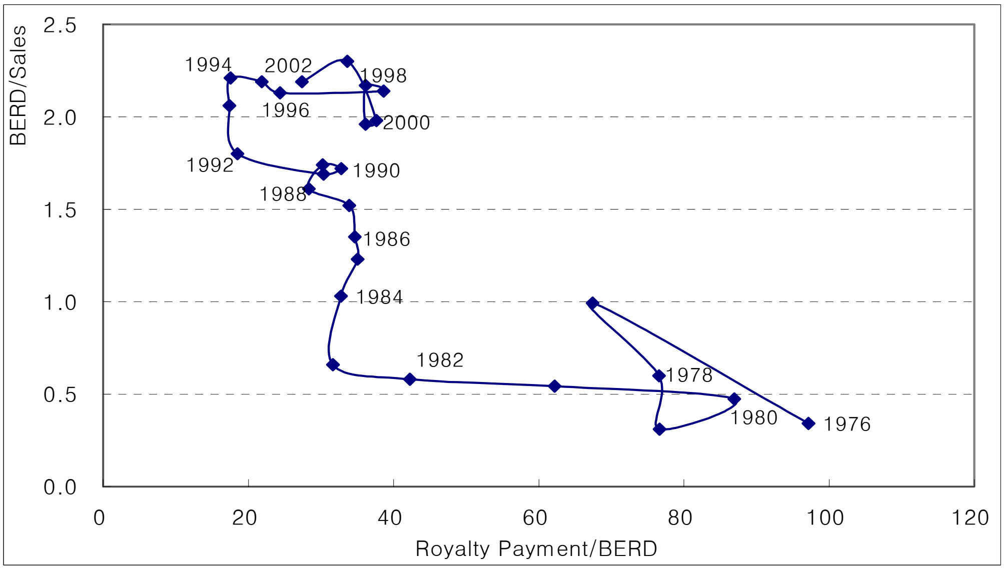
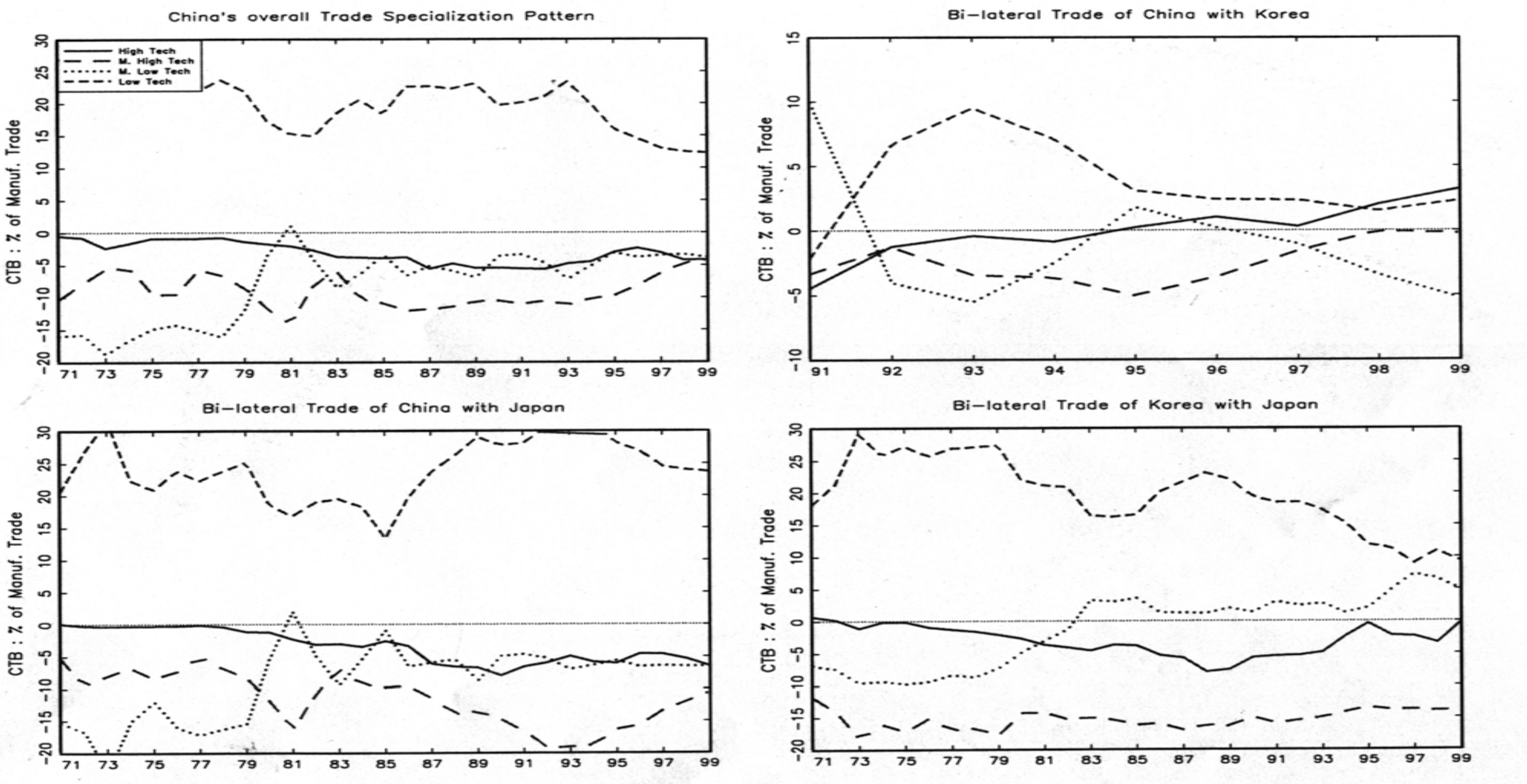


Figure 8: Trade Specialization Patterns



[Appendix] Emerging Patterns of Innovation Networks and Clusters

	NTBF	*Large Manufacturers*	*SMEs in transition*	*Foreign-owned companies*
Main Challenges	As a new entrant, needs growth strategy.	Feel the necessity to enter into new businesses	Face more competition, and feel strong necessity to upgrade tech. capability.	Need to secure market positions; restructuring from MNE's strategic viewpoints
Industrial Characteristics	Emerging high-tech sectors such as ICT and bio-tech	Scale-intensive industries where chaebols, Korean conglomerates, have dominated.	i) Traditional sectors where Korea is trying to move to higher-valued areas; ii) Specialized-suppliers where Korea is still behind world frontier.	i) Science-based sectors where MNEs have been dominating; ii) Firms that have yielded ownership to foreigners.
Examples of Regional Agglomeration	Daeduck valley, Pohang Techno-park Seoul Teheran valley	Kumi electronics complex, Woolsan Automobile & Shipbuilding industries.	i) Taegu textile, Pusan footwear industries; ii) Chonan semiconductor equipment, Changwon machinery industries.	i) Pharmaceutical industry in southern Kyoung-ki ii) Regional agglomeration not yet found
Innovative Capabilities	Highly-specialized; have core competence.	Strong in-house R&D capability; have wider spectrum	Mostly weak; but some have strong competitive advantages	i) Mostly weak; but mother companies are very strong ii) Diverse
Engines of growth	New ideas and innovation from in-house R&D.	Scale economies, in-house R&D	Skill-intensive, cost-efficient production	Proprietary assets from mother companies; some have technological competence
Inter-firm networking	Horizontal relationships.	Vertical integration prevailed, but cooperative relations are developing.	Diverse. Trying to strengthen ties with other actors, but faces bottlenecks – internal competence is weak.	Strong ties with mother company. Linkages with domestic actors have been weak, but tend to be increasing.
Linkages with other innovation actors	Good	Moderate	Weak	Not yet well developed

Source: Suh(2003).

Comments on "Enhancing Productivity through Innovation: Korea's Response to Competitiveness Challenges"

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Dr. Joonghae Suh has presented us with a fine paper on enhancing productivity through innovation, a very suitable paper for this specific session on productivity. I find it a very thoughtful paper with many good points.

His paper started with the analysis of structural changes in Korean industry. By comparing various measures such as productivity, trade performance, profitability and financial performance, Dr. Suh confirmed that stellar economic performance of Korea after Asian financial crisis in 1997 was lead by mainly ICT industry and large conglomerate. This paper reconfirms polarization of Korean industry by sector and firm size.

Dr. Suh expressed his concern on eroding industrial competitiveness of Korea in this paper. According to his analysis using IIT indices he found that vertical IIT dominates horizontal IIT between Korea and Japan, Korea and US, whereas he found increasing horizontal IIT between Korea and China. This implies that nutcracker hypothesis can not be rejected. While the quality and price of China's products is approaching that of Korea's, the gap between Korean and Japan or US is far from diminishing.

In response to polarization of Korean industry by sector and firm size, and eroding industrial competitiveness, Dr. Suh puts weights on two policy issues. Dr. Suh pointed out that it would be impossible to sustain a high growth rate and improved competitiveness in the manufacturing sector without making a transition to more effective innovation system and having a sufficient productivity growth of small and medium size firm.

I think Dr. Suh correctly identified challenges for sustaining high economic growth rate and improving industrial competitiveness. The ultimate questions are, however, how to make SMEs more productive and how to make innovation system more efficient? We have blamed polarization as a consequence as well as a barrier to further economic growth from large-conglomerate driven economic growth for so long. Our growth strategy mainly depending on large conglomerates is efficient for industries that need huge investments and Korean economy indeed has been leapfrogging other economy from the economy of scale. If our economic growth, productivity enhancement are still largely dependent on large firms, does polarization really matter? Although policy makers stressed importance of productivity enhancement of the SMEs for more than 20 years, the productivity of large firms and SMEs has been widening.

I think we need more industry specific approach to tackle the issue of polarization, SMEs, and innovation system. For more narrowly classified industries, we are confronted with much different issues. For some narrowly defined industries, role of SMEs are increasing whereas for others the contrary is true. We might need more industry specific diagnosis and remedies to maintain high productivity growth. I expect that Dr. Suh and his team will make contribution to this arena of narrowly-classified industry-specific analysis and policy making in the future.

CHAPTER 4-2

Productivity and Patterns of Trade - The Experience of Korea in the 1990s

by
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Abstract

This paper analyzes the industrial growth of Korea in the 1990s and its relationship with the nation's export performance. The paper showed that total factor productivity (TFP) played a significant role in the growth of some industries, where in particular a sharp increase in TFP was observed in the electrics and electronics industry and the automobile industry in the late 1990s. While CEPII RCA indexes for the Korean industries such as IT industry and automobile industry significantly increased since 1998, only limited evidence was found that TFP or TFI influenced RCA. Investigating Korea's export performance in the Northeast Asian context, this paper shows that, in the 1990s, the growth of Korea's exports to Japan was led by industries that recorded relatively fast growth in total factor input (TFI). In contrast, that to China was almost equally contributed by industries that experienced relatively fast growth in TFP or TFI. This paper also investigates competition between Korea and China, and Korea and Japan in the world market. The competition between Korea and China was relatively stronger for the Korean industries to whose growth TFI made a more significant contribution. While no decisive evidence is found for the relationship between TFP growth in Korean industries and their competition against Japan in the world market, it is revealed that the competition between Korea and Japan became less intense for the Korean industries to whose growth TFI made a stronger contribution.

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I. Introduction

Korea has been one of the most important players in Asia since the early 1960s, contributing to the world's economic growth and dynamism. While each and every stage in the Korean economy's development process since the early 1960s has been dramatic, one of the most significant turning points of the Korean economy was the ambitious launching of the heavy and chemical industry oriented policy by the government in 1972. This policy of encouraging six strategic industries - steel, petrochemicals, non-ferrous metals, shipbuilding, electronics and machinery - has been criticized for having distorted markets. Nevertheless, it is also observed that the industries protected or subsidized by this policy grew up to lead the nation's economic growth, at least up to the crisis in 1997.

While the Korean economy recorded remarkable growth until 1997, Kim (2001) and Kwack (2001) point out that the economy in fact had lost its competitiveness in the run up to the outbreak of the economic crisis, through unnecessary compromise of the Roh government (1988-1993) over the demands of workers. They also argue that large-scale economic reform without prudent economic considerations by the successive Kim government (1993-1998) worsened the situation. As a result, costs such as material costs, labor costs, and borrowing costs had been consistently increasing, which was accompanied with a substantial increase in the unit value of exporting goods until 1995 (Tcha and Lee, 2003). KDI's (2003) study on the competitiveness of the Korean industries also revealed that total productivity of Korean industries during the first half of the 1990s fell short of that before and after the period.

The 1990s was a period of storm and stress for the Korean economy. Though the economy faced various challenges, it broke through US$10,000 of GDP per capita entering a new era, joined the OECD, but shortly after, was engulfed in a crisis. Nonetheless, the years of 1999 and 2000 demonstrated unprecedented recovery from the crisis. This paper investigates the Korean economy during this critical period, in particular, concentrating on growth of the industry and changes in certain aspects of trade. In analyzing the aspects of trade, the nation's relationship with China and Japan is particularly focused.

Section II of this paper analyzes the structural changes in the industries by concentrating on their growth. In particular, based on growth accounting, the contribution of total factor inputs (TFI) and total factor productivity (TFP) to growth is analyzed for 17 manufacturing sectors using the KDI multisectoral data. Section III discusses structural changes in trade in the 1990s. Revealed comparative advantage (RCA) indexes developed by Centre d'Etudes Prospectives et d'Information Internationales (CEPII) are calculated for each industry to find structural changes in relative advantage of the nation. In addition, the export similarity index (ESI) is used to discuss competition between Korea, China and Japan in the world market. The evolution of the nation's export pattern during this period is also discussed. The findings from Sections II and III are integrated in Section IV. The relationship between growth of TFI and TFP, and certain aspects of trade – RCA and ESI – in each industry is analyzed. Further, it is investigated whether each industry's RCA and its experience of competition against Japan and China is inter-related. The paper concludes with Section V.

II. The Changes in Industrial Structure in Korea

1. The Changes in Industrial Structure - Overview

In 1990, as reported in Table 1, Korea's total GDP was 178,797 billion won (nominal), where the contribution from manufacturing reached 55,681 billion won, or 31.1% of GDP.[1] This fell slightly to about 30.9% of GDP in 1992 and remained stably within the range of 30-31% until 1997. The year of 1998 witnessed a rapid growth in manufacturing, and the sector bounced back to explain more than 32% of GDP, producing 156,877 billion won.

While manufacturing stably explained about 30-32% of GDP throughout the period of the 1990s, some dramatic changes in the structure inside of the manufacturing sector was observed. The most prominent change is, as shown in Table 1, the sharp decrease in the share of textile & apparel (T&A) in manufacturing which fell from 10.7% in 1990 to 4.3% in 2000. The value of product from this industry during the period in fact increased until 1994 in both nominal and real terms, nevertheless, the industry's growth rate was far behind that of the entire manufacturing sector, subsequently shrinking relative to other industries. Similarly, the chemical products and automobile industries experienced slight decreases in their shares during the period, which respectively ranged about 11-13% and 8-10% of the entire manufacturing. General machinery explained about 7.6% of manufacturing on average, and maintained a share of 7-8% throughout the period, ending up with 7.2% in 2000. The electric & electronics (E&E) industry, which contains four sub-industries – semiconductors, electronics and parts (E&P), IT equipments and home appliances – experienced the most dramatic increase in product value and share. The industry produced 7,956 billion won or 14.3% of manufacturing in 1990, which increased by more than four times to reach 32,663 billion won or 18.5% of manufacturing in 2000.

Table 1. Total Product and Manufacturing Share for Major Industries in Korea

(unit: billion won, %)

	1990	1995	2000
Textile & Apparel	5,979	7,833	7,549
	(10.7)	(6.7)	(4.3)
Chemical Products	7,422	15,057	20,232
	(13.3)	(12.9)	(11.5)
General Machinery	4,147	9,385	12,798
	(7.4)	(8.1)	(7.2)
Electricity & Electronics	7,956	19,221	32,663
	(14.3)	(16.5)	(18.5)
Semiconductors	947	6,775	6,642
	(1.7)	(5.8)	(3.8)
Electronics & Parts	2,837	5,271	8,428
	(5.1)	(4.5)	(4.8)
IT Equipment	3,690	6,582	16,155

[1] Most figures used in this paper are from KDI (2003) unless otherwise informed.

	(6.6)	(5.7)	(9.2)
Home Appliances	482	593	1,438
	(0.9)	(0.5)	(0.8)
Automobiles	5,675	11,787	14,486
	(10.2)	(10.1)	(8.2)
Others	24,502	53,200	88,806
	(44.0)	(45.7)	(50.3)
Total Manufacturing (A)	55,681	116,483	176,534
	(100.0)	(100.0)	(100.0)
GDP (B)	178,798	377,350	521,959
A/B	(31.1)	(30.9)	(33.8)

Source: Rearranged from KDI (2003).

Notes: Numbers in parentheses are the manufacturing share of each industry.

In summary, the total value of products and shares increased for all five major manufacturing industries[2], except for T&A, for which the share rapidly decreased. The share of E&E increased most significantly, and the shares for the remaining three industries – chemical products, general machinery and automobiles - were by and large maintained or slightly declined with mild fluctuations.

Looking inside of E&E revealed that the four sub-industries in this category experienced different growth patterns. For example, semiconductor industry grew more than seven folds for five years since 1990, and explained 5.8% of manufacturing products in 1995. Since then, growth has been retarded and the share has fallen to 3.8% in 2000. The growth of IT equipment showed an opposite trend. Larger than the semiconductor industry by almost four times in 1990, despite the rapid growth, its size fell behind semiconductors industry in 1995, accounting for 5.7% of manufacturing output. However, the industry grew very rapidly in late 1995, and regained its position as the largest E&E sub-industry in 2000, with a share of more than 49% in E&E or 9.2% of manufacturing. E&P and home appliances also recorded substantial growth during the period, however, their growth rates were lower than the other two industries, and subsequently their shares in total manufacturing were relatively stable.

2. Total Factor Inputs (TFI) and Total Factor Productivity (TFP)

In conventional economic analysis of economic growth, total output is determined by a combination of factors, in particular, capital and labor. Therefore, the growth of output is contributed by the growth of factor inputs and total factor productivity. Total factor productivity used in this paper is obtained from KDI (2003), where each manufacturing industry's TFP was calculated based on growth accounting.

According to Solow (1957) and Griliches (1994), the objective of growth accounting is to break down the growth rate of aggregate output into contributions from the growth

2 These five major industries include T&A, E&E, chemical products, general machinery and automobile industries as shown in Table 1. As E&E in turn disaggregates into four industries, these five major industries are in fact eight industries in the classification by the KDI (2003). They explained major portions of employment, total output and exports throughout the 1990s.

of inputs and the growth of technology. Using a conventional neoclassical production function, this aggregate relationship at time *t* is,

$$Y(t) = A(t) \cdot F[K(t), L(t)],$$

where *Y* is output[3], $A(t)$ is and index of the level of technology, or is called total factor productivity (*TFP*)[4], and *K* and *L* represent capital and labor respectively. To take logarithms of both sides and time derivatives produces the growth rate of aggregate output,

$$\dot{Y}/Y = \dot{A}/A + \left(\frac{AF_K}{Y}\right) \cdot \dot{K} + \left(\frac{AF_L}{Y}\right) \cdot \dot{L} \ ,$$

where $\dot{X}$ stands for changes in X over time, and F_i means the first order derivative of *F* with respect to input *i* (i = *K*, *L*). Therefore AF_i is the marginal product of input *i*. Multiply and divide the expression in the first set of brackets by *K* and the expression in the second set of brackets by *L* to obtain

$$\dot{Y}/Y = \dot{A}/A + \left(\frac{AF_K K}{Y}\right) \cdot (\dot{K}/K) + \left(\frac{AF_L L}{Y}\right) \cdot (\dot{L}/L) \ .$$

If the factor markets are competitive, then the marginal product of each input equals its factor price, so that AF_K equals the rental rate on capital, *R*, and AF_L equals the wage rate, *w*. Therefore, the term $AF_K K/Y$ is the share of the rental payments to capital in total income, and the expression $(AF_L L)/Y$ is the share of wage payments to labor in total income.

Under the assumption of constant returns to scale, the capital share and the labor share add to 1 ($AF_K K/Y + AF_L L/Y = 1$). If $\alpha(t)$ is the capital share ($= AF_K K/Y$)[5], then the growth can be decomposed as,

$$\dot{Y}/Y = \dot{A}/A + \alpha(t) \cdot (\dot{K}/K) + [1-\alpha(t)] \cdot (\dot{L}/L) .$$

In other words, the growth rate of aggregate output equals $\dot{A}/A$ (the growth rate of TFP), plus $\alpha(t) \cdot (\dot{K}/K) + [1-\alpha(t)] \cdot (\dot{L}/L)$, a weighted average of the growth rates of the two inputs, where the weights are the corresponding input shares. KDI (2003) collated data on the quantities, *Y*, *K*, and *L*, and total labor income for each industry. The share of labor, $\alpha(t)$, was computed from total labor income and total value added, and the share of capital was calculated as *(1- a(t))*. As the growth rates, $\dot{Y}/Y$, $\dot{K}/K$, and $\dot{L}/L$ were all directly obtained from the dataset, the only term in growth accounting that could not be measured directly was the growth rate of technology, $\dot{A}/A$. Using the equation mentioned above, the growth rate of technology or TFP, $\dot{A}/A$, was indirectly obtained from

3 Total value added was used as Y in KDI (2003).

4 To simplify the algebra, it is assumed that technology is Hicks neutral (or output augmenting).

5 For a Cobb-Douglas technology, Y = AKαL1–α, the input shares are constant at α and 1 – α, respectively.

$$\dot{A}/A = \dot{Y}/Y - \{\alpha(t) \cdot \dot{K}/K + [1-\alpha(t)] \cdot \dot{L}/L\}.$$

In other words, we measured the TFP growth rate — or the rate of technological progress — as a residual; we subtracted from Y/Y the part of this growth rate that could be accounted for by the growth rate of the inputs, *K* and *L*.[6]

Table 2 breaks down the growth of value added as contributions from TFI and TFP for selected periods.[7] For 1985-2001, the average annual growth of valueadded in manufacturing was 10.60%. While the annual growth rate was 15.64% in the late 1980s, it decreased to 9.40% in the 1990s and then rose up to 17.47% after the crisis. Hahn (2003) also points out that TFP for the Korean manufacturing decreased in 1995- 1998, compared to 1990-1995. These figures support Kim (2001) and Kwack (2001) who argue that the competitiveness of the Korean economy eroded in the early 1990s, although some fundamentals of the economy appeared to be healthy. The resurgence of a high growth rate after the crisis is considered to be largely due to the death and exits of inefficient firms during the crisis, and the birth of young and efficient firms sine then, together with the better allocation of resources. This view is in line with the rapid increase in TFP after the crisis, as will be discussed later. Overall, machinery, E&E and automobile industries experienced higher growth whereas T&A did not grow at all. Though not reported in Table 2, it is noteworthy that the KDI study (2003) revealed that the leaders of growth changed from small firms to large firms during this period.

It is well known that Korea started its economic growth in the 1960s by concentrating on the industries that had comparative advantage, i.e. simple labor-intensive industries such as T&A. The fast accumulation of factors is regarded as being one of the most crucial sources of rapid economic growth, since the launch of the development plans in the early 1960s. Table 2 shows that for most industries, both labor and capital input kept increasing during 1985–2001. Three more observations regarding TFI and industrial growth are clear from the table:

(i) During the period, industries traditionally using relatively more labor (labor-intensive industries) did not grow as fast as capital-intensive industries;

(ii) The growth rate of labor input in each industry overall decreased throughout the period in general;

(iii) The growth rate of labor input in each industry was, in general, lower than that of capital. As a result, for the whole manufacturing sector for the entire period (1985-2001), labor and capital increased by 0.12% and 10.40%, respectively on average each year.

[6] KDI's (2003) study used real values for all the variables, where the base year was 1990.

[7] KDI (2003) also computed TFP using the multisectoral index method as suggested by Caves, Chritensen and Diewert (1982) and developed by Good, Nadiri and Sickles (1997). For more information, please see KDI (2003).

Table 2. Decomposition of Industrial Growth (selected years)

year	1985-2001								1985-1989								1998-2001							
year	Avg.Annual Growth(VA)				Contribution (%p)				Avg. Annual Growth (VA)				Contribution (%p)				Avg. Annual Growth (VA)				Contribution (%p)			
year	VA	L	K	TFP	TFI	L	K	TFP	VA	L	K	TFP	TFI	L	K	TFP	VA	L	K	TFP	TFI	L	K	TFP
Food Prod. & Bev.	5.68	-1.10	6.93	1.01	4.67	-0.29	4.96	1.01	9.51	0.48	10.37	1.95	7.53	0.14	7.39	1.98	4.72	1.71	3.50	1.42	3.28	0.41	2.87	1.44
Textiles & Apparels	0.00	-4.37	3.97	1.07	-0.18	-0.46	0.28	0.18	9.29	1.95	12.23	2.86	6.37	1.06	5.31	2.92	6.90	1.36	4.55	4.11	2.72	0.80	1.92	4.18
Paper Prod.,Printing,Pub.	6.21	0.82	10.13	1.50	4.70	0.48	4.22	1.52	12.00	3.26	12.78	4.35	7.53	1.97	5.56	4.47	8.91	6.93	8.73	0.97	7.93	3.87	4.06	0.98
Chemical Products	10.64	2.69	12.51	1.94	8.67	1.10	7.57	1.97	17.01	7.67	16.65	3.47	13.45	2.92	10.53	3.57	7.31	5.68	4.79	1.91	5.36	2.23	3.14	1.94
Petroleum & Coal	9.00	1.83	15.48	-4.29	13.02	0.14	12.89	-4.02	9.13	0.54	17.77	-6.06	14.60	0.05	14.55	-5.47	4.34	-1.02	5.91	-1.14	5.46	-0.05	5.51	-1.12
Non-metallic Min. Prod.	6.60	-2.18	7.97	3.56	2.99	-1.06	4.05	3.62	16.46	1.92	11.65	8.47	7.66	0.88	6.78	8.80	9.56	-0.26	0.47	9.34	0.20	-0.15	0.34	9..36
Basic Metals	9.73	-0.12	9.21	2.95	6.72	-0.04	6.76	3.01	15.33	3.05	16.79	1.64	13.67	0.83	12.84	1.66	5.86	0.84	6.60	0.74	5.12	0.22	4.90	0.74
Metals	6.92	3.09	8.97	1.08	5.83	2.13	3.70	1.09	22.11	8.15	16.49	8.12	13.58	4.27	9.31	8.53	5.21	6.62	6.75	-1.33	6.52	4.38	2.14	-1.31
General Machinery	12.99	3.44	10.88	4.84	8.01	1.45	6.56	4.98	24.37	9.98	18.49	8.35	15.58	4.23	11.35	8.79	19.82	7.20	8.12	11.23	8.08	2.93	5.14	11.75
Semiconductors	28.91	7.29	24.25	9.32	19.03	2.73	16.29	9.89	45.51	20.07	29.19	15.37	28.64	10.07	18.58	16.86	20.44	0.44	5.42	16.56	3.42	0.12	3.30	17.02
Electronics & Parts	21.13	3.74	15.77	9.76	10.88	1.61	9.27	10.25	24.27	9.86	27.29	4.25	19.87	4.45	15.42	4.40	38.79	9.84	14.89	22.88	14.02	3.92	10.10	24.77
IT Equipment	19.96	0.66	8.65	14.01	5.41	0.29	5.12	14.55	28.56	11.13	18.45	11.88	15.89	5.41	10.49	12.67	40.02	7.01	11.20	27.50	10.53	3.08	7.45	29.49
Home Appliances	11.95	0.86	8.52	6.87	4.89	0.49	4.40	7.06	29.46	16.83	25.52	7.01	22.08	9.00	13.08	7.38	21.79	3.33	5.84	16.55	4.66	2.14	2.52	17.14
Automobiles	14.56	5.22	16.12	2.98	11.51	2.43	9.08	3.05	27.04	17.21	29.58	2.35	24.64	7.28	17.36	2.40	20.00	1.61	3.12	17.11	2.53	0.78	1.75	17.48
Other Trans. Equipment	10.61	0.82	8.11	5.60	4.87	0.41	4.46	5.74	-6.96	-7.45	1.40	-3.76	-3.26	-3.76	0.50	-3.70	24.57	4.82	1.73	20.77	3.23	2.22	1.02	21.34
Precision Instruments	7.17	0.75	8.16	1.49	5.66	0.26	5.40	1.51	25.01	8.02	23.33	5.81	18.94	3.03	15.91	6.07	-1.06	4.71	-3.15	-0.42	-0.64	1.26	-1.90	-0.42
Other Manufacturing	4.31	-2.81	6.18	3.29	1.00	-1.27	2.27	3.31	17.34	3.77	13.78	8.116	8.84	2.13	6.71	8.50	11.92	4.71	7.32	5.46	6.31	2.23	4.07	5.61
Manufacturing	10.60	0.12	10.40	4.33	6.16	0.05	6.11	4.44	15.64	5.10	15.55	4.14	11.38	2.18	9.20	4.26	17.47	4.34	5.68	11.68	5.37	1.69	3.68	12.10

Source: Rearranged from KDI (2003).

As a result, GDP (or manufacturing) share of labor-intensive industries decreased and the capital-labor ratio in each industry increased. In other words, the whole manufacturing sector was oriented towards more capital-intensive industries, and the production technology for each industry itself became more capital intensive. It is noteworthy that the semiconductor industry led the growth of labor input, recording 7.29% of annual growth of employment whereas it also led the increase of capital input with 24.25% of annual growth. The growth of TFI became slow after the crisis (1998-2001) compared to the late 1980s. The role of capital accumulation has been substituted by higher growth rates of TFP in leading the growth since the late 1990s.

Table 2 also provides crucial information regarding TFP growth and industrial growth. The table shows that the average annual growth rate of TFP for the whole manufacturing was only 4.33% for the entire period of 1985-2001, which soared up sharply over the crisis; for 1998 – 2001, the growth rate of TFP was as high as 11.68%. Before the 1990s, the contribution of TFP growth to the growth of manufacturing was 27%, which increased to 70% after the crisis. While it may indicate that firms improved their production technology, at the same time, as suggested above, such a change might be the result of inefficient firms not being able to survive the crisis, and as new firms with greater efficiency entered the market after the crisis.

It should be also noted that, in general, the industries that grew fast showed high growth of TFP as shown from IT equipment, semiconductors, E&P, automobiles and home appliances industries, which supports the view that TFP became an important source of growth in Korean manufacturing. In particular, in the late 1990s, the growth rates of general machinery, E&E and automobile industries were far higher than the manufacturing average, where rapid increase in TFP was observed in E&E and automobiles.

In summary, the industries with a relatively large share in manufacturing and high growth rate, such as E&E and automobile industries, led the growth of manufacturing since the late 1980s. It is also noteworthy that industries with large firms and high TFP became the engines of growth over time, in particular, since the crisis.

3. Contributions of TFI and TFP to the Growth of Manufacturing Sector

For the period of 1985-2001, the contribution of TFI to growth of the manufacturing sector reached about 58.10% while TFP was 41.90% (KDI, 2003). TFP contribution was particularly high in IT equipment (72.89% or 14.55%p out of 19.96%) and home appliances (59.10% or 7.06%p out of 11.95%). Conversely, TFP contribution was relatively low in automobiles (20.95% or 3.05%p out of 14.56%) and chemical products (18.48% or 1.97%p out of 10.64%). In the late 1990s, however, TFP became substantially high in these industries as well; the contribution of TFP to growth increased from 27.24% in the late 1980s to 69.26% after the crisis (1998-2001) for the entire manufacturing sector including industries such as semiconductors (83.28% or 17.02%p out of 20.44%), automobiles (87.37% or 17.48%p out of 20%), home appliances (78.62% or 17.14%p out of 21.79%) and IT equipment (73.68% or 29.49%p out of 40.2%).

Figure 1. Decomposition of Contribution from TFP and TFI to Growth (1985-2001)

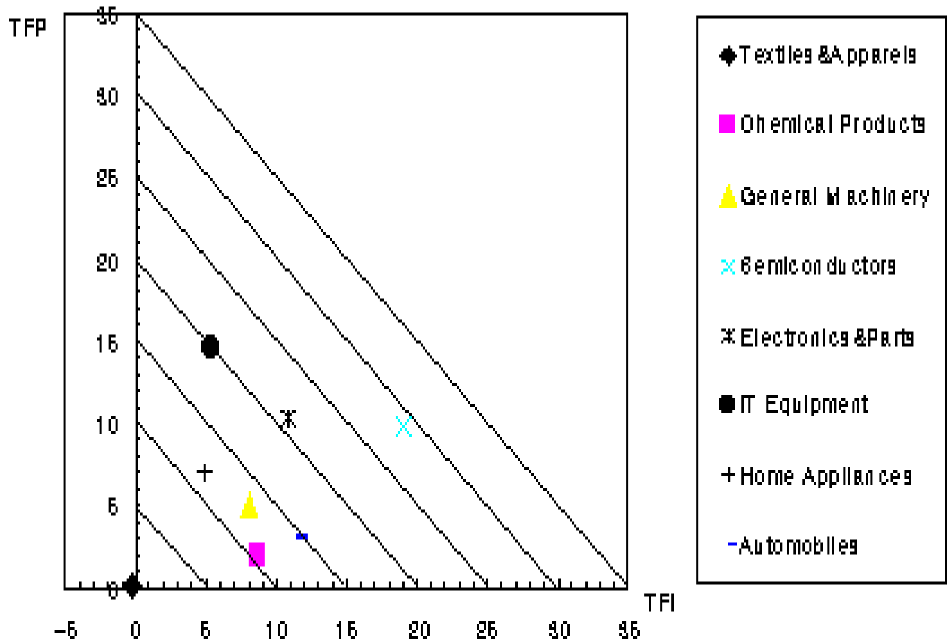
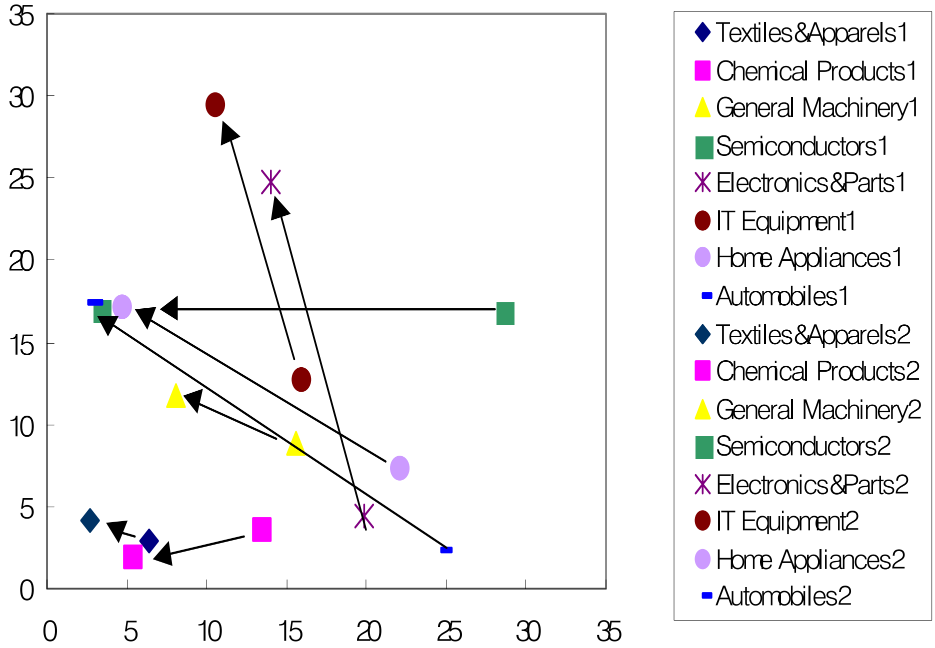


Figure 1 shows the average annual growth rate of some major industries and contributions from TFI and TFP growth for 1985-2001 based on KDI (2003). The straight line connecting the same numbers in each axis indicates the iso-growth curve, where any point on the line represents the same growth rate. For example, the growth point for IT equipment lies around the line connecting 20% growth of TFI and TFP, respectively, meaning that the industry experienced about 20% of annual growth during the period. Furthermore, the accurate position of the point explains the contribution of TFI and TFP to growth. For instance, the figure shows that for IT equipment industry that recorded about 20% of annual growth, 5%p of growth (or about 25% of total growth) was due to factor accumulation, while 15%p (or about 75% of total growth) was due to TFP growth.

Figure 2. Changes in Contribution from TFP and TFI to Growth
(From 1985-1989 to 1998-2001)



The figure illustrates that while the overall growth rate was the highest in semiconductors, a large portion of the growth was due to factor accumulation. The three industries that recorded the highest growth rates (semiconductors, E&P and IT equipment) received a larger contribution from TFP in absolute terms. However, in relative terms, the contribution from TFP to growth was the highest in semiconductors followed by home appliances. The contribution of TFP to growth was relatively low for automobiles, chemical products and T&A.

The dynamics of the growth, as summarized in Figure 2, provides substantially different features from Figure 1. The arrows in the figure represent the move of the average annual growth for each industry from 1985-1989 to 1998-2001. Four findings should be highlighted:

(i) For all the concerned industries, except chemical products, the arrows point in a northwest direction; meaning that over the period, the industries' growth became more dependent on TFP growth;

(ii) The growth points of industries such as IT equipment and E&P moved up, indicating that they grew faster in the late 1990s than in the late 1980s;

(iii) While the contribution of TFP to growth increased, the growth rate of each industry, in general, decreased except for IT equipment and E&P.[8] KDI (2003) reported that the growth rates of the industries were particularly low in the early and mid 1990s, up to the crisis. Therefore, these low growths for 1998-2001 should be regarded as what recovered from the growth rates for the mid 1990s;

(iv) Contrast to our common belief, semiconductors, one of the representative exporting commodities of Korea, experienced a huge decline in the rate of growth. This decline is found to be a result of a decrease in the contribution from factors, while TFP's contribution was still maintained.

III. The Relationship between Industrial Structure and Trade Structure

1. Changes in the Structure of Trade9

For nine years since 1992, the Korean manufacturing sector increased its exports to the world substantially, as summarized in Table 3. The fastest growing market for Korea during the period was China. While Korea's export of manufacturing goods to the world increased 11% on average annually, those to China recorded an annual growth of about 27%. Korea's exports to Japan grew slower compared to the world, recording an annual growth of 8%.

Table 3 also shows that most industries in Korea recorded double-digit growth in their exports to China. In particular, exports of semiconductors expanded as much as 85%, IT equipment 48%, and precision instruments 50%, annually. Korea's exports to Japan were also led by E&E; 22% of annual growth of exports of IT equipment, 20% of semiconductors, and 18% of home appliances were observed. However, the growth rate of E&P is considerably low, which implies that the patterns of regional division of trade that Korea imports parts from Japan was strong, and it was hard for Korea to penetrate the Japanese market with E&P. This finding is consistent with Ko, Cho, Lee, Lee, and Lee (2003). While the annual growth of automobile exports to China increased by 32%, exports to Japan increased by only 1%. Also, exports of petroleum and coals, chemical products and paper products to Japan recorded relatively high growth rates.

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[8] While it is not shown in Figure 1, "Other Transport Equipment" recorded 24.57% of annual growth for 1998-2001, from –6.96% in the late 1980s. This is provided in Table 2.

[9] All the trade data used in this section are from KDI (2003), which modified PC/TAS by UNCTAD/WTO.

Table 3. Annual Average Growth Rate of Korea's Exports (1992-2000)

	Korea to China	Korea to Japan	Korea to world
Food Products & Beverages	0.43	0.02	0.03
	(1.56)	(0.27)	(0.26)
Textiles & Apparels	0.27	-0.08	0.00
	(0.97)	(-1.05)	(0.03)
Paper Products, Printing, Publishing	0.20	0.22	0.17
	(0.74)	(2.84)	(1.61)
Chemical Products	0.28	0.10	0.12
	(1.00)	(1.27)	(1.09)
Petroleum & Coal	0.47	0.25	0.24
	(1.71)	(3.27)	(2.24)
Non-metallic Mineral Products	0.42	-0.04	0.07
	(1.53)	(-0.58)	(0.62)
Basic Metals	0.09	0.01	0.07
	(0.34)	(0.09)	(0.65)
Metals	0.18	0.09	0.06
	(0.66)	(1.16)	(0.56)
General Machinery	0.31	0.12	0.14
	(1.12)	(1.59)	(1.31)
Semiconductors	0.85	0.20	0.15
	(3.08)	(2.62)	(1.43)
Electronics & Parts	0.41	0.07	0.15
	(1.50)	(0.95)	(1.36)
IT Equipment	0.48	0.22	0.17
	(1.74)	(2.91)	(1.60)
Home Appliances	0.39	0.18	0.10
	(1.41)	(2.40)	(0.91)
Automobiles	0.32	0.01	0.17
	(1.17)	(0.12)	(1.60)
Other Transport Equipment	-0.11	0.13	0.09
	(-0.39)	(1.76)	(0.87)
Precision Instruments	0.50	0.08	0.09
	(1.83)	(0.99)	(0.81)
Other Manufacturing	0.29	-0.02	0.00
	(1.05)	(-0.24)	(0.03)
Total Manufacturing	0.27	0.08	0.11
	(1.00)	(1.00)	(1.00)

Source: Rearranged from KDI (2003).
Notes: Numbers in parentheses are the ratio of annual growth rate of each industry's exports to that of total manufacturing exports.

2. Revealed Comparative Advantage

The comparative advantage that firms or industries can acquire originates in various ways. Lafay (1992) categorizes them as follows:

(i) favorable natural resource endowment of the territory concerned;
(ii) lower relative costs through the choice of segment that are best suited to the macroeconomic factors of production;
(iii) lower relative costs through innovation at microeconomic level in the production process;
(iv) the acquisition of monopoly elements through the microeconomic creation of new products.

Therefore, changes in both resource endowments and technology affect comparative advantage of producers. TFP may be related to microeconomic innovation in the production process (iii) or product creation (iv), and change comparative advantage. This concept of comparative advantage is often confused with competitiveness. The two essential differences between the two concepts are, according to Lafay (1992):

(i) whereas competitiveness is measured between countries, for a given product, comparative advantage is measured between products for a given country;
(ii) whereas competitiveness is subject to changes in the macroeconomic situation, comparative advantage is structural in nature.

As it is impossible to measure comparative advantage, which can be defined in the autarky in a very strict sense, there have been efforts in the field of economics to find comparative advantage revealed through economic activities, in particular, from transaction of commodities between countries. While one of the most significant contributions for these revealed comparative advantage (RCA) was proposed by Balassa (1963, 1979)[10], it has been widely criticized that most indexes, including Balassa's, distorted the real figures of comparative advantage as they ignore domestic consumption and production (and therefore trade balance), and take into account the flow of the relevant commodity only (for example, see Ballance, Forstner and Murray, 1987; Webster 1991). In this regard, RCA index proposed by CEPII (Lafay, 1992), which adopted a weighted indicator to reflect the contribution of trade balance and each product's importance for the country's total trade, is recognized as a proper index. This index f_{ik} for industry k in country i (hereafter a weighted RCA index or CEPII RCA index) is defined as

$$f_{ik} = y_{ik} - z_{ik}$$

where y_{ik} is balance in relation to GDP (= $1000 \times (X_{ik} - M_{ik})/Y$) and z_{ik} is attributed balance to industry k (= $\frac{X_{ik}+M_{ik}}{\sum_k (X_{ik}+M_{ik})} \cdot y_{ik}$).[11] In other words, this weighted RCA index for a specific industry is obtained by correcting the conventional

[10] KDI (2003) presents RCA indexes for the Korean industries using the Balassa methods.

[11] Y is GDP, X is exports and M is imports

RCA utilizing relative balance and the attribution of the balance to the industry. Rewriting this index gives

$$f_{ik} = \frac{1000}{Y_i} \cdot \frac{2(X_{ik} M_{i.} - X_{i.} M_{ik})}{X_{i.} + M_{i.}}$$

where the subscript . stands for the flow of commodities to a reference zone (such as the world). The RCA status of an industry can be classified as:

Country i has RCA in industry k *iff* $f_{ik} > 0$,
Country i has RCD[12] in industry k *iff* $f_{ik} < 0$,
Country i has neither RCA nor RCD in industry k *iff* $f_{ik} = 0$.

Different from most RCA indexes, the absolute value of this f_{ik} can be larger than one. Table 4 and Figure 3 summarize the weighted RCA indexes for Korean industries for the period from 1992 to 2000. The general trends of the indexes in the table and figure show that, in spite of relatively large fluctuations in the indexes for some industries, only P&C industry moved from the range of revealed comparative disadvantage (RCD) to RCA over the eight years, and semiconductor industry is the only one that changed its position from RCA to RCD. As of 2000, IT equipment, automobile and T&A industries possessed a strong RCA: the indexes for IT equipment and automobile industries increased and that for T&A industry decreased dramatically, but remaining positive. Overall, in 2000, Korea maintained RCA for seven industries – P&C (though very close to zero), T&A, home appliance, IT equipment, metal products, automobiles and other transport equipment industries.

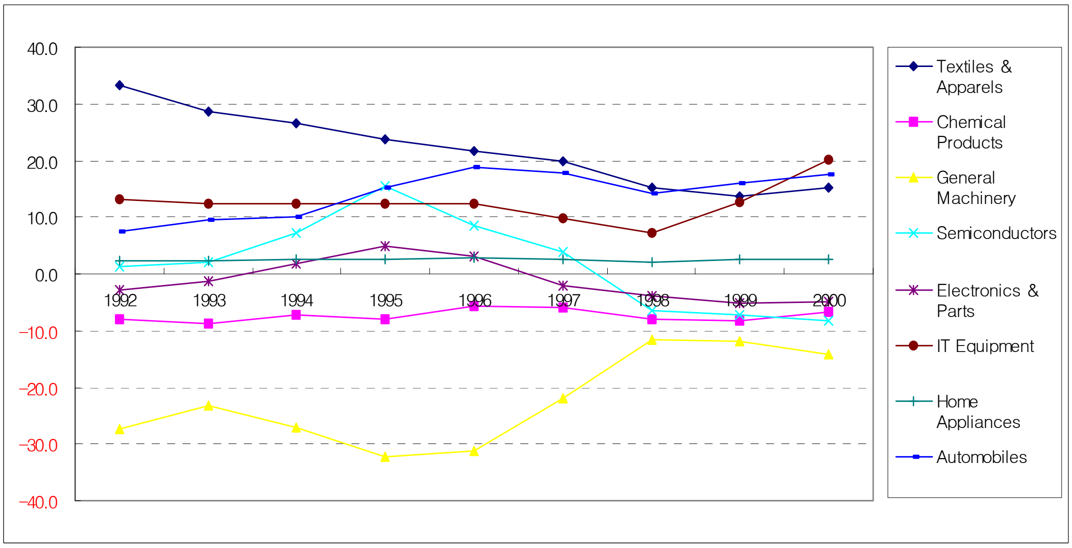
Table 4. CEPII RCA Indexes for Korean Industries (1992, 1996, 2000)

	1992	1996	2000
Food Products & Beverages	-6.2891	-7.2793	-8.4938
Textiles & Apparels	33.2642	21.6454	15.1646
Paper Products, Printing, Publishing	-3.1205	-2.3753	-3.8737
Chemical Products	-7.9924	-5.7064	-6.8058
Petroleum & Coal	-3.9165	-1.8785	0.3701
Non-metallic Mineral Products	-1.5673	-1.9944	-1.3128
Basic Metals	-4.2772	-11.4629	-9.5031
Metals	1.2685	1.0982	1.2282
General Machinery	-27.3191	-31.2455	-14.2997
Semiconductors	1.3044	8.3993	-8.1473
Electronics & Parts	-2.7402	3.0339	-4.8919
IT Equipment	13.2469	12.3974	20.0207
Home Appliances	2.2241	2.9467	2.6003
Automobiles	7.4267	18.7344	17.6350
Other Transport Equipment	2.4981	4.7563	9.4857
Precision Instruments	-5.6289	-9.7698	-10.4158
Other Manufacturing	1.6176	-1.2975	-0.6589

Source: Calculated from KDI (2003).

[12] RCD stands for revealed comparative disadvantage.

Figure 3. CEPII RCA Indexes for Selected Korean Industries (1992~2000)



It is worth noting that semiconductor industry, which has been regarded as one of the most important exporting sectors of Korea, recorded a very high level of RCA in 1995 and then lost its revealed comparative advantage. In 1998, the industry recorded RCD first time in the 1990s, and the degree of disadvantage became deeper since then.

The average RCA and RCD of the Korean industries in the 1990s are compared to those of China and Japan in Figure 4.[13] Including P&C industry, Korea has RCA in seven industries, China in eight industries and Japan also in eight industries. For three industries such as IT equipment, metal products and non-automobile transport, the three economies share RCA. In addition to these three industries, Korea and Japan have RCA for automobile industry, and Korea and China share RCA for T&A and home appliances. There is no industry that only Japan and China share RCA. In addition, no country has RCA against the world for basic metal industry. More findings from RCA analysis are summarized as the following.

(i) Excluding P&C industry (where the RCA index of Korea is almost zero), at least either China or Japan has RCA for all the industries that Korea has RCA. This indicates that all the exporting commodities that Korea has structural strength are likely to face challenges from China and Japan in the world market. Further, the industries that Korea has RCA consist of both labor intensive and capital (or technology) intensive industries.

(ii) Japan is the only country that has RCA for some capital or technology intensive sectors such as machinery, semiconductor, E&P and precision machinery industries. It also has RCA for automobile, IT equipment, metal products and other transport equipment industries, for which Korea and/or China also have (has) RCA.

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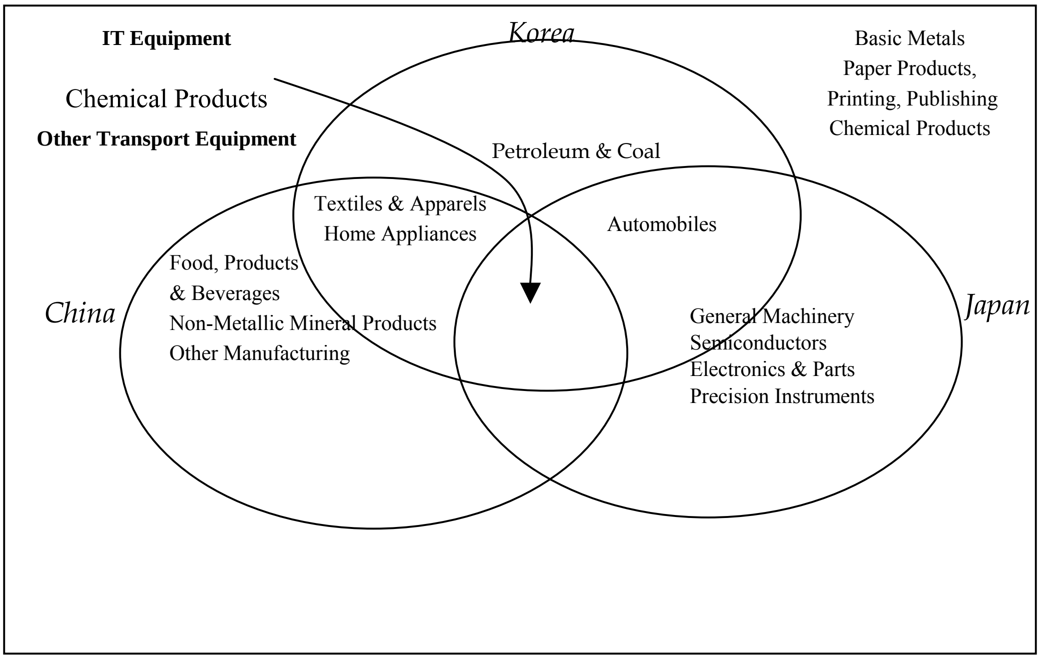
[13] Weighted RCA indexes for China and Japan's industries are available from the author on request. KDI (2003) contains Balassa's RCA indexes for the industries for the three economies.

(iii) China is the only country that has RCA for F&B and NMMP industries. In T&A and home appliances industries, it may compete with Korea as both countries share RCA for these two industries.

Figure 4. RCA and RCD for Korea, China and Japan



3. ESI for Korea-China and Korea-Japan

A variety of indexes related to trade have been developed and utilized in the previous literature. These indexes have different definitions and investigate different aspects of trade. This section reviews the trade performance of Korea using the index that investigates the extent of competitiveness of commodities exported from Korea in specific markets, in comparison with those from other countries. This index, labeled as the export similarity index (ESI), quantifies the similarity of trade structures between two countries in the same market under the assumption that the possibility of competition is higher when the trade structures for two countries are similar. ESI is computed by summing up the minimum values of each country's ratio of export of a specific commodity to a specific commodity group as

$$\mathrm{ESI} = \sum_{k=1}^{n} \min\left(\frac{M_{ih}^{k}}{M_{ih}^{K}}, \frac{M_{jh}^{k}}{M_{jh}^{K}} \right),$$

where
M_{ih}^{k} = market h's imports of commodity k (in commodity group K) from country i,
M_{ih}^{K} = market h's total imports of commodity group K from country i,
M_{jh}^{k} = market h's imports of commodity k (in commodity group K) from country j, and
M_{jh}^{K} = market h's total imports of commodity group K from country j.[14]

In this study, the entire world market is used as a destination. When two competing

Table 5. ESI of Korean Industries against China and Japan

	$ESI_{K\text{-}C}$ (Korea-China)			$ESI_{K\text{-}J}$ (Korea-Japan)		
	1992	2000	Change*	1992	2000	Change*
Food Products & Beverages	0.35	0.48	0.13	0.53	0.58	0.05
Textiles & Apparels	0.54	0.40	-0.14	0.49	0.58	0.09
Paper Products, Printing, Publishing	0.49	0.39	-0.10	0.55	0.49	-0.06
Chemical Products	0.34	0.37	0.03	0.54	0.56	0.02
Petroleum & Coal	0.39	0.44	0.05	0.65	0.54	-0.11
Non-metallic Mineral Products	0.58	0.40	-0.18	0.50	0.60	0.10
Basic Metals	0.32	0.35	0.03	0.54	0.66	0.12
Metals	0.61	0.62	0.01	0.44	0.48	0.04
General Machinery	0.48	0.50	0.02	0.62	0.62	0.00
Semiconductors	0.30	0.68	0.38	0.82	0.77	-0.05
Electronics & Parts	0.63	0.57	-0.06	0.55	0.57	0.02
IT Equipment	0.64	0.69	0.05	0.67	0.69	0.02
Home Appliances	0.74	0.67	-0.07	0.75	0.71	-0.04
Automobiles	0.43	0.17	-0.26	0.71	0.88	0.17
Other Transport Equipment	0.51	0.49	0.02	0.42	0.45	-0.02
Precision Instruments	0.52	0.62	0.10	0.62	0.64	0.02
Other Manufacturing	0.51	0.49	-0.02	0.42	0.45	0.03
Manufacturing	0.42	0.40	-0.02	0.43	0.53	0.10

Source: Computed and rearranged from KDI (2003)
Note: * denotes the change of the index.

[14] Accordingly, the industries in subcategories are investigated to calculate ESI. For more information

countries in a market are compared, if the index is zero for a specific goods, the two countries do not compete for the market with the product as one country does not export the relevant goods at all. If the index is one, then for each commodity, the trade structures of two countries are exactly the same, and they compete very intensively. Table 5 shows ESI in 1992 and 2000 computed for Korea-China and Korea-Japan. The last column for each case is the growth of ESI. As of 2000, there was almost the same extent of competition measured by ESI between Korea and China overall, as in 1992. This finding does not indicate that the competition between the two countries was unchanged: there were some substantial changes in competition structure over the period. For example, competition between Korea and China in the semiconductor market significantly increased from 0.30 in 1992 to 0.68 in 2000 in ESI. It reveals that China has already become a competitor of Korea in the world semiconductor market as more foreign firms invested and produced in China. In comparison, competition between the countries in automobile industry sharply decreased from 0.43 in 1992 to 0.17 in 2000. This change implies that Korea's superiority in automobile industry has accelerated during the period, and China's automobile industry has failed to catch up Korea's in the 1990s. $ESI_{K\text{-}C}$ also significantly decreased for NMMP and T&A industries, meaning that Korea has lost its competitiveness in these two industries. For home appliances and general machinery, the index stably moved in the range of 0.50 and 0.65 throughout the period. The change for these industries over the period was insignificant, indicating that the competition structure for these goods for the two countries did not change notably. For E&E industries (except semiconductor industry) such as E&P, home appliances and IT equipment, the competition between the two economies were overall high showing intense competition has been maintained in these industries throughout the period.

Table 5 also reports export similarity indexes in 1992 and 2000 computed for Korea and Japan. It is noteworthy that overall $ESI_{K\text{-}J}$ substantially increased for the period for the two countries from 0.43 to 0.53 indicating that competition between them intensified in the 1990s. The competition became significantly severe for automobile, basic metals, NMMP and T&A industries while became less intense for P&C, PPP and semiconductor industries. An increase of $ESI_{K\text{-}J}$ for automobile industry is most dramatic reaching as high as 0.88 in 2000. This shows enormous contrast to a sharp decrease in $ESI_{K\text{-}C}$ for the same industry for Korea and China. For automobile industry, Korea far exceeded China and grew up to be a significant competitor of Japan in the world market. T&A is another industry that shows prominent contrast of ESI between Korea-China and Korea-Japan. While ESI for Korea-China for T&A industry decreased from 0.54 to 0.40 in the 1990s, that for Korea-Japan increased from 0.49 to 0.58 in the same period. While it needs further investigation with more disaggregated data, nevertheless, it indirectly proves that the Korean T&A industry moved its focus from labor-intensive, low-price goods to more technology-intensive and high-quality goods, and, in consequence, competition between Korea and Japan intensified. While $ESI_{K\text{-}J}$ for home appliances and semiconductor industries decreased, those for E&P and IT equipment industries increased only marginally. For E&P, the competition index between the two countries is also very stable around 0.55-0.57, and the extent was about the same as or slightly lower than that of Korea-China. Nevertheless, the continuous decrease in the index for semiconductors and home appliances (1% per year respectively) is observed, which might be due to the relocation of production bases from the two countries to China.

In summary, the overall competition between Korea and Japan intensified in the 1990s. Nevertheless, there were substantial changes in competition between Korea and China in selected industries. Competition between Korea and China increased very rapidly in the

regarding sub-industries for each industry, please see KDI (2003).

semiconductor industry, due to the catch up process of China. In contrast, in the automobile industry, Korea has increased the gap between the two countries as proven by decrease in ESI_{K-C}. Korea's automobile industry grew relatively successfully, stably increasing its competitive edge against Japan (say 3% per year as measured by the ESI).

IV. EFFECTS OF TFP growth ON TRADE

1. Introduction

This section investigates the effect of TFP growth on some aspects of trade that the Korean economy experienced in the 1990s. The aspects of trade to be investigated include export growth to China and Japan (and the world), RCA and ESI. While this section is, in particular, interested in the effects of TFP growth, the effects of other variables such as TFI growth and overall industrial growth are also analyzed. As a result, it will reveal how structural changes in industries can be interpreted in the context of international competition and revealed through trade.

More specifically, this section analyzes the relation between each industry's TFP growth and export growth followed by the relation between each industry's TFI growth and export growth. These will show how the export structure of Korea, in particular, exports to China and Japan, was affected by the growth of TFI and TFP. Second, each industry's TFP and TFI growths are compared with each industry's competition against China and Japan. This will reveal how competitiveness of Korean industries in the world market was influenced by the growth of TFP and TFI. It is also one of the major concerns of this section how the change in RCA is affected by TFI and TFP growth, and how it is related to export performance and ESI.

2. Growth of TFP, TFI and Exports

Previous sections investigated structural changes in Korea's industries in the 1990s, and found which industries contributed to economic growth, increasing its share in manufacturing and GDP. The contribution of TFP and TFI to industrial growth and annual growth of exports were also investigated. It is believed that the growth of TFP and TFI are related to the changes in Korea's RCA, growth in exports, and competition against China and Japan. Table 6 summarizes the correlation coefficients between the sources of each industry's growth and export growth, ESI changes, and RCA changes.

First of all, it is striking that the changes in RCA were not contributed by either source of industrial growth. Changes in RCA are positively related to TFI growth only (ρ = 0.091), but the magnitude is negligible. This result cast an important question regarding the RCA fluctuation for the Korean industries in the 1990s. The RCA index is by definition the measure of comparative advantage revealed through trade. If neither TFI nor TFP growth (and even the industrial growth itself!) explains the fluctuation of RCA, it indicates that domestic consumption pattern also substantially changes and in consequence changes in comparative advantage may not be properly reflected in trade performance. It needs further investigation whether there is any other reason that can explain why the industrial growth is not related with RCA in the 1990s. In fact, RCA does not explain Korea's export performance to China and Japan. The growth in each industry's RCA is not correlated with the growth of Korea's export to the two countries.

This finding supports the view that domestic consumption pattern might change substantially during the period.

Table 6. Industrial Growth and Trade Performance: Correlation Coefficients (1992-2000)

	X_C	X_J	X_W	ESI_{K-C} (Korea-China)	ESI_{K-J} (Korea-Japan)	RCA
GIP	0.578	0.454	0.498	0.564	-0.242	-0.015
TFI	0.336	0.436	0.528	0.625	-0.326	0.091
TFP	0.533	0.282	0.259	0.245	-0.056	-0.014
TFI-TFP	-0.156	0.116	0.205	0.279	-0.202	-0.124
RCA	-0.052	-0.049	-0.119	-0.138	0.122	1

While the magnitudes of figures are still small, the changes in RCA is negatively related to ESI for Korea-China (ρ = - 0.138) and positively related to that for Korea-Japan (ρ = 0.122). It implies that the Korean industries, which experienced relatively large extent of RCA improvement, faced slightly less competition from China and more competition from Japan in the world market. This finding is reasonable considering that in Korea RCA indexes increased significantly for leading industries such as automobile and E&E in the 1990s, which were in the frontline of catching up with more advanced Japan's industries.

Secondly, the table indicates that all correlation coefficients for growth in industrial output (value added is used here) and export growth are positive. The industries that experienced higher growth in output, in general, experienced higher growth in exports to the world market, including both Chinese and Japanese markets. It is noteworthy that the correlation coefficient between the growth rates of TFP and exports (ρ = 0.533) is substantially larger than that between the growth rates of TFI and exports to China (ρ = 0.336). In other words, the Korean industries with relatively higher TFP growth are more likely to increase their export to China compared to those with relatively higher TFI growth. In contrast, the correlation coefficient for TFP growth and export growth (ρ = 0.282) is substantially smaller than that for TFI growth and export growth for Korea's exports to Japan (ρ = 0.436), indicating that Korea's exports to Japan were more closely related to TFI growth rather than TFP growth. This result may reflect that Korea has comparative advantage against China in the industries with higher TFP growth, and against Japan in those with higher TFI growth.

Thirdly, it is also noteworthy that the correlations between the growth rate of TFP and exports to China or exports to Japan are larger than that to the world. In contrast, the correlations between the growth of TFI and exports to China or Japan are smaller than to the world. In the world market, Korea's export growth was more closely related to TFI accumulation rather than TFP improvement during the 1990s. The appropriateness of these analyses may be questioned as the industries with higher TFP growth could experience higher TFI growth as well. However, the correlation coefficient for TFP growth and TFI growth is only 0.142 during the period, showing that the two growth rates for each industry are fairly independent. Nonetheless, this study also calculates the correlation coefficient between the difference between TFI growth and TFP growth and export growth; the results support previous findings, showing that it is negative for growth of exports to China and positive for that to Japan. The industries with relatively higher TFI growth than TFP growth are more likely to penetrate the Japanese market successfully, while they are less likely to penetrate the Chinese market.

3. Growth of TFP, TFI and ESI

The comparison of the correlation coefficients between the industrial growth, growth of TFP and TFI, and ESI results in some interesting findings. First, the average annual growth rates of industry's output, TFP and TFI are all positively correlated with ESI between Korea and China, and negatively correlated with ESI between Korea and Japan. For a Korean industry, which experienced a higher growth in industry's output, TFP, and TFI during the 1990s, competition between Korea and China in the world market increased (ρ = 0.564 for GIP-$ESI_{K\text{-}C}$, ρ = 0.245 for TFP-$ESI_{K\text{-}C}$ and ρ = 0.625 for TFI-$ESI_{K\text{-}C}$ respectively), while competition between Korea and Japan decreased (ρ = - 0.242 for GIP-$ESI_{K\text{-}J}$, ρ = - 0.056 for TFP-$ESI_{K\text{-}J}$ and ρ = - 0.326 for TFI-$ESI_{K\text{-}J}$ respectively). The positive correlations for Korea-China imply that China also increased its exports of the commodities that grew rapidly in Korea, and consequently, competition intensified. It is interesting that competition between the two countries has the highest correlation with the growth of TFI; the Korean industries, which recorded higher growth of TFI had to deal with more intense competition from China. In contrast, the correlation between the growth rates of TFP or TFI and changes in ESI for Korea-Japan decreased for the period, indicating that competition between Korea and Japan became less intensive in the industries that grew fast in Korea. Three kinds of answers, which are completely opposite to each other, may be suggested for the Korea-Japan case:

(i) Those industries that grew fast in Korea might grow even faster in Japan and, as a result, Japanese firms were able to capture more of the growing world market;

(ii) Some Korean industries might completely catch up with Japanese industries, which would lead to a decrease in Japan's share such as memory semiconductors (in particular DRAM);

(iii) Alternatively, as KDI (2003) points out, the acceleration of relocation of production bases for these industries to foreign countries such as China, would induce a decrease in competition between Korea and Japan.[15]

Second, the correlation between TFP growth and ESI for both Korea-China and Korea-Japan is weaker than that between TFI growth and ESI for both cases. The industries whose growth was based on TFI faced more severe competition from China as aforementioned. In other words, competition from China was relatively weaker for the Korean industries that achieved a high rate of TFP growth. On the other hand, competition between Korea and Japan decreased more significantly for the industries with a relatively higher growth rate of TFI than TFP. In other words, the industries that had more contribution from TFI growth (than TFP growth) to their output growth faced less competition from Japan.

The size of the correlation coefficients for Korea and Japan requires further discussions. First of all, competition between Korea and Japan in the world market was not stable in aggregated data for selected industries. Nevertheless, the changes of ESI for many industries were insignificant. The coefficient for the growth of TFP and change in

[15] The three suggestions should be applied with care, especially when TFP is considered, as the correlation between TFP growth and ESI growth is almost zero.

ESI for Korea-Japan is also very close to zero, which implies that TFP improvement in the Korean industries may not be sufficient to gain the competing edge from Japan in the world market. Over the period, while six Korean industries experienced very rapid growth in TFP including E&E, automobiles and other transport equipment, only one of these six industries, automobile industry, recorded substantial and positive increase in ESI against Japan. For most of these industries, notwithstanding the rapid growth, Korea still seems to have failed to catch up to Japan in the world market except for a few commodities such as DRAM.

In summary, it can be concluded that the Korean industries faced challenges from China in the 1990s, where the challenge was relatively stronger for the industries with higher TFI growth. This implies that the industries that grew fast in Korea based on factor accumulation also grew rapidly in China, possibly even faster than those in Korea. The overall competition between Korea and Japan in the world market became less intense for the Korean industries that enjoyed fast growth in TFP or TFI. More specifically, while the effect of TFP is negligible, competition was significantly reduced for the Korean industries, which were largely contributed by growth in TFI. This is consistent with the phenomena that Japan has moved from the industries dependent on TFI to those dependent on TFP, and left more room for the Korean industries supported by TFI growth. The growth of TFP is found not to have influenced competition between Korea and Japan. The relocation of production bases offshore or relatively fast growth of Japan's industries may be the cause of this phenomenon as discussed earlier.

4. Further Considerations

While this study investigates the growth of industries in Korea by disaggregating the sources into TFI and TFP, and analyzes their relationship with selected trade figures and indexes, there is no reason to limit our discussion to only those trade figures used in this study. For example, some other trade-related indexes such as trade specialization index, or other RCA indexes may provide invaluable information from different angles. This study analyzes the relationship between industry' growth, RCA and ESI by investigating correlation coefficients between relevant figures. More rigorous quantitative analyses could be performed when longer time series data and the information regarding sources of industrial growth for China and Japan are available. For example, ESI_{K-C} is considered to depend on variables of the two countries, Korea and China, where certain variables such as TFP and TFI for China are not available at present. In this regard, to run regression using only available data will estimate parameters with bias, which will render the entire estimation meaningless. This is one of the major reasons that this study does not perform regression analysis to find the effect of TFP and TFI on competition. Nonetheless, even with the simple quantitative analyses, this study presents many interesting results, where most of them are consistent with intuition. Omission of discussion on any change in trade policy at Korea's export destinations such as China and Japan and the patterns of intra-industry trade also remains as a limitation of this study in providing more affluent and accurate information. Further studies are planned for service industries as well as manufacturing industries, and utilization of more variables such as TFP, TFI and some trade figures for relevant countries including Japan and China will enable a more direct and implicative analysis of the structural relationship between Korea, China and Japan. Furthermore, a close investigation of firm level data would supplement this study that is based on industry level data, as aggregation may distort some real figures. Also, although there is a consensus on the stylized fact that TFP or TFI growth causes changes in patterns of trade, causality between structural changes in production and trade should be further confirmed as more data are compiled.

V. Summary

This study disaggregates the industrial growth that progressed in the 1990s in Korea into contributions from TFI and TFP growth by using data collated for KDI's multi-sectoral model. These findings are applied to the exploration of the relationship between different sources of growth (TFP and TFI) and trade performance, such as RCA and ESI.

In the process of restructuring in the 1990s, it was found that capital accumulated faster than labor in proportion in most industries. In consequence, the entire manufacturing sector was restructured towards more capital intensive, and even the labor-intensive industry used more capital-intensive production technology. TFP played a significant role in growth for select industries, and a sharp increase in TFP was observed in the late 1990s, especially for E&E and automobiles. The contributions of TFP and TFI to the growth of industries varied considerably across industries. In the 1990s, Korea's exports to China dramatically increased at an average annual growth of 27%, which is far higher than the average growth rate of exports to the world, 11%. E&E industries led Korea's exports, in particular to China, recording 40-85% of annual growth. While the industry overall led its exports to Japan as well, growth rates were lower, and exports of E&P to Japan grew very slowly, 7% per year. However, if these performance are standardized by considering the slow expansion of exports to Japan, Korea's exports of IT equipment and home appliances to Japan grew relatively faster than those to China. Overall, TFP was more closely related to Korea's export performance to China and TFI for Korea's exports to Japan.

Furthermore, it is striking that competition between Korea and China became more intense regardless whether the Korean industries experienced a fast increase in TFI or TFP. For the Korean industries that experienced fast growth in TFI, the competition against Japan became weaker. The more intense challenges from China indicate that some industries, which grew fast in Korea also grew fast, probably even faster, in China. The extent of challenges from China was relatively weaker for the Korean industries, which recorded relatively higher contribution from TFP growth. While no decisive evidence is found for the relationship between the growth of TFP and competition with Japan, it was revealed that the industries experiencing the high growth of TFI faced less competition from Japan. This pattern partly reflects that the industries whose growth depended on TFI accumulation significantly declined in Japan. It is noteworthy that this finding confirms the general concern possessed by the Korean people, from a new angle, that the Korean industries are nut-cracked between developing countries (such as China) and developed countries (such as Japan). Nevertheless, there is also a mild clue that the Korean industries climbed up the ladder to compete the Japanese industries, concentrating on the industries with higher improvement in RCA. It was found that the Korean industries that achieved higher improvement in RCA competed against Chinese industries less severely, whereas they faced more intense competition against Japanese industries throughout the 1990s.

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Comments on "The Productivity and Pattems of Trade – The Experience of Korea in the 1990s"

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One objective of this paper seems to be to provide empirical evidence related to industry growth and trade patterns in Korea and evaluate them in the context of North East Asia. For this objective, this paper summarizes growth of industries using growth accounting results provided by KDI (2003), documents trade patterns of Korea in a broad North East Asian context, and finally tries to explain the changes in trade patterns of industries with total factor productivity growth (TFPG) and total factor input growth (TFIG) of industries based on correlation analysis.

Another objective of this paper, although it is not explicitly stated by the author, seems to be to evaluate the so-called "nutcracker hypothesis": while Korea is losing comparative advantage in low-end products to China, it is not acquiring comparative advantage in high-end products from Japan." This is a decade-long subject with wide public attention. Nevertheless, this paper seems to be one of the few well-framed analyses conducted so far on this subject.

In the correlation analysis, the author finds, first, that industry's growth (in output, TFP, and TFI) is positively related to changes in export similarity index between Korea and China (ESI_{K-C}) and interprets this finding as suggesting that China increased exports of commodities that grew rapidly in Korea, and hence, competition between Korea and China has intensified over time. By contrast, the author finds no association between Korean industry's TFPG and the changes in export similarity index between Korea and Japan (ESI_{K-J}). The author interprets this finding as suggesting that TFPG in Korean industries was not sufficient to ensure the gain in competitive edge over Japan in the world market. These two findings are interpreted as supporting the nutcracker hypothesis in Korea during the 1990s.

I think this is a very interesting paper with lots of evidence and with lots of reasonable interpretations which are not summarized here. There are three comments I would like to make. First, although it is argued that Korea is making a transition to productivity-driven growth after the crisis, the three-year averages (1998-2001) in growth accounting results, which have been presented to support this argument, might suffer from business cycle effects. In order to evaluate the trends in TFP performance, longer-run analysis might be more appropriate. Meanwhile, the author suggests that the role of entry and exit might have played an important role in the high rate of TFPG for 1998-2001 period, which might be true to a certain extent. However, But usually, the role of entry and exit in TFPG is very modest in cyclical upturn (and is pronounced in downturn). So, the high rate of TFPG for 1998-2001 period might be due to the business cycle effect.

Second, what are the characteristics of industries with "high TFPG"? Can we expect Korean industries with high TFPG to gain comparative advantage over Japan, for example? If the rates of TFPG of industries reflects systematically some industry 'fixed' characteristics, such as R&D intensity, then there might be no reason to expect an industry with high TFPG to increase RCA or ESI_{K-J} for the simple reason that TFPG of that industry was high. If it is the case, the absence of correlation between TFPG and ΔESI_{K-J} might simply suggest that "Competition structure between Korea and Japan is not related to industry's R&D intensity."

Third, evidence on "nutcracker hypothesis" presented in this paper seem to be mixed. Based on correlation analyses, the author claims that while competition between Korea and China became more intense Korea did not gain competitive edge over Japan in most high tech industries. However, Table 5 might be suggesting a different story; in MFG total, Korea-China ESI didn't change much (0.42 $\rightarrow$ 0.40) but Korea-Japan ESI increased noticeably (more intense competition: 0.43 $\rightarrow$ 0.53). That is, export structure of Korea became more similar to Japan, but export structure of China did not become more similar to Korea.

CHAPTER 5-1

How the Exchange Rate Regime Has Been Switched in Korea : A Public Choice Inquiry*

by

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Abstract

Public choice submits that legal changes can be endogenous in such a way that they are manipulated by bureaucrats who want to maximize rents from transactions with various interest groups. This paper takes the change in Korean exchange rate regimes to empirically examine the premise. It offers a two-stage method, in which we first show that the exchange rate is influenced by interest group pressures, and subsequently that the 1990 market average regime (MAR), as a phase-in policy in Korea, was introduced at least partly to serve bureaucratic incentives. This method is expected to be useful to various studies attempting in many countries to test a possible existence of bureaucratic or other hidden motivations behind any "isolated" event of policy change.

JEL Classification: K42, D78

Key Words: bureaucratic incentive, endogeneity, exchange rate regime, interest group, phase-in policy

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I. Introduction

Public choice recognizes laws as the outcomes of a political market dominated by narrowly focused interest groups seeking rents, resulting occasionally in inefficient laws which injure the losers more than they benefit the gainers. It thus suggests an endogeneity of legal changes in that they occasionally serve the political purpose of accomplishing wealth redistribution and diverting opposition. In particular, public choice has already established that legal changes are often endogenous such that they are manipulated by bureaucrats. They act as agents to the legislature, but, with significant rule-making influence, capture some of the wealth, or raise transaction costs for the principal and other competitors à la Breton and Wintrobe (1982). In fact, the central bank's self-interest in monetary policy has been noted for long time (Havrilesky, 1995).

This paper addresses the exchange rate regime from the forementioned endogeneity perspective, following the proposition that most changes in government policy involve special interests hiding beneath the veneer. It theoretically and empirically demonstrates that an exchange rate regime switch hinges, to a nontrivial extent, specifically on a bureaucratic incentive -- the incentive to maximize the discretionary budget through transactions with various interest groups. Not surprisingly, the previous literature, generally treating the exchange rate regime exogenously, focuses mainly on the goals, implementation, and effects of certain exchange rate policy under the given regime.[1]

Nonetheless, it is encouraging that researchers, at least in determining the exchange rate, have recognized the various influences of interest groups.[2] Although most of the discussions lack solid empirical evidence from systematic estimation, they shed significant insights on our study. In this paper, we go one step further and claim that the regime itself is an outcome of interest group politics orchestrated by bureaucrats in charge as middlemen. They respond to incentives and constraints just like us after all.

The 1990s witnessed a burgeoning of perspectives along this line.[3] These share a common ground, though in somewhat varying tones, that interest groups favoring one regime over another[4] play a decisive role in sculpting the exchange rate regime, thereby endogenizing regime switches. This paper emphasizes the role of bureaucrats as self-

[1] The studies usually assess which regime performs better in terms of output (or employment) stabilization and price stability with the choice of the regime as given. See, among the numerous studies, Stockman (2002), Kenen (2000), Nilsson and Nilsson (2000), Fischer (2001). While the endogeneity of observed regime switches was recognized to a certain degree (e.g., Savvides, 1990; Bordo and Kydland, 1995; Collins, 1996; Edwards, 1996; Freeman et al., 2000; Fischer, 2001), along with the optimum currency area literature (see de Grauwe(1994) for surveys), they generally can be viewed as phrased in de Kock and Grilli (1993, 347), a certain "result of incompatible monetary and exchange rate policies, "thus virtually within the public interest model framework.

[2] Of course, they have implicitly assumed that the government can manipulate it scurrency value at least in the short run. Such manipulation would be easier expecially if a country had capital control more in place as it was obviously the case of Korea up to eh 1997 financial crisis. See Section III for the literature.

[3] These include among others Vaubel (1991), Epstein(1991), Fratianni and von Hagen(1992), Ruland and Viaene (1993), Colambatto and Macey (1996), Hefeker (1997, 2000), Leblang(1999).

[4] Among such competing forces are capital vs. labor (Epstein, 1991), tradablies vs. nontradables (Hefeker, 1997), importers vs. exporters Ruland and Viaene, 1993), and some financial firms' preference of the fixed system (Hefeker, 2000).

interested middlemen who compromise among various conflicting forces, rather than dealing narrowly with the preferred regime choices of an exemplary pair of two sectors.

Moreover, to the authors' knowledge, there is no empirical work, concerning a country's regime switches, which explicitly tests this endogeneity hypothesis. This indicates that its empirical validation within an individual economy has yet to be established. Even the scarce empirical work among the endogeneity literature, although in line with the traditional public interest perspective, had to rely on cross-country analyses, such as a probit estimation of major characteristics of the countries adopting a fixed regime.[5] This is obviously due to the inherent difficulty in within-country testing, that is, "*disentangling economic (i.e., public interest) and political (i.e., public choice) influences*" (Crone and Tschirhart, 1998, 106) usually concerning an "unprecedented or only sporadic" policy (i.e., exchange rate regime) change. This paper attempts to overcome this inherent difficulty using a two-stage estimation technique.

The order of the paper is as follows. Section II starts with discussions on the political economy of the exchange rate regime choice, and provides, by way of a case illustration of the 1990 regime change in Korea, a simple theoretic account of the regime choice optimal to bureaucrats. Section III, as the first stage of our empirical work, estimates the exchange rate equation with variables reflecting interest group pressures. Based on this equation, Section IV tests our main hypothesis that the forementioned 1990 regime change was caused by bureaucrats' own incentive in facilitating interest group politics, which will complete the second stage of our empirical testing. Summarizing the paper, Section V concludes that our analysis would certainly shed a critical implication not only specifically to the 1997 liquidity crisis in Korea, but more generally to a host of countries under similar situation.

II. Public Choice Perspective on Changes in the Exchange Rate Regime

1. Outline

Political-economic reasons for the observed cyclical movements of exchange rate regimes were rarely tackled in the literature, except for some attempts to explain observed regime switches in terms of, for example, incompatibility in monetary and exchange rate policies (Rose, 1996) or inflexibility in (de Kock and Grilli, 1993), the relative value of (Bordo and Kydland, 1995), or the use of inflation tax. Even the very scarce empirical studies following the endogenous choice views (Savvides, 1990; Edwards, 1996; Leblang, 1999) assume overall that a welfare-maximizing government chooses the exchange rate regime.

We relax this assumption and adopt a view of policy making in which politicians act to benefit interest groups. The essence of this public choice critique of the optimal policy approach is that domestic political and bureaucratic pressure almost always leads to some interests being counted more than others (Willett, 1999, 221-253). Particularly, we emphasize, especially in developing economies with a strong bureaucracy like Korea, the role of bureaucrats as self-interested middlemen compromising between various conflicting forces.[6]

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[5] Furthermore, problems with this kind of dichotomous classification introduce important caveats to all of the cross-country empirical analyses (Collins, 1996, 118).

[6] In this regard, the limited literature concerning bureaucratic self-interest in European monetary integration is significantly illuminating for our study. Fratianni and von Hagen (1992) view the monetary union

We adopt a reasonable presumption that, while an interest group prefers a certain "level" of the exchange rate, bureaucrats in charge as accommodators might prefer its determining "regime" of a certain kind. In other words, on the one hand, the welfare of interest groups is much more affected by rates (i.e., final products of bureaucrats) than by regimes (i.e., production facilities of bureaucrats). On the other hand, differing regimes impose differential levels of costs to bureaucrats themselves when maneuvering the exchange rate, in all levels and directions, to accommodate the demands from interest groups.[7] To be sure, such policy makers would face a certain efficiency constraint in switching the regime. Within the limit of the efficiency constraint, nevertheless, they adjust the regime, unless the related marginal cost exceeds its marginal benefit. Below we offer a simple theoretic illustration of how the optimal regime choice is made by bureaucrats to serve their own interest-group related benefits, and subsequently apply it to the 1990 regime change in Korea for illustrative purposes.

2. A Bureaucratic Incentive Model of Exchange Rate Regimes

Suppose first that the bureaucratic utility function consists of two arguments: public interest, and private benefits derived from lobbying efforts by interest groups to obtain a certain exchange rate.[8] For analytical simplicity, assume that the lobbying efforts, and thus the benefit flows to bureaucrats, are constant across exchange rate regimes. After all, it is the demand for changes in the exchange rate *per se*, largely determined by their intervention and other economic factors, that matters to the lobbying parties. For the bureaucrats, on the other hand, the cost associated with exchange rate manipulation varies significantly, depending on which regime they adopt. Therefore, the bureaucrats' utility-maximizing incentive, subject to the relevant constraints of accommodating the rate manipulation requests, comes downs to how easily they can manipulate the exchange rate -- finding the least-cost exchange rate regime.[9]

History has left open a wide range of regimes, ranging from hard pegs sustained by currency boards and the abandonment of a national currency, to a variety of crawling bands with wide ranges, and to complete floating. Following Fischer's (2001) conceptual spectrum to reflect the reality better, and to make a continuous analysis available, we define the set of exchange rate regimes according to their permitted bands in which the currency may move daily. <Figure 1> displays on the X -axis the perfectly fixed (or hard pegs) regime (*FIX*) with a zero permitted band, and the perfectly flexible (or floating) regime (*FLX*) under which the rate may change without bound.

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partly as the outcome of central bankers' collusive efforts to reduce competition in their race to provide monetary stability. Vaubel (1991) also interprets the creation of a common central bank as a device to increase comfort, and to decrease accountability of central bankers.

[7] While Frieden (1994, 81) and Hefeker (1997, 22) assume that the regime choice is the major concern of interest groups, they also acknowledge our presumption that they surely have preferred levels of exchange rates. Refer to Stephan (1994) for a similar perspective.

[8] See Shunghart and Tollison (1983), Poole (1990), and Havrilesky (1995). The Korean bureaucracy has been well known for its extraordinary level and scope of discretionary power and organizational cohesiveness. It appears that the Bank of Korea bureaucrats and ex-bureaucrats receive various benefits from the private sector. See, for instance, Kim and Kim (2001) and Cho and Kim (2001).

[9] We adopt a simplifying assumption that the public inerest utility is not sensitive to eh type of regimes.

We define the "total manipulation cost (*C*)" as the sum of the "non-financial cost (*NF*)" and the "financial cost (F)."[10] The former refers to the various political cost, domestically or internationally, stemming from adjusting the exchange rate by, say, a unit change. In fact, the definition of is very similar to the "political cost" in Collins (1996).[11] Other things being constant such as capital mobility, this cost will increase as the regime approaches , since all information regarding government intervention should be revealed to the market under *FIX*.[12] *F* is the monetary cost, necessary to warrant a successful per unit adjustment through intervening the market, which increases as the regime gets close to . With gradually larger bound upward or downward, the government encounters an increased risk of losses from the money game with market speculators under , effectively reducing its "room to maneuver" (Freeman et al., 2000, 449).[13] Note that the very steep slope of the upper part of the F curve is perfectly consistent with the widely shared belief among current experts that any manipulation of the exchange rate has recently become extremely difficult. <Figure 1> reflects these relationships with the downward sloping , and the upward sloping curves.

<Figure 1> displays the U-type total cost ($= NF + F$) curve, , and shows that its minimum will usually be placed at some point between the two extremes on the -axis. Interestingly enough, this is consistent with Frankel's (1999, 30) observation that "*[I]ntermediate solutions are more likely to be appropriate for many countries than are corner solutions.*"[14] Moreover, at least from this paper's perspective, the exact minimum position of a country in <Figure 1> will be determined by its own politico-economic characteristics. For example, as the curve shifts in a south-western direction, the optimal regime will become more fixed. This implies that bureaucrats tend to be more reluctant to let its currency fluctuate, the more closed the economy, the smaller its trade capacity, or the less matured its free-market system (or equally, the more authoritarian the bureaucracy), etc.[15]

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[10] To keep our argument simple, we take as fixed not only the usual performance criteria appearing in the loss function of optimal policy literature (e.g., the credibility of monetary policy, or the stability of prices and financial system), but the bureaucratic incentives of international agencies such as the IMF.

[11] In the fixed system, any nominal exchange rate change is visible and clearly indentifiable, while, in a more flexible regime, it can be difficult to distinguish between market outcomes and government decisions (Collins, 1996, 120).

[12] Failure of "international coordination" to keep the exchange rate within a preengaged zone under pegging or fixed regimes imposes enormous burdens on bureaucrats (Willett, 1999). This is consistent with Gärtner's (1991) observation that bureaucrats are very reluctant to the stigma overseas of pushing beggar-thy-neighbor policies. Under a fixed system, the uncovered manipulation of eh exchange rate for a special interest group will surely provoke domestically stronger resistance by the losers.

[13] We preclude situations such as currency crisis. However, this argument is reinforced by the finding that the amount of foreign currency intervention used each time was greater under the floating system than under the Bretton Wood system (de Grauwe, 1996, 207).

[14] For empirical evidences, See Masson (2001) or Calvo and Reinhart (2002). However, all their results come from the public-interest approach such as those mentioned in footnote 1), not from a bureaucratic incentive as in this paper.

[15] The implications of these hypotheses are all similar: lower political costs to bureaucrats. It is interesting in this regard to note Leblang's (1999, 609) finding that more democratic countries are likely to adopt a floating regime. Furthermore, Collins (1996, 128-129) found that smaller countries were most likely to choose a fixed regime. She also found less open countries to be associated with the fixed regime, although Bernhard and Leblang (1999, 86) obtained the opposite result.

<Figure 1> HERE.

3. The Case of Korea

Since 1945 for forty five years, Korea had adopted three exchange rate regimes which, despite their different names of "Fixed", "Single Floating", or "Multicurrency Basket Pegging" exchange rate system, have been demonstrated to be practically rather close to hard pegs (The Bank of Korea, 1997). The monetary authority changed the regime to the "market average regime (MAR)" in 1990 as a "phase-in" policy, à la Kaplow (1986), allowing the exchange rate to move daily within a permitted band (initially ±0.4% to ±2.25%) around the weighted average of rates calculated from dollar transactions among domestic financial institutions on the previous day.[16] Thus, the 1990 regime change was basically a switch from the "fixed" system to a narrow band regime, meaning it was "getting closer to *FLX*" in <Figure 1>. The monetary authority claimed that MAR was intended to let the exchange rate be determined by the market supply and demand. But it also announced that the introduction of the narrow band was to "*alleviate the turbulences in the foreign exchange market and the harmful effects on the economy,*"[17] which is similar to the underdevelopment of financial markets argument in Nilsson and Nilsson (2000, 331). This paper does not intend to refute the authority's claim outright, but to highlight the embedded bureaucrats' incentive to defend their own interests, including discretionary power.

As mentioned, all the previous exchange rate regimes had been close to fixed ones before MAR. A backward conjecture, based on our bureaucratic framework, thus suggests that, around 1990, the total cost curve must have moved to the right (i.e., from C to C' as in <Figure 1>). We argue that the major cause of the movement lies in the shift of the non-financial cost curve in the north-eastern direction, from NF to NF'. A three-fold explanation is plausible: the sudden increase in the worldwide attention to the Korean economy, the rapid growth of the Korean trade volume and, politically, a launching of actual democratization.[18] We believe that all these factors in the late 1980s raised encountered by bureaucrats in manipulating the exchange rates. We claim that the transition to a slightly more flexible system, but not completely to *FLX* in <Figure 1>, can be explained by the bureaucrats' calculated move to better serve their interests.

As indicated in the Introduction, however, testing this compound hypothesis of the bureaucratic incentive in facilitating interest group politics has been very hard to undertake, mainly because only a single event (i.e., the switching to MAR) is involved. We offer a two-stage method to overcome this empirical barrier. In Section III, we estimate the exchange rate equation to verify the existence of interest group influences on its level determination along the entire time horizon. This equation of interest group politics will subsequently be utilized in Section IV, to confirm that the bureaucratic incentive played an active role in the 1990 switch to MAR. This will complete our endogeneity hypothesis.[19]

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[16] Taiwan, for example, also used this market average regime from 1982 to 1989.

[17] *Dictionary of Key Terminologies in Economic Policy*, The Economics Education Section, The Bank of Korea Homepage (www.bok.or.kr).

[18] Please refer to <Referee's Appendix> for a little more elaboration on this.

[19] Use of MAR was terminated and switched to the floating system with the 1997 financial crisis. One can describe *ex post* that this transition was mostly due to the view that intermediate solutions (or soft pegs) are not viable for sustained periods (Fischer, 2001). We believe, however, that the phenomenon can be at least partially explained *ex ante* by our own bureaucratic incentive framework. Korean bureaucrats, formally required to obtain the IMF's scrutiny for every major policy decision including market interventions, must have

III. Estimating the Interest Group Model of the Exchange Rate Determination

1. Main Hypotheses and Data

We empirically show in this section that the exchange rate is, at the margin, subject to interest group pressures as well as to traditional macro-variables. It is well taken that interest groups play a vital role in the formation of public policy (Potters and Sloof, 1996, 403). As to exchange rate determination, one can find some theoretical work in this line, as Stephan (1994) described.[20] However, few empirical works explicitly examining such influences exist except those which included political variables like election or partisan identity in Dornbusch (1987), van der Ploeg (1989), Blomberg and Hess (1997), to name a few. Although varying kinds of interest group pressure might exist, we identify below the three major ones playing important roles in Korea.

■ Identification of Pressures and Their Proxies

(1) Importers vs. Exporters

The literature strongly conveys that the exchange rate can become an effective device to protect importing and/or exporting industries. The government, by depreciating its own currency, can benefit exporting or import-competing industries (Corden, 1982; Bliss and Joshi, 1988). G?tner (1991) claims that the central bank always seeks political support domestically and overseas, and that the domestic support is reflected mainly by the interests of importers and exporters.[21] In a similar context, Huizinga (1997) theoretically shows that the real exchange rate tends to be overvalued in countries with a high proportion of import consumption to income.

We particularly note a body of research claiming that such arguments hold quite extensively throughout the "entire line of production."[22] It is thus imperative to use industry-based data, for which we will utilize the *Input-Output Table* (See <Appendix> for details), because it provides relevant import/export statistics for disaggregated, i.e., for up to 77 industries.

It is by nature difficult to develop an ideal proxy of lobbying forces by importers and exporters, as clearly identified by Broz and Frieden (2001, 327-328): the "proxy problem" and the "Olson problem." In most of the studies on general interest group pressures, when such direct measures as campaign contribution or lobbying expenditure are not

perceived the *NF* cost curve to shift upward further, thus making the floating system a more favorable choice.

[20] In particular, Corden (1982, 281), by calling it "exchange rate protection" for a certain industry, emphasizes the so called special interest group feature in exchange rate intervention à la Olson (1965) and Tullock (1989). Also, Huizinga (1997) and Lohmann (1998) highlight its inherent inefficiency. To be sure, there have been discussions regarding the central bank's bureaucratic incentive. Gärtner (1991) and Stephan (1994), for instance, cope directly with bureaucratic incentives, arguing that central banks are also political entities which, to varying degrees, respond to political demands, and strive for support from those groups or actors. Their empirical jobs, however, do not include parametric estimation of the interest group pressures.

[21] Importers' and exporters' ultimate concern will be the real exchange rate changes. Primarily, however, they are concerned with changes in the nominal exchange rate, which are in the short-term expected to change the real exchange rate (Stephan, 1994, 98).

[22] For example, the pressures from producers using imported inputs lead to currency overvaluation (e.g., Hirschman, 1971; Rodrick, 1986).

available, the average size of the producers or the percentage of proprietorial income is a typical variable used to measure the stake of an industry in influencing government policies (Potters and Sloof, 1996). In this paper, as an experimental attempt, we calculate for each industry the proportion of exports to their total output (i.e., the export proportion), from the *Input-Output Tables*, in order to proxy the pressure of the industry.[23] The higher the export proportion, the greater incentive to lobby for depreciating their currency value.

We utilize this export proportion in two ways to include into the empirical equation as the "exporters' pressure variable in the economy (EXP_PRESS)." Firstly, in attempting to overcome the "proxy problem" of Broz and Frieden (2001), we calculate the weighted average of these proportions across industries for each period. Note that the denominator of this average is equal to the "total demand" in the *Input-Output Table*, which we believe reflects our purpose appropriately, since it counts the intermediate as well as the final goods and services, thus extensively capturing the level of pressure. Secondly and more interestingly, in hoping to reflect the free-riding problem in collective action of Mancur Olson as identified by Broz and Frieden, we calculate the same weighted average only of industries whose export proportion exceeds some value. Lobbying has a public good characteristic. The export proportion (as well as the import proportion to be discussed later) should exceed a threshold value so that the benefit from lobbying is large enough to overcome the free-riding problem. We take, as a rather experimental threshold value, 0.05, which is approximately the median both in the import and export proportions.

As to the "importers' pressure variable in the economy (IMP_PRESS)," we go through the similar process of calculating for each industry the proportion of imports to their total output (i.e., the import proportion) from the *Input-Output Tables*. Again, we try both the weighted average of these proportions and that consisting of industries whose import proportion exceeds a threshold value in order to ameliorate the Olson problem.

(2) Foreign Debts vs. Foreign Credits

Foreign debt is already known to affect the exchange rate either by the traditional portfolio model or by the fundamental exchange rate approach (Williamson, 1985). Fabella (1996) argues that the current account deficits backed up by foreign debt tend to overvalue the currency. Chow (1997) submits that a weak currency can be sustainable owing either to low foreign debt or to higher pressures from exporters. All these suggest that the higher the net foreign debt, the greater likelihood of pressure to appreciate the exchange rate. In this section, we take the proportion of the net foreign debt of Korean firms to their total assets as the pressure variable ($FOREIGN\_DEBT$), whose data source is the *Financial Assets and Liability Balances,* published quarterly by the Bank of Korea.

(3) Election Effects

Exchange rate policy has been discussed by many commentators, as cited earlier, in the context of the political business cycle. The major tenet of their arguments is that the incumbent administration, right before the election, tends to appreciate the currency to temporarily increase exports by the J-curve effect, and, through declining import prices,

[23] It would be more complete if we could include import-competing industries as well. Due to the technical difficulty, however, we leave this task for future research.

to lower the domestic price level to temporarily increase real income. In this paper, we use presidential and parliamentary election dummies (*ELECTION*) to examine such tendencies.

2. The Empirical Model

We start from the traditional monetary exchange rate model[24], following the spirit of continuity among different exchange rate regimes as illustrated in <Figure 1>, and add our interest group variables as in equation (1) below. The sample period includes 1980:Q1 to 1997:Q4.

$$\begin{aligned}\Delta s_t &= \beta_0 + \beta_1\Delta(m_t - m_t^*) + \beta_2\Delta(y_t - y_t^*) + \beta_3\Delta(i_t - i_t^*) + \beta_4\Delta(\pi_t^e - \pi^{e^*}_t)\\ &+\beta_5 D_{X,t-1} \bullet \Delta EXP\_PRESS_{t-1} + \beta_6 D_{M,t-1} \bullet \Delta IMP\_PRESS_{t-1}\\ &+\beta_7 D_{D,t-1} \bullet \Delta FOREIGN\_DEBT_{t-1} + \beta_8 ELECTION_t\\ &+\beta_9 D_{X,t-1} + \beta_{10} D_{M,t-1} + \beta_{11} D_{D,t-1} + \varepsilon_t.\end{aligned}$$

- s_t is the log of the won-dollar quarterly average and Δ indicates differenced values.
- m_t, y_t, i_t, and π_t^e are log M2, log real income, short-term interest rate (call rate for Korea and the federal fund rate for the US), and expected inflation rate (inflation rate of CPI for the previous 4 quarters), respectively. * indicates the US. (Data sources: The Bank of Korea database.)
- For EXP_PRESS and IMP_PRESS two versions of the weighted averages explained earlier are used.
- *ELECTION* dummies take one during two quarters before the all direct elections for the president and the parliamentary members.

We posit that the interest group pressures are asymmetric in their influences. For example, we suspect that the exporters' pressure actually comes into play only when the export is in a down turn, and that, when the export is going smoothly, the pressure would not be as strong or, considering nontrivial lobbying costs, even fade away. In order to capture this asymmetry in lobbying pressure, three dummies have been included in equation (1). First, $D_{X,t}$ takes one for the quarter in which the seasonal growth rate of exports is lower than the previous quarter's. Second, as a dummy associated with the importers' pressure, $D_{M,t}$ takes one for the quarter in which the seasonal growth rate of imports becomes lower than the previous quarter's. Finally, we design $D_{D,t}$ as taking the value of one when the growth rate of the net foreign debt exceeds that of the previous quarter. The specification in equation (1) reflects our *prior* belief that these dummies might affect the dependent variable either through the intercept or the slope, although the latter is our major interest in estimating an interest

[24] Among various versions of the monetary models, we adopt the flexible price model of Frenkel and Bilson (F-B), and the fixed price model of Dornbusch and Frankel (D-F). See Meese and Rogoff (1983) for details. In terms of equation (1) the F-B model imposes a restriction $\beta_4 = \beta_5 = \beta_6 = \beta_7 = \beta_8 = \beta_9 = \beta_{10} = \beta_{11} = 0$ while the D-F model does $\beta_5 = \beta_6 = \beta_7 = \beta_8 = \beta_9 = \beta_{10} = \beta_{11} = 0$.

group pressure model of the exchange rate. We also assume that the interest group pressures become effective with one-period lag.[25]

According to our expectation, $\beta_1 > 0$ [26] and $\beta_2 < 0$ both under the F-B and D-F models. However, the former model expects that $\beta_3 > 0$, while under the latter, it is predicted that $\beta_3 < 0$ and $\beta_4 > 0$. (See Frankel (1979) for restrictions on coefficients.) To be sure, our prediction about the interest group pressures is that $\beta_5 > 0$, $\beta_6 < 0$, and $\beta_7 < 0$. The coefficient of *ELECTION*, $\beta_8 < 0$ is expected.

3. Estimation Results

Estimation results of equation (1) are presented in <Table 1>.[27] Looking first at the traditional variables of the F-B and the D-F models, $\hat{\beta}_1$ and $\hat{\beta}_4$ are significant with expected signs. However, since the D-F model gives a much higher adjusted R^2, we use it as the baseline to which we add our pressure variables. Case 1a uses the weighted averages for EXP_PRESS and IMP_PRESS, while Case 2a uses those made of industries selected by the threshold values explained earlier. To verify the robustness of our estimates, all pressure variables used in Cases 1a and 2a, respectively, are log-transformed in Cases 1b and 2b. There is no significant change in signs and statistical significance of the estimates for traditional variables throughout these models. Of particular interest is the finding that the coefficients of EXP_PRESS and IMP_PRESS have expected and statistically significant signs, which validates our hypothesis of interest group pressures on the exchange rate. Note particularly Case 2a; EXP_PRESS, which takes account of the Olson effect, is statistically more significant. The significant coefficient of *ELECTION* indicates that the exchange rate was politically utilized. Finally, higher adjusted R^2s in all four cases reinforce the explanatory power of our hypothesis. Upon verifying the existence of interest group influences at this first stage, we now turn to the second stage of testing our endogeneity hypothesis along the exchange rate regime change.

<Table 1> HERE.

4. A Few Remarks on the Lobbying Power Proxies

We went through a great deal of scrutiny and statistical testing in order to convince ourselves that our proxies in equation (1) actually capture the lobbying power. Furthermore, we intended to overcome a possible criticism that it might be hard to distinguish such variables from those based instead on a welfare maximizing government's policy. It appears that we have a rather strong case on this point: Our proxies do represent the lobbying power.

Our efforts have been three-fold. Firstly, the correlation between the exports and the weighted averages for EXP_PRESS across industries is -0.07, while that between the

[25] We tried various lags, and the interest group pressures were most evident with one-period lag.

[26] $\beta_1 = 1$ should be predicted when the exchange rate is assumed to be the first-degree homogeneous function of the relative money supplies in two countries. We posit that $\beta_1 > 0$ suffices with the relaxation of this assumption.

[27] The stationarity of all variables has been confirmed by the augmented Dickey-Fuller test. The possible existence of endogeneity of contemporaneous explanatory variables has been rejected by the Hausman test.

imports and the weighted averages for IMP_PRESS is -0.01. No Granger-causality has been found between the dependent variable and each of the lagged interest group pressure variables in equation (1). These facts effectively invalidate a potentially different interpretation of our pressure variables, such that they are just the "export" or "import."

Secondly, our *a priori* expectation and empirical confirmation that $\beta_5 > 0$ and $\beta_6 < 0$ reinforces the validity of our pressure proxies. The signs would have to be exactly the opposite if the forementioned different interpretation were correct.

Lastly and probably most important, we investigated any possible spuriousness, stemming merely from the interaction dummy $(D_{x,t-1})$, in the positive $\hat{\beta}_5$. We reestimated Case 2a with a constraint of $\beta_5 = \beta_6 = \beta_7 = 0$ to see if $\hat{\beta}_9$ would be positive with significance. If that were the case, since $D_{x,t-1}$ represented the quarters of declining exports, it would be interpreted such as "government simply depreciated the exchange rate," just as the forementioned welfare maximizing premise would indicate. Then, our lobbying pressure hypothesis would be hampered because $\hat{\beta}_5$ could also have been influenced by the interaction dummy, $D_{x,t-1}$, i.e., by such government interventions out of the public interest concern. But $\hat{\beta}_9$ was found not significant at all (p-value=.84), accordingly further warranting the legitimacy of our lobbying power proxies.

IV. Testing the Endogenous Change in the Exchange Rate Regime

1. Methodology: Estimation of Time-Varying Parameters

We prove now, through the single event of the 1990 switch to MAR, the embedded bureaucrats' incentive to defend their own interests. In Section II, we postulated that several events in the late 1980s increased the political cost of exchange rate manipulation encountered by bureaucrats in accommodating interest group politics. We subsequently claimed that transition to a more flexible system (i.e., MAR), if not completely refuting the Korean monetary authority's "phase-in" policy justification, was a calculated move faithful to bureaucrats' own interests.

If our hypothesis holds, one can reason that, for some period before the switch, it was getting more difficult for the Korean monetary authority to accommodate the interest group pressures. Also, if the switch was actually successful in lowering its cost of exchange rate manipulation, the interest groups must have recovered the lobbying capacity. This reasoning can be translated into the empirical equation (1): the estimated coefficients of the pressure variables become somewhat insignificant before the switch, but their significance levels recoup afterwards. We finish the second stage of testing our endogeneity hypothesis with a systematic examination of these factors.

The time-varying parameter estimation, based on Kalman Filter, allows us to investigate this matter (Kim and Nelson, 1999). We select Case 2a as the representative model and make time-varying the coefficients of the three pressure variables in (1) as follows:

$$\beta_{j,t} = \beta_{j,t-1} + \upsilon_{j,t}, \quad (j = 5,\ 6,\ 7),$$

where and $\upsilon_{j,t} \sim i.i.d.N(0,\ \sigma^2{}_{\upsilon_j})$ and $\varepsilon_t \sim i.i.d.N(0,\ \sigma^2{}_{\varepsilon})$ (2)

The time-varying estimates of , $\hat{\beta}_{5,t}$, $\hat{\beta}_{6,t}$, and $\hat{\beta}_{7,t}$ under specification (2) are displayed as solid lines in <Figure 2> to <Figure 4>.[28] Dotted line in the figure indicates the critical value of the 95% confidence level under the one-tail test. Most striking is the finding that the critical values of $\hat{\beta}_{5,t}$ in <Figure 2> which are mostly positive up to 1986:Q3 (which is consistent with the fact that $\hat{\beta}_{5,t}$ was significant at the 5% significance level in <Table 1>) become mostly negative from 1986:Q4 to 1991:Q1. They become positive again in 1991:Q2. Thus, we infer that the exporters' pressure was not able to influence the exchange rate for about three years before the 1990 switch, and that it took about a year to recover the lobbying power afterwards.

As to $\hat{\beta}_{6,t}$ in <Figure 3>, the critical value of 95% confidence level is mostly negative, as expected except for the same four years around the 1990 switch. This indicates that the importers pressure did not work during the period, either. Finally, from the positive $\hat{\beta}_{7,t}$ in <Figure 4>, we figure that the net foreign debt during the whole period did not affect the exchange rate in the way predicted, which is consistent with the result in <Table 1>. As to $\hat{\beta}_{7,t}$ the alternative hypothesis was $\hat{\beta}_{7,t} < 0$, so the critical value of 95% confidence level must be less than zero to reject the null hypothesis, $\hat{\beta}_{7,t} = 0$. But even $\hat{\beta}_{7,t}$ itself is larger than zero and not significant throughout the whole sample period.[29] Therefore, it confirms the results of the <Table 1>.

We thus conclude that the importers' and exporters' pressures were not conveyed to affect the exchange rate for about three years before the introduction of MAR, and that, after approximately one year of adjustment, they started regaining lobbying powers. We believe this second stage completes our endogeneity hypothesis test.

<Figure 2>, <Figure 3> and <Figure 4> HERE.

2. Reinforcing the Argument

We intend to reinforce our endogeneity argument by an alternative testing method of the second stage, which consists of two simple steps. In Step 1, if our arguments hold, estimation of equation (1) would produce better results for $\hat{\beta}_{5,t}$ and $\hat{\beta}_{6,t}$ with the problematic intervals (approximately the three years before MAR, as evidenced in the above figures) excluded. Meanwhile, in Step 2, if those pressures regained their lobbying powers, exclusion of the three-year period afterwards would undermine their estimates. As shown below, this alternative testing reinforces the endogeneity theme in exchange rate regimes.

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[28] More detailed results of estimation are available upon request.

[29] Although not shown in <Figure 4>, the lower critical values of $\hat{\beta}_{7,t}$ under the 95% two-tail test are below zero. This implies its statistical insignificance.

Step 1: Case 3a in <Table 1> reports the reestimation results of Case 2a, with three years (1987 to 1989) before MAR outsampled. The statistical significance level of $\hat{\beta}_5$ increased from 5% to 1%, and that of $\hat{\beta}_6$ also improved from 5% to 1%. In addition, we obtain an improvement in the adjusted R^2.[30]

Step 2: Case 3b are the reestimation results of Case 2a, with the three years after MAR excluded. We observe that the statistical significance of $\hat{\beta}_6$ has been hampered as predicted.

V. Conclusions

We took the change in exchange rate regimes, i.e., MAR introduced by the Bank of Korea in 1990, to empirically examine the public choice premise: legal changes can be endogenous in such a way that they are manipulated by bureaucrats. Admittedly, our work in this paper is experimental. But it is believed to contribute to the existing research, almost none of which explicitly tests the endogeneity hypothesis on the exchange rate regime.

As the first stage of testing the hypothesis, we estimated the exchange rate equation which includes proxies of varying interest group pressures along with typical macro-fundamentals. We subsequently verified that this interest group equation provides a much higher explanatory power than traditional models, and more intriguingly, that importers, exporters, and elections play significant roles in influencing the exchange rate at least in the short run.

In the second stage, we utilized the time-varying estimation in order to discover what really happened behind the introduction of MAR. We found the similar pattern in the significance of the interest group pressures across time. But we discovered that the importers/exporters pressures lost their lobbying powers for about three years, and that they regained the powers about one year after MAR, which led us to a further conviction regarding our endogeneity hypothesis. We believe that the two-stage method offered in this paper can be fairly useful for various studies attempting to test, behind an isolated event of policy change such as ours, the existence of bureaucratic or any other hidden motivations.

Finally, one can look at the introduction of the 1990 MAR as a "phase-in" policy along the transition from hard pegs to independent floating. This paper's result might be another confirmation of the famous proposition that phase-ins as transition policy tend to undermine social efficiency rather than to play the alleged shock-absorbing role (Kaplow, 1986). The increasing number of observers suggest either that Korea could have adopted independent floating before 1990, or that the intermediate position, MAR, was one of critical causes of the 1997 currency crisis (e.g. Sachs, 1999; Grier and Grier, 2001).

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[30] To maintain the degree of freedom, instead of excluding the period, we also gave $D_{X,t}$ and $D_{M,t}$

<Referee's Appendix> Three Causes for the Upsurge of NF in Korea

The first was the increased recognition of Korea by the international community. The 1986 Asian Games and the 1988 Summer Olympic Games gave Korea an image far beyond that of a small neighboring country to Japan and China. In particular, the latter event, which was the biggest ever since the country's foundation, triggered the world to seriously inquire about the operations of the Korean economy. In September of 1988, the Korean government accepted the obligations of Article VIII of the IMF Articles of Agreement, and undertook the open-door policy in full force. For example, the import liberalization ratio rose to 95.4% in 1988, and the government initiated deregulation in foreign investment, including real estate transactions.

Second and more importantly, the size of the Korean economy had grown very rapidly by the late 1980s. In fact, the country was ranked 11th in world-wide trades. Accordingly, major trading partners and competitors started closely monitoring whether the Korean government's intervention in the exchange rate undermined their interests in any way. The pressure from these trading partners mounted almost immediately. For instance, "*The US is increasing its pressure on South Korea to open its market, notably by raising the prospect of invoking a tough new trade law*" (*Wall Street Journal*, February 3, 1989). In fact, the US utilized both Section "Super 301" and the Uruguay Round for its purposes of opening the financial market. See US Department of Treasury (1988, 1989). The US also expressed a strong suspicion that the Korean monetary authority had manipulated the exchange rate by the multicurrency basket pegging exchange rate system (Bank of Korea, 1997). For example, in the Treasury report of April 1989 ("*Report to the Congress on International Economic and Exchange Rate Policy*") to the Senate and House banking committees, it formally designated Korea and Taiwan as the countries that manipulate their currencies.

Finally, the 1987 "June Civil Demonstration" against the military dictatorship is unanimously regarded by experts as the launching of meaningful democratization in Korea. The incidence naturally resulted in civilians' stronger and more frequent expressions of dissatisfaction of government policy. This change made it possible for losing interest groups to speak out against government action regarding exchange rate manipulation. An example of titles of some competing slogans covered in the mass media include "*Pain in Declining Exports behind the Ever-Strong Won*" (*The Chosun Daily*, August 23, 1989) versus "*Stop All the Exchange Rate Plays: Liberalizing the Market is the Answer*" (*The Chosun Daily*, April 7, 1988).

<Appendix> Data Collection from *the Input-Output Tables*

The input-Output Tables published by the Bank of Korea classify the entire economy into 77 industries. ""*Total Demand*$_i$," the code number of which is **086** in *the Tables*, is defined as the total output produced by industry i. It thus includes the th industry's output used, as intermediate goods, into other industries' production. The Total Demand of the economy is the summation of the industry total demands across 77 industries.

The Tables are published every five years (in 1980, 1985, 1990, 1995), and additionally reported in between (in 1983, 1986, 1987, 1988, 1993, 1998). These observations of Total Demand were first interpolated to produce an annual series under the assumption of linear growth rates. We then converted these into a quarterly series, using the Chow and Lin (1971) method with GDP as a related series in which the sum of the four quarterly estimates for each year ought to equal the observed value for the year.

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zero values for the period in question. The results were even stronger.

The same conversion method was used for the sum of the industry total demands across industries whose export (and import) proportions exceed a threshold value (0.05), designed to capture the Olson effect explained in the text. As to the imports and exports, however, we used the total imports and exports quarterly released by the Bank of Korea, independent of *the Input-Output Table*. This was done upon discovering from the observed annual data that the excluded amounts of exports (and imports) each year, in the course of calculating the weighted averages to capture the Olson effect, are very negligible, unlike the excluded amounts of the total demands.

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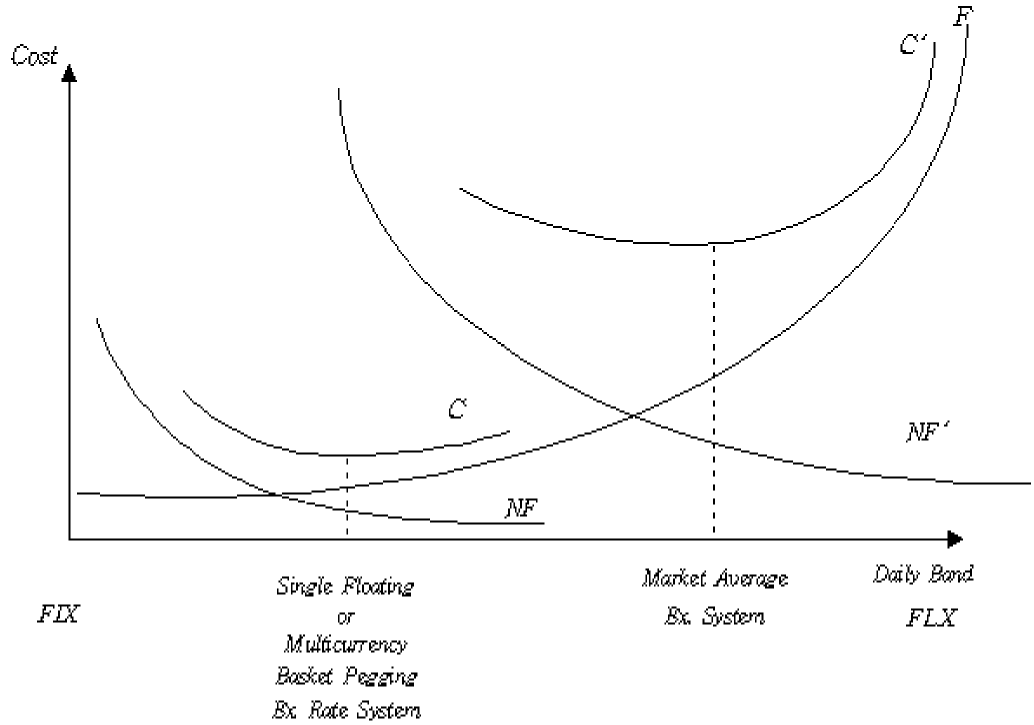
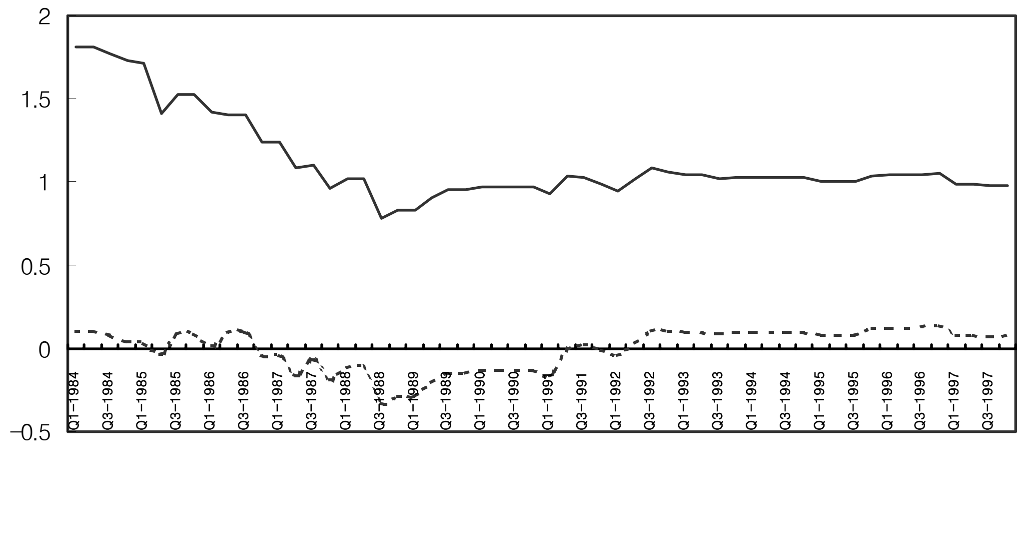
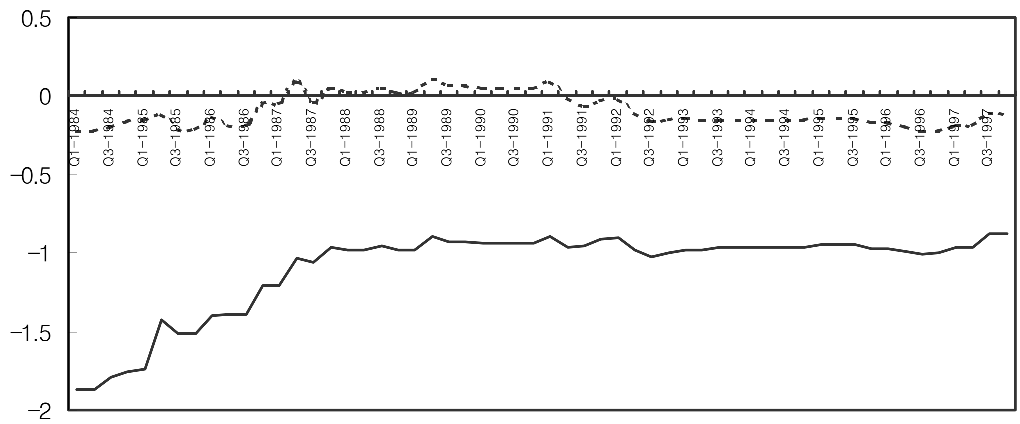
<Figure 1> Exchange Rate Regimes and Manipulation Costs



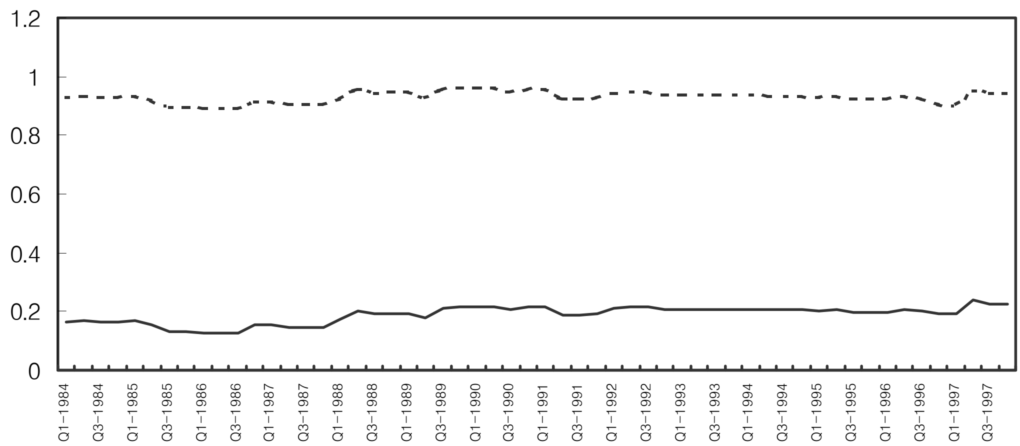
<Figure 2> Exporters' Pressure $\hat{\beta}_{5,\ t}$



<Figure 3> Importers' Pressure $\hat{\beta}_{6,\ t}$



<Figure 4> Foreign Debtors' Pressure $\hat{\beta}_{7,\ t}$



<Table 1> Estimation of Interest Group Pressure Models of the Exchange Rate

	Constant	$\Delta(m_t - m_t^*)$	$\Delta(y_t - y_t^*)$	$\Delta(i_t - i_t^*)$	$\Delta(\pi^e_t - \pi^{e*}_t)$	$D_{X,t-1} \bullet \Delta EXP\_PRESS_{t-1}$	$D_{M,t-1} \bullet \Delta IMP\_PRESS_{t-1}$	$D_{D,t-1} \bullet \Delta FOREIGN\_DEBT_{t-1}$	$ELECTION_t$	Adj−R^2
F−B model	0.0025 (0.0059)	0.3269* (0.1909)	−0.0286 (0.0294)	0.0049 (0.0049)						0.05
D−F model	0.0012 (0.0060)	0.3798* (0.2027)	−0.0228 (0.0208)	0.0046 (0.0041)	0.7129* (0.3923)					0.12
Case 1a	−0.0048 (0.0073)	0.4550* (0.2520)	−0.0240 (0.0225)	0.0047 (0.0044)	1.0018*** (0.3858)	1.2960* (0.6681)	−0.8668** (0.3922)	0.3829 (0.3098)	−0.0254** (0.0129)	0.17
Case 1b	−0.0040 (0.0075)	0.4478* (0.2566)	−0.0225 (0.0212)	0.0048 (0.0044)	1.0097** (0.4108)	0.1410* (0.0761)	−0.1015** (0.0465)	0.0585 (0.0474)	−0.0253** (0.0128)	0.17
Case 2a	−0.0043 (0.0071)	0.4672* (0.2567)	−0.0276 (0.0216)	0.0047 (0.0044)	1.0143*** (0.3953)	0.5415** (0.2437)	−0.3683** (0.1624)	0.4178 (0.3005)	−0.0260** (0.0132)	0.17
Case 2b	−0.0040 (0.0075)	0.4637* (0.2627)	−0.0253 (0.0210)	0.0049 (0.0044)	1.0201** (0.4166)	0.1206* (0.0610)	−0.0784** (0.0362)	0.0673 (0.0446)	−0.0259** (0.0130)	0.16
Case 3a[1)]	−0.0014 (0.0083)	0.5344* (0.2866)	−0.0415* (0.0222)	0.0053 (0.0045)	1.0471*** (0.3760)	0.6712*** (0.2173)	−0.3822*** (0.1486)	0.2212 (0.4094)	−0.0188* (0.0110)	0.20
Case 3b[2)]	−0.0098 (0.0078)	0.6544** (0.3132)	−0.0270 (0.0248)	0.0047 (0.0052)	1.1571*** (0.4338)	0.5833** (0.2527)	−0.3784* (0.2002)	0.3847 (0.3596)	−0.0360** (0.0149)	0.20

***, **, * indicate statistical significances at the 1%, 5%, and 10% level, respectively. Numbers in parentheses are standard errors. We used Newey-West(1987) estimation method. All the coefficient estimates of the constant terms for the pressure variables ($\widehat{\beta}_9$, $\widehat{\beta}_{10}$, and $\widehat{\beta}_{11}$) were insignificant and they are available upon request.

1) The same as Case 2a except outsampling 1987:Q1-1989:Q4.

2) The same as Case 2a except outsampling 1990:Q1-1992:Q4.

Comments on "How the Exchange Rate Regime Has Been Switched in Korea: A Public Choice Inquiry"

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The most important conclusion of this paper is that the adoption of the market average regime (MAR) in 1990 was not a phase-in policy, but the result of the bureaucrat's private incentive maximization. That is, as current account surplus enlarged and the pressures from the U.S. for the won's appreciation increased, the bureaucrats found it difficult to further manipulate the exchange rate under the transparent basket regime in the late 1980s. Therefore, it is possible that the bureaucrats chose to adopt the relatively opaque MAR, in which their exchange rate manipulation is not easily identified.

In order to empirically support this hypothesis, the authors first construct proxy variables that are claimed to measure political pressures by exporters and importers. Then the authors present the results of exchange rate regressions that the coefficients of these proxy variables are statistically significant with expected signs. In addition, the authors find that the coefficients appear to become weak in the late 1980s but regain statistical significance in the 1990s. Based on these results, the authors conclude that the paper's hypothesis is proven by data.

This approach of the paper is so fresh and provocative that would readily interest readers. Nevertheless, in order to make the paper's claims convincing, it is recommended to strengthen the arguments for the following three aspects.

(1) First, it seems necessary to better explain the key empirical variables, the proxies for the political pressures of exporters and importers. Currently, these variables are defined as the average portions of exports (or imports) in total demand, multiplied by a dummy variable that takes one for the quarter in which the seasonal growth rate of exports (or imports) is lower than the previous quarter's. Conceptually, however, the variable relevant to the political pressures seems to be the former part, and the economic interpretation of the latter part (dummy variable) is not entirely clear. Therefore, if the paper's empirical results critically hinges upon the latter part rather than the former part of the proxy variables, then the claim of the paper would be weakened. In fact, such a possibility seems plausible, considering that the former part was constructed by the interpolation from IO tables that are collected only every five years. That is, interpolated data series tend to be too smooth over time to significantly affect regression results, and thus it seems likely that the paper's empirical results are driven by the dummy variables that have relatively weak relevancy to the paper's arguments. Considering all this, it seems necessary to provide detailed explanations for these variables and various robustness test results. At least, it seems indispensable to provide the plots of the two series, interpolated data and dummy variables.

(2) Second, it seems necessary to think about how much economic meaning should be given to the 5 percent significance level in discussing the coefficient variations over time. Although the 5 percent confidence level *is conventionally* popular in the literature, it does not have any *absolut*e economic (nor statistical) meaning. Therefore, when the

p-values fluctuate only at the margins around 5 percent as in<Figure 2> and <Figure 3>, it seems difficult to give decisive interpretations depending upon whether the values exceed 5 percent or not. In particular, the key observation that the p-values exceed 5 percent in the late 1980s but were lowered below 5 percent in the 1990s appears to be the result of smaller standard errors due to larger sample sizes rather than the coefficient estimates. If this is true, it is difficult to take this observation as a piece of evidence for the authors' claim

(3) Finally, the authors tend to attach overly decisive interpretations to empirical findings. Even though it were true that the paper's empirical findings were unarguably robust, the paper's hypothesis is just *a* hypothesis, rather than *the* hypothesis, that is consistent with such findings. Therefore, it is desirable to interpret the results with caution, considering that alternative hypotheses consistent with the same findings may always exist.

CHAPTER 5-2

The Term Structure of Interest Rates as Target of Monetary Policy

by

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Abstract

Our paper explores a transmission mechanism of monetary policy through bond market. Based on the assumption of delayed repsonses of economic agents to monetary shocks, we derive a system of equations relating the term structure of interest rates with the past history of money growth rates and test the equations with the US data. Our results confirm that monetary policy targeting a certain shape of the term structure of interest rates could be implemented with certain time lags due to path-dependency of interest rates.

I. Introduction

The primary purpose of our paper is to investigate the roles of monetary policy in shaping the term structure of interest rates. The roles of money are defined in various ways. Among the most critical ones are the roles of money as an accounting unit, a store of value, and a medium of exchange. Due to these particular functions of money, monetary policy governing the stock of money, influences the relative prices of money delivered at different time and different states. In turn, the current relative prices of money defined in the space of time and states, which are , in other words, collectively called the term structure of interest rates, influence economic decisions of private agents. Thus, a thorough exposition of monetary policy would encompass the analysis of a monetary general equilibrium model including all of the above mentioned processes. However, for tractability, we narrow down the scope of this paper to demonstrating how the monetary policy can manipulate diverse interest rates along the passage of time.

Intuitively speaking, the term structure of interest rates is much more informative than any single economic variables and thus will be useful as a reference for monetary policy. So far there have been continuous debates over what should be optimal targets of monetary policies. Mostly a combination of inflation and GDP gap is cited as a candidate for the target of monetary policy (Taylor(1993)). Further developed models would allow autoregressive formations in inflation and GDP gap (Clarida, Gali, and Gertler(2000)). Based on such criteria, a certain level of short-term interest rate (e.g. call rate in Korea, federal fund rate in the US) is prescribed that a central bank should maintain. Though such concentration on the determination of the short-term interest rate is relatively easy to implement in practice, it only sequentially cross-checks the level of inflation and GDP gap with the current short-term interest rate. It neglects how the term structure of interest rates as a whole reacts to the adjustment of the short-term interest rates, which might explain why the same level of the short-term interest rate brings about different economic performances at different time and states.

Frequently we read numerous articles about predicting the future path of federal fund rate from newspapers. All of them are written on the implicit belief that monetary policies have influence on major aggregate economic activities, such as consumption, investment, and production, though their influence on these economic activities may differ in terms of directions, magnitudes, and timing. Unfortunately, a true transmission mechanism of monetary policies has not yet been thoroughly explored. A true description for the economy would be that the transmission mechanism works through multi-channels, only a small number of which so far have been highlighted. In our knowledge, very few economic models have emphasized the effects of monetary policies in the context of analyzing the movements of the whole nominal bond market equilibrium[1]

Apart from the tradition, our paper argues that an effective monetary policy should consider the whole term structure of interest rates rather than a yield rate of a bond with specific maturity. Furthermore, though control over the short-term interest rate has influence on the yields of bonds with longer maturities, it has not yet been clearly verified in which direction a change in the short-term interest rate shifts the whole term structure of the interest rates. Considered that different yield curves lead to different performances of an economy, the monetary authority should perceive at least the impact of its current short-term interest rate policy on the term structure of interest rates. However, an answer to this question would require thorough understanding of the whole economy as well as the bond market itself.

Basically we are interested in exploring how the money growth rates over a certain span of time shifts the term structure of interest rates. In addition most of economic activities are determined by the anticipation of the future, which is well embedded in the term structure of interest rates. Thus it is believed that the shape of the yield curve controlled by the money growth rates does a crucial role in determining the levels of the economic activities.

From the literature on durable consumption and investment, we understand that both of them are quite sensitive to economic fluctuations in comparison with consumption on non-durable goods and services. Intuitively speaking, since the flows of benefit from durable goods and capital continue for a certain period of time, durable good consumption and investment entail the feature of irreversibility or indivisibility of purchase, which reduces durable goods consumption and investment decisions to optimal stopping problems. For the reason, it is absurd to expect that the monetary authority can control the economy by merely changing the short-term interest rate. In reality, the falling short-term interest rate is often accompanied by an increase in the long-term interest rate, which may discourage an agent from purchasing durable goods and physical capital. Thus, the monetary authority should find a certain pattern of a yield curve in order to reset the current yield curve to the pattern, which will boost the aggregate demand in times of depression.

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[1] Ellingsen and Sőderstrőm (2004) explain how the yield curve responds to monetary policy. In their work, monetary policy is determined by the central bank's preference parameters over the volatilities of inflation, output, and the short-term interest rate. They claim variations in the preferences result in another yield curve by affecting people's expectation for the future. In contrast, our paper takes a more straightforward stance and focuses on verifying the relationship between the yield curve and the past money growth rates.

On the other hand, supply side is also dependent on the term structure of interest rates. Production requires a multi-period binding planning horizon in addition to a time-to-build capital driven technology, in which the adjustments of production inputs are not completely flexible across time. Thus, the assignment or the employment of production inputs, not only capital but also labor, is perceived to be a function of the term structure of interest rates.

Our paper proposes to (1) investigate how a monetary policy (not only quantity-easing but also targeted at controlling the short-term interest rate) shifts the whole term structure of interest rates, (2) discuss the implications of the observations that production as well as durable consumption and investment are sensitive to changes in the term structure of interest rates, and (3) arrange monetary policies of maintaining a certain shape of the term structure of interest rates based on empirical results.

The contents of the paper are organized as follows: Section 2 discusses a transmission channel of monetary policy in the economy, which relies on the lagged adjustment processes of various interest rates in the bond market. The feature of lagged adjustments resulting from delayed responses to monetary shocks is critical in that it relates the dynamics of interest rates to the past history of money growth rates. Section 3 tests all the hypotheses obtained from the models introduced in section 2 using the US data, both monthly and quarterly. The relationship between the term structure of interest rates and the money growth rates are estimated in presence of as well as in absence of endogenous production fluctuations. Section 4 deduces the policy implications by discussing the time lags of monetary policy in implementing a certain yield curve as well as considering the impact of the current short-term interest rate targeting policy on the yield curve. Finally section 5 concludes.

II. Theoretical Framework

From a survey of the existing literature on the optimal monetary policy, we identify two common approaches from two distinctive traditions of thoughts-new classical and new Keyensian. New classical approach[2] admits that market incompleteness, such as market segmentation, may cause the differential effects of monetary policy across time and across agents in the short run whereas new Keynesian approach[3] introduces sticky prices and wages to refute the neutrality of money. In essence both approaches have common in exploiting implicit or explicit delayed responses of economic agents. Regardless of seemingly different appearances, these two approaches have common in that they assume private agents respond to shocks in heterogeneous ways.

This section is purposed to provide a logical explanation about the delayed responses of aggregate macro variables to monetary shocks and reveal the consequences of the delayed responses on the dynamics of the term structure of interest rates induced by monetary policy. From the perspective of new classical approach, we build a model, which allows a path dependent dynamics of the interest rates governed by the past money growth rates.

To begin with, we investigate a limited bond market participation model and show that the higher order moments of money supply can influence the term structure of interest rates. Extended from a traditional Cash-in-Advance model of Lucas and Stokey(1987), a general m-period-ahead CIA condition is imposed. The adoption of CIA feature is critical because it, combined with the assumption of limited bond market

[2] Refer to Alvarez, Lucas and Weber (2001) and Monnet and Weber (2001).

[3] For more details, refer to Clarida et. al. (1999) and Yun (1996).

participation, brings about the redistributive and persistent effects of monetary policies on the economy. From the assumptions, it is deduced that the term structure of interest rates is approximated by a system of linear equations of the lagged money growth rates. As is generally understood (Clarida et al.(2000) and Ellingsen and Sőderstrőm(2004)), the expectation of the future money growth rates (or the future monetary policy) has effect on the current term structure of interest rates. However, we emphasize the importance of the past path of monetary expansion in a sense that money shock would be realized in differential manners across heterogeneous agents in the economy.

Second, we explore the implications the non-negativity restriction of nominal bond yield rates holds in financial market, while showing that our approximation of the term structure of interest rates by the past money growth path does not necessarily satisfy the non-negative condition. The non negativity restriction of nominal bond rate is a critical ground for the central bank to consider when it exercises open market operation policy. Especially, in a very low inflation regime, the possibility of reaching zero short-term interest rate often cast worries because zero rate is regarded as a natural lower boundary of so called liquidity trap. It is commonly believed that the monetary policy without coordination with the expansionary fiscal policy would be ineffective in such a situation. However, the ineffectiveness of monetary expansion in case of falling into the zero nominal interest rate trap may be supported when only one type of bond is available in the financial market other than money. Such extreme absence of variety in bond market is not realistic at all, and the plunge of the whole term structure into zero has not been observed in the history, either. Hence, after complementing our term structure model with non-negativity restrictions, we discuss the effectiveness of monetary policy near zero short-term interest rate and explore a transitional path on which the bond market equilibrium retrieves the positivity of interest rates.

Third, we examine a claim that consumption, investment, and production decisions are significantly affected by the term structure of interest rates while the demands for durable goods and production factors are more sensitive to a change in the term structure of interest rates than consumption of non-durable goods and services due to their (longer) duration of usage. All other things equal, a lower short-term interest rate is likely to induce more current consumption. However, what if the lowered short-term interest rate is matched by higher long-term interest rate? An answer without considering the dynamics of the term structure would lead to the imprecise reasoning that lowering the short-term interest rate may encourage the consumption. Thus, we also aim to answer for a question why a monetary policy targeting a certain level of the short-term interest rate leads to different economic performances at different times and states.

Nominal bonds, which guarantee the delivery of pre-defined amount of money at maturities, are (gross) substitutes for money[4]. Private agents allocate their resources between money and nominal bonds[5]. Thus, a change in money stock indicates that the economy should move to another equilibrium sustaining different relative prices of bonds with respect to money. This section focuses on analyzing a mechanism, through which variations in monetary policy lead to different term structure of interest rates. A basic idea that not only the expectation of the future money growth rates but also the past money growth path determine the current term structure of interest rates, would explain

[4] In other words, money is a kind of nominal bond, which expires and is renewed instantly.

[5] In fact, nominal bonds vary not only by the the length of maturities but also by the magnitude of default risk. However, for simplicity our paper deals with government issued bonds only. The status of the government as a sole provider of currency in the economy eliminates default risk premium on the government bonds.

why it leads to different outcomes to maintain the same level of the short term interest rate at different periods[6].

Needless to say it would be another paper topic to verify whether and how the term structure of interest rate can have real effects on the economy. The emphasis on the relationship of the term structure of interest rates and real macro variables is originated from our original intention to transform the issue of finding optimal monetary policy to that of finding an appropriate term structure, which induces more consumption, investment and production. This issue has been tried commonly from the stance of so called New Keynesian (though at a slightly different angle from ours). However, in this paper, we do not delve into this issue further. Instead we concentrate on revealing the relationship between money growth rates and the term structure of interest rates.

2-1. Lagged Transmission Channel of Monetary Shocks

In this section we derive an equation linking the term structure of interest rates with the past history of money growth rates. We introduce an economy with limited bond market participation in order to induce a situation in which a monetary shock has differential impacts on heterogeneous agents across time (mainly redistributive effects). The impact differential is caused by the different timing of money shock transmitted or perceived to the agents or their different speed of reactions to the shock, and it leads to a non-trivial change of patterns in the term structure of interest rates. In absence of such impact differential, the yield curve shifts vertically in a uniform way or it depends only on the expectation of the future monetary growth path and real macro variables. Of course, it is reasonable that the yield curve is influenced by the future policy variables and we need a model where the term structure of interest rates depends on the future monetary policy as well as the past history of monetary policies. However, we have no clear clue as to how the accumulation of the information on the past history is reflected on the formation of the expectation for the future. Thus, instead of separately including the future variables, it is implicitly assumed that the expectation for the future is evaluated on the past history.

Our model is an adapted version of Alvarez et al.(2001). Our model assumes the following. First, there are two types of assets in the market-money and bond. Considered that the assets are means of storing or growing values along the passage of time, the nominal return on money is always zero by construction whereas the nominal return on bond is positive nominal interest rate. Due to the yield difference in these two types of assets, we need a mechanism guaranteeing the positive holding of money. Thus, we assign a CIA restriction, which is modified from the original one in Lucas and Stokey (1987).

Second, we assume limited bond market participation, under which not every consumer can purchase bonds in the financial market due to transaction costs or information costs or regulation. There are two groups of consumers in the market-bond market participants and non-participants, whose shares in the total population are λ and $1-\lambda$ respectively[7]. These two groups are homogeneous in all the other aspects than the bond market participation.

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[6] The expectation for the future can be understood as reflection of the past. In this sense the persistent effect of the past policy can be more substantial than we guess

[7] It is assumed that all the bond market participants hold all kinds of bonds with various maturities. A more realistic setup would allow that the bonds market participants shoud be classified into several groups by the maturities of bonds they hold (for example, short-term, medium-term, and long-term investors). Then,

Third, the CIA condition to be introduced is defined on a multi-period time horizon as follows. At the current period, nominal consumption is afforded by a certain portion from the current nominal income, another certain portion from nominal income of the previous period, another certain portion from income earned two period ago, and so on. A more intuitive interpretation of the multi-period ahead CIA condition is that at the beginning of period t the current income (y_t) would be cashed instantly ($p_t y_t$) and it would be spent for the next m periods by certain fractions of $v_{t,t+j}$, j = 0,1,2,..., $m-1$ $(\sum_{j=0}^{m-1} v_{t,t+j}=1)$.

Based on the above model, we derive a system of equations of our concern as below[8]

$$\Gamma_t = \Phi\Delta_t + R(v^t, g^t) + \varepsilon_t, \qquad (1)$$

$$\Gamma_t \equiv \begin{bmatrix} \tau_{t,t+1} \\ \tau_{t,t+2} \\ \cdots \\ \tau_{t,t+n-1} \\ \tau_{t,t+n} \end{bmatrix}, \Delta_t \equiv \begin{bmatrix} \mu_t \\ \mu_{t-1} \\ \cdots \\ \mu_{t-m+2} \\ \mu_{t-m+1} \end{bmatrix}, \Phi \equiv \begin{bmatrix} \phi_{1,1} & \phi_{1,2} & \phi_{1,3} & \cdots & \phi_{1,m-1} & \phi_{1,m} \\ \phi_{2,1} & \phi_{2,2} & \cdots & \cdots & \cdots & \phi_{2,m} \\ \phi_{3,1} & \cdots & \cdots & \phi_{i,j} & \cdots & \cdots \\ \cdots & \cdots & \cdots & \cdots & \cdots & \phi_{n-1,m} \\ \phi_{n,1} & \phi_{n,2} & \cdots & \cdots & \phi_{n,m-1} & \phi_{n,m} \end{bmatrix},$$

where Γ_t is a n×*1* vector of yield rates with different maturities, Δ_t a m×1 vector of money growth rates up to date for the last m-1 periods, R a n×1 vector, and Φ a n×m matrix. $R(v^t, g^t)$ is the term evaluating the effects of other variables on the term structure of interest rates, such as a vector of the current and the past GDP growth rates (g_t) and a vector closely related to the current and the past velocities of money circulation (v_t)[9]. The importance of $R(v_t, g_t)$ is highlighted later in empirical analysis.

The above equations show path dependency in that the present term structure of interest rates is affected not only by the money growth rate of the current period but also by those of the past (*m-1*) periods[10]. Theoretically, path dependency is a common

then the equilibrium yield rate would display more dynamism.

[8] For more details on the derivation of the equations, see Appendix A. In appendix A, we derive the system of equations with additional simplyfying assumptions , such as zero GDP growth rate (g_t =0 for all t) and the absence of taxation (τ_t 0 for all t). In contrast Equation (1) covers more general cases.

[9] For formal definitions of g_t and v_t , see Appendix A.

[10] Inclusion of money growth rates for the past m-1 periods can be interpreted to be proxies for the

phenomenon and may arise from various sources. First, it can come from the learning process. All the economic decisions in a dynamic context should involve the formation of expectation for the future, which is in turn based on the learning process from the past experience. This is also an excuse for not including the expectation for the future in the model. Second, path dependency can arise from some sort of market frictions, which prevent economic agents from responding to shocks in a uniform manner and with simultaneous timing. Such inevitably heterogeneous responses of the agents may lead to persistent and lagging effects of monetary policy. There are many other sources of path dependency, but here we are particularly interested in these two sources. Our paper introduces frictions in consumer/investor side in order to derive a path dependent relation of interest rates and money growth.

Another notable point from Equation (1) is that the lagged adjustment of interest rates in response to monetary policy vary across different types of bonds in terms of directions as well as magnitudes of changes. This implies that the monetary authority can adjust the shape of the term structure by using the dynamic or path dependent relation of the term structure with monetary policy. As earlier mentioned, understanding the dynamics of the term structure is very important because most major economic activities, such as durable consumption and investment, are significantly influenced by the shape of the term structure. However, to find an optimal term structure is beyond the scope of this paper. Instead we focus on how a certain term structure of interest rates could be implemented with the accommodation of monetary policy.

2-2. Zero lower boundary and liquidity trap

The term structure of interest rates described in Equation (1) provides static information evaluated at a point of time on the dynamics of various interest rates. Considered that Equation (1) is obtained from the first order log-linear approximation of Equation (A-2), the interest rate dynamics may violate the non-negativity of nominal interest rates and it additionally requires the non-negativity restrictions on the yields of all maturities for completion.

A nominal interest rate is the rate of return on holding nominal bonds. Due to the definition and the existence of money, zero is a natural lower boundary for the nominal interest. So far the probability of hitting zero interest rate has been evaluated extremely low and the consideration of non-negativity yields has not been strongly enforced. However, the recent low interest rate regime in a few economies including US and Japan has caused worries that the nominal interest rate might hit zero and the economy might fall into the natural lower bound of the liquidity trap.

In this section, we analyze the propagation mechanism of the monetary policy in case of hitting the zero short-term interest rate by levying the non-negativity restriction on Equation (1). In addition, we distinguish the liquidity trap from the state of zero nominal interest rate and discuss an escape strategy from the liquidity trap using monetary policy.

There may be various ways of including the non-negative condition to Equation (1). Among them, the most intuitive one is to introduce shadow processes, which are equivalent with the yield rates when they are positive and diverges (become negative) when the yield rates are zero. In consideration of the non-negativity condition as in this method, Equation (1) should be modified to

higher order moments of the money growth rate(μ_t).

$$\begin{bmatrix} \tau_{t,t+1} \\ \tau_{t,t+2} \\ \\ \tau_{t,t+n-1} \\ \tau_{t,t+n} \\ \end{bmatrix} = \begin{bmatrix} \max\left[\sum_{j=1}^{m} \phi_{1,j}\mu_{t-j}^{E} + R_1(v^t, g^t) + \varepsilon_{1t}, 0\right] \\ \max\left[\sum_{j=1}^{m} \phi_{2,j}\mu_{t-j}^{E} + R_2(v^t, g^t) + \varepsilon_{2t}, 0\right] \\ \max\left[\sum_{j=1}^{m} \phi_{n-1,j}\mu_{t-j}^{E} + R_{n-1}(v^t, g^t) + \varepsilon_{n-1t}, 0\right] \\ \max\left[\sum_{j=1}^{m} \phi_{n,j}\mu_{t-j}^{E} + R_n(v^t, g^t) + \varepsilon_{nt}, 0\right] \end{bmatrix}, \tag{2}$$

$$R(v^t, g^t, \tau_t) \equiv \begin{bmatrix} R_1(v^t, g^t) \\ R_2(v^t, g^t) \\ \ldots \\ R_{n-1}(v^t, g^t) \\ R_n(v^t, g^t) \end{bmatrix} \quad and, \quad \varepsilon_t \equiv \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ \ldots \\ \varepsilon_{n-1t} \\ \varepsilon_{nt} \end{bmatrix}$$

Looking at Equation (2), we may wonder what difference it makes from Equation (1) except the additions of an operator max $[x, 0]$ to each row. More critical difference than the inclusion of the non-negativity condition comes from the movement of a newly defined money growth rate μ_t^E . μ_t^E is defined to be the effective money growth rate and is equal to the pre-defined money growth rate μ_t in absence of a zero rate bond. The divergence of μ_t^E from μ_t arises when the yield rate of a bond hits, or stays at, or escapes from the zero boundary. A bond, once its yield rate hits zero, would be treated as an equal for money. Accordingly, the money growth rate should be modified to account for a sudden change in the categories of money stock . Also, when the bond yield escapes from the zero rate, the exactly opposite movement in the money growth rate as well as in the money stock would be observed.

So far we haven't clarified how the zero short-term interest rate is different from the liquidity trap. The liquidity trap is a state in which monetary expansion through open market operations or helicopter money drops cannot encourage economic agents to increase bond holdings and lower the interest rate further. In other words, the liquidity trap is a mental phenomenon, in which the substitution between money and bonds is extremely sensitive to the interest rate change. Accordingly, the level of the short-term interest rate, at which the liquidity trap arises, doesn't have to be zero.

On the other hand, the zero short-term interest rate does not necessarily imply the advent of the liquidity trap. There has never been a period in which the whole term structure meet the ground zero line. Though there were some cases in which a point on the term structure curve hit zero, not the whole term structure of interest rates has collapsed into zero. Hence, even in the zero short-term interest rate environment, the government commanding monetary policy through open market operation can carry out expansionary monetary policy by using other bonds with positive yield[11].

Comprehension of the differences between the liquidity trap and the zero interest rate gives a clue to finding escape strategies from the liquidity trap. One of them is to use the increment of money stock neither for tax reduction, nor for the purchase of bonds, but for the purchase of goods. This can be regarded as a fiscal policy in that it increases the government expenditure. On the other hand, it holds a feature of a monetary policy in that there is no additional fiscal burden in the government account. The inflationary effect of the government expenditure expansion funded by printing money would induce private agents to consume more and faster. In other words, the inflationary policy raises the velocity of money $(\frac{1}{1-\mu_{t,t}})$. The faster velocity is meaningful in that monetary expansion through the open market operation is known to reduce the velocity of money in a liquidity trap. A more detailed description of the escape strategy is available in Appendix A.

2-3. Consumption, investment, production and the term structure of interest rates

In this section we discuss the relationships of the term structure of interest rates with consumption, investment and production. The term structure of interest rates matters because most intertemporal decisions are the functions of the term structure of interest rates. Among the various intertemporal decisions made by economic agents, we are particularly interested in consumption on durable goods and capital investment as well as production because each of them takes substantial portion in the economy and they are more volatile than other economic decisions[12]

Unlike consumption on non-durable goods and services, capital investment and durable good consumption show more fluctuations in response to economic shocks including interest rate changes. By nature, decisions on durable good consumption and physical capital investment are very close to discrete choice or optimal exercises of real options in presence of indivisibility and irreversibility[13].

. To rephrase, durable good consumption and capital investment are simply reduced to optimal stopping models, in which the term structure of interest rates is a critical determinant.

Hong(1996) and Hong(1997) compare the sensitivities of durable good consumption and fixed capital investment to price and interest rate changes using the US data and shows that durable good consumption and investment react sensitively to the price change but not so sensitively to the variations in the interest rate. He interprets that the

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[11] Orphanides(2003) appreciates the usefulness of the open market operation policy, which is to "implement additional monetary expansion by shifting the targeted interest rates to that on succcessively longer-term instruments, when additional monetary policy easing is warranted at near zero interest rates".

[12] Consumption on durable goods and capital investment constitute aggregate demand whereas production determines the aggregate supply of an economy.

[13] Due to concavity of instantaneous utility functions, an agent prefers to smooth cross-time allocation of consumption. Thus, he prefers to schedule consumption on both durable and non-durable goods evenly across time. On the other hand, consumption of durable goods is measured by the stock of the durable goods accumulated up to date and the change in the consumption on durable goods is net purchase of durable goods at the current period. Accordingly, the net purchase of durable goods is more volatile than consumption of durable goods in order to guarantee the smoothing of durable good consumption. This is another reason that the purchase of durable goods draws more attention in diagnosing a business cycle in addition to indivisibility and irreversibility.

price, which reflects the longer horizon forecast of an economy, is more influential in determining durable goods consumption than the short-term interest rate. The linkage of his idea to this paper is in that the price of durable good is the discounted sum of the future benefit flows by the term structure of interest rates. In addition, Breitung, Chrinko, and Kalckreuth (2003), using German firm data, reach a similar conclusion that business investment is responsive to the user cost of capital.

Summing up, the private agents make decision based on both the future cash flows and the interest rate movement. The future path of interest rates, anticipated in the yield rates of bonds with different maturities, is linked with consumption and investment decisions. Channels, through which monetary policy affects the economy, may be numerous. However, the channel through the bond market is the most direct but the least mentioned one.

Weakness of our model is that it doesn't consider the effect of monetary policy on production. Description of the production sector and its interactions with monetary policy are omitted because the introduction of a production function in the economy would require the calculation of a steady state and discussions on transitional paths. True that the interactions of monetary policy with production is crucial, we do not pursue in the direction further[14]. Instead we represent a supply condition by linking the real sector production growth with the term structure of interest rates. In reality, most production inputs, not only physical capital but also labor employment, are more or less irreversible in a sense that commonly the contracts for hiring these production factors are made for multi years in advance. Thus, the current production growth should reflect the past anticipation for the long-run economic forecasts, which is recorded in the past term structure of interest rates. Hence, we accept the supply condition below:

$$g_t \equiv \frac{y_t - y_{t-1}}{y_{t-1}} = f(\tau_{t-q,t-q+1}, \tau_{t-q,t-q+n}) + \eta_t$$
$$g_t = \sum_{i=1}^{n} = s_i \tau_{t-q,t-q+i} + s_0 + \eta_t \tag{3}$$

Equation (3) is different from a usual Phillips curve type supply condition, which describes the relationship between the inflation rate and the real GDP gap. However, the differences are acceptable on the following grounds. First, the concept of potential GDP used in the Phillips curve is ambiguous and its estimation is merely to filter the real GDP data. Second, the information on the future inflation rates is already embedded in the term structure of (nominal) interest rates. Third, labor supply, a determinant of real GDP gap, is chosen simultaneously with household consumption and it is also influenced by the term structure of interest rates. In the following empirical section, Equation (3) are added to Equation (1) in order to eliminate possible endogeneity of interest rate determination arising from running Equation (1) only[15].

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[14] As a further extension or a generalization of our model, we may consider the supply side restriction to Equation (1). For a more general setup allowing for delayed repsonses of producers, an aggregate supply function could be represented as follows: θ_t where x_t is a GDP gap at time *t* (refer to Woodford (2003)).

[15] Intuitively, Equation (1) is a demand condition and Equation (3) is a supply condition for bond market.

III. Empirical Analysis

This section verifies the validity of the claims deduced in the previous section. Equation (1) implies that the term structure of interest rates is governed by the past money growth rates. In this section, mainly we use several modifications of (1) and (3) for empirical analysis.

3-1. Data

Our analysis is based on the US data from July 1959 to February 2000. We use the US data because the US government bond market is the most developed one and the maturities as well as the volume of the bonds traded in the market are diverse and huge enough to plot a reliable yield curve.

The variables of our concern are money stock, price and income variables in addition to five key interest rates[16]. For the key interest rates, we select federal fund rate, 3-month treasury bill, 6-month treasury bill, 1-year treasury bill, and a composite of long-term U.S. government securities[17]. For the macro variables, we use M1 for an index of money stock, GDP deflator for price index, and real and potential GDP[18] for income measures.

The data frequencies differ from a category to another. For example, all the interest rates and M1 are recorded monthly whereas GDP deflator and GDP[19] are recorded quarterly. To reconcile the conflicts of the data frequencies at the same time exploiting the benefit of using monthly data, we run models separately with monthly and quarterly data.

As a variable for money stock, we use seasonally adjusted M1 for a couple of reasons. First, we choose M1 because it is a money stock indicator closest to high powered money. Other money stock indicators, such as M2 and M3, are under the less direct control of the monetary authority and are more likely affected by money demand fluctuations. M1, like other money stock variables, are still susceptible to money demand fluctuations. Admitted that it is hard to distinguish money demand shock from supply shocks, we still maintain the use of M1 because M1 fits much better than the high powered money with the real data.

Second, the data for M1 are seasonally adjusted, considering that the asset prices tend to have no seasonality due to the prevalence of no-arbitrage condition. Accordingly, in order to couple the interest rates with the money growth rates, it is recommendable to use the seasonally detrended M1.

[16] Interest rates are measured in annum whereas M1, GDP deflator, and GDP measures are on a quarterly basis.

[17] The composite of the long-term treasury bonds is specifically defined to be an unweighted average on all outstanding bonds neither due nor callable in less than 10 years.

[18] H-P filtered real GDP is used for potential real GDP.

[19] As for the monthly data, an index of industrial production may be used as a proxy for nominal GDP. In that case, since the monthly GDP deflator is unavailable, CPI or PPI index can be substituted for the GDP deflator.

3-2. Test strategies and stationarity of variables

Before running regressions on Equation (1) with or without Equation (3), we test the stationarity of each variable included in the equations by DF-GLS method. The result shows that real GDP growth rate, potential GDP growth rate, and M1 growth rate are stationary with the significance of 1%-10% for the varying lags from 1 to 10. On the other hand, the velocity of money circulation $(\mu_{t,t})$, the inflation rate (π_t ,measured by GDP deflator) and the yield rates (Γ_t) turn out to be non-stationary.

The stationarity test result indicates that Equation (1) is not testable only with the yield rates and the money growth rate. The remainder $R\,(v^t, g^t)$ should be a non-stationary process by construction. Hence a test strategy for Equation (1) is either to take the difference for the elimination of non-stationarity or to use $R\,(v^t, g^t)$ in the estimation procedure by representing it in a linear function of (v^t, g^t).

Given that the GDP data is not available monthly, only the first strategy is applicable to the monthly data whereas the quarterly data can implement even the second one. Thus, depending on the frequency of the data, we adopt different testable equations. For the monthly data, we use the difference method as below

$$\begin{aligned}\Gamma_t - \Gamma_{t-1} &= \Phi\Delta_t - \Phi\Delta_{t-1} + R(v^t, g^t) - R(v^{t-1}, g^{t-1}) + \varepsilon_t - \varepsilon_{t-1} \\ &= \Phi(\Delta_t - \Phi\Delta_{t-1}) + R(v^t, g^t) - R(v^{t-1}, g^{t-1}) + \varepsilon_t - \varepsilon_{t-1} \\ &= \Phi^* \Delta_t^* + R(v^t, g^t) - R(v^{t-1}, g^{t-1}) + \varepsilon_t - \varepsilon_{t-1} \\ &= \Phi^* \Delta_t^* + \pi_t,\end{aligned} \tag{4}$$

where

$$\Phi^* \equiv \begin{bmatrix} \phi_{1,1} & \phi_{1,2} - \phi_{1,1} & \phi_{1,3} - \phi_{1,2} & \cdots & \phi_{1,m} - \phi_{1,m-1} & -\phi_{1,m} \\ \phi_{2,1} & \phi_{2,2} - \phi_{2,1} & \cdots & \cdots & \cdots & -\phi_{2,m} \\ \phi_{3,1} & \cdots & \cdots & \phi_{i,j} - \phi_{i,j-1} & \cdots & \cdots \\ \cdots & \cdots & \cdots & \cdots & \cdots & -\phi_{n-1,m} \\ \phi_{n,1} & \phi_{n,2} & \cdots & \cdots & \phi_{n,m} - \phi_{n,m-1} & \phi_{n,m} \end{bmatrix}, \Delta_t^* \equiv \begin{bmatrix} \mu_t \\ \mu_{t-1} \\ \cdots \\ \mu_{t-m+1} \\ \mu_{t-m} \end{bmatrix}$$

$$\eta_t = R(v^t, g^t) - R(v^{t-1}, g^{t-1}) + \varepsilon_t - \varepsilon_{t-1}$$

On the other hand, for the quarterly data, we use a fully linearized version of Equation (1) as below:

$$\Gamma_t = \Phi\Delta_t + \Psi_v v^t + \Psi_g g^t + \varepsilon_t \ , \tag{5}$$

where Ψ_v and Ψ_g are vectors of the same dimension with v^t and g^t respectively.

Equation (4) and (5) are not the only solutions to the non-stationarity. Another test strategy would be to multiply a lag polynomial matrix A(L)=[I-A_1 L-A_2 L^2-A_3 L^3-...-A_{q}L^{q}] to both sides of Equation (1) so that an error term (A(L) ε _{t}) or the sum of error term and the remainder term (A(L)R(v^{t},g^{t})+A(L) ε _{t}) could become a vector of white noises. Then the testable equation is modified to a VAR (Vector Auto-Regressive) system as below:

$$A(L)\Gamma_t = A(L)\Phi\Delta_t + A(L)R(v^t, g^t) + A(L)\varepsilon_t$$

$$\Leftrightarrow$$

$$\Gamma_t = A_1(L)\Gamma_{t-1} + A_2\Gamma_{t-2} + \cdots + A_g\Gamma_{t-q} + A(L)\Delta_t + A(L)R(v^t, g^t) + A(L)\varepsilon_t$$

Such modification of Equation (1) to a VAR representation is justified by a couple of points. The first and most common case is the presence of autocorrelated error processes. The second one is the error correction VAR argument. The non-stationarity of $(v_t, t, \ \pi_t, \Gamma_t)$ combined with Equation (1) confirms that the autocorrelation exists $R(v^t, g^t) + t$ or ε_t as well as $(I, -\Delta)$ is the cointegrating vector. Whichever point we may take, we will lead to the same VAR representation as above. However, this VAR representation may underestimate the effects from the past money growth rates, giving impression that it is a minor extension to the traditional expectation theory. Thus, we do not use this test strategy[20] and instead focus on Equation (4) and (5).

3-3. Results

Equation (4) and (5) consist of several equations and they are to be estimated by seemingly unrelated regression (SUR) in principle. However, in practice SUR usually underestimates the standard errors of estimates. Hence, we run regressions equation by equation with Newey-West estimates of standard deviations instead of SUR.

Equations (4) and (5) are tested with the monthly and the quarterly US data respectively. Especially, with the quarterly data, we include GDP deflator, real GDP growth, real GDP and money stock(M1) for the estimation of Equation (5). In addition, a

[20] The results from the VAR representation can be obtained upon request.

short-term interest rate policy function of a monetary authority as well as a supply condition (Equation (3)) are jointly estimated with Equation (5).

[Figure 1] displays the historical patterns of the yield rates of our concern. Overall the five key interest rates commove but with apparent idiosyncratic fluctuations. Our paper distinguishes itself from other literature in that it represents such term structure dynamics by a common factor of the current and the past money growth rates.

3-3-1. Tests with Monthly Data

We test Equation (4) with a little modification of $\Phi * \Delta_t^*$. Since the lagged money growth rates in Δ_t^* are hard to interpret intuitively, they are replaced by a vector θ_t, which contains the information on the current money growth rate and its higher order moments[21][22].

$$\theta_t \equiv \begin{bmatrix} \mu_t \\ \mu_t - \mu_{t-1} \\ \mu_t - 2\mu_{t-1} + \mu_{t-2} \\ \mu_t - 3\mu_{t-1} + 3\mu_{t-2} - \mu_{t-3} \\ \mu_t - 3\mu_{t-1} + \mu_{t-3} \\ \varepsilon_{nt} \end{bmatrix}$$

The adoption of θ_t [23] changes Equation (4) to

$$\Gamma_t - \Gamma_{t-1} = \Phi^{**}\theta_t + \pi_t \, , \qquad (6)$$

where Φ^{**} is modified from Φ^{**} matched with θ_t. We estimate Equation (6) by running regressions equation by equation. The variances of the coefficient estimates are estimated by the Newey-West method.

Results from Equation (6) are displayed in [Table 1]. Money growth rate (μ_t) is excluded the list of explanatory variables due to very low significance. Instead, the next three higher order moments, slope, curvature, and the third order moment of money growth rate, are used in the estimation of Equation (6). Our findings include a couple of notable patterns. First, the signs of coefficients change alternatively from negative to

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[21] The first order moment of the money growth rate is to be called "slope" and the second one is "curvature". Higher order moments than the second one are to be denoted as their matching ordnial numbers.

[22] The contents of information in θ_t is equalized to those of Δ_t^* by including higher order moments of money growth up to m.

[23] On a quarterly basis, [Figure 2] shows how different order moments of money growth rate move in a heterogenous way, which is also observable on a monthly basis. Another notable point is that the volatilities of the n-th order moments tend to increase with n as is shown in [Table 6].

positive and positive to negative. Second, the longer the maturity is, the less likely it is to be influenced by the changes in the higher order moments of money growth.

Reminded that [Table 1] summarizes the linear relation between the first order differences of yield rates and the higher order moments of money growth rate, we need to convert the results of Equation (6) and evaluate directly the impact of money growth rate on the yield rates. [Table 2] shows the liquidity effect is prevalent in the beginning and the Fisher effect shows up at later periods for all of the five key interest rates. Additionally, [Figure3], a graphical exposition of [Table 2], discovers a couple of interesting points. First, the longer the maturity is, the less responsive the yield rate is to the changes in money growth rate. Second, the longer the maturity is, the shorter time it would take to get out of the liquidity effect. Third, the bonds with different maturities move in the different directions (at period 1) as well as with different magnitudes.

3-3-2. Test with Quarterly Data

As in the case of the monthly data, we modify Equation (5) to

$$\Gamma_t = \overline{\Phi}\theta_t + \varphi_v v_{t,t} + \varphi_g g_t + \varepsilon_t \,, \tag{7}$$

where $\overline{\Phi}$ is modified from Φ matched with θ_t. All the components except the current velocity of money $(v_{t,t})$ are omitted due to unobservability. In addition, for simplicity, only the current growth rate (g_t) is used from the vector g^t Furthermore, $v_{t,t}$ is not directly observable. However, from the money equation of $m_t \dfrac{1}{1-v_{t,t}} = P_t y_t$, we see that $v_{t,t}$ is a function of money stock, price level and real GDP. Accordingly, a linear combination of money stock, GDP deflator and the real GDP is substituted for $v_{t,t}$.

Results from running Equation (7) are displayed in [Table 3][24]. As in the case of the monthly data, we run regressions equation by equation with Newey-West estimates of standard errors. However, Equation (7) differs from Equation (6) in that money stock, as a determinant of money velocity, is included and the yield rates, not their first order differences, are used as dependent variables. Compared with Equation (6), Equation (7) has greater explanatory power.

In [Table 3], most higher order moments of money growth rate as well as all of the macro variables are significant at a 5% significance level. The negative signs of money stock and money growth rate reveal the presence of the short-term liquidity effect at least in the short-run. Especially, the negative sign of money stock implies that there even exists a scale of economy in monetary policy and a certain money growth rate may lead to a greater change of the interest rates depending on the size of money stock.

[24] The results are mostly the same even when a Taylor type short-term rate policy function and /or a supply side condition Equation (3) are included. Thus, the results from running only Equation (7) are reported.

Converting the high order moments of money growth into the lagged money growth rates as in [Table 4], we find that in the short run the signs of the estimated coefficients mostly coincide with our theoretical predictions and they supports the short-term liquidity effect at 95% confidence intervals. In contrast, the long-term Fisher effect is not conspicuous. Since the effect from M1 is not included, the negative sign of its coefficient implies that the cross-time and the cross-sectional persistence of the liquidity effect should be longer than it is shown in [Table 4]

[Figure 4] graphically exposes the cross-sectional variations in the term structure of interest rates along the passage of time in response to 1% increase in money growth rates. [Figure 4] shows that the bonds with different maturities move in the same direction but with varying magnitudes. As seen in the monthly data, the longer the maturity is, the less responsive the yield change is.

[Table 5] is a result from running Equation (3) with $q=1$[25]. Five different yield rates are used in the estimation procedure-federal fund rate, three and six month treasury bills, 1 year treasury bonds and the unweighted average of yields rates of the long-term government bonds (over 10 years). Alternatively changing signs of the coefficients imply that the rising(slope) and concave(curvature) yield curve accompanied by the low short-term interest rate(location) spurs production growth.

IV. Policy Implications

From the previous sections, it is demonstrated theoretically and empirically that the impulse response functions of the yield rates with respect to money shocks determine the shape of the term structure of interest rates. Using this property, the monetary authority can implement a certain shape of the term structure of interest rates when there is no exogenous shocks other than changes in money growth rate. Then, what the monetary authority has to concern about are the representability of a certain term structure of interest rates as well as the time lags to take for the implementation.

4-1. Implementability and time lags

In a type of Equation (5), the dimension of the $n \times m$ matrix Φ determines the representability of the term structure[26]. If dim Φ is no less than the number of bond types available in the market (n), then a certain money growth rate path can lead to an arbitrary term structure of interest rates within m periods. Otherwise, complete representability is not achievable[27]

An easier criterion for the representability and the time lags of the implementation process is to check an impulse response matrix, which is defined to be a stack of impulse response function values with respect to maturities and time horizon. Define the impulse

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[25] Equation (3) fits best at $q=1$.

[26] Representing a certain term stuructre of interest rates doesn't necessarily guarantee the system would stay at the level continuously. Stability is another isssue to tackle but will be not be dealt with further in the paper.

[27] In that case, Gaussian least square method would provide a minimum Δ_t^* from solving

$$\min_{\Delta_t} \varepsilon_t' \varepsilon_t = \left[\overline{\Gamma}_t - \Phi\Delta_t - \Psi_v v^t - \Psi_g g^t\right]' \left[\overline{\Gamma}_t - \Phi\Delta_t - \Psi_v v^t - \Psi_g g^t\right],$$

where $\overline{\Gamma}_t$ is a target level of the yield curve.

response matrix Ξ to be a $n \times T$ matrix, where T is an arbitrarily set time horizon (before all the impulse responses completely phase out) and n is the types of bond maturities available in the market. If $n > T$, then the representability of the system is limited to dim $(\Xi) < n$. If $n \leq T$ and dim $(\Xi) > n$, then the composite effect of the money growth rates during the last n quarters can represent any arbitrary term structure of interest rates. Thus, we see that at least the horizons of impulse response functions should be longer than the kinds of assets available in the market in order to guarantee the representability. The time lags of implementation, is not easy to answer due to the presence of multiple solutions. However, the higher dimension of Ξ is more likely to raise the likelihood of attaining at a certain term structure of interest rates within a shorter time horizon.

4-2. Determination of the short-term interest rate

In reality, it is more often the case that monetary authorities use the short-term interest rate rather than the money stock M1[28] for a control variable of monetary policy. Especially in the US, it seems that the federal reserve sets the short-term interest rate based on the deviations of inflation and GDP from certain levels[29].

$$\Gamma_{t,t+1} = -\overline{\Gamma} + \phi_{\pi}(\pi_t - \overline{\pi}) + \phi_t(y_t - y_t^p)$$

The effect of such monetary policy of the short-term interest rate determination on the yield curve can be analyzed as a brief extension of our model.

Suppose that the short-term interest rate is prescribed by the federal reserve at period t as in the above Taylor type rule. Then, by combining it with Equation (1) and (7), we obtain an autoregressive equation of money growth rate μ_t as follows.

$$\mu_t = \frac{1}{\phi_{1,1}}\left(\sum_{i=1}^{m}\phi_{1,i+1}\mu_{t-i}, + \psi_{v,}v_{t,t} + \psi_{g,}g_t - \phi_{\pi}(\pi_t - \overline{\pi}) - \phi_x(y_t - y_t^p) - \overline{\tau} + \varepsilon_t \right. \tag{8}$$

The impulse response functions of the yield rates in regard to such federal fund rate policy can be obtained by representing the series of $\left\{\mu_{t-j}, j = 0, 1, \cdots, m\right\}$ by Equation (8) and plugging them to Equation (7).

[Table 7] provides results from running simultaneously all the equations of Equation (7) with the Taylor rule. Compared with [Table 3], there are some changes in the size of estimates but the qualitative results remain mostly the same. On the other hand, [Table 8], which provides the results from running a simplified version of Equation (8), shows that the Taylor type short-term interest rate rule causes μ_t to move in an autoregressive way. The first and the second lags of μ_t are positive at 1% significance while M1 holds negative sign at the same significance level. The size of lags is chosen from Bayesian Information Criteria(*BIC*).

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[28] Throughout the whole paper, we implcitly assume that M1 is under the control of monetary authority. However, in reality, M1 is not directly controlled by the monetary authority because variations in the demand side are hardly predictable and the magnitude of the demand side effect is greater than our anticipation. Despite such problems, we do not use monetary base instead of M1 because the money equation does not hold for the monetary base.

[29] Taylor (1993) estimates $\tau_{t,t+1} = 0.04 + 1.5(\pi_t - 0.02) + 0.5(y_t - y_t^p)$ using the US data of 1980s.

4-3. Escape from zero short-term interest rate

Suppose that the yield rate of *n-period* bond, $\tau_{t,t+n}$, hits(or escapes from) zero at period *t*. Then the effective money growth rate and money stock would be $\mu_t^E \equiv \mu_t + \frac{B_{t,t+n}}{M_t}$ and $M_t^E \equiv M_t + B_{t,t+n}$, (or $\mu_t^E \equiv \mu_t - \frac{B_{t,t+n}}{M_t}$ and $M_t^E \equiv M_t$) , where $B_{t,t+n}$ is the amount of *n-period* bond available in the market and μ_t is the ordinary money growth rate. It is noticeable that μ_t^E would jump (drop) in a more volatile way when a yield of a certain bond hits (escapes from) the zero level.

Given that the effect of increased μ_t is negative in the short- run (the liquidity effect) and positive in the long run (the Fisher effect), then a monetary system itself has a automatic mechanism of returning to a positive interest rate as follows: Once a type of bond hits zero, then the total nominal value of the bond issue is added to the effective money stock, which in turn gives downward pressure on the interest rates of bonds with near maturities. Such a tendency of the yield curve approaching the zero line would continue until the short-run negative liquidity effect coming from new entrants to the category of the effective money stock M_1^E dominates the long-run Fisher effect arising from the accumulation of M_1^E . So far we have assumed that the monetary authority keeps the money growth rate μ_t constant. Considering that the monetary authority is able to speed up the money growth rate μ_t , then the time required to return to the positive yield curve will be shorter.

V. Conclusing Remarks

Our paper explores a transmission mechanism of monetary policy through bond market. Based on the assumption of delayed responses of economic agents to monetary shocks, we derive a system of equations relating the term structure of interest rates with the past history of money growth. The equations are empirically tested with the US data after some modifications. Impulse response functions of various yield rates with respect to monetary shocks as well as to the short-term interest rate (such as federal fund rate in the US) reveal that the reactions of the yield rates may vary across the bonds with different maturities in terms of directions as well as in terms of magnitudes. From this observation, we find that the policy of maintaining a certain level of the short-term interest rate may lead to different economic consequences depending on the differences of the past monetary policy. Such path-dependency of monetary policy induces that monetary policy targeting a certain shape of the term structure of interest rates could be implemented with a certain time lags.

So far the effects from other omitted exogenous variables are neglected. For example, seemingly significant parameters or variables, such as the variability of money velocity and a shift in consumers' preference, are not fully considered. Such an omission problem would not cause a significant trouble in practice only if omitted variables are deterministic. On the contrary, when the omitted variables are stochastic and are not observable, an algorithm for implementing an optimal monetary policy becomes a usual Kalman filtering setup. This issue is very critical at the stage of application and is expected to be dealt in the following works.

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Appendix A. An m-Period Extension of Alvarez, Lucas, and Weber (2001)

Our model is an adapted version of Alvarez, Lucas and Weber (2001). Consider an economy where exist two types of agents-bond-market participant and non-participant. Regardless of the type, both group have the same intertemporal utility function.

$$\sum_{t=0}^{\infty}\left(\frac{1}{1+\rho}\right)^t U(C_t), \quad \text{where } U(C_t)=\frac{C_t^{1-\gamma}}{1-\gamma}$$

λ portion of the population participates in bond trading and the (1-λ) portion does not. The aggregate production of this economy is y_t .

$$y_t = \lambda C_t^T + (1-\lambda)C_t^N + \frac{T_t}{P_t},$$

where C_t^T and C_t^N are consumption of the trader and the non-trader each and T_t is the nominal value for lump-sum tax payment. The budget constraint for the non-trader is

$$P_t C_t^N = \sum_{j=0}^{m} v_{t-j,t} P_{t-j} y_t, \quad \text{where } \sum_{j=0}^{m} v_{t,t+j} = 1 .$$

At each period he sells his product in the market and receives cash in return $(P_t y)$. He allocates this proceeds across *m+1* periods on consumption with the proportion of $v_{t,t+j}, j=0,\ 1,\cdots,m$. Another more realistic interpretation of this m-period-ahead *CIA* feature is that $v_{t,t+j}, j=0,\ 1,\cdots,m$, is the proportion of consumers who need *j* period time lag in responding to monetary shocks.

On the other hand, the trader spends his money not only on consumption but also on bond trading.

$$\begin{aligned} P_t C_n^T &= \sum_{j=0}^{m} v_{t-j,t} P_{t-j} y_t + \frac{1}{\lambda}\left(B_t - \left(\frac{1}{1+\tau_t}\right)B_{t+1} - T_t\right) \\ &= \sum_{j=0}^{m} v_{t-j,t} P_{t-j} y_t + \frac{M_{t-1}}{\lambda} \end{aligned}$$

Bond and money supplies satisfy

$$B_t - (\frac{1}{1+\tau_t})B_{t+1} - T_t = M_t - M_{t-1},$$

where the government levies the lump-sum tax T_t on the trader only. The effect of money stock increment would be used either in purchasing bonds or in reducing tax burden.

The goods market equilibrium is attained when the next equation holds:

$$P_t C_t = (1-\lambda)P_t C_t^N + \lambda P_t C_t^T = P_t y_t$$

Combining the above equations, we obtain

$$\begin{aligned} P_t y_t &= \sum_{j=0}^{m} v_{t-j,t}(P_{t-j} y_{t-j}) + M_t - M_{t-1} \\ &= M_{t-1} + V_{t,t} P_t y_t + M_t - M_{t-1} \\ &= V_{t,t} P_t y_t + M_t \;.. \end{aligned}$$

Accordingly, the equation of exchange is written as

$$M_t \frac{1}{1-v_{t,t}} = P_t y_t \;.$$

Thus, $V_{t,t}$ can be understood as the money velocity.

From the above equations, we represent the consumption of the trader in the function of money growth rates. Here it is noteworthy that we are interested in the consumption of the trader because in the bond market only the marginal utility of the trader matters for the determination of a yield curve.

$$C_t^T = \frac{1}{\lambda} y_t - \frac{(1-\lambda)}{\lambda} C_t^N = \frac{1}{\lambda} y_t - \frac{(1-\lambda)}{\lambda P_t} \sum_{j=0}^{m} v_{t-j,t} P_{t-j} y_{t-j}$$

where $\mu_t = (\mu_{t-m})$, and ., $v_t = (v_{t,t} \cdots , v_{t-m,t})$. Then, the equilibrium nominal interest rate must satisfy the following marginal condition

$$\left[\frac{\frac{1}{1+\tau_{t,t+k}}}{\frac{1}{1+\rho}} \right]^k = E_t \left[\frac{U'(C_{t+k}^T}{U'(C_t^T} \frac{\frac{(1-v_{t,t})}{(1-v_{t+k,t+k})}}{\Pi_{i=0}^{k}(1+\mu_{t+i})} \right]$$

Notably, the consumption plugged in the above equation is the consumption of trader's, neither that of non-trader's nor the aggregate consumption. This is a way of inducing distributional effect between the trader and the non-trader groups, which in turn leads to the short-term liquidity effect.

For simplicity, we assume $y_t = y$ and $\tau_t = 0$ for all *t*. Then,

$$C_t^T = \frac{1}{\lambda} y \left\{ 1-(1-\lambda) \sum_{j=0}^{m} v_{t-j,t} \frac{P_{t-j}}{P_t} \right\}$$

$$= \frac{1}{\lambda} y \left\{ 1-(1-\lambda) \sum_{j=1}^{m-1} v_{t-j+1,t} \frac{1}{\Pi_{i=1}^{j} (1+\mu_{t-i+1})} \frac{(1-v_{t,t})}{(1-v_{t-j,t-j})} \right\}$$

$$c(\mu_t, \cdots, v_{t,t}, \cdots, v_{t-m,t}) y \equiv c(\mu^t, v^t) y,$$

$$\left[\frac{\frac{1}{1+\tau_{t,t+k}}}{\frac{1}{1+\rho}} \right]^k =$$

$$E_t \left[\frac{U'(C(\mu^{t+k}, v^{t+k}) y)}{U'(C(\mu^t, v^t) y)} \frac{1}{\Pi_{i=0}^{k} (1+\mu_{t+i})} \frac{(1-v_{t,t})}{(1-v_{t+k,t+k})} \right] \quad \text{(A-1)}$$

$$E_t \left[\left(\frac{c(\mu^{t+k}, v^{t+k}) y}{c(\mu^t, v^t) y} \right)^{-\tau} \frac{1}{\Pi_{i=0}^{k} (1+\mu_{t+i})} \frac{(1-v_{t,t})}{(1-v_{t+k,t+k})} \right]$$

We assume that the velocity of money $(v_{t,t})$ is constant or exogenously given and the money increase is directed towards the purchase of bonds in the financial market. On the other hand, the last line of (A-1) enables us to briefly analyze the effect of a change in v_{t,t} on the term structure of interest rates.

Consider the liquidity trap as an extreme case, in which any interest rates would not be affected by an increase in money stock. This phenomenon can arise in the economy of (A-1) exactly when the increase of μ_t is cancelled out by the decrease of $\mu_{t,t}$. Under the situation like this, the only policy option the government can take is to increase expenditure by speeding up the money growth rate. Then, the market interest rates would go higher following the money increase. It is notable that such a way of monetary expansion transmits a stimulus not through the bond market but through the goods market. The shift of the term structure of interest rates following the monetary expansion is attributed to a new equilibrium in the goods market, which works in an opposite direction to the usual propagation mechanism of open market operation. Anyway, this suggests a way of escaping from the liquidity trap with monetary policy[30]

Taking the first order approximation of log (μ^t, v^t) around the point $(\underline{0}, \underline{\bar{v}})$, we obtain

$$\log\, c(\mu^t, v^t) \cong \left(\frac{1-\lambda}{\lambda}\right) \left\{ \sum_{j=0}^{m} \bar{v} \left(\sum_{j=0}^{j} \mu_{t-i} \right) + f(v^t) \right\}$$

---

[30] Though the arguments in this paragraph consider neither Ricardian equivalence nor crowding-out effect explicitly, the equations from our model can test their validity.

$$U'(c(\mu^t,\nu^t)y) = \exp\left[-\gamma(\frac{1-\lambda}{\lambda})\left\{\sum_{j=0}^{m}\overline{\nu}(\sum_{j=0}^{j}\mu_{t-i}) + f(\nu^t)\right\}\right]y^{-\gamma} \quad \text{(A-2)}$$

Substituting (A-2) into (A-1) and taking log by both sides, then we obtain

$$\begin{bmatrix} \tau_{t,t+1} \\ \tau_{t,t+2} \\ \cdots \\ \tau_{t,t+n-1} \\ \tau_{t,t+n} \end{bmatrix}, = \begin{bmatrix} \phi_{1,1} & \phi_{1,2} & \phi_{1,3} & \cdots & \phi_{1,m-1} & \phi_{1,m} \\ \phi_{2,1} & \phi_{2,2} & \cdots & \cdots & \cdots & \phi_{2,m} \\ \phi_{3,1} & \cdots & \cdots & \phi_{i,j} & \cdots & \cdots \\ \cdots & \cdots & \cdots & \cdots & \cdots & \phi_{n-1,m} \\ \phi_{n,1} & \phi_{n,2} & \cdots & \cdots & \phi_{n,m-1} & \phi_{n,m} \end{bmatrix} \begin{bmatrix} \mu_t \\ \mu_{t-1} \\ \cdots \\ \mu_{t-m+2} \\ \mu_{t-m+1} \end{bmatrix} + R(\nu^t) \quad \text{(A-3)}$$

or simply

$$\Gamma_t = \Phi_t \Delta_t + R(\nu^t),$$

where R_t is a n×1 vector, and Δ_t a m×1 vector, and Φ_t a n×m matrix.

The coefficients of the matrix in (A-3) are derived from (A-1) and (A-2). For $1 \le j < m-i+1$,

$$\Phi_{i,j} = -\gamma(\frac{1-\lambda}{\lambda})\overline{\nu}$$

For m $m \ge j \ge m-i+1 \ge 1$,

$$\Phi_{i,j} = -\gamma(\frac{1-\lambda}{\lambda})\overline{\nu}\left\{\frac{m-j+1}{i}\right\} > 0$$

Neglecting that the expectation for the future monetary policies does not change, then the coefficients of Φ indicates that cross-sectionally an increase in μ_t lowers the yield rates of bonds with shorter maturities than m+1 periods while the yield rates of the bonds with maturities longer than m are raised. Combining these two, we can deduce that there is a slope change in the yield curve between m and m+1. Accordingly, the liquidity effect view is supported for bonds with maturities shorter than m and the Fisher's view is valid for bonds with maturities longer than m+1. In addition, the cross-time effect of μ_t changes signs from negative to positive, which also confirms that in the long run Fisher effect prevails.

Appendix B. Tables

[Table 1] Regression[B1] results of Eq (6) (monthly)

	d_fedfundr	d_tb3mon	d_tb6mon	d_tb1yr	d_longbd
slope	-127.9254 **	-94.39297 **	-85.78889 **	-73.42162 **	-30.08043 **
	(27.96452)[B2]	(20.4626)	(18.60477)	(15.1847)	(8.06099)
curv	110.9467 **	63.6107 **	53.95926 **	44.23584 **	12.22965
	(24.56312)	(19.44036)	(17.83941)	(15.38967)	(9.06536)
third	-29.04991 **	-9.744747	-7.625036	-5.851174	-0.8182089
	(7.56772)	(6.55566)	(6.007119)	(5.438865)	(3.474307)
R-square	0.1701	0.1994	0.1947	0.1795	0.1091

** P-value < 0.01
* P-value < 0.05

[Table 2] Cross-sectional variations in yield rates in response to 1% increasein money growth rate (monthly)

	fedfundr	tb3mon	tb6mon	tb1yr	ltgovtbd
Estimates					
0	-46.0286	-40.527	-39.4547	-35.037	-18.669
1	-6.81832	-3.59419	0.745467	2.503457	8.075756
2	23.79699	34.37646	31.08415	26.68232	9.775025
Lower (95%)					
0	-67.9137	-56.9441	-54.4702	-47.6539	-25.8992
1	-24.7057	-19.6211	-12.7498	-9.68692	0.594773
2	-2.21603	13.99041	13.67072	12.30465	2.59023
Upper(95%)					
0	-24.1434	-24.1099	-24.4391	-22.42	-11.4388
1	11.06904	12.43267	14.24075	14.69383	15.55674
2	49.81001	54.7625	48.49759	41.05999	16.95982

[B1] We run regression equation by equation with Newey-West estimates of variances. The same method is applied in the estimation of Eq (7), the output from which is summarized in [Table 3].

[B2] All the numbers in parentheses are estimates of standard errors

[Table 3] Regression results of Eq (7) (quarterly)

	fedfundr	tb3mon	Tb6mon	tb1yr	ltgovtbd
m1sl_g	-76.99609 *	-63.07492 *	-64.10236 **	-62.75473 **	-17.39448
	(31.5835)	(25.66712)	(23.21046)	(19.82346)	(13.17486)
slope	-128.2924	-100.8881	-101.4461 *	-95.13843 *	-99.38094 **
	(70.01885)	(56.9168)	(51.87965)	(44.61863)	(30.2464)
curv	238.1501 **	176.1443 **	183.5877 **	183.3664 **	171.3927 **
	(60.87203)	(51.02896)	(48.52384)	(42.76306)	(29.70285)
third	-174.7073 *	-127.8155 *	-135.675 **	-139.2755 **	-130.5185 **
	(68.19693)	(56.05653)	(50.81901)	(43.75916)	(28.82497)
fourth	51.36435	36.92932	39.26172 *	40.61439 *	37.68054 **
	(31.71773)	(25.7025)	(22.95705)	(19.4546)	(12.26265)
m1sl	-0.03379 **	-0.028509 **	-0.028257 **	-0.026989 **	-0.021644 **
	(0.0026121)	(0 .0021817)	(0.0020829)	(0.001892)	(0.0013401)
gdpdef	0.325513 **	0.2956538 **	0.2923121 **	0.2854734 **	0.3406851 **
	(0.0372945)	(0 .0295202)	(0.0275346)	(0 .0245559)	(0.0179704)
rgdp	0.001349 **	0.0008278 *	0.0008153 *	0.0006974 *	-0.000806 **
	(0.0004773)	(0.0003734)	(0.0003648)	(0.000346)	(0 .0002619)
rgdp_g	-78.2219 **	-47.51647 **	-45.50964 **	-38.88831 **	-18.04747 *
	(18.48785)	(13.47141)	(12.74745)	(11.56509)	(8.427331)
_cons	-0.615336	0.1695507	0.4198887	0.7155139	2.70567 **
	(1.053493)	(0.8676736)	(0 .8527895)	(0.8149884)	(0 .6244242)
R-square	0.6753	0.6953	0.7083	0.7264	0.8399

[Table 4] Cross-sectional variations* in yield rates in response to 1% increase in money growth rate (quarterly)

	fedfundr	tb3mon	tb6mon	tb1yr	ltgovtbd
Estimates					
0	-90.4813	-78.7049	-78.3741	-73.1878	-38.22073
1	-29.3433	-15.6714	-15.7512	-16.2255	-2.571018
2	22.21436	14.27385	12.13303	9.226298	5.920387
3	-30.7501	-19.9018	-21.3719	-23.1821	-20.20366
Lower (95%)					
0	-129.246	-110.433	-107.024	-97.8495	-56.89042
1	-75.2743	-53.2482	-50.7906	-47.0053	-23.88314
2	-35.2496	-31.3383	-30.6236	-27.8615	-18.46947
3	-166.433	-128.475	-118.122	-104.288	-69.49829
Uppper(95%)					
0	-51.7168	-46.9771	-49.7239	-48.5261	-19.55103
1	16.58761	21.90539	19.28824	14.55418	18.7411
2	79.67828	59.88599	54.8897	46.31408	30.31025
3	104.9329	88.67106	75.37808	57.92365	29.09098

* The effect from money stock (m1sl) is not included.

[Table 5] Regression result of Equation (3)

(Quarterly, 163 observations)

	real GDP growth rate (t+1)
fedfundr (t)	-0.0058828 **
	(0.001273)
tb3mon (t)	0.0177324*
	(0.0060302)
tb6mon (t)	-0.0250236 *
	(0.0120913)
tb1yr (t)	0.01445
	(0.00737)
ltgovtbd (t)	-0.0007248
	(0.0007363)
constant	0.0106001 **
	(0.0021766)
R-square	0.2610

** P-value < 0.01
* P-value < 0.05

[Table 6] Covariances of different ordered moments of money growth

(Monthly, 487 observations)

	m1sl_g	slope	curv	fourth	fifth
m1sl_g	0.000025				
slope	0.000011	0.000022			
curv	6.3e-06	0.000028	0.000057		
fourth	1.3e-06	0.00003	0.000087	0.000173	
fifth	-6.2e-06	0.000031	0.000089	0.00018	-0.000212

(Quarterly, 159 observations)

	m1sl_g	slope	curv	third	Fourth
m1sl_g	0.00012				
slope	0.000039	0.000076			
curv	0.000025	0.000101	0.000202		
third	0.000018	0.000119	0.000322	0.000645	
fourth	0.000068	0.000123	0.000461	0.001081	0.002076

[Table 7] Results from running simultaneously a system of equations in Eq (7) with a Taylor type federal fund rate determination rule

(Quarterly, 159 observations)

	fedfundr	tb3mon	tb6mon	tb1yr	ltgovtbd	6fedfundr
m1sl_g	-45.3135 * (20.7154)	-39.0019 * (16.4791)	-42.0153 ** (15.95189)	-43.7244 ** (14.77506)	-8.28862 (11.58109)	
slope	-119.533 ** (46.1740)	-94.2325 ** (36.7196)	-95.3396 ** (35.5328)	-89.8770 ** (32.89808)	-96.8634 ** (25.74425)	
curv	193.915 ** (49.3225)	142.5335 ** (39.2193)	152.7499 ** (37.94754)	156.7963 ** (35.12915)	158.6791 ** (27.47552)	
third	-135.256 ** (44.7487)	-97.8397 ** (35.5918)	-108.172 ** (34.44723)	-115.579 ** (31.89939)	-119.180 ** (24.98296)	
fourth	38.5775 * (16.8957)	27.2136 * (13.43996)	30.34752 * (13.0092)	32.93385 ** (12.0487)	34.00546 ** (9.44168)	
m1sl	-0.02637 ** (0.001948)	-0.02287 ** (0.0015466)	-0.02309 ** (0.0014939)	-0.02254 ** (0.0013801)	-0.01951 ** (0.0010704)	
gdpdef	0.239849 ** (0.029514)	0.230565 ** (0.0234024)	0.232593** (0.022576)	0.234019 ** (0.0208244)	0.316065 ** (0.0160479)	
rgdp	0.001205 ** (0.000413)	0.0007184 * (0.000327)	0.0007149 * (0.0003151)	0.0006109 * (0.0002903)	-0.00085 ** (0.0002225)	
rgdp_g	-72.903 ** (15.3313)	-43.47517 ** (12.18547)	-41.8018 ** (11.78481)	-35.6936 ** (10.90345)	-16.51881 (8.508546)	
_cons	0.957174 (0.882548)	1.364377 (0.7004436)	1.516141 * (0.6763709)	1.660053 ** (0.6246324)	3.157624 ** (0.4837461)	4.046584 ** (0.3323494)
gdpdef_g						253.7386 ** (27.99782)
lgdp_ gap						-18.9074 ** (6.682002)
R-square	0.6413	0.6657	0.6823	0.7049	0.8347	0.4410

** P-value < 0.01
* P-value < 0.05

[Table 8] Autoregressive movements of money growth rate induced by a Taylor type short-term interest rate policy function

(1) Lag length selection order criteria (quarterly, 159 observations)

	Lag 0	**Lag 1**	**Lag2**	**Lag3**	**Lag4**
LL	510.685	551.373	555.103	557.026	557.036
LR		81.376	7.459	3.846 *	0.019
FPE	0.0001038	0.000063	0.0000609	0.0000602 *	0.0000609
AIC	-6.33566	-6.83488	-6.86922	-6.88083 *	-6.86837
HQIC	-6.28079	-6.77218	-6.79868	-6.80245 *	-6.78215
SBIC	-6.20055	-6.68047	-6.69551 *	-6.68782	-6.65606

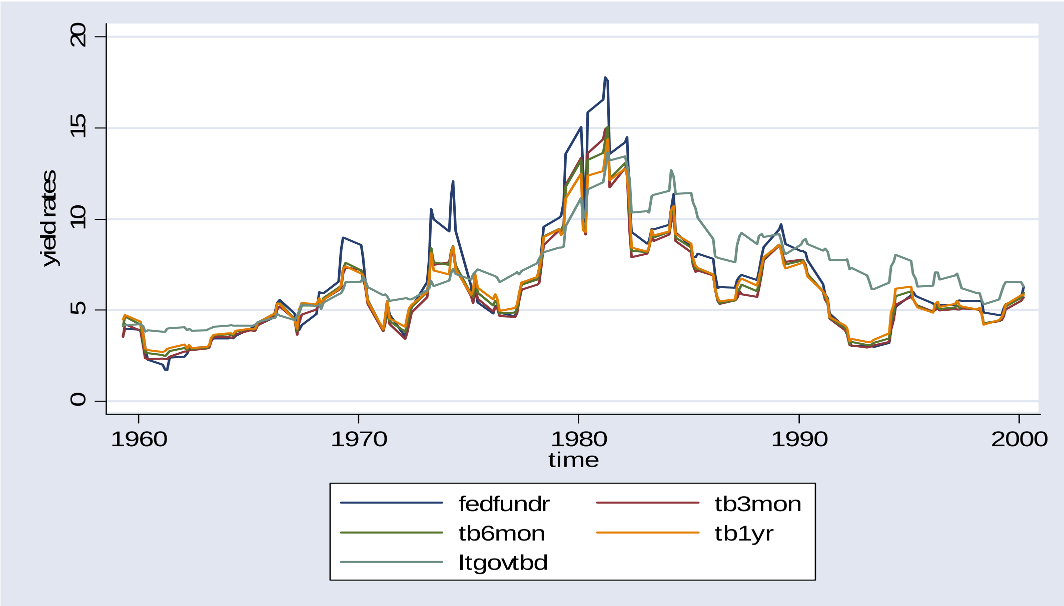
(2) Estimation results

	Coefficient	**Std. Err**	**Z**
L1	0.4928921	0.0751039	6.56 **
L2	0.2061028	0.0738131	2.79 **
lgdp_gap	-0.0341836	0.0347653	-0.98
gdpdef_g	-0.281095	0.1318882	-2.13 *
rgdp_g	-0.1517057	0.0712509	-2.13 *
gdpdef	0.0002253	0.000173	1.30
rgdp	2.17e-06	2.57e-06	0.84
m1sl	-0.0000343	9.78e-06	-3.51 **
_cons	0.0014172	0.0041283	0.34

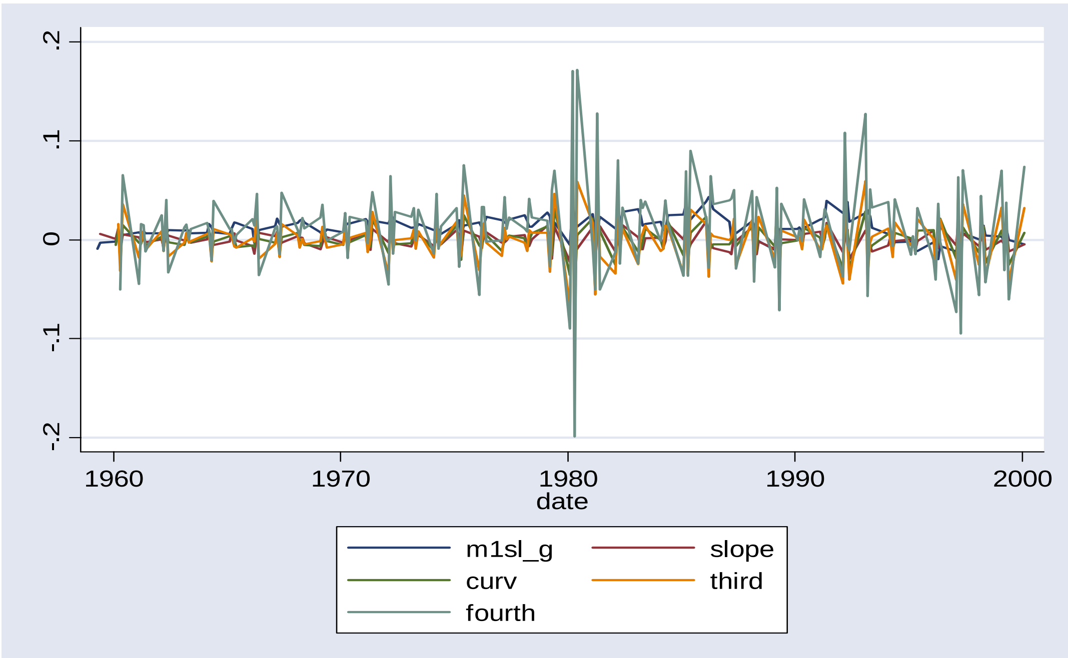
** P-value < 0.01
* P-value < 0.05

Appendix C. Figures

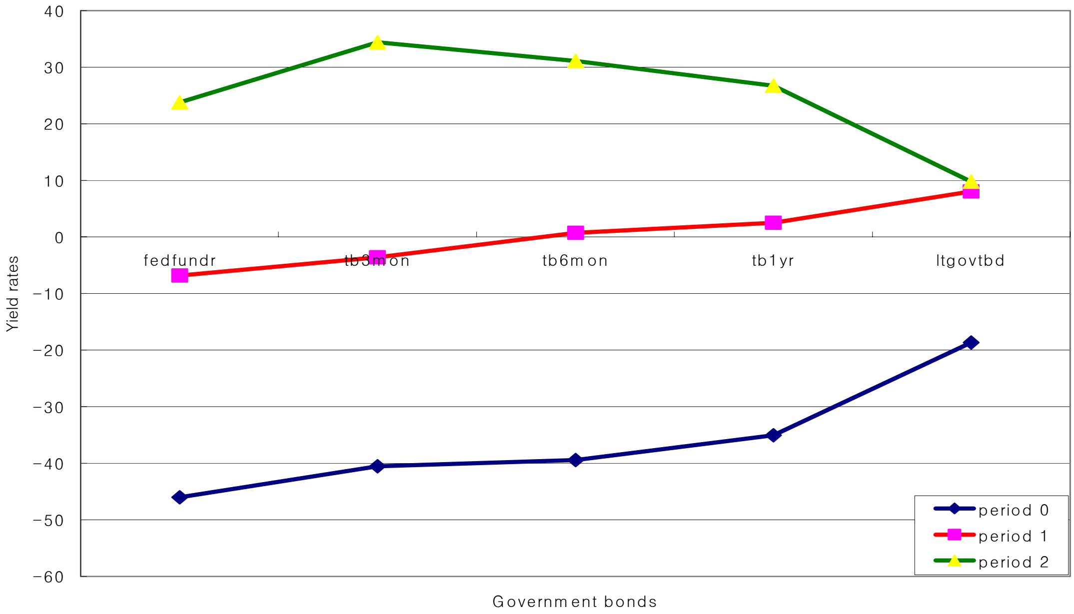
[Figure1] The movements of yield rates in the US during 1960-2000 (quarterly)



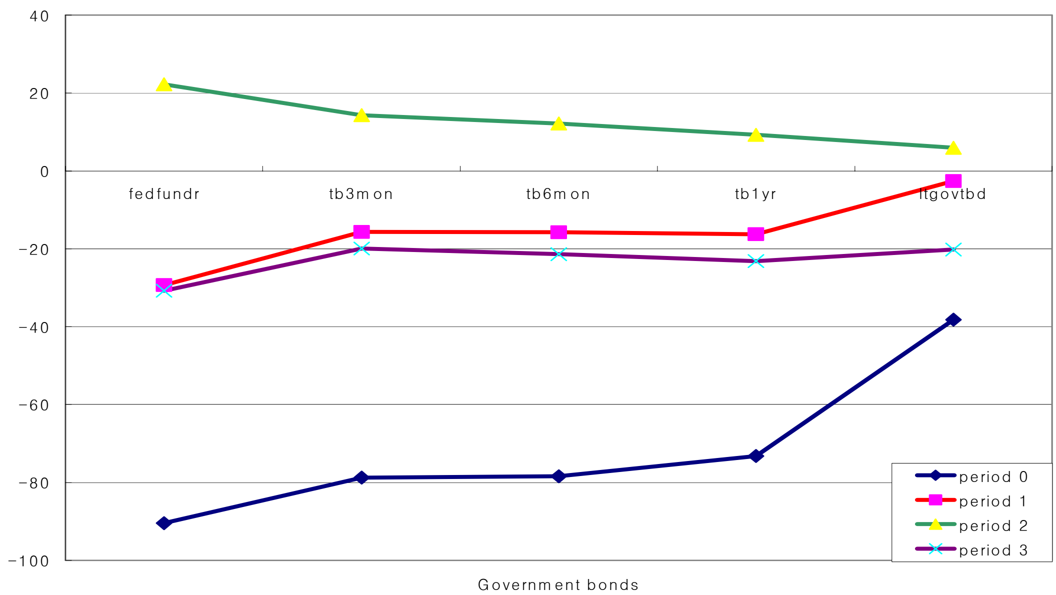
[Figure 2] The movements in the higher order moments of M1 growth rate (quarterly)



[Figure 3] Cross-sectional variations in the term structure of interest rates in response to 1% increase in the money growth rate (monthly)



[Figure 4] Cross-sectional variations in the term structure of interest rates in response to 1% increase in the money growth rate (quarterly)



Comments on "The Term Structure of Interest Rates as Target of Monetary Policy"

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This paper shows a theoretical model that monetary shocks affect the bond market with time lags on the assumption of the cash-in-advance and the limited bond market participation constraints, and then empirical tests with the US data between July 1995 to February 2000 have been carried out to examine whether the theoretical model is held or not.

With results of such theoretical and empirical studies, this paper argues, for policy implications, that the monetary authority can manipulate the term structure of interest rates targeting its certain shape with the control of money supply considering time lags in which money supply affects interest rates. In addition, this paper suggests, based on such studies, that the term structure of interest rates could be employed as a monetary policy instrument, and even the term structure of interest rates could be better than a short-term interest rate for a monetary policy instrument since consumption of durable goods and investment are affected more by the former than the latter.

As contributions of the paper, it is noteworthy that the relationship between the term structure of interest rates and money supply is theoretically derived with an extension of the model of Alvarez et al. (2001), and then the effect of monetary shocks on the term structure of interest rates is examined with a VAR model.

In fact, studies on the term structure of interest rates and monetary policy have been popular subjects in monetary studies since the 1990s, in general, focusing on two directions such as tests on the predictability of the term structure of interest rates on the real economy or the inflation rate, and studies on the effect of monetary policy on the term structure of interest rates (See Oh(1998) in the Korean experiences). Results of studies, in general, shows that the term structure of interest rates could be used as an information variable for monetary policy rather than a policy instrument (Friedman 1994).

However, in this paper some points seem to be reconsidered for further improvement of the paper as the followings:

First, in theoretical aspects, it may be necessary to explain why interest rates are described as the past history of money growth in this paper, differently from a rational expectation model of Alvarez et al. (2001)(See difference between equation (6) in Alvarez et al. (2001) and equation (15) in this paper), although an extended model of Alvarez et al. (2001) is employed in this paper. Is adaptive expectation assumed differently from the model of Alvarez et al.? In addition, it may be noted that a theoretically important equation (16) is held only on the very limited assumption, as the author notes, and, accordingly, theoretical robustness seems not strong.

Second, in policy aspects, monetary policy affects the term structure of interest rates mainly because monetary policy affects short-term interest rates and long-term interest rates differently. For instance, a tight monetary policy raises short-term interest rates. But long-term interest rates may be affected by a change in expectations on inflation rate or a change in an ex-ante real long-term interest rate. When a certain tight monetary policy is perceived credible and effective, long-term inflation expectation becomes weak, and, as a result, long-term interest rates increase less or decrease. As a result, interest rate spreads become smaller. In such ways, monetary policy affects the term structure of interest rates differently depending on the credibility of monetary policy and inflation expectations etc.

In addition, central banks have not usually intervened into the long-term bond market directly to manipulate the term structure of interest rates targeting its certain shape, without exceptional cases such as in the recent Japanese experiences, in order not to distort the financial market structure.

Third, in empirical studies, the VAR model should be more carefully specified since, as we know, estimation results of the VAR model would be different depending on the model specification; for instance, in this paper, too many variables of interest rates are included, it would be better to note whether seasonal adjustments and transformations of variables have been done, tests of stationarity of variables and cointegration among variables should be carried out, order of variables also should be checked again, and it should be noted how many lags are included together with the results of lag test.

In general, an increase in money supply leads to a positive interest rate spread, and an increase in interest rate leads to a negative interest rate spread. However, figure 4 shows that a shock of an increase in money supply results in a negative interest rate spread.

Fourth, as one of minor points, terminologies of participant/non-participant and traders/non-traders are used together. It would be better for the latter to be used as in Alvarez et al. (2001) to escape unnecessary confusion.

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CHAPTER 5-3

Enhancing Efficiency of Government Budget and Fiscal Policy

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ABSTRACT

When one thinks of efficiency in connection with government budget and fiscal policy, the first thought is usually how to find ways to make the budget and fiscal process work more efficiently. How can the funds needed to pay for government be collected and disbursed with minimum cost? A corollary to this mindset is that taxpayers are entitled to have their public servants spend their tax dollars, yen, won or euros wisely and efficiently. There is some validity to this viewpoint, since it seems irrational to advocate less efficiency rather than more.

However, there are two sides to this coin. Those who think efficiency should be the goal are thinking like a businessman. Businesses should be run efficiently and so should governments, according to this mindset. But there are other ways to view this issue. It should be kept in mind that government has no resources of its own. Whatever resources it has, it must first take from someone. That being the case, is it really a good idea to try to find ways to make it easier for government to take assets from private individuals and businesses?

This article explores this question from both perspectives. It begins by looking at the methods that have been found over the years to make the budget and fiscal process work more efficiently. It then looks at the other side of the issue and discusses instances when less efficiency might be better.

I. INTRODUCTION

The usual way to look at efficiency in connection with government budget and fiscal policy is that more is better. It is better to be efficient than inefficient and the goal should be to find ways to improve efficiency with each passing year. That is the mindset of businessmen and it is a good way to look at things – if you are running a business. But government is not quite like a business. Businesses provide goods and services that consumers want. If they don't do a good job of it, they go bankrupt. Consumers have

[♣] Yeomin Yoon gratefully acknowledges the research support provided by the Institute of International Business at the Stillman School of Business, Seton Hall University.

choices and they vote with their dollars, Euros or won to purchase goods and services of whoever will give them the quality they want at the lowest price.

But government does not run that way. Governments, although they can become temporarily bankrupt, never go away if they provide services that no one wants. If anything, such governments just raise taxes to cover their cost of operations. Government is more like a monopoly than a competitive business. Although there is some competition between governments, the basic structure of government is monopoly. Taxpayers have little choice but to pay for the services of whatever government they live under. If particular taxpayers do not like the services their government provides, the most they can do is move to another jurisdiction. If they cannot or will not move, they must be content with the services of the government they have. They cannot hire a different government that provides better services.

II. THE CASE FOR EFFICIENCY

Since governments possess most of the attributes of monopoly – lack of competition, higher cost and lower quality than would exist under competitive conditions – one of the few options that government bureaucrats and policy makers have is to try to make their government work more efficiently. Several techniques have been tried in the past, some more successful than others. The next few pages will explore some of these options.

Efficiency in government can be classified into several categories. On the budget side, governments can find ways to spend money more efficiently. From the perspective of political philosophy, the threshold question to ask is – What should government do? We will not address that question in this paper, since it would take us too far afield of the main topic, which is efficiency in budget and fiscal policy. But it is an important question to ask, because one must determine which services governments should provide before determining the size and content of the budget. Once the proper functions of government have been decided, the next step is to determine the best and least expensive way to provide those services.

The other way to look at efficiency is to examine fiscal policy with the goal of making the collection of taxes more efficient. Some taxes have historically proven to be more efficient than others. Some taxes are easier to collect than others. Some taxes result in less distortion to the economy than others. Some taxes have proven to be counterproductive. Governments should examine their fiscal policy, taking these factors into account. There is no need to continue to make the mistakes that governments in the past have made in this regard. Past experience should be the guide when it comes to formulating fiscal policy. Unfortunately, many governments continue to make the same mistakes because they fail to learn from the mistakes of the past.

To summarize, there are two basic avenues that can be taken to increase efficiency in budget and fiscal policy, the spending side and the revenue-raising side. These two approaches are not mutually exclusive. They can be, and should be used in tandem. Both are important.

III. THE PRIVATIZATION OPTION

Once it has been decided which services government should provide, the next step is to determine how those services should be provided. When making this decision, it is important not to fall prey to perhaps the most popular *non sequitur* of all – something needs to be done, therefore the government needs to do it. Just because it appears that something needs to be done, it does not follow logically that government should do it. There are at least four options from which to choose when it has been determined that there is a need for some service. Government provision of the service is only one option. Another option is to have the function performed by the private, profit-making sector. The third option is to have the nonprofit sector do it. The last option is to do nothing at all. This option may not seem like a very desirable option, but it is an option nonetheless. Not everything that needs to be done should be done. Since the amount of resources available is insufficient to allocate to meet all the needs of every individual and group, some things that need to be done must remain undone.

The point is that government is not the only solution. However, once it is decided that government involvement is necessary in a particular case, it does not follow that some government must actually provide the service. Government can hire someone in the private sector – either profit or nonprofit – to perform the task.

The evidence is clear that the private sector can provide just about any service more efficiently and at a lower cost than government. One reason for this structural advantage is because of the profit motive. If a business does not cut costs ruthlessly and focus its attention on consumer wants, it will soon go out of business. Governments do not work under those constraints. If some government does not provide quality service at a reasonable price, there is nowhere its constituents can go. There is no alternative service provider because government, practically by definition, is a monopolist. Where there is little or no incentive to increase quality or reduce cost, quality will tend not to be improved and costs will tend not to be reduced.

There are ample real world examples to prove this point. The collapse of the Soviet Union in the late 1980s is partly attributable to the massive misallocation of resources that necessarily results when there is no price system to make allocations efficient. Ludwig von Mises (1881-1973), an Austrian economist, predicted as far back as the 1920s that the Soviet Union would collapse because of this inefficiency (1923, 1928, 1935).

But the collapse of the Soviet Union is not the only example that could be given to illustrate what can happen when budget allocations are not made efficiently. The privatization movement, which started in the 1970s in the UK and the USA, provides hundreds, if not thousands of examples to illustrate the benefits of privatization, if it is done transparently without collusion. The Privatization Center [www.rppi.org/privatization/index.shtml and www.privatization.org] has a rich trove of publications to document how costs can be cut for practically any services provided by government.

By hiring private sector firms to perform tasks that would otherwise be provided by government it is possible to inject competition and the profit motive into areas where this incentive structure would otherwise be absent. Hiring private firms to provide government services allows the price system to operate to allocate resources in the most efficient manner. In the absence of the price system it is impossible to rationally and efficiently allocate resources. Thus, it is necessary to find a way to create an environment in which the price system can be allowed to function. Privatization does exactly that.

One of the classic books on privatization was written by Bennett and Johnson (1981). Their book, titled *Better Government at Half the Price: Private Production of Public Services*, documents hundreds of cases where government services can be provided by the private sector at greatly reduced cost, often with remarkable increases in efficiency as well. Robert Poole (1980) and Randall Fitzgerald (1988) have also written classic books on the topic of privatization. Here are some examples of cost savings that can be had if government hires private sector firms to perform a service rather than allowing government employees to do it.

Table 1. Cost Reductions and Efficiency Increases as a Result of Privatization

Service Provided	Cost Saving
Asphalt overlay construction (Goodman)	96%
Grass maintenance (Goodman)	40%
Janitorial services (Goodman)	73%
Municipal solid waste disposal (Savas)	61-71%
Prison administration (Segal)	69%
Refuse collection (Goodman)	42%
School food services (Segal)	28%
Street cleaning – 121 cities in Los Angeles county (Goodman)	43%
Street maintenance (Goodman)	37%
Traffic signal maintenance (Goodman)	56%
Waste collection (Stevens)	22-30%
Waste water treatment (Segal)	35%

It takes 68 percent more federal government employees to remove 21 percent as much railroad track as private sector employees over the same period of time and under similar conditions (Fitzgerald). The U.S. Department of Defense has achieved cost savings through outsourcing tasks that were formerly performed by government employees. Table 2 summarizes cost savings in selected areas.

Table 2. Selected Cost Savings from Outsourcing U.S. Department of Defense

Service Provided	Cost Savings
Supply/logistics	15-38%
Housing maintenance	17-42%
Visual information services	61%
Base operations support	42-46%
Aircraft maintenance	42-66%
Vehicle ops and maintenance	48%

Source: Segal.

Quality also tends to improve when government tasks are turned over to the private sector. In the case of emergency medical and fire services, for example, private providers react faster and are better equipped. Such increased efficiencies save lives.

Some defense functions have been privatized. Some of the governmental functions that have been successfully privatized include:

Airplane maintenance
Bill collection
City management
Criminal justice
Data processing
Day care
Delivery services
Education
Electricity
Emergency ambulance service
Fire protection
Garbage and solid waste
Grounds-keeping
Health care
Leisure and recreational services
Mental health services
Payroll accounting
Pension management
Police
Prisons
Public works
Road construction and maintenance
Sewage treatment
Ship maintenance
Social security
Social services
Toll collection
Transit systems
Weather forecasting

IV. Privatizing Social Security

Social security is an excellent example of a governmental function that can benefit by being privatized. Many governments in developed countries as well as countries in Eastern Europe and the former Soviet Union are facing a crisis in their government pension system. The birth rate has declined, so fewer people are putting money into the social security system. Medical advances have made it possible for people to live longer, which places a further strain on the system, since people will be drawing money out of the system for more years. Also, in some countries, people have been retiring earlier. As a result, fewer people are putting money into the system and more people are taking money out of the system for a longer period of time. This phenomenon has been described as a demographic nightmare (Ferrara and Tanner 1998: 129).

Numerous studies have discussed the benefits of privatizing social security (Aaron et al., 1989; Crane 1997; Ferrara 1980, 1985; Ferrara and Tanner, 1998a). Rather than paying into some government's dubious trust fund (not all governments have a trust fund set up for social security. Some use a pay-as-you-go method), workers would pay into a private investment trust that they would actually be able to claim as property when they retire. Since it is their property, their heirs would be able to inherit.

Such is not the case with social security in the United States and in many other countries. When someone dies, there is no asset to inherit. Payments stop when the recipient is no longer living. Thus, one of the benefits of a privatized system is that a massive pool of funds would accumulate. This fund would be available for investment, thus leading to a stock market boom. Interest rates would drop, making it easier to finance a home. Those who placed money into the system for a number of years would be able to retire as millionaires (Tanner, 1996a). According to Martin Feldstein of Harvard University, "the combination of the improved labor market incentives and the higher real return on savings has a net present value gain of more than $15 trillion, an amount equivalent to 3 percent for each future year's GDP forever." (cited in Tanner, 1979).

Rather than being mere transfer payments, as they are today, a privatized system would result in a ready pool of wealth that people can draw on when they retire. Monthly retirement checks could be two or three times more than what would be paid under a governmentally run system. Such a reform would be of special benefit to the poor, since poor people receive a higher percentage of their total income from social security than do middle class and rich people (Gokhale 2001; Tanner 1996).

Women would stand to benefit disproportionately from social security privatization. Under present U.S. rules, benefits are cut by as much as half when the spouse (usually the husband) dies. One study found that this partial cut-off throws one widow out of five into poverty (Shirley and Spiegler, 1998). This would change under a privatized system, since the widow would retain the assets that were placed into the fund.

Some countries have started to privatize their social security systems, with some success. As the pool of capital builds, it is invested in projects, leading to economic growth. Poor countries that previously could not attract sufficient foreign capital are now exporting capital to other countries. The prospects for continued capital growth and the expansion of employment and a higher standard of living are very real prospects.

Chile was the first country to privatize its social security system, in 1981. Ninety-five percent of all workers are now covered under the private system (Pinera, 1996). The compound annual rate of return has been more than 11 percent (Rodriguez 1999). Pension benefits in the private system are now 50 to 100 percent higher, adjusted for inflation, than they were in the state-run system. Chile's growth rate jumped from its historic 3 percent annual rate to a rate that has averaged 7 percent over the 12 years prior to the Rodriguez study. The savings rate jumped to 25 percent of GDP and the unemployment rate dropped to about 5 percent (Pinera, 1998). Argentina, Peru, Colombia, Bolivia, Mexico and El Salvador have also privatized their social security systems (Ferrara, 1997).

The Cato Institute [www.cato.org] has published a number of studies that investigate various aspects of social security privatization in the United States and other countries. It has a Social Security Benefit Calculator on its website. Table 3 compares the benefits that would be received under a private system to the benefits projected to be received under the present government system. The results are shown in Table 3.

Table 3. Comparison of Social Security Benefits Private System vs. Government System in the United States

		Estimated Annual Benefits			Estimated Asset Accumulation	
Recipient	Annual Salary $	Private System $	Govt. System $	Ratio of Pvt/Govt System	Private System $	Govt. System $
Male, age 25	35,000	52,236	19,794	2.64	548,546	0
Female, age 25	35,000	50,021	19,794	2.53	600,746	0
Male, age 25	40,000	59,011	21,816	2.70	619,694	0
Female, age 25	40,000	56,389	21,816	2.58	677,229	0
Male, age 25	60,000	83,596	26,963	3.10	877,872	0
Female, age 25	60,000	79,015	26,963	2.93	948,979	0
Male, age 25	100,000	116,320	32,182	3.61	1,221,518	0
Female, age 25	100,000	108,775	32,182	3.38	1,306,388	0

Source: www.socialsecurity.org

Table 3 makes a number of assumptions. Retirement age is assumed to be 67, which is the projected retirement age for most people presently paying into the U.S. government plan. Dollar amounts are in constant 2004 dollars. Contributions into the private plan are estimated to be 6.2 percent of earnings, up to the Social Security limit, which changes every year. Under present rules, employees and employers each pay more than 7 percent of salary into the social security system. Thus, the private plan would be less costly, since less than half as much money is put into the private plan (6.2% vs. 14+%). Additional assumptions are explained by Tanner (2004).

Women in the United States live an average of 7 years longer than men. This difference is reflected in the privatized system but not in the government system. For example, a male who starts contributing into the private or government social security system at age 25 and who earns $35,000 a year, with annual cost of living increases can expect to receive $19,794 under the government program or $52,236 under a privatized system. In other words, the private system will pay $2.64 for every $1 paid by the government program. A woman who is the same age and who earns the same salary can expect to receive the same $19,794 annually under the government system. Also, and what the figures in Table 3 do not show, is that she will receive this amount for 7 years longer than the male, which means she will receive an additional $138,558 over her lifetime. Under a privatized plan she would receive $50,021 a year for the rest of her life, which means she would receive $2,215 less per year than her male counterpart, but she would be receiving her $50,021 for an additional 7 years, which amounts to an extra $350,147.

Another point to be made is the difference in asset accumulation that would occur in a privatized system. Under the government system, no assets would accumulate, so if a worker dies before retirement, the heirs get nothing, whereas under a privatized system, the heirs of the male worker discussed above would receive $548,548. The heirs of the female worker discussed above would receive $600,746.

These numbers jump dramatically for individuals who start putting money into the system at an earlier age or who earn more than the $35,000 given in the first case. For example, if the annual salary were $40,000, a male retiring at age 67 would receive $59,011 annually under a privatized system, compared to $21,816 under the government system, or $2.70 under the private system for each $1 under the government system. A female would receive the same $21,816 under the government system, compared to $56,389 under a privatized system. So she would receive $2622 a year less than her male counterpart, but she would receive the $56,389 for an average of 7 years longer than a male, or an extra $394,723. Thus, it can be concluded that a privatized system would benefit both males and females, but would benefit females more than men, since females would receive more in total benefits.

As can be seen from Table 3, it is quite possible that employees can retire as millionaires under the private system. A male who starts contributing into the private system at age 25 and who earns $70,000 can expect to retire at 67 with $1,000,893 in asset accumulation. A female who earns the same amount can expect her assets to be worth $1,077, 002 at retirement.

The big question is how do we get from here (the present system) to there (a private system)? What would happen to those who now (or soon to be) on the system if the system went private? Various proposals have been made. For example, young people could elect to set aside a portion of their present social security payments in a private fund and the remainder of their social security taxes could continue to be used by those presently (or soon to be) drawing benefits. That way, those presently (or soon to be) drawing benefits would continue to do so.

One rather alarming proposal would be for the government to invest the funds in the capital markets. If this were done, the government would become the largest shareholder in most American businesses, and would be able to influence corporate policy. In all likelihood, corporate decisions would be made for political rather than economic reasons (Ostaszewski 1997). Perhaps there would be restrictions on the types of company that the funds could be invested in. Such a possibility is not far-fetched, judging from what has taken place in the state public employee pension funds (Tanner, 1996b). Of course one could also point out that if the government were the largest shareholder in all or most American corporations, it would, in effect, own or at least control the means of production, which means the American economy would become socialist, an economic system that has proven to be structurally inferior to the market system.

One problem with partial privatization is that young workers would still be forced to pay for other peoples' benefits. Thus, it is unfair to young workers who have to pay into a system that they cannot draw from. Another solution that has been proposed is to sell federal land and use the proceeds to fully fund the present system. The federal government owns more than 50 percent of some western states, and owns substantial assets in every state. If these assets were sold, some estimates conclude that there would be enough money to fully fund the system for those who are presently on the system and for those who will retire within a few years.

V. THE CASE AGAINST EFFICIENCY

"…government has proved incompetent at solving social problems. Virtually every success we have scored has been achieved by nonprofits." (Drucker)

The evidence that the private sector can perform many functions better and cheaper than government is overwhelming. Thus, it does not make sense, from an economic point of view, to allow government to do much of anything directly. It is almost always better to have the service performed by the private sector. If government involvement is deemed to be necessary, for some reason, the more efficient approach is for the service to be contracted out to the private sector and paid for by government. One cannot make a case against efficiency if one is discussing the spending side of government.

However, a case can be made for creating inefficiencies on the tax collection side of government. Government has no resources of its own. Whatever resources it has it must first take from someone in the private sector. Since the private sector has proven to be more efficient than the government sector, the more resources that are shifted from the private sector to the government sector, the more overall welfare declines. If one is interested in increasing total utility, the way to go about achieving the goal is not to give government more resources but rather to give it less.

Governments have a tendency to expand over time. If one looks at the relative and absolute size of most governments today and compares them to the relative and absolute size they had a few decades ago, one would find that government has increased in size, regardless of the measurement technique used. One study points out that government spending in the United States relative to Gross National Product (GNP) has risen from 10 percent during World War I to nearly 40 percent during the 1990s. At the federal level, the government went from taking $1 out of every $12 earned in 1890 to $1 out of every $3 earned in 1990 (Perry).

If the transfer of resources from the more productive private sector to the less efficient government sector is to be minimized, methods must be found to make the transfers more difficult. Several techniques have been advocated over the years.

One approach that has been advocated is to require the government to balance its budget. This approach would prohibit government from borrowing money for current spending. The problem with this proposal is that it does not guarantee that government expenditures will be restrained. There are two ways to balance the budget. One may either reduce spending or increase taxes. Having a balanced budget requirement without a rule that would make it difficult to increase taxes would not be a very effective restraint on government spending.

The argument could be made that balancing the budget over the business cycle would be better than balancing it annually, the reasoning being that fiscal policy should be used as a tool to stimulate economic growth. Keynes (1936) and various Keynesians (Hansen 1953) and post-Keynesians have advocated this approach. There are several problems with this view. For one, fiscal policy has been historically ineffective, at best, and counterproductive at worst in smoothing out the business cycle.

It takes the legislature many months to agree that spending should be increased or decreased and many more months before their decision has any effect on the economy. By the time the new government spending pattern injects itself into the economy, the economy is in a different phase of the business cycle. If the legislature starts debating how spending should be increased to stimulate a weak economy, for example, it will take several months to agree on the specifics and another several months before the increased spending has the desired effect. By the time the new spending permeates the economy, it could be out of the recession and moving toward a boom. Having government artificially stimulate spending could cause the boom to expand even further, which causes the business cycle to fluctuate more than would be the case if the government did nothing.

Another problem with using fiscal policy as a tool to smooth out the business cycle is that much, if not all of the additional spending is little more than a shifting of existing spending rather than the creation of new spending. If government obtains the extra money by borrowing, it shifts funds from the private sector to the public sector. The gross quantity of funds remains the same. If the government prints money to finance the boom, the increase in the quantity of money dilutes the purchasing power of the money that is in the private sector at the same time it is pumping money into increased government spending. The total value of goods and services remains about the same, so spending is merely shifted, not increased, in terms of purchasing power. If government finances its additional spending by raising taxes, it merely takes money out of private hands and puts it into public hands. The total amount of money in circulation remains the same. There is merely redistribution from the more efficient private sector to the less efficient government sector. Hazlitt (1959, 1960), Hutt (1963) and Terborgh (1968), among others have pointed this out. Yet the perception persists that government stimulation of the economy can smooth out the business cycle.

Of course, one may point out that the whole argument about balancing the budget over the business cycle is a mere theoretical argument anyway, since governments the world over have been unable to balance their budgets. Almost all governments at the national level run continuous budget deficits every year, whether the economy is in a recession or a boom. Government officials seem incapable of balancing their budgets in the absence of constitutional constraints. The fact that most state governments in the United States are able to balance their budgets every year is mostly because their state constitutions have provisions that require a balanced budget. Without such a constitutional rule the legislature is usually incapable of exercising the needed restraint to achieve a balanced budget.

Requiring a balanced budget, coupled with rules that make it more difficult to increase taxes, would be a more effective way to prevent resources from being shifted from the more efficient private sector to the less efficient government sector. One way to make it difficult to raise taxes would be to require more than a simple majority of the legislature to vote in favor of any tax increase. If a 2/3rds or 3/4th requirement were needed to increase taxes it would be more difficult to increase taxes than if a simple majority vote were all that was needed. Having such a supermajority requirement has proven to be somewhat effective in the U.S. states that have adopted this rule.

The evidence is clear that having a supermajority requirement decreases the rate of government growth. Between 1980 and 1996, the state tax burden as a percentage of personal income rose five times as fast in states that did not have a supermajority requirement than in states that did have such a requirement. Between 1990 and early 1998 the top tax rate increased in ten states. In all ten states where the top rate was raised, there was no supermajority requirement. During this same time period, the top tax rate was reduced in three of the 13 states that do have a supermajority requirement (Stansel 1998).

In Arizona, taxes had been raised eight times in the nine years before its supermajority requirement was enacted into law in 1992. Between then and early 1998, Arizona reduced taxes five years in a row (Stansel 1998).

The rate of government growth at the federal level would also likely be reduced if a supermajority requirement were in place. Four out of five federal tax increases would not have passed if a two-thirds vote were needed for passage (Perry, n.d.). The four largest tax increases between 1980 and 1998 [1982, 1983, 1990 and 1993] would not have passed if the two-thirds supermajority requirement would have been in place (Cato 1999).

The argument has been made that occasional tax increases are necessary to reduce the deficit. But a closer analysis shows that such is not the case. The history of the last few decades is that when Congress increases taxes, it increased spending by even more. In recent years, Congress has increased spending by $1.59 for each $1 increase in taxes

(Perry, n.d.). The evidence is clear that the way to balance the budget or reduce the deficit is to reduce spending, not increase taxes.

Another technique that could be used to restrain government's taxing tendencies would be to make taxes more visible. If taxpayers can see what they are actually paying for government services, they will be more sensitive to having a portion of their income taken from them. One way to make taxpayers more aware of the cost of government would be to abolish the rule that allows employers to withhold a portion of an employee's salary for taxes. Many jurisdictions require employers to withhold a portion of an employee's salary from the paycheck. Such a policy is good, from a government's perspective, because it makes it easier to collect larger sums of money than would otherwise be the case. It is an efficient way to collect taxes.

However, efficiency may not be a good thing if increased efficiency in collecting taxes results in making it easier to transfer resources from the more efficient private sector to the less efficient government sector. If taxpayers had to write out a check to the government every month instead of having a portion of their income taken from them before they get to see it and touch it, people would have a better feel for what government costs. It would cause them to think harder about how much government really costs and whether they want to continue to maintain that level of government spending (Schmidt 2002).

A similar technique would be to replace the value added tax (VAT) with a retail consumption tax. One criticism that has been made of the VAT is that it can be administratively burdensome. The tax is assessed at each level of production, subject to tax credits (OECD 1988). In some jurisdictions, where the VAT is complicated, it has been jokingly referred to as an accountant's full employment act because it takes so many accountants to administer it. One advantage of replacing the VAT with a retail consumption tax is that it would only need to be collected once, at the end of the process. Another advantage is that the full cost of the tax would become more visible.

One criticism of the VAT is that the people who ultimately pay it cannot always see that they are paying it. It is included in the cost of whatever product they are buying, in many cases. With a retail consumption tax, consumers are better able to see how much the tax is, especially if the tax is added on to the price at the cash register rather than hidden in the price tag. This technique would make the tax more visible, and thus would increase resistance to increasing it.

Taxing sales rather than income may also have a positive effect on the savings rate. If people are not taxed until they buy something, there may be more of a tendency to save rather than consume. If savings increase relative to income, the supply of funds available for investment will increase, which will lead to lower interest rates, lower cost of capital, and more investment, which will increase economic growth and create jobs.

Another suggestion that has been made would be to allow the taxpayers themselves to choose where their tax money is spent. Podolsky (2002), Murray (2004) and McGee (2004) have suggested that taxpayers be given a list of possible destinations for their tax money as part of the tax forms that they must complete every year (in the USA). They could then check off which government functions they want their tax money to support. In the Podolsky suggestion, taxpayers would insert percentages in the spaces provided, based on the percentage of taxes paid that would be allocated to the various budget items.

Such an option would add a level of administrative burden to the already burdensome tax administration system. However, if one defines efficiency based on the relationship between taxes collected and the destination of the proceeds, implementation of such a proposal would greatly increase the efficiency of the system. Taxpayers in California would no longer be forced to pay to construct a bridge in Florida. Taxpayers in Texas would no longer be forced to pay for a sports stadium in New York. In all likelihood, the most wasteful government programs would no longer be funded because they would no longer have any support.

Such programs currently receive support only because of the special interests that advocate spending for these projects. If taxpayers were allowed to allocate how their tax money is spent, the power of special interests would be greatly reduced, because they would no longer be able to lobby the legislature to fund their pet projects. Another benefit of such an approach would be that politicians would have much less incentive to pander to the various special interests by promising to increase spending for their projects because such decisions would be totally out of their control. Rather than trying to buy off potential voters with their own tax money, politicians would have to find other ways to convince voters to vote for them rather than their opponent. Implementing such a proposal would have far reaching effects on the whole structure of political debate.

VI. Concluding Comments

When one talks about efficiency in government budget and fiscal policy, it is really necessary to talk about two aspects of the issue. From the spending side, one must strive for efficiency. Ways must be found to cut costs so that government revenues can stretch farther. But from the collection side, efficiency should not necessarily be the goal. Collecting taxes should be made more difficult rather than less if the goal is to increase overall economic welfare. The easier it is to transfer resources from the more efficient private sector to the less efficient government sector, the more overall welfare will be decreased. In other words, efficiency and welfare can be increased by making it more difficult to shift resources from the private sector to the government sector. Economic efficiency and overall welfare will be maximized only if the amount of resources that are left in the private sector is maximized. Making it easy to shift resources to the government sector will defeat the goal, not make it easier to achieve, since funds are being transferred from the more efficient private sector to the less efficient government sector.

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Comments on "Enhancing Efficiency of Government Budget and Fiscal Policy"

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As the title indicates, this paper is concerned with ways to enhance the efficiency of fiscal policy. In the discussions on fiscal policy, efficiency usually has two dimensions. One is allocative efficiency and the other is technical or operational efficiency. Allocative efficiency is obtained when the resources are allocated across various sectors and programs in the way that best meets the needs of the society, while operational efficiency is obtained when a given function is carried out in the least costly way. The authors are concerned only with operational efficiency and not with allocative efficiency. But they add another dimension of efficiency in the discussion, namely the efficiency of tax policy.

To enhance the operational efficiency of expenditure policy, the authors argue that privatization and out-sourcing should be extended to practically all areas of government activities. Social security is a prime example that can be subjected to privatization. On the revenue side, it is very important to control the growth of tax burden. The authors suggest that a balanced budget principle be enshrined in constitution or a supermajority rule be imposed on tax increases. Other methods to restrain tax increases include abolishing withholding taxes, replacing VAT with retail sales taxes, and letting taxpayers to choose the spending programs they want to support.

As an economist trained in the U.S, I agree with the authors on their argument that government intervention in our economic and social life should be minimized to the extent possible. Privatization should be pursued whenever possible, and the tax burden needs to be contained to support economic growth.

These points deserve special attention these days in Korea. The government spending and the tax burden have been increasing rapidly in recent years. Privatization drive has been stalled in many areas, including the electricity industry. Larger and larger resources are devoted to welfare and other social programs. These developments can produce in the long run an over-sized public sector and lead to economic inefficiency. A call for a return to fiscal conservatism and neo-classical economic philosophy is therefore more than appropriate at this point of time.

Having said that, I would like to add a few things to the authors'argument. First, I would like to point out that privatization cannot be a panacea. For privatization to work, competition is a prerequisite. When the market is not competitive, privatization will only replace a public monopoly by a private monopoly, reducing the economic welfare further.

I also doubt whether the current social security system in the U.S can be privatized in a Pareto-optimal way. The authors argue, citing studies from the Cato Institute, that in a privatized system, pension benefits will be two to three times larger than in the current system. This is simply impossible without a concurrent reduction of benefits for somebody else. You can let those in the private system keep their savings for their own retirement, but then what happens to those who have contributed to the current pay-as-you-go system and suddenly find that nobody will support their retirement?

Selling federal properties would be one solution as hinted by the authors. But this does not alter the economic nature of the problem. By selling federal properties, the government is foregoing the revenues from those properties, and will need to raise taxes to make up for the losses. In this sense, selling federal properties is equivalent to issuing debts; the net worth of the government is the same whether it sells its properties or issues debts. In both cases, so long as the government is ready to honor the entitlement of the older generations, income transfer from the younger generations to the older is inevitable, and nothing will change in national savings as well as in individual welfare.

I also have reservations on enshrining a balanced budget principle in constitution or imposing a supermajority rule on tax increases. I fully agree with the authors that discretionary fiscal actions to smooth out the business cycle can do more harm than good because of the time lag and the possibly asymmetric response to booms and recessions. But there is a third option in addition to the two options mentioned by the authors. The first option is a balanced budget principle and the second option is a discretionary fiscal action. The third option is to let the automatic stabilizer work to reduce the cyclical fluctuation. This option avoids the possibility of pro-cyclical fiscal policy, but still has the potential to contribute to macroeconomic stability.

I also agree with the authors that increasing tax revenues to balance the budget will in most cases only lead to larger spending, and the deficit will remain. But imposing a supermajority rule on tax increases looks as impractical as enshrining a balanced budget principle in constitution at a national level. Even when such a rule isin place, governments will find ways to circumvent it, for example by introducing or increasing non-tax levies on various items. A more effective and direct solution might be imposing a ceiling on spending itself, as was the case in the U.S in the 1990s. Similar practices can be found in the U.K., Sweden, and the Netherlands.

Lastly, I want to point out that it would be practically impossible to let taxpayers choose their favorite spending programs. In the first place, there are simply too many programs to decide on. In the U.S, the federal budget is composed of about 1,200 appropriation accounts. It will probably take days for any serious taxpayers to review these accounts in detail and make their minds regarding the usefulness of each program. Probably less than 1 percent of the population will have enough time and interest for this grudging task. Even when they do, it is doubtful whether their choices will be always rational.

To summarize, I found myself fully in line with the authors' fiscal conservatism and liberal economic philosophy. But I feel uncomfortable with most of the solutions suggested by the authors.

CHAPTER 5-4

Exchange Rate Targeting and Economic Stabilization

An Empirical Exploration

by

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Abstract

In this paper, we investigate the effects of increasing exchange rate flexibility at the margin instead of comparing the polar regimes of fixed and flexible rates. A VAR model with a structural analysis of the financial sector, including exchange rate intervention, is set up for a set of five major industrial countries and estimated using monthly data from the post-Bretton Woods period. IRFs suggest that in most countries intervention appears to be effective, although responses seem very short-lived, lasting just a few months. Counterfactual experiments are undertaken in which the central bank limits exchange rate fluctuations within a prescribed band. Varying the bandwidths shows that the only variable that systematically changes is foreign reserves, which become more volatile with a narrower band. Greater exchange rate flexibility obtained through wider bands neither increases nor decreases volatilities in the interest rate, output, or inflation for the majority of cases. Our results suggest that exchange rate stability is not necessarily earned at the cost of sacrificing interest rate stability and thereby support the idea that stable exchange rates can be welfare improving from a purely domestic point of view and for countries with heavy external debt.

Keywords: Exchange rate targeting, macroeconomic stability, counterfactual experiment

JEL classification: F3, F4

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1. Introduction

Exchange rates among major industrial countries continue to fluctuate in large magnitudes. The euro declined more than 30 percent against the dollar in less than 20 months following its January 1999 inception before completely recovering by the end of 2002. The Japanese yen was no less volatile over the same period, fluctuating nearly 30 percent over the same three year period. Understanding the implications of these exchange rate changes is an important step in determining the relative merits of various exchange rate arrangements. Among other things, whether flexible exchange rates stabilize output and/or inflation more effectively than fixed rates in the presence of diverse shocks is a perennial issue in international finance.

The stabilizing property of exchange rate flexibility is model specific and dependent on the types of shocks. For instance, according to the Mundell-Fleming-Dornbusch model, fixed rate regimes have a superior stabilizing property against nominal shocks while flexible exchange rates can better handle real shocks. Nevertheless, the presumption is that greater exchange rate flexibility reduces volatility in the interest rate and that output and inflation are likely to be more stable with increases in exchange rate variability; see Friedman (1953). Frenkel and Mussa (1980) most succinctly represent this view, termed "conservation of volatility" by Flood and Rose (1995): stabilizing the exchange rate "may only transfer the effect of disturbances from the foreign exchange market to somewhere else in the economic system. … Since the foreign exchange market is a market in which risk can easily be bought and sold, it may be sensible to concentrate disturbances in this market, rather than transfer them to other markets, such as labor markets, where they cannot be dealt with in as efficient a manner." (p. 379)

Typical empirical studies on the issue compare the volatility of macroeconomic variables under different exchange rate regimes. Other than greater variability of real and nominal exchange rates in a flexible rate regime, Baxter and Stockman (1989) find little evidence of systematic differences in the behavior of macroeconomic aggregates under alternative exchange rate systems (pegged, floating, and cooperative systems). Similarly, Flood and Rose (1995) report that the volatility of macroeconomic variables such as money and output does not change much across exchange rate regimes and conclude that there is no clear tradeoff between reduced exchange rate volatility and macroeconomic stability. They argue that "the exchange rate volatility is not in fact transferred to some other part of the economy; it simply seems to vanish." (p. 4) On the other hand, Ghosh et al. (1997) find that pegged regimes are characterized by lower and more stable inflation but more pronounced output volatility. Levy-Yeyati and Sturzenegger (2003) report that greater exchange rate flexibility promotes economic growth and reduces output volatility in developing countries while it has no significant effects on either in industrial countries.

Other studies of the stabilizing property of the exchange rate regime have investigated narrower and more precisely defined types of shocks. For instance, Hutchison and Walsh (1992) employ structural VAR methods to show that flexible exchange rates allowed Japan some insulation from external influences, and thus were stabilizing compared to the Bretton Woods system. Broda (2001) finds that flexible rates were stabilizing for a panel of countries against terms-of-trade shocks. While an improvement over the earlier studies, these studies suffer from the same fundamental problem that all differences in the behavior of the variable under consideration are attributed to the change in the exchange rate regime.

A recently-recognized problem with empirical studies that condition their results on the extant exchange rate regime is that the nominal classification of the regime may be incorrect, as revealed by Calvo and Reinhart (2002) and Reinhart and Rogoff (2002). Even when countries say their currencies float, they often engage in heavy intervention in the foreign exchange market; conversely, when other countries claim to fix their exchange rates, they frequently undergo devaluation cycles. Therefore, a lack of guidance for proper classification of the exchange rate regime complicates interpretation of the empirical results.

Truly fixed or flexible exchange rates for a significant length of time are a rarity. Very often, an important policy question for countries operating on the wide spectrum of intermediate regimes is whether the exchange rate should be allowed to fluctuate a bit more or less. Moving from a fixed rate to a free float or vice versa would be a virtual revolution, which is likely only with crisis situations. It is not expected to happen frequently. Nonetheless, studies on the issue of exchange rate regime still mainly deal with two polar regimes of fixed and flexible exchange rates. Their implications on exchange rate policy are limited and could be misleading.

In this paper, we investigate the effects of modifying exchange rate flexibility in small steps instead of comparing the polar regimes of fixed and flexible rates. We consider an exchange rate regime similar to a target zone system in which central bank interventions limit exchange rate changes within prescribed fluctuation bands. As a hybrid of fixed and flexible exchange rate systems, target zones have been a popular choice, de facto or de jure, among both developed and developing countries. This popularity is likely due to the fact that the system of target zones can potentially provide some exchange rate flexibility and monetary independence to shield exports and the current account from adverse shocks while at the same time providing the stability and anti-inflation commitment of fixed rates as long as the policy authority can credibly correct movements outside the band. See, *inter alia*, Williamson (1983, 2000), Frenkel and Goldstein (1986), and Svensson (1992, 1994) for more detailed discussion of the target zone system.

The rest of the paper is organized as follows. In Section 2 we discuss estimation and specification of a simple macroeconomic model in which the central bank uses its foreign assets to intervene in the foreign exchange market. Section 3 introduces the simulation methodology based on the VAR model. The simulation results are reported in Section 4. The paper concludes with discussion in Section 5.

2. The Model

2.1 Overview

Using data from the post-Bretton Woods period, we estimate for a set of five major countries (Japan, Germany, the U.K., France and Canada) models in which we can evaluate the effects of exchange rate bandwidth on model variables. Specifically, we use the semi-structural VAR technique of Bernanke and Mihov (1998) to divide the model for each country into one block of variables representing the “fundamentals” for the exchange rate (world output and inflation, a supply shock, and domestic output and inflation) and another representing financial market conditions (the exchange rate, foreign reserve holdings, the quantity of money, and domestic and world interest rates). A structural specification for the second block allows us to recover estimates of the structural shocks of the variables in this block.

Choosing the width of the exchange rate band and determining the method of intervention to enforce the band are important components of a monetary policy rule. In this paper, we use as the policy instrument the shock to the equation for central bank holdings of foreign reserves and then empirically determine the macroeconomic implications of various exchange rate bandwidths. We do so by identifying key structural elements of models of each country, including the policy shocks. Conditional on the assumption that the structural shocks are independent of each other, we can manipulate this shock without having implications for the other model shocks. Thus, we can use the shock in the policy equation to manage the exchange rate when it would otherwise violate the boundaries of the exchange rate band. These policy interventions, when combined with the other equation disturbances, can be used to construct the dynamic path the economy will follow given the policy interventions. Bootstrap trials then allow us to estimate the variances of key variables, such as output and inflation, implied by various bandwidths.

After specifying a particular bandwidth, we undertake a counterfactual analysis in which we take random draws from the estimated residuals. Using the moving average representation, this set of residuals implies values for all system variables, including the exchange rate. If the draw implies an exchange rate outside the band, then a policy response, in our case a shock to the equation for foreign reserves holdings, is computed that will return the exchange rate to the band. This policy shock, combined with the other shocks to the other equations, then implies values of the other variables under the chosen bandwidth. A large number of such draws then allows computation of statistics of interest, such as the standard deviations of output, inflation, and the domestic interest rate. Conducting these types of bootstrap experiments with different bandwidths then allows us to reach conclusions of how marginal changes in exchange rate policy affect economic outcomes. Since changes in exchange rate flexibility are small in each step, we have more assurance that the assumption of structural constancy can be a reasonable approximation, at least in the range of the actual (though perhaps implied) exchange rate variability allowed by the policy authority.

Since one of main goals of this paper is to investigate the effects of exchange rate flexibility without drastic changes in regime itself, we pay close attention to the possibility that interventions are too frequent or too extreme. In terms of our model, interventions that lead to negative rates of interest or negative foreign reserve holding are possible symptoms of such extremity. Interest rates, however, became negative especially when the band is very narrow, probably because rates were extremely low towards the end of our data set and there was not much room to maneuver. We exclude trials in which the nominal interest rate is negative in all results reported below. Even if trials with negative interest rates are included, however, virtually all the conclusions continue to hold and the empirical results are surprisingly close numerically to what we report.

The main findings of the counterfactual experiments can be summarized as follows. The frequency and size of interventions declines as the bandwidth widens, as do the number of trials with any intervention. The only variable that systematically changes with the bandwidth is the variability of foreign reserves, with foreign reserves become more volatile as the bandwidth narrows. Reflecting the fact that the central banks of major industrial countries typically sterilize their interventions, however, the money supply is hardly related to the variability of the exchange rate. More importantly, greater exchange rate flexibility obtained through a wider band neither increases nor decreases volatilities in the interest rate, output, or inflation for the majority of cases. These results are broadly consistent with the findings of Baxter and Stockman (1989) and Flood and Rose (1995). They also confirm that the "exchange rate disconnect" puzzle (Obstfeld and Rogoff, 2000) may indeed be widespread.

2.2 Estimation: The General Strategy

We use the Bernanke-Mihov (1998) semi-structural VAR to build a model of the financial sector of each country's economy, controlling for broader macroeconomic fundamentals. This approach is useful in that it allows us to identify the structural policy shocks without having to identify (perhaps incorrectly) a complete structural system.

As in Bernanke and Mihov, we start with a structural model:

$$F_t = \sum_{i=0}^{k} B_i F_{t-i} + \sum_{i=1}^{k} C_i P_{t-i} + H^F \varepsilon_t^F$$

$$P_t = \sum_{i=0}^{k} D_i F_{t-i} + \sum_{i=0}^{k} G_i P_{t-i} + H^p \varepsilon_t^p$$

where F_t is an (Mx1) vector of fundamentals, P_t is an (Nx1) vector associated with the policy block, ε_t^F and ε_t^p are the structural shocks associated with these vectors, and the matrices B_i, C_i, D_i, G_i, H^F, and H^p are, respectively, (M×M), (M×N), (N×M), (N×N), (M×M), and (N×N) coefficient matrices. It is assumed that the structural shocks are orthogonal to one another. Under this assumption, non-zero off diagonal elements of the H^F and H^p matrices allow for shocks to one equation to affect other equations contemporaneously. While this assumption is of use in some settings, in our application we set these two matrices equal to identity matrices.

Notice two features of this system of equations. First, fundamentals are affected by the variables in the policy block only with a lag. In our particular case, this means that the variables in P_t do not affect the fundamentals within the month. Second, P_t is expressed in terms of both fundamentals - i.e., variables in the F_t vector - as well as in terms of its own lags. As we will summarize below, the Bernanke-Mihov approach leads to estimation of the vector of structural shocks in the policy block - i.e., ε_t^p - so that we can analyze how this set of structural shocks affects the system, including the relevant influence of the fundamentals.

Straightforward manipulation of the structural model above yields the reduced-form:

$$\begin{bmatrix} F_t \\ P_t \end{bmatrix} = \sum_{i=1}^{k} \begin{bmatrix} \Pi_{11} & \Pi_{12} \\ \Pi_{21} & \Pi_{22} \end{bmatrix} \begin{bmatrix} F_{t-i} \\ P_{t-i} \end{bmatrix} + \begin{bmatrix} u_t^F \\ w_t^p \end{bmatrix} \tag{1}$$

with the Π_{ij} derived in the usual way by inverting the matrix of contemporaneous structural coefficients, with residuals in the F block given by

$$u_t^F = (I - B_0)^{-1} \varepsilon_t^F$$

and those in the P block given by

$$w_t^p = (I - G_0)^{-1} D_0 (I - B_0)^{-1} \varepsilon_t^F + (I - G_0)^{-1} \varepsilon_t^p .$$

Given the definition of u_t^F, we rewrite w_t^p as

$$w_t^p = \alpha u_t^F + u_t^p ,$$

where α = $(I - G_0)^{-1} D_0$.

We proceed as follows. First, we estimate the reduced-form equation (1), saving the residuals
u_t^F and w_t^p. Second, we regress w_t^p on u_t^F, obtaining u_t^p. Since u_t^p = $(I - G_0)^{-1} \varepsilon_t^p$, $(I - G_0) u_t^p$ = ε_t^p, or

$$u_t^p = G_0 u_t^p + \varepsilon_t^p , \qquad (2)$$

where G_0 is the matrix of "own" contemporaneous structural parameters in the policy block of the original model. We estimate G_0 by specifying a model of the variables in the policy block.

The residuals in equation (2), ε_t^p, represent the structural shocks to the variables in the policy block, which then allow construction of the IRFs and VDCs, the usual objects of interest in VAR analysis. In addition, and especially important for our purposes, by working under the maintained assumption that the structural shocks are independent of one another, we can replace the shocks to the policy equation with those needed to attain a given policy objective without, at least as a first approximation, having to consider the implications of these counterfactual shocks for the other shocks in the system.

For each country, we estimate a 10-variable model. The fundamentals block, F, contains five variables: deviations of the log of U.S. industrial production from its Hodrick-Prescott (HP) trend ($\tilde{y}^f$), the U.S. inflation rate as measured by the log change in the CPI (Δp^f), the change in the log of the world price of oil as a proxy for supply shocks, expressed as U.S. dollars per barrel (Δp^{oil}), deviations of the log of domestic production from its HP trend ($\tilde{y}$), and domestic inflation as measured by the log change in CPI (Δp). The "output gap" for both the U.S. and domestic economies not only gives the model a New Keynesian flavor but, more importantly, allow us to focus on how policymakers use interest rate changes or respond to exchange rate fluctuations in order to maintain output at or near its long-term trend level.

The policy block, P, contains variables related to determination of contemporaneous exchange rate changes, including the variable used as the policy tool. P includes the log change in the central bank's foreign reserve holdings (Δfr), the log changes in the quantity of money (Δm), changes in the levels (rather than logs) of domestic and foreign

(U.S.) interest rates (Δi , Δi^f), and the deviation of the log of the exchange rate around its HP trend ($\tilde{e}$). We model the policy authority as managing these percentage deviations of the exchange rate around its long run trend, using holdings of foreign reserves as the policy instrument. This approach allows policy makers to respond to short-run exchange rate movements without eliminating its low-frequency information, a problem in the alternative approach of first-differencing the data.

Note several things about our approach. First, even though we focus on the deviation of the exchange rate from its HP trend, this deviation is nonetheless affected by the fundamentals, i.e., the variables in the F block. Thus, if during the simulation periods in the experiments conducted below, forces in the broader domestic or world economies persistently push this deviation in some particular direction, policymakers are modeled as taking these pressures into account. In fact, as we have set up the analysis, if such persistent movements occur, then ever-stronger policy actions will be needed to maintain the exchange rate in its band, and evidence of these actions will show up in the descriptive statistics of the policy actions. Implicitly, then, longer run pressures are accounted for. Second, by employing the deviation of the exchange rate around trend as our variable of focus, we mainly discuss the short-run operating procedures of policy authorities. That is, the objective of the policymaker on a monthly basis is maintaining the exchange rate within a given band. The exchange rate policy considered here is of the leaning-against-the-wind type to limit the short-run volatility of the exchange rate. Specifically, in the experiments we limit these deviations from trend by specifying bandwidths relative to short run fluctuations in the exchange rate around trend.

2.3 Specification of the Structural Component of the Model

For the level of data aggregation we employ, rather than identifying country-specific models, we instead choose to adopt a set of generic identifying restrictions. This approach is similar, for instance, to cross-country comparisons of the type reported by Eichenbaum and Evans (1995), Kim and Roubini (2000) and Kim (2002). This is not to claim that a “better” set of restrictions for a given country could never be found. But we would like to stress that the approach developed below to evaluate the empirical implications of various exchange rate bands can be applied to any structural model, so that a researcher with a different set of restrictions can still undertake a policy analysis of the type presented here.

Our specification of equation (2) above, which allows estimation of the structural parameters in the policy block in the original model, is:

$$u_e = g_{0,12}u_{fr} + g_{0,13}u_m + g_{0,14}(u_i - u_{i^f}) + \varepsilon_e \tag{2.1}$$

$$u_{fr} = g_{0,21}u_e + \varepsilon_{fr} \tag{2.2}$$

$$u_m = g_{0,31}u_e + g_{0,34}(u_i - u_{i^f}) + \varepsilon_m \tag{2.3}$$

$$u_i = g_{0,41}u_e + g_{0,42}u_{fr} + g_{0,43}u_m + g_{0,45}u_{i^f} + \varepsilon_i \tag{2.4}$$

$$u_{i^f} = \varepsilon_{i^f} \tag{2.5}$$

In equations (2.1) - (2.5), „ u_m , u_i , and u_{i^f} are the individual elements of the u_t^p vector, with the subscripts referring to the exchange rate, holdings of foreign reserves, money, and the domestic and foreign interest rates.

Before beginning explicit discussion of the structural part of the model, note that in equations (2.1)-(2.5) we suppress notation relating to the role of the "fundamentals." That is, each equation also has some response to the U.S. output gap, U.S. inflation, the price of oil, as well as the domestic output gap and inflation. We have chosen the Bernanke-Mihov approach in large part to avoid having to build a larger structural model with the potential for a relatively large number of "incredible" identifying restrictions. Thus, while this approach captures the relevant reduced-form relationship between the fundamentals and those variables in the policy block, for our purposes we do not need to model all the underlying structural relations in order to attain estimates of the structural policy shocks

Equation (2.1) allows the exchange rate to respond to central bank holdings of foreign reserves, shocks to money demand, and the interest rate differential between the domestic and world interest rate. Equation (2.2) represents the equation for foreign reserve holdings, which respond to the exchange rate. Note that the policy variable, ε_{fr} , is used for intervention as appropriate, altering the level of foreign reserve holdings over and above the endogenous response of these reserves to both the fundamentals as well as exchange rate shocks. Through equation (2.2), ε_{fr} affects the exchange rate at the margin, which as detailed below allows us to maintain the exchange rate inside a pre-specified band. Equation (2.3) is the money demand schedule, which responds to the exchange rate as well as the interest rate differential. The inclusion of the exchange rate in the money demand schedule reflects the assumption that exchange rate variability reflects changes in relative prices of goods across countries, and so alters the quantity of domestic currency held for local purchases. The interest rate differential reflects the relative opportunity cost of holding the domestic currency. Equation (2.4) assumes that the monetary authority sets the interest rate as its monetary policy instrument, and allows the local interest rate to respond to all the other variables. In our setup, when the exchange rate is within the pre-specified band, there is modest room for interest rate adjustments for domestic control purposes. Equation (2.5) allows the world interest rate to respond to fundamentals, but not to contemporaneous movement in variables in the policy block.

Equation (2) is estimated according to Bernanke's (1986) method of moments approach. He notes that this estimator provides consistent estimates of the parameters regardless of distributional assumptions and that the estimates are numerically equivalent to full information maximum likelihood when the structural residuals are normal and the model is just-identified.

2.4 Descriptive Data Analysis

We employ monthly data for Canada, France, Germany, Japan, and the United Kingdom. The U.S. is used as a proxy for the rest of the world for all cases except France, for which Germany is substituted as the proxy. The basic period of analysis begins in 1975:1, after the breakdown of the Bretton Woods system. For Canada, Japan and the UK, our estimation ends at 1998:12, with the period 1999:1 - 2001:12 being used for counterfactual simulations, to be described below, to evaluate alternative exchange rate bands and their implications for the fluctuations of output, inflation, and selected financial market variables. For France and Germany, the estimation period ends in 1995:12, with 1996:1-1998:12 being held out for the simulations. The shorter period for

France and Germany is due to the fact that data on their exchange rates ends with the introduction of the euro.

Table 1 here

Standard deviations of the main variables employed in this study are reported in Table 1, where period I refers to the estimation period and period II to the simulation period. All variables except the interest rate are in logs. Δ denotes the difference operator. Industrial production and the nominal exchange rate are expressed as deviations from their Hodrick-Prescott trends. Typical flexible-rate countries such as Japan and Germany have large exchange rate changes. The variability of the U.K. pound during the estimation period approaches a similar level. In contrast, Canada has maintained much more stable exchange rate while officially on a managed float. In period I, the standard error of Canada's exchange rate is even lower than that of France, which has been under a target zone for the majority of the period, with the franc-mark rate kept within a narrow band except for several devaluations.

It appears that most macroeconomic aggregates were more stable during the simulation period (period II) than during the estimation period (period I), perhaps reflecting the higher rate of growth in the industrialized economies along with lower variability that are said to characterize the 'new economy'. Exchange rates became less volatile in all countries, and notably, the standard error declines to less than half in the U.K. and virtually disappears in France. Volatility in the interest rate, foreign reserves, money supply and inflation declined in all countries without exception. Output was also more stable in period II with the exception of Japan.

2.5 Estimation Results

The results of estimation of the contemporaneous structural parameters, by country, are reported in Table 2. While some of the coefficients are imprecisely estimated, a number of key coefficients are significant and of the expected sign. Among them are (i) in the exchange rate equation, we find that increases in holdings of foreign assets lead to depreciations (rises in the exchange rates) and that increases in the interest rate differential tend to lead to appreciations; (ii) in the equation for foreign reserve holdings, a depreciation leads to declines in foreign reserves, presumably as each central bank sells foreign assets to limit the fall in the values of its currency; (iii) in the money demand equation, rises in the local interest rate relative to world rates leads to declines in the quantity of money demanded; (iv) in the interest-rate setting equation, depreciations lead to increases in the domestic interest rate and using domestic assets to acquire foreign assets leads to a decline in domestic rates.

Table 2 here

The contemporaneous coefficients represent only a small portion of the overall model, and accepting or rejecting the model based solely on their signs and/or statistical significance is a highly restrictive approach. Accordingly, we also present and briefly discuss selected impulse response functions since the entire dynamic response of the model to innovations are also of interest. Our focus is on how the exchange rate (relative to the HP trend) responds to domestic financial shocks (changes in foreign asset holdings, the money stock, and the domestic interest rate) and how exchange rate deviations from trend affect these same domestic financial market variables.

Figure 1 here

For each country, we present in Figure 1 six selected impulse response functions, along with 95% confidence bands. The impulse responses appear reasonable and consistent across countries. For each country, the first three panels show the responses of the exchange rate to a unit shock in foreign reserves, the interest rate, and money demand, respectively. In all cases except France, the exchange rate rises with an increase in foreign reserves indicating that a buying intervention by the monetary authority depreciates the domestic currency. Also in all cases except France, the effects on the exchange rate appear to be significant although they invariably last just a few months. A higher interest rate appreciates the domestic currency in all countries but Canada and Japan. However, the effects are significant only in France and Germany. A money demand shock, representing a rise in liquidity preference, depreciates the domestic currency only in Japan, which is also insignificant. It leads to an appreciation in all other countries with some significance in Canada, France, and the UK. The last three panels for each country show the responses of foreign reserves, the interest rate, and money, respectively, to a unit shock in the exchange rate. In all cases except France, an exchange rate shock is followed by a significant reduction in foreign reserves, indicating that these countries have been quite ready to intervene to stabilize the exchange rate. The extent of intervention appears to vary across countries, strongest in Canada and weakest in the two ERM countries - Germany and France. The fifth panel suggests that, in response to an exchange rate shock, the domestic interest rate is raised in all countries except Japan. The last panel suggests that money demand increases in the aftermath of a surprise depreciation. Increases in money demand may be due to increases in the import prices and the overall price level. Money demand may also increase if domestic assets including money become more attractive as the unanticipated depreciation breeds anticipation of currency appreciation. Finally, these policy responses seem very short-lived, lasting just a few months.

The impulse responses suggest that our models behave reasonably well compared to previous structural VAR studies such as Eichenbaum and Evans (1995), Cushman and Zha (1997), and Kim and Roubini (2000). What is more interesting is that central bank intervention in the foreign exchange market through buying and selling foreign reserves is effective and moves the exchange rate and the interest rate in the expected direction. The effects on the exchange rate seem to last only a few months, however. These results are consistent with recent studies of the effectiveness of central-bank intervention surveyed in Edison (1993) and Sarno and Taylor (2001) showing that sterilized intervention is effective through portfolio-balance and signaling channels and the effects are mainly short term. It is interesting that we are able to confirm the effectiveness of intervention using structural VAR analysis and monthly data unlike typical studies that rely on high frequency data and single equation regression of the intervention function.

3. Simulation Methodology

In this section, we present the basic methodology used to evaluate measures of volatility of key variables, such as output, inflation, and key financial market variables, for alternative bandwidths. Prior to the technical presentation, we provide a brief overview of our approach.

We set up the historical decomposition of the VAR, using a planning horizon of 36 months. We take a random draw from the set of historical residuals and use these to compute the values of the model variables, starting with the residuals drawn for the first month. Combined with the base projection as of the end of the estimation period, if the exchange rate is within the pre-specified band, we compute the values of the system variables implied by the first month's shocks and proceed to the next month. However, if the value of the exchange rate violates the pre-specified band, a policy intervention is undertaken designed to bring the exchange rate back to some pre-determined point within the band. This intervention is represented as a shock to the foreign reserves equation, and replaces the shock from the random draw for the foreign reserves equation for this particular month. We re-compute the values of the system variables and then incorporate the next month's residuals. Again we test to see if the exchange rate lies inside the band. If it does, no intervention is computed; if it does not, we again find the size of the intervention needed to return to the band and again re-compute the values of the system variables. As we pass through the planning horizon, in some months the policymaker would intervene, and in other months no policy action is needed. At the end of a trial, we have the path the system would follow for this particular set of draws combined with any needed policy interventions. If policy makers read and react (when needed) to incoming information on a monthly basis, then our procedure mimics policy implementation. Repeating these trials, sampling from the estimated residuals with replacement, we can simulate the means and standard deviations of the variables in the system under the given policy regime, keep track of the frequency of the policy interventions, monitor the size of the interventions to compare with the historical shocks to the policy equation, etc.

Our goal is to simulate policy in the presence of a tolerance band around a given exchange rate objective, using foreign reserves as the policy tool. Three kinds of bandwidths merit attention. At one extreme, the policymaker may choose to manage foreign reserves, net of the endogenous response of these reserves to other variables in the system, so as to set the bandwidth to zero. This policy amounts to a "hard peg" and implies a specific foreign reserves path designed to attain a specific time path for the exchange rate. In terms of a moving average representation, when combined with the other shocks in the system, such a path implies specific paths for variables such as output and inflation. Second, the policymaker may want to evaluate as the policy objective a given exchange rate path, plus or minus some non-zero tolerance range. In this case, a policy intervention is not undertaken unless the exchange rate moves outside the pre-specified band. The bandwidth, along with the chosen path (the midpoint of the chosen band, for example) and a rule as to where to return the exchange rate if it wanders outside the band, presumably determines the frequency of policy interventions, the magnitude of the interventions, and the variability of the goal variables of output growth and inflation. We presume that the policymaker would like to know the behavior of the economy under different, nonzero but finite, bandwidths. Finally, the policymaker may like to evaluate the impact of a freely floating exchange rate, which can be thought of as the limiting case of an arbitrarily large bandwidth. While we do not explicitly set up a loss function to be minimized subject to our empirical model, it is nonetheless easy to compute the values of "loss functions" from these various bandwidths by picking a weight for output relative to inflation and using the simulation results to select the "optimal" bandwidth.

A more detailed investigation of our analysis of policy alternatives begins with the properties of the historical decomposition of the moving average representation (MAR) of the structural model. Recalling the notation from equation (1), define $\Pi(L) = (I-\Pi_1L^1-...-\Pi_kL^k)$. Next define $C(L) = [\Pi(L)]^{-1}$, with $C_0 = I$. Then the MAR of equation (1) is:

$$\begin{bmatrix} F_t \\ P_t \end{bmatrix} = \sum_{s=0}^{\infty} \begin{bmatrix} C_{11,s} & C_{12,s} \\ C_{21,s} & C_{22,s} \end{bmatrix} \begin{bmatrix} u_t^F \\ \alpha u_t^F + u_t^p \end{bmatrix} = \sum_{s=0}^{\infty} \begin{bmatrix} C_{11,s} & C_{12,s} \\ C_{21,s} & C_{22,s} \end{bmatrix} \left[\begin{pmatrix} u_t^F \\ \alpha u_t^F \end{pmatrix} + \begin{pmatrix} 0 \\ u_t^p \end{pmatrix} \right],$$

$$= \sum_{s=0}^{\infty} \begin{bmatrix} C_{11,s} & C_{12,s} \\ C_{21,s} & C_{22,s} \end{bmatrix} \left[\begin{pmatrix} u_t^F \\ \alpha u_t^F \end{pmatrix} + \begin{pmatrix} 0 \\ (I - G_0)^{-1} \varepsilon_t^p \end{pmatrix} \right]. \quad (3)$$

To help fix some basic ideas, suppose that one equation, say equation i (in the policy block of system (3)), is the equation of the target variable, the exchange rate in this discussion. Let equation j (also in the policy block) be the equation for the policy tool, central bank holdings of foreign reserves in our example. The element in ε_t^p corresponding to equation j is the structural shock to the foreign reserves equation. The policymaker is seen as using this tool to achieve a particular time path for the dependent variable in equation i. The policymaker controls the level of foreign reserves by manipulating the shock in the foreign reserves equation. Since transactions in foreign reserves alter the exchange rate, in each trial we obtain the appropriate time series of shocks that brings about the desired time path of the exchange rate. We refer to the time path of the policy interventions as the ε-path for equation j, or, for brevity, the "ε_j -path". By choosing a particular ε_j -path, the policy authority reinforces (or offsets) the endogenous response of foreign reserves to the economy, in the process producing the desired path for the exchange rate. The impact of the chosen ε_j-path on the ultimate variables of interest is also evident from equation (3), where system variables are expressed, *inter alia*, in terms of shocks to the foreign reserves equation. That is, a shock to the foreign reserves equation that brings about the desired exchange rate also affects the other variables in the economy, whose responses are captured by the appropriate elements of the C_s, α, and G_0 matrices.

Focusing on the policy block in equation (3), and advancing to period t+h, the policy block may be written in terms of its historical decomposition (HD):

$$P_{t+h} = \sum_{s=0}^{h-1} \{C_{21,s} u_{t+h-s}^F + C_{22,s} \alpha u_{t+h-s}^F\} + \sum_{s=0}^{h-1} C_{22,s} u_{t+h-s}^P$$
$$+ \sum_{s=h}^{\infty} \{C_{21,s} u_{t+h-s}^F + C_{22,s} \alpha u_{t+h-s}^F\} + \sum_{s=h}^{\infty} C_{22,s} u_{t+h-s}^P \quad (4)$$

An important aspect of equation (4) is the in-sample accounting identity associated with the HD. In particular, from the perspective of time t, the data at time t+h is the sum of four terms. The last two terms in (4) represent the dynamic forecast or base projection (BP) of P_{t+h} based on information at time t; the first of these terms corresponds to the contribution to the BP of the shocks to the fundamentals while the second corresponds to the contribution of the shocks to the variables in the policy block. The initial two terms in (4) are weighted averages of the actual shocks over the period t+1 to t+h, again with contributions from both fundamental and policy block variables. Conditional on the identification of the model, the historical decomposition quantifies, period by period, the relative importance of the various shocks to the system. Taking into account the terms relating to the BP and the relationship between the u_t^P and ε_t^p,

$$P_{t+h} = \sum_{s=0}^{h-1} C_{2\bullet,s} u^F_{t+h-s} + \sum_{s=0}^{h-1} D_{22,s} \varepsilon^P_{t+h-s} + BP_{t+h} \quad , \tag{5}$$

where $C_{2\bullet,s} = C_{21,s} + C_{22,s}\alpha$ and $D_{22,s} = C_{22,s}(I - G_0)^{-1}$.

We exploit this accounting identity in the following way. Model estimation produced not only estimates of the structural parameters in the policy block but also estimates of the structural residuals in this block. From the perspective of equation (5), at time t we can make a base projection. Using the residuals from the random draw we add to the BP the first two terms on the right hand side of equation (5), yielding the vector P_{t+h}. Finally, if the value computed for the exchange rate equation lies outside the desired exchange rate band, replace the shocks to the policy variable in equation j with those needed to meet the policy objective, retaining the shocks to the other equations. Using these, we can compute the values of the elements of P_{t+h}, the path the economy *will follow* under this policy, conditional on this particular draw. We call this the "fundamental property of counterfactual analysis." Repeated trials allow us to compute the moments of the entire system of variables given the particular policy objective under consideration.

The technical steps needed to evaluate a given policy alternative are now discussed. The initial step is to show how to compute the policy shocks needed to attain a given path of the exchange rate specified by the policymaker. (For the moment, we ignore the possibility of conducting policy with tolerance bands; equivalently, we assume the width of the band is zero.) Using the coefficients estimated through period t, equation (5) shows the decomposition for a particular period, t+h, in terms of the base projections conditional on information at time t and the contributions of non-policy shocks subsequent to t, which for now we assume known. Consider the ith equation in system (5) for h=1:

$$P_{i,t+1} = \sum_{k=1}^{M} c_{2\bullet,0,ik} u^F_{k,t+1} + d_{22,0,ij}\varepsilon^p_{j,t+1} + \sum_{\substack{k=1\\k\neq j}}^{N} d_{22,0,ik}\varepsilon^p_{k,t+1} + BP_{1,i,t}$$

where $c_{2\bullet,0,ik}$ is the i,k element of the $C_{2\bullet,0}$ matrix, $d_{22,0,ik}$ is the i,k element of the $D_{22,0}$ matrix, $BP_{1,i,t}$ is the one-period-ahead base projection for the ith equation at time t, and where $\varepsilon^p_{j,t+1}$ is the shock to the foreign reserves equation.

Suppose we want to find the policy shock that will produce a pre-determined value for the exchange rate, denoted by $P^*_{i,t+1}$. Given the other shocks to the economy, there is an $\hat{\varepsilon}^p_{j,t+1}$ such that:

$$P^*_{i,t+1} = \sum_{k=1}^{M} c_{2\bullet,0,ik} u^F_{k,t+1} + d_{22,0,ij}\hat{\varepsilon}^p_{j,t+1} + \sum_{\substack{k=1\\k\neq j}}^{N} d_{22,0,ik}\varepsilon^p_{k,t+1} + BP_{1,i,t}$$

the solution for which is

$$\hat{\varepsilon}^p_{j,t+1} = (d_{22,0,ij})^{-1}[P^*_{i,t+1} - BP_{1,i,t} - \sum_{k=1}^{M} c_{2\bullet,0,ik} u^F_{k,t+1} - \sum_{\substack{k=1\\k\neq j}}^{N} d_{22,0,ik}\varepsilon^p_{k,t+1}] \quad , \tag{6}$$

which is the value for the policy shock the policy authority must achieve to attain the target value for the exchange rate. This policy response takes into account the values of the fundamentals, expressed in terms of the u_t^F terms, as well as the values of the other variables in the policy block, expressed in terms of the ε_k^p terms for k ≠ j.

Proceeding in a similar manner, it can be shown that the structural residual needed to achieve a particular value for $P_{i,t+2}$, denoted by $P_{i,t+2}^*$, is:

$$\hat{\varepsilon}_{j,t+2}^p = (d_{22,0,ij})^{-1}[P_{i,t+2}^* - BP_{2,i,t} - \sum_{k=1}^{M} c_{2\bullet,0,ik}u_{k,t+2}^F - \sum_{k=1}^{M} c_{2\bullet,1,ik}u_{t+1}^F - \sum_{\substack{k=1\\k\neq j}}^{N} d_{22,0,ik}\varepsilon_{k,t+2}^p - \sum_{\substack{k=1\\k\neq j}}^{N} d_{22,1,ik}\varepsilon_{k,t+1}^p - d_{22,1,ij}\hat{\varepsilon}_{j,t+1}^p] \quad (7)$$

Similar iterations produce a path of structural shocks that generate a path for $P_{i,t+h}$ that matches the desired path $P_{i,t+h}^*$, for h = 1,...,T, where T is the planning horizon. This path of structural shocks for the policy variable, combined with the values of the shocks to the other variables, then produces an expected path for the system as a whole.

Note that in computing the policy shock needed to attain the policy objective, as in equations (6) and (7), we assume that the policy maker can observe the set of shocks and respond within the period represented by the data frequency, monthly in our case. In markets as deep as the worldwide financial markets, including the currency markets, this seems a reasonable approximation. An alternative that could be explored, but which we have not, is to allow the exchange rate to move outside the band in a particular month, pursuing policy actions that would return the exchange rate to its objective the following month (assuming no further shocks in the second month in this sequence).

The second step in constructing the algorithm we use in the experiments below is to compute the ε_j -path when the objective is keeping the exchange rate within a target band. For some period t+r, r=1,…,T, we want the exchange rate within the pre-specified band $P_{i,t+r}^* \pm \tau$ where τ is half the bandwidth. It may be that no policy intervention is needed, which will occur when

$$P_{i,t+r}^* - \tau < \sum_{q=0}^{r-1}\sum_{k=1}^{M} c_{2\bullet,q,ij}u_{k,t+r-q}^F + \sum_{q=0}^{r-1}\sum_{\substack{k=1\\k\neq j}}^{N} d_{22,q,ik}\varepsilon_{k,t+r-q}^p + \sum_{q=0}^{r-1} d_{22,q,ij}\hat{\varepsilon}_{j,t+r-q}^p + BP_{r,i,t} < P_{i,t+r}^* + \tau$$

where $\hat{\varepsilon}_{j,t+r-q}^p$, q=0,…,r-1, are the shocks to the policy equation, some of which may represent policy interventions undertaken prior to period t+r to attain that period's objective, and some of which may simply represent the random draw for those periods in which no policy intervention is needed. That is, when the above inequalities hold, the shocks in the economy, combined with the base projection, imply an exchange rate within the target band, so that no policy intervention is required in period r. If, on the other hand,

$$\sum_{q=0}^{r-1}\sum_{k=1}^{M} c_{2\bullet,q,ij}u_{k,t+r-q}^F + \sum_{q=0}^{r-1}\sum_{\substack{k=1\\k\neq j}}^{N} d_{22,q,ik}\varepsilon_{k,t+r-q}^p + \sum_{q=0}^{r-1} d_{22,q,ij}\hat{\varepsilon}_{j,t+r-q}^p + BP_{r,i,t} < P_{i,t+r}^* - \tau$$

or if

$$\sum_{q=0}^{r-1} \sum_{k=1}^{M} c_{2\bullet,q,ij} u_{k,t+r-q}^{F} + \sum_{q=0}^{r-1} \sum_{\substack{k=1 \\ k \neq j}}^{N} d_{22,q,ik} \varepsilon_{k,t+r-q}^{p} + \sum_{q=0}^{r-1} d_{22,q,ij} \hat{\varepsilon}_{j,t+r-q}^{p} + BP_{r,i,t} > P_{i,t+r}^{*} + \tau$$

the endogenous forces in the economy, along with any previous policy interventions, produce values for the exchange rate outside the band. Then a policy intervention is needed to return the exchange rate either to the edge of the band or to some pre-specified value interior to it. For instance, if the policy choice is to return to the edge of the band, as we assume in the following exercise, then the policy innovations analogous to those in equations (6) and (7) are computed so as to attain $P_{i,t+r}^{*} \pm \tau$, depending on whether the exchange rate is expected to be above or below the tolerance range.

In the experiments below, we specify a target path, construct a band around this path, and then take 1000 draws from the estimated residuals by employing a bootstrap. Note that in this approach, we do not impose an arbitrary assumption about the probability density generating the residuals. Rather, by sampling from the estimated residuals, we hope to capture the type of randomness that is in the economy. For each trial, computed values for the system variables, consistent with our fundamental property, are those the economy will follow under the assumed ε_j -path that attains the desired exchange rate path, given the shocks to the other equations.

To reinforce the earlier discussion of how the policy process is mimicked by our approach, note that the iterative process by which we compute $\hat{\varepsilon}_{j,t+1}^{p}$, $\hat{\varepsilon}_{j,t+2}^{p}$, …, incorporates the 'new information' that has arrived in the form of the shocks to the entire ε vector in the previous periods. If the realized values of these shocks are negligible, the shocks are such that the exchange rate stays within the target zone. But the policy shocks are modified in response to realizations of shocks to any system variables when they move the exchange rate outside the target zone.

4. Simulation Results

The panels in Table 3 contain selected results for the countries in the sample. Prior to discussing specific results, several comments about Table 3 are needed. First, the target zone in each experiment is expressed in terms of percentage deviations around the HP trend. That is, we adopt the position that at least in the short-run, the policy authority does not (or cannot) alter the fundamental forces in the domestic economy relative to the world economy, so that management of the exchange rate is relative to the existing value of the trend. Second, as indicated above, in the reported results we have excluded trials for which the domestic interest rate turns out to be negative. Third, we increase the bandwidth in each country until it becomes wide enough that no policy interventions are called for. For Canada, this threshold is ±10% and for France it is ±5%, so no additional results are reported for in those panels.

Table 3 here

The first two rows of each panel show the number of policy interventions needed under the various bandwidths for the alternative cases where the exchange rate is above and below the pre-specified bands. Note that each experiment has 1000 trials, and each trial has a 36 month horizon. Thus, for example, using Canada and a ±1% bandwidth, we intervene 3,466 times of the 36,000 months in the trials when the exchange rate violates the top of the band, and 4,113 times when the exchange rate is below the band. (Note that lower in the table we also report these statistics combined in the form of the average number of interventions per trial, which adds together these numbers and divides by the number of trials. For instance, for Canada for the ± 1% bandwidth, we report average interventions per trial of 7.6.)

The remaining rows of each table give impressionistic evidence as to whether the Lucas critique is applicable. Before starting a review of this evidence in rows 3 and 4 of each panel, recall that when the exchange rate is within the target band, the shock to the foreign reserves equation is simply the result of the random draw for that particular trial. When the exchange rate is outside the band, the foreign reserves shock is computed so as to return the exchange rate to the edge of the band. Thus, for each of the 1000 trials, we have a vector of length 1000 where element i of this vector represents the maximum shock to the foreign reserves equation in trial i. Similarly, there is another vector in which element i is the minimum shock in trial i. The intent is to discover if the required policy interventions are far outside the bounds of the historical record; that is, whether these interventions are frequent and unusually large in absolute value. When the band is narrow, we relatively frequently need to replace the random draws with computations of the shocks needed to return to the band. If these interventions are large and/or frequent enough, then policy makers would need to be concerned about whether policy interventions were signaling to agents that the model had changed in some fundamental way; if not, then policy makers have a much better chance at implementing the indicated policy without having to worry about Lucas critique issues. Note that as the band widens and fewer policy interventions are needed, the distribution of the elements of these vectors will converge to the distribution of the actual residuals in the foreign reserves equation.

We report in rows 3 and 4, respectively, the 95th percentile of the maximum shocks and the 5th percentile of the minimum shocks across the 1000 trials. (We cut off the tails to avoid outliers; however, this has virtually no effect on the reported results as there is little difference between these percentiles and the absolute maximum or minimum.) We also report the interquartile ranges for the vectors of maximum and minimum shocks to obtain an impression of both the central tendency and variability of these shocks. In the cells labeling these rows, we also note the maximum and minimum structural residuals from the estimation. For example, for France with the ±2% band, the 95th percentile for positive policy shocks was .370, and the interquartile range was (.153, .077) compared with a maximum in-sample residual for the foreign reserves equation of .132. For the 5th percentile for negative policy shocks, the extreme value in the interventions was -.227 with an interquartile range of (-.062, -.110) compared with a value of -.104 in the estimated residuals.

Our general observation from the results in rows 3 and 4 is that for all the countries in our sample, when exchange rate targets are controlled with a bandwidth of ±5%, the extreme values of the policy interventions are seldom larger than a factor of about 1.2 of the largest residual from the estimation. At least casually, policy authorities should be able to pursue an exchange rate within about five percent of its long run trend without needing unduly large policy shocks. Note that this includes the cases of Germany, Japan and the UK for whom frequent interventions are made in this range.

The remaining rows of each panel give additional information on whether the Lucas critique may be appropriate. Row 5 reports on the average number of interventions per trial, along with the computed standard deviation. This row allows the reader to judge whether the interventions are “frequent enough” to alert agents that a policy different than what may have been observed in the estimation period is in place, regardless of the size of the interventions reported above. Row 6 reports on the average maximum number of consecutive months of intervention, also with a standard deviation. Rows 5 and 6 are included, in addition to rows 3 and 4, since it may be not only the size of the policy shocks relative to estimated residuals that signal to agents that a new policy is in place, but also the frequency and/or duration of intervention. The final row reports on the number of the 1000 trials which require any intervention.

The frequency and size of interventions declines as the bandwidth widens, as do the number of trials with any intervention. In all countries, with a 15% band, little or no intervention is necessary. The results indicate that maintaining a narrow band is possible only with relatively frequent, relatively large-sized interventions. For instance, maintaining a ±1% band around the German mark requires on average interventions in 27 out of 36 months. However, for ±1% bands, the sizes of policy shocks are large and often well outside the boundary set by actual maximum or minimum values. On the other hand, midsize bands of ±5% to ±10 % would not cause excessive strain in any of the economies we examine in that the number of interventions in most cases is in the range of three or four months using a 36 month horizon. These results on frequency are in addition to those noted above, where the size of the shocks for bandwidths in the range of ±5% is also not unduly large. It is also interesting to note that the “comfortable” degree of exchange rate flexibility closely matches actual flexibility that each country has experienced. For instance, countries that have maintained fairly narrow exchange rate bands such as Canada and France may handle a 5% band with little difficulty. For the other countries, typical floaters such as Germany, Japan, and the UK, the same bandwidth may likely cause some strain and perhaps a wider band such as 10% or so appears more plausible. With a 10% band, the need for intervention is reduced to less than one in 36 months in all three floaters. Incidentally, most proposals of target zones for G-3 currencies recommend ±10 to 15 % (Clarida, 2000) ; our results suggest that bands on the order of ±5 to 10 % may also be viable.

Figure 2 here

Six plots for each country shown in Figure 2 summarize the main results of this paper. Each plot shows changes in the standard deviation over the final 24 months (of the 36 month simulation period) of a particular variable as the bandwidth varies. We drop the initial 12 months to guard against initial conditions affecting the results. We consider various bandwidths: ±1, ±2, ±5, ±10, and ±15. The maximum bandwidth we consider is ±99 %, which approximates a float, and is shown on the far right side of each plot.

The first row of plots shows that across countries exchange rates become more variable as the band widens. It should be noted that, even with an extremely wide band, the exchange rate changes may be at least partially constrained by actual data. For instance, the standard deviation of simulated exchange rate changes never goes beyond 1.5% for Canada. In all cases, it is held within a 5 % range.

The second row in Figure 2 shows that with a wider band, the standard deviation of changes in foreign reserves in most countries declines since the central bank does not have to intervene as often or as aggressively. In marked contrast, money supply variability, shown in row 3, appears hardly affected by variations in the bandwidth, excluding the case for France. Although we do not constrain the results by imposing sterilized intervention, they are consistent with the conventional wisdom that most interventions are sterilized.

Interest rate volatility, shown in the fourth row, seems hardly affected by exchange rate bands with the sole exception of the narrowest band for France. This suggests that (presumably sterilized) intervention does not entail significant changes in the interest rate. In Japan and Germany, whose interest rates would affect more countries in the world, varying the width of the exchange rate bands has little or no effect on interest rate volatility.

The issue of whether a wider band reduces output or inflation volatility is addressed in rows 5 and 6 of Figure 2. Both output and inflation volatilities decline sharply in France as the bandwidth increases from 1 to 2%, but little thereafter. In Germany, the standard deviation of output declines almost 20 percent by moving from a 1% to a 5 % band. Some considerations suggest that it is difficult to consider these cases as representative. First of all, these volatility reductions occur when the band widens from a very narrow range of 1 or 2%. As mentioned above, the results obtained from such narrow bands are less reliable and should be viewed with more care especially when the band under consideration is very different from the actual band. In all other cases, neither output nor inflation volatility is affected by changes in bandwidths, especially around the realistic ranges of 5 to 10%.

Our findings are generally consistent with Baxter and Stockman (1989), Flood and Rose (1995), and Obstfeld and Rogoff (2000a). These authors suggest that the increases in real and nominal exchange rate volatilities since the move to the generalized float in 1973 have not been associated with any significant changes in volatilities of macroeconomic variables. Our results, in addition, suggest that the tradeoff between exchange rate and interest rate volatility investigated in Svensson (1991) is not inevitable. As a corollary, the suggestion by Reinhart and Reinhart (2001) that the G-3 should be concerned with increases in interest rate volatility when they attempt to reduce exchange rate volatility might be misguided. This paper also casts doubt on the applicability of the finding by Ghosh et al. (1997) that pegged regimes are characterized by lower and more stable inflation but more pronounced output volatility. A more recent study by Levy-Yeyati and Sturzenegger (2003) shows, consistent with our findings, that exchange rate regimes have no significant impact on output growth or volatility in industrial countries although they find that greater exchange rate flexibility promotes output stability and growth in developing countries.

5. Discussion

In this paper, we develop a methodology with which we can evaluate the stabilizing properties of exchange rate flexibility. Instead of dealing with polar regimes, we consider changes in exchange rate flexibility at the margin by adjusting the size of exchange rate fluctuation band in a target zone. The main findings of paper can be summarized as follows.

Coefficient estimates and impulse response functions indicate that a generic, small structural VAR model employed in this study captures the behavior of key relationships in the foreign exchange and money markets of major industrial countries. The IRFs are consistent with the notion that the effects of intervention dissipate in a matter of a few months; intervention can be effective but the effectiveness is largely short term.

Our most notable result is that greater exchange rate flexibility obtained through a wider band neither increases nor decreases volatilities in the interest rate, output, or inflation for the majority of cases. These results are broadly consistent with the findings of Baxter and Stockman (1989) and Flood and Rose (1995). They confirm that the “exchange rate disconnect” puzzle (Obstfeld and Rogoff, 2000a) may indeed be widespread.

We also find a variety of additional results of interest. First, our results show little effect on the variability of the money supply. Specifically, in Table 2 we reported that the during the simulation period, the actual standard deviation for log changes in the money supply in Canada was .046. In our experiments with Canada pictured in Figure 2, we find that the standard deviation across bandwidths is, with slight variability, .036. Similar results hold for France (.017 in the data in the simulation period vs. .018 for bandwidths greater than ±1%), Japan (.026 vs. .030) and the United Kingdom (.015 vs. .014). The only country where this observation does not hold is Germany (.017 vs. .032). Thus, to the extent that actions by countries to sterilize their interventions are in the data, in practice, adoption of target zones and the accompanying change in monetary policy would not dramatically alter the stability of key macroeconomic variables. Second, we find evidence that intervention significantly affects exchange rate volatility in all countries but France. Further, as documented in Table 3, the frequency and size of interventions declines as the bandwidth widens, as do the number of trials with any intervention. Third, we find that foreign reserves become more volatile as the exchange rate band is narrowed, reflecting the need for the policy makers to be more active in attaining the exchange rate goals.

An important implication follows from the finding that varying the width of the exchange rate band has virtually no impact on the volatility of key macroeconomic variables such as the interest rate, output and inflation. Specifically, promoting exchange rate stability, at least at the margin, does not in any obvious way result in higher costs typically associated with greater volatility in output or inflation. While in some cases very narrow bands do tend to raise output and inflation volatility, our results suggest that promoting exchange rate stability in small steps does not obviously sacrifice interest rate stability. The results thus support the idea that promoting stable exchange rates is welfare improving from a purely domestic point of view. One could make even a stronger case for greater exchange rate stability by invoking the fact that both exchange rate and interest rate stability of major industrial countries are public goods for countries with heavy external debt. If greater exchange rate stability of the G-3 currencies can be obtained with little or no increase in interest rate volatility, pursuing greater exchange rate stability appears to be more worthwhile than previously thought; for additional discussion, see Frankel (1999), Mussa, et al ., (2000), and Reinhart and Reinhart (2002).

A variety of topics remain for future research. First, what is the source of the repeated occurrence of negative interest rates, especially with narrow bands? It may be a technical issue: in a world with historically low interest rates, bootstrapping exercises in which we draw from historical residuals may simply imply a relatively high incidence of these negative rates. Since, in our analysis, variability of virtually all the variables under discussion is unaffected whether trials with negative rates are included or not, it is not obvious that there are any empirical implications. Or, it may be a substantive issue: we have assumed that all responses are unilateral. Further analysis that models (at least occasional) policy coordination between countries may help address this issue. For example, if a country suspects that unilateral action will cause nominal interest rates to approach zero, it may trigger a request to other countries for joint action in the currency markets. Second, we have expressed exchange rates for all countries terms of the U.S. dollar (except France, where we employ the German mark), but have not modeled any U.S. policy behavior. Of course, U.S. policy action, either in terms of domestic policy initiatives or international ones, may have an impact on the manner in which other countries manage their exchange rates.

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Table 1: Standard Deviations

	Canada		France		Germany		Japan		UK		US	
	I	II	I	II	I	II	I	II	I	II	I	II
$\widetilde{e}$	.014	.013	.016	.003	.042	.035	.047	.037	.042	.020		
, Δi^f	.031	.013	.026	.014	.022	.007	.021	.002	.031	.012	.026	.018
Δfr	.238	.041	.271	.145	.107	.053	.301	.255	.381	.201		
Δm	.062	.046	.048	.017	.055	.017	.042	.026	.035	.015		
$\widetilde{y}, \widetilde{y}^f$	.017	.010	.015	.010	.017	.013	.017	.025	.014	.008	.013	.009
Δp	.033	.008	.039	.006	.018	.005	.031	.004	.054	.008	.030	.007
Δp^{oil}											.298	.383

Note: I and II denote the estimation and simulation period, respectively.

Table 2: Estimation Results of Structural Policy-Block Parameters

Coefficient (t-stat)	Canada	France	Germany	Japan	U.K.
$g_{0,12}$	0.30 (1.11)	-0.13 (0.73)	0.14 (1.53)	0.14 (0.68)	0.17 (0.91)
$g_{0,13}$	-0.12 (0.53)	0.97 (0.56)	-1.44 (0.85)	0.22 (1.05)	-0.25 (0.54)
$g_{0,14}$	-1.89 (1.17)	-0.40 (1.69)	-0.45 (2.37)	-0.20 (0.79)	-0.56 (1.53)
$g_{0,21}$	-30.69 (2.14)	0.36 (0.45)	-1.24 (0.82)	-2.43 (0.63)	-4.17 (1.23)
$g_{0,31}$	-0.21 (1.51)	-0.13 (0.54)	0.33 (0.67)	-0.07 (0.28)	0.09 (1.83)
$g_{0,34}$	-0.15 (0.83)	-0.12 (1.02)	0.03 (0.20)	-0.39 (2.24)	-0.03 (0.45)
$g_{0,41}$	0.39 (1.88)	0.08 (2.37)	0.05 (2.90)	0.02 (2.04)	0.23 (2.74)
$g_{0,42}$	-0.06 (3.36)	-0.04 (2.37)	-0.01 (1.77)	-0.01 (2.25)	-0.04 (2.46)
$g_{0,43}$	-0.03 (0.40)	0.01 (0.16)	-0.04 (1.26)	0.01 (0.68)	0.14 (0.71)
$g_{0,45}$	-0.11 (0.78)	0.02 (0.36)	-0.04 (1.25)	0.01 (0.42)	-0.07 (0.63)

Table 3: Selected Simulation Results

A. Canada	±1.0%	±2.0%	±5.0%	±10.0%	±15.0%	Float
1. Interventions at upper bound	3466	743	7	0		
2. Interventions at lower bound	4113	873	0	0		
3. Max policy shock, 95 % (actual	.492	.638	.693	.693	.	.
maximum: .736; s.d.: 0.25) IQ	.333	.485	.653	.653		
Range: 75% 25%	.162	.183	.486	.486		
4. Min policy shock, 5 % (actual	-.516	-.697	-.710	-.710		
minimum: -.720; s.d.: 0.25) IQ	-.372	-.481	-.656	-.656		
Range: 25% 75%	-.209	-.211	-.436	-.436		
5. Mean # of interventions / trial	7.6	1.6	0.01	0		
(s.d.)	(2.9)	(1.0)	(0.8)			
6. Mean max consecutive	2.6	1.2	0.01	0		
interventions (s.d.)	(1.1)	(0.6)	(0.8)			
7. No of trials with any intervention	935	856	810	779		

B. France (/Germany)	±1.0%	±2.0%	±5.0%	±10.0%	±15.0%	Float
1. Interventions at upper bound	3556	587	0			
2. Interventions at lower bound	4825	348	0			
3. Max policy shock, 95 % (actual	0.618	.370	.135			
maximum: .132; s.d.: 0.038) IQ Range:	.406	.135	.112			
75% 25%	.161	.077	.077			
4. Min policy shock, 5 % (actual	-2.05	-.227	-.128			
minimum: -.104; s.d.: 0.038) IQ Range:	-.660	-.110	-.110			
25% 75%	-.159	-.062	-.069			
5. Mean # of interventions / trial	13.7	1.1	0			
(s.d.)	(7.5)	(1.6)				
6. Mean max consecutive interventions	5.7	0.8	0			
(s.d.)	(4.4)	(1.0)				
7. No of trials with any intervention	997	490	0			

C. Germany	±1.0%	±2.0%	±5.0%	±10.0%	±15.0%	Float
1. Interventions at upper bound	14225	10053	3022	218	3	0
2. Interventions at lower bound	12401	9464	2867	137	5	0
3. Max policy shock, 95 % (actual	.892	.741	.500	.358	.358	.358 .
maximum: .385; s.d.: 0.066) IQ	.601	.665	.423	.127	.217	217
Range: 75% 25%	.261	.223	.088	.088	.088	.094
4. Min policy shock, 5 % (actual	-.979	-.800	-.516	-.516	-.516	-.516
minimum: -.520; s.d.: 0.066) IQ	-.660	-.529	-.322	-.264	-.264	-.264 -
Range: 25% 75%	-.309	-.233	-.101	-.087	-.010	.010
5. Mean # of interventions / trial	27.1	19.8	5.9	0.4	0.01	0
(s.d.)	(4.2)	(5.2)	(3.6)	(0.8)	(0.1)	
6. Mean max consecutive	13.7	8.3	2.7	0.3	0.01	0
interventions (s.d.)	(8.0)	(5.6)	(1.9)	(0.6)	(0.1)	
7. No of trials with any intervention	1000	1000	984	240	6	0

D. Japan	±1.0%	±2.0%	±5.0%	±10.0%	±15.0%	Float
1. Interventions at upper bound	13046	9229	3160	295	6	0
2. Interventions at lower bound	11265	8234	3016	326	12	0
3. Max policy shock, 95 % (actual	.612	.545	.408	.376	.376	.376
maximum: .381; s.d.: 0.101) IQ	.491	.434	.284	.255	.268	.268
Range: 75% 25%	.332	.268	.140	.150	.173	.173
4. Min policy shock, 5 % (actual	-.636	-.582	-.444	-.333	-.333	-.333
minimum: -.323; s.d.: 0.101) IQ	-.496	-.434	-.312	-.317	-.317	-.317
Range: 25% 75%	-.328	-.268	-.141	-.175	-.163	-.186
5. Mean # of interventions / trial	24.8	18.0	6.5	0.6	0.02	0
(s.d.)	(2.9)	(3.5)	(2.9)	(0.8)	(0.1)	
6. Mean max consecutive	8.3	5.0	2.5	0.6	0.02	0
interventions (s.d.)	(3.5)	(2.2)	(1.1)	(0.8)	(0.1)	
7. No of trials with any intervention	1000	1000	998	407	17	0

E. United Kingdom	±1.0%	±2.0%	±5.0%	±10.0%	±15.0%	Float
1. Interventions at upper bound	14957	10393	2999	229	5	0
2. Interventions at lower bound	7844	4932	1332	153	6	0
3. Max policy shock, 95 % (actual	.492 .3	.462 .3	.340 .3	.340 .3	.340 .3	.340 .30
maximum: .417; s.d.: 0.114) IQ	74 .208	24 .147	24 .120	07 .182	07 .195	7 .214
Range: 75% 25%						
4. Min policy shock, 5 % (actual	-.544 -	-.501 -	-.401 -	-.501 -	-.501 -	-.501 -
minimum: -.543; s.d.: 0.114) IQ	.425 -	.377 -	.271 -	.307 -	.309 -	.307 -
Range: 25% 75%	.281	.241	.140	.163	.171	.171
5. Mean # of interventions / trial	23.7	16.1	4.5	0.4	0.1	0
(s.d.)	(3.5)	(4.0)	(2.5)	(0.7)	(0.1)	
6. Mean max consecutive	8.2	5.1	2.2	0.4	0.1	0
interventions (s.d.)	(4.1)	(2.6)	(1.1)	(0.6)	(0.1)	
7. No of trials with any intervention	1000	1000	989	280	8	0

Figure 1: Impulse Responses

가로 표 (별도파일)

Figure 2: Bandwidth and Macroeconomic Volatility

가로 표 (별도파일)

Figure 2. 계속

Comments on "Exchange Rate Targeting and Economic Stabilization"

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This paper examines the question whether there is a trade-off between stabilizing exchange rates and some key macro variables such as interest rates, output and inflation. In fact, the so-called exchange rate disconnect puzzle (i.e., high exchange rate volatility under floating rates appear not to be related to the high volatility of other macroeconomic variables) has been tackled in many previous studies. A notable feature of this paper, however, is that the question is addressed in a hybrid exchange rate system with flexible degree of floating. For this aim, the authors adopt an identified VAR method to construct a small open economy model, and combine the model with an exchanger rate policy that manages the exchange rate within a prescribed band or a 'target zone.' The main finding of the authors is that the exchange rate disconnect puzzle is still a puzzle, i.e., greater exchange rate flexibility via a wider band neither increases nor decreases volatilities in the key macro variables. Below, I would like to make a few comments on this paper under three headings: identification, interpretations, and policy instruments.

[1] Identification

When modeling a small open economy, the authors adopt a semi-structural (or semi-recursive) identification scheme. More specifically, the policy block describes the form of money demand, rules for foreign reserve manipulation and domestic monetary policy, and exchange rate determination, given the evolution of the fundamental block that takes a reduced form. Although the authors can sidestep the problem of 'incredible' identification restrictions in the fundamental block by this approach, I am a little concerned that the feedbacks from the fundamental block to the policy block are not explicitly considered, and vice versa. It seems desirable at least to check if the fundamental block's responses toward the structural shocks in the policy block are reasonable. For example, it would be a good exercise to see whether the monetary policy shock generates the usually expected responses of output and inflation, such as hump-shaped responses of output or the resolution of price puzzle.

Another issue I want to raise is whether the identification scheme in the policy block is well suited for the aim of the paper in the first place. I would like to confirm the credibility of the identification restrictions against the following touchstone: does the identification scheme resolve two puzzles related to the exchange rate, i.e., the exchange rate puzzle and the forward discount bias puzzle. In regard to the first puzzle, a contractionary monetary policy shock should *not* generate depreciation of domestic currency against the key currency, while innovations in domestic interest rate be followed by impact appreciation and subsequent persistent depreciation of domestic currency in view of the second puzzle. To me, impulse responses suggest that the identification scheme is justifiable in this regard for countries such as Germany and

France, but not for Canada and Japan. Searching for more refined identification strategy would be a promising further research agenda.

[2] Interpretation

In the simulation results, policy interventions in the foreign exchange market by changing foreign reserve holdings tend to generate insignificant changes in the variability of money. The authors justify this result by resorting to the practice of sterilization. However, with monetary policy implemented in the spirit of Taylor rule, the amount of money is demand determined in the model. Therefore, there is no built-in mechanism in the model that supports the 'sterilization' interpretation of the result. As a check for the validity of such interpretation, I would suggest the authors impose an equation for sterilization policy, and test if the extra restriction does not cause significant changes in the results, at least casually by comparing impulse responses.

In defense of using a new economic environment (with a target zone) combined with the structure of the model estimated for the period (without the target zone), the authors compare the magnitudes of historical policy shocks and those of policy interventions under the target zone, and argue that the similar magnitudes of policy shocks across the two regimes can be an effective defense against the Lucas Critique. Here, I would like to point out a possibility of totally different interpretation. Suppose that a country was under a floating exchange rate regime (with moderate policy intervention) during the estimation period. Now suppose that a credible target zone is imposed with a fairly narrow band. Since the target zone is credible, the 'honeymoon' effect of target zone renders compatible moderate degree of policy intervention and a very narrow exchange rate band. Since the exchange rate becomes a mean –reverting series under a target zone, the degree of policy intervention required is smaller as well. In this sense, similar magnitudes of policy shocks across the two regimes may not be a good reason not to worry about the Critique.

[3] Policy instruments

In the policy block, the model has both the monetary policy rule to control domestic interest rate and the reserve manipulation rule to manage exchange rates. Looking at the impulse responses and the structure of the rules, I think the shocks in both the monetary policy rule and reserve manipulation rule can be used to manage the exchange rate within a band. Then it is possible to consider some linear combination of those shocks that can control exchange rate more effectively (i.e., in a narrower band without much policy stress), and this possibility in turn requires a different identification scheme. Of course, a new scheme should pass the puzzle test discussed in the first section of this comment.

CHAPTER 6-1

The Dynamics of Korean Stock Market in Response to Fiscal and Monetary Shocks Around Foreign Currency Crisis

by
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Abstract

This paper investigated the efficiency of the Korean capital market with respect to fiscal and monetary policies before and after a crisis has occurred. For this purpose, the paper applied FIML technique to a set of monthly data over the period 1982.01 to 2000.12. The model was particularly designed to take into the problems of generated regressors and simultaneous equation bias in the test of market efficiency. The overall results indicate that the Korean stock market is efficient with respect to monetary policy. However, the result with fiscal policy is inconclusive. The study also found that market participants reacted to the macro-economic shocks more sensitively after the recent foreign currency crisis in Korea. However, there is no concrete evidence that the stock market opening contributed to the market efficiency.

1. Introduction

According to Fama (1970), the market is reasonably semi-strong efficient if the market adjusts security prices very quickly to publicly available information, whether the information is of a micro accounting nature or of a general macro-economic nature.

Since the efficiency of financial markets has extensive implications for the implementation of economic policy, it is not surprising that it has been widely tested in a variety of ways. Although most of the empirical research in this area has been primarily concerned with the US stock market, the attention to the non-US stock market has rapidly increased in recent years (e.g., Darrat (1988), and Ali and Hasan(1993), Kawakatsu and Morey (1999), Wu(2001)). Unfortunately, relatively little attention, if any, has been devoted to the semi-strong form efficiency of the Korean stock market. Analysis of the Korean stock market is useful in terms of offering useful implications to the financial market deregulation policy of the Korean government. From the early 1980s, as a first step toward to the market mechanism based economy, Korean government has implemented wide ranges of deregulation policies to promote competition, liberalization and internationalisation in the financial market, and the issue of deregulation still remains a high priority for governmen since the country expericenced foreign currency crisis in late 1990's. Because the main purpose of the market deregulation is to enhance market efficiency, it will be appropriate to re-examine the issue of (semi-strong form) efficiency of the Korean stock market during this deregulation period.

The aim of this paper is to investigate the efficiency of the Korean stock market with respect to macro-economic information. Unlike the previous works, this paper employs the full-information-maximum-likelihood (FIML) approach. A conventional approach is to use a two-step procedure where the movement in the macro-economic variable (i.e., money growth) is estimated by ordinary least squares (OLS) over the sample period, and the residuals from this regression are then used as the unexpected macro shocks. Then a test is performed to see whether stock price movements only reflect the contemporaneous shock. Pagan (1984) shows that this two-step OLS procedure for estimating such models will produce biased and inconsitent parmeter estimates and may lead to erroneous conclusions in hypothesis tests. This is called simultaneous equation bias. In addition, two-step OLS technique yields inefficient parameter estimates because all the information available in the description of the system of equations is not used in the estimation procedure. An alternative source of inefficiency arises because two-step OLS estimation does not account for the fact that error terms across equations are likely to be correlated. The problem of loss of efficiency and simultaneous equation bias can be resolved by using the FIML method. Unlike the two-step OLS method, the FIML method used in this paper is a system method, where all the equations of the structural model are estimated simultaneously by maximizing the likelihood function subject to restrictions on all the parameters in the model. The advantage of using the FIML method is that FIML estimates is unbiased as well as (asymptotically) efficient.[1] The utilisation of the FIML method in this paper is motivated by this property of the FIML estimates. Another important aspect of this study is the use of monthly data for a deregulation period ranging from January 1982 to December 2000. During this period, the Korean stock market has experienced various government deregulation policies and, as a result of the government measures it has expanded very rapidly. For instance, the total market value of shares listed in the Korean Stock Exchange has increased by almost 2000% during this period. The ratio of the market value to the nation's GNP increased to 52.2 % in 2000 from 5.9% in 1982. Therefore, this period provides an interesting research case whether the remarkable financial market expansion and government deregulations experienced during this period were accompanied by corresponding market efficiency. In addition, quarterly or a yearly period used in previous works is a fairly long time, particularly when one is analysing the efficiency of the stock market where the stock prices are determined on a daily basis. The extended quarterly period stock returns is more likely to be contaminated by the other information besides the shock in the macro policy while this contamination will be much less when monthly data are used.

The paper is organised as follows. The following section provides a framework for testing the semi-strong efficency. Section 3 reports the results of FIML methods used to test the Korean stock market efficiency. Section 4 provides some concluding remarks.

2. Model and Methodology

By assuming that the efficient market follows a fair game model, we describe one-period return to an asset, R_t at time t, as the sum of two components, the expected return at last period t-1,

$E_{t-1}(R_t)$, and an unexpected or "abnormal" component, Z_t.

---

[1] See Schmidt, P. (1976,pp. 216-236). For a general discussion of OLS estimation problem in testing market efficiency, see Oxley, L., and M. McAleer (1993)

$$R_t = E_{t-1}(R_t) + Z_t; \qquad (1)$$

where E_{t-1} is the conditional expectation operator with the conditioning set consisting of information up to and including period t-1. Thus

$$E_{t-1}(R_t) = E(R_t \mid \Phi_{t-1}) \qquad (2)$$

where Φ_{t-1} denotes the set of information available to agents at time t-1. If the market is efficient it must be true that

$$E(Z_t \mid \Phi_{t-1}) = 0 \qquad (3)$$

Equation (3) indicates that the excess return sequence $\{Z_t\}$ is a fair game with respect to the information sequence $\{\Phi_{t-1}\}$.

The weak form of the efficient market hypothesis requires the information set Φ_{t-1} to include only past prices and returns. In a semi-strong efficient market, the set of information, Φ_{t-1}, available to investors at time t-1 would contain all publicly available information. Thus equation (3) can be expressed alternatively as

$$E(Z_t \mid X_{t-1}, \ldots, X_{t-n}) = 0 \qquad (4)$$

where X_t is a vector of publicly available information excluding return R_t. According to this semi-strong efficient condition, the abnormal return, Z_t, is influenced only by current information (i.e. the current unanticipated value of some variables thought to influence share prices) and it is independent of all past information since this news would already have been incorporated into share prices in past periods. One of the methods for testing semi-strong market efficiency is to test the effect of the past information exclusion on Z_t. The available information set in period t is $X_t - E_{t-1}(X_t)$, in which X_t is the vector of variables thought to influence stock prices. Therefore, exclusive of past information, the abnormal return Z_t can be written as following:

$$Z_t = \sum_{i=1}^{k} \sum_{s=0}^{m} \beta_{is}[X_{i,t-s} - E_{i,t-s-1}(X_{t-s})] + e_t \qquad (5)$$

where e_t is a random error term, serially independent and uncorrelated with the expectation errors, m denotes the lag on the vector X, k is the element number of information variables vector which defines how many macro-economic variables will influence the stock returns.

Recalling equation (1), the semi-strong market efficiency test can be based on the following regression:

$$R_t = E_{t-1}(R_t) + \alpha V_t + \sum_{i=1}^{k} \sum_{s=0}^{m} \beta_{is}[X_{i,t-s} - E_{i,t-s-1}(X_{t-s})] + e_t \qquad (6)$$

where **V** is a vector of other potential determinants of stock returns including time trend, short-term interest rates, inflation measured by GDP growth rate, exchange rate, money (m2) demand, budget deficit. Since GDP and budget deficit are only available on quarterlyly basis, these varibles are converted into monthly data by using SAS PROC EXPAND procedure. To conserve degrees of freedom, m is restricted to 3.

The testable hypothesis is to investigate whether only unexpected shock in period t, $X_t - E_{t-1}(X_t)$ influences the movements of stock return, R_t ; that is, to investigate whether for all i, $\beta_{is} = 0$ for $S \geq 1$ and $\beta_{is} \neq 0$ for S=0.

The problem in the implementation of the testing procedure identified by (6) is the generation of the unanticipated components of the variables in the vector X as the regressors. Economic theory might not be very valuable in generating an accurate model of expectations formation because it is difficult on theoretical grounds to exclude any piece of information available at time t-1 as a useful predictor of a policy valuable. We resolve this problem by using ad hoc forecasting equations, which are based on the assumption that rational agents will form their one-period-ahead forecast on the basis of any information which is easily available and useful in predicting the variable of interest. Thus an appropriate prediction equation should rely on only lagged explanatory variables. We use an approach relatively common in the macro-economic rational-expectations literature. The first step is to choose the macro-economic variables in the X vector. It is generally made in an ad hoc way, determined as much by data availability as by theoretical considerations. Most of the early empirical research in this area has been primarily concerned with whether stock prices fully reflect available information on interest rates and inflation in particular. Some recent studies pay attention to the monetary aggregates. Yet, on purely theoretical grounds (e.g., Tobin (1969)), both monetary and fiscal policy could have important effects on the returns of assets, including equities. In his well-known general equilibrium model of the financial sector, Tobin emphasised stock returns as an important link between the real and financial sides of an economy. In that model, Tobin demonstrated how stock returns may respond to changes in the monetary and fiscal policy variables of the model. Tobin's theoretical analysis, when consistently applied, suggests that both money growth and budget deficits may have significant impacts upon stock returns.

Expectation of money growth is measured by;

$$M_t = \sum_{i=1}^{k} \sum_{s=1}^{m} \beta_{is} X_{i,t-s} + u_t \qquad (7)$$

Expectation of fiscal policy is measured by;

$$F_t = \sum_{i=1}^{k} \sum_{s=1}^{m} \Psi_{is} X_{i,t-s} + w_t \qquad (8)$$

where X_t is the vector of variables employed for predicting monetary and fiscal policies, u_t and w_t are white noises. The variables included in vector X are as the following.

F : Fiscal Policy
M : Monetary Policy
U : Unemployment Rate,
CPI: consumer price index
I : Interest rate ,
GDP: Gross Domestic Product
EXCH : Exchange Rate,

Except interest rate, every variable is expressed by the rate of change. This particular list of variables was chosen because it contains readily available information which many researchers have cited as being of potential use in explaining policy responses (i.e., Fair (1978). The short-term interest rate is used as a proxy for the required return on equity during that period. To insure that the contemporaneous interest rate only captures the effect of changes in the expected rate of return on equity, this variable is instrumented using lagged interest rates, inflation rates, and fiscal and monetary variables as instruments. Inflation is measured by the monthly growth rate in consumer price index. The optimal lag distribution of policy forcasting model was identified as two.[2]

3. The Results

The tests of the semi-strong form market efficiency in the text use monthly data over the 1982-2000 period. All variables are obtained from the Korea Bank Database. The first step is to specify the variables in the monetary policy equation (7) and fiscal policy equation (8). Second step is to jointly estimate equation (6), (7), and (8), imposing the cross-equation rationality constraints (that is, estimated values in equation (7) and (8) should be equal to E(X) in equation (6). In simultaneous systems of equations, endogenous variables are determined jointly rather than sequentially. Estimation of the model involves joint estimation of equation (6), (7), and (8) as a system using FIML. Unlike the two-step OLS estimate, the FIML estimate is not only consistent but efficient since estimation imposes cross-equation restrictions. Table 1 reports the results of FIML estimates. Approximately 14.8% of the variance in stock return is accounted for by the equation. With respect to monetary policy, only unexpected contemporaneous shock is significant while all lagged shocks are not significant . This finding for monetary policy is consistent with the efficient market hypothesis. That is, given the publicity of the view that money growth can influence stock returns, participants in the Korean stock market appear to have incorporated all available information about monetary policy moves. More specifically, market participants in Korea stock market view that unexpected increase in money supply as a negativ shock to the market. However, the evidence of efficiency with respect to fiscal policy is somewhat mixed. Insignificant lagged fiscal shocks support efficient market hypothesis while insignificant contemporaneous fiscal shock show the opposite evidence. Therefore, fiscal policy does not have any statistically

[2] Both AIC (Akaike Information Criterion) and SBC (Schwarz Bayesian Criterion) values for forcasting equations reached to the minimum when lagged term is two. In emplementing forecasting equation, lagged term of twelve is added to control the yearly effect.

significant role in impacting on stock market in Korea. Among the variables in V, exchange rate and short-term rate are significant in explaining stock returns.

Table 1. Semi-strong Effciency of Stock Market for Entire Period (1982-2000)

Monetary Policy R^2/adj R^2 =70.25%/68.7% DW=2.069			Fiscal Policy R^2/adj R^2 =80.2%/79.1% DW=2.542			Stock Market Return R^2/adj R^2 =30.9%/14.8% DW=2.043		
Varible	Estimates	P -value	Varible	Estimates	P -value	Varible	Estimates	P -value
C	-0.31	0.64	C	-0.03	0.98	C	12.76	0.00
M(t-1)	-0.01	0.91	M(t-1)	0.00	0.99	T	-0.02	0.10
M(t-2)	0.06	0.60	M(t-2)	0.42	0.02	I	-0.67	0.01
M(t-12)	-0.02	0.86	M(t-12)	-0.14	0.43	CPI	0.79	0.38
CPI(t-1)	0.04	0.84	CPI(t-1)	0.69	0.04	EXCH	-0.41	0.01
CPI(t-2)	-0.02	0.90	CPI(t-2)	0.41	0.20	M	-1.34	0.00
CPI(t-12)	0.30	0.09	CPI(t-12)	0.17	0.57	F	0.05	0.68
F(t-1)	-0.05	0.14	F(t-1)	-0.48	0.00	UM	-1.87	0.00
F(t-2)	-0.03	0.32	F(t-2)	-0.31	0.00	UM(t-1)	-0.55	0.32
F(t-12)	-0.01	0.74	F(t-12)	0.61	0.00	UM(t-2)	-0.43	0.42
GDP(t-1)	-1.04	0.00	GDP(t-1)	0.04	0.89	UM(t-3)	-0.27	0.58
GDP(t-2)	0.56	0.00	GDP(t-2)	0.30	0.31	UF	0.36	0.18
GDP(t-12)	-0.27	0.07	GDP(t-12)	-0.27	0.27	UF(t-1)	0.01	0.98
I(t-1)	-0.53	0.00	I(t-1)	-0.24	0.17	UF(t-2)	0.19	0.53
I(t-2)	0.02	0.87	I(t-2)	0.30	0.21	UF(t-3)	-0.24	0.36
U(t-2)	-0.04	0.86	U(t-2)	0.10	0.77			
U(t-12)	-0.13	0.54	U(t-12)	0.14	0.70			
EXCH(t-1)	0.00	0.05	EXCH(t-1)	0.00	0.23			
EXCH(t-2)	-0.06	0.17	EXCH(t-2)	-0.02	0.77			
EXCH(t-12)	-0.28	0.00	EXCH(t-12)	-0.02	0.80			

F : Fiscal Policy
M : Monetary Policy
U : Unemployment Rate, CPI: consumer price index
I : Interest rate , GDP: Gross Domestic Product
EXCH : Exchange Rate,
UM: Monetary shock,
UF:Fiscal shock
T : Month

To isolate the effect of foreign currency crisis in late 1990's, I apply the same model to 1982~1997 period. The results are shown in Table 2. Table 2 shows that coefficients of contemporaneous shocks are not significant, implying that stock market is not efficient with respect to the macro-economic shocks during this period. The results indicate that stock marekt efficiency with respect to monetary policy is mainly driven by the period during foreign currecncy crisis. That is, stock market reaction to the monetary shock seems to be more sensitive since the foreign currency crisis in Korea. Table 3 shows the efficiency of Korean stock market before the opening of stock market to foreign investors.[3] The results show that both coefficients of contemporaneous monetary shock and t-3 lagged shocks are not significant, implying that stock market is not efficient with respect to the monetary shock during this period. In addition, contemporaneous fiscal shock is not significant while all of the lagged fiscal shocks are significant. The results indicate that Korean stock market is not efficient with respect to the fiscal shock during this period.

Table 2. Semi-strong Effciency of Stock Market for the Period 1982-1997 (Before the Foreign Currency Crisis)

Monetray Policy R^2/adj R^2 =47.77%/44.85% DW=1.992			**Fiscal Policy** R^2/adj R^2 =81.9%/80.9% DW=2.554			**Stock Market Return** R^2/adj R^2 =25.1%/6.3% DW=2.037		
Varible	Estimates	P -value	Varible	Estimates	P -value	Varible	Estimates	P -value
C	1.32	0.40	C	-6.37	0.01	C	10.64	0.00
M(t-1)	-0.05	0.71	M(t-1)	0.15	0.43	T	-0.02	0.02
M(t-2)	0.13	0.29	M(t-2)	0.55	0.01	I	-0.52	0.01
M(t-12)	0.00	0.97	M(t-12)	-0.05	0.79	CPI	-0.10	0.90
CPI(t-1)	0.00	1.00	CPI(t-1)	0.86	0.01	EXCH	-1.67	0.00
CPI(t-2)	0.09	0.67	CPI(t-2)	0.49	0.15	M	0.45	0.40
CPI(t-12)	0.25	0.18	CPI(t-12)	0.18	0.54	F	0.01	0.92
F(t-1)	-0.05	0.20	F(t-1)	-0.48	0.00	UM	0.20	0.77
F(t-2)	-0.03	0.36	F(t-2)	-0.31	0.00	UM(t-1)	0.68	0.14
F(t-12)	-0.02	0.61	F(t-12)	0.61	0.00	UM(t-2)	0.51	0.27
GDP(t-1)	-1.11	0.00	GDP(t-1)	0.02	0.95	UM(t-3)	-0.08	0.87
GDP(t-2)	0.59	0.00	GDP(t-2)	0.54	0.09	UF	0.33	0.17
GDP(t-12)	-0.25	0.12	GDP(t-12)	-0.03	0.89	UF(t-1)	0.18	0.49
I(t-1)	-0.52	0.00	I(t-1)	-0.19	0.48	UF(t-2)	0.37	0.15
I(t-2)	0.24	0.20	I(t-2)	0.23	0.42	UF(t-3)	-0.12	0.62
U(t-2)	0.06	0.77	U(t-2)	0.17	0.63			
U(t-12)	0.06	0.80	U(t-12)	0.28	0.42			
EXCH(t-1)	0.00	0.77	EXCH(t-1)	0.01	0.05			
EXCH(t-2)	-0.10	0.41	EXCH(t-2)	-0.20	0.32			
EXCH(t-12)	0.09	0.56	EXCH(t-12)	-0.22	0.35			

F : Fiscal Policy, M : Monetary Policy
U : Unemployment Rate, CPI: consumer price index
I : Interest rate , GDP: Gross Domestic Product
EXCH : Exchange Rate,
UM: Monetary shock,
UF:Fiscal shock
T : Month

[3] Although it is somewhat ambiguous to pinpoint the openning period, it is usually known that Korean government gradually opens the stock market to foreign investors since 1992.

Table 3. Semi-strong Effciency of Stock Market for the Period 1982-1992 (Before Stock Market Opening to Foreign Investors)

Monetary Policy R^2/adj R^2 =16.99%/9.3% DW=1.997			**Fiscal Policy** R^2/adj R^2 =85.05%/83.07% DW=2.554			**Stock Market Return** R^2/adj R^2 =43.1%/18.05% DW=2.024		
Varible	Estimates	P -value	Varible	Estimates	P -value	Varible	Estimates	P -value
C	1.87	0.03	C	-2.61	0.36	C	-4.38	0.51
M(t-1)	0.18	0.08	M(t-1)	0.18	0.42	T	0.04	0.13
M(t-2)	0.01	0.89	M(t-2)	0.40	0.07	I	0.29	0.52
M(t-12)	-0.02	0.72	M(t-12)	-0.33	0.08	CPI	-1.11	0.27
CPI(t-1)	0.11	0.24	CPI(t-1)	0.43	0.21	EXCH	-0.70	0.39
CPI(t-2)	0.10	0.33	CPI(t-2)	0.31	0.38	M	-7.93	0.01
CPI(t-12)	0.28	0.01	CPI(t-12)	0.21	0.52	F	-0.05	0.86
F(t-1)	-0.08	0.01	F(t-1)	-0.36	0.00	UM	-9.59	0.00
F(t-2)	-0.08	0.01	F(t-2)	-0.27	0.00	UM(t-1)	-2.49	0.03
F(t-12)	-0.06	0.06	F(t-12)	0.72	0.00	UM(t-2)	-0.51	0.60
GDP(t-1)	-0.29	0.02	GDP(t-1)	-0.14	0.68	UM(t-3)	0.88	0.15
GDP(t-2)	0.10	0.32	GDP(t-2)	0.58	0.11	UF	0.10	0.81
GDP(t-12)	-0.14	0.08	GDP(t-12)	-0.32	0.24	UF(t-1)	0.69	0.13
I(t-1)	-0.08	0.42	I(t-1)	0.38	0.22	UF(t-2)	-0.22	0.60
I(t-2)	0.16	0.13	I(t-2)	-0.03	0.92	UF(t-3)	-0.61	0.10
I(t-12)	0.05	0.42	I(t-12)	-0.16	0.53			
U(t-1)	-13.4	0.13	U(t-1)	36.83	0.20			
U(t-2)	0.16	0.14	U(t-2)	-0.02	0.95			
U(t-12)	-0.25	0.02	U(t-12)	0.10	0.76			
EXCH(t-1)	0.00	0.12	EXCH(t-1)	0.00	0.75			
EXCH(t-2)	0.15	0.06	EXCH(t-2)	0.09	0.73			
EXCH(t-12)	0.10	0.19	EXCH(t-12)	-0.22	0.47			

F : Fiscal Policy,
M : Monetary Policy,
U : Unemployment Rate,
CPI: consumer price index,
I : Interest rate ,
GDP: Gross Domestic Product,
EXCH : Exchange Rate,
UM: Monetary shock,
UF:Fiscal shock,
T : Month

To investigate the effct of stock market opening to the market efficiency, I apply the same model to 1992~2000 period. Comparison of this result with the result for table 3 shows that stock market became more sensitive to the various lagged macro shocks after stock market opening. For instance, only t-1 lagged monetray shock was significant before the opening while all lagged shocks except t-2 lagged monetary shock were significant for the opening period. The statistical significancy of lagged macro shock shows that the inseminnation of macro-economic informations into stock market becomes more delayed and complicated after the opening of Korean stock market to foreign investors. The results show no evidence that market became more efficient by its opening to foreign investors. But this study does not take this result as an evidence that liberalization has no effect on market efficiency since liberalization is a gradual process and has a structural impact on stock market that includes other policy changes (i.e., trade liberalization, banking liberalization, and etc).

Table 4. Semi-strong Efficiency of Stock Market for the Period 1992-2000(After Stock Market Opening to Foreign Investors)

Monetray Policy R^2/adj R^2 =77.19%/72.93% DW=1.98			**Fiscal Policy R^2/adj R^2 =79.31%/75.66% DW=1.90**			**Stock Market Return R^2/adj R^2 =89.58%/76.84% DW=2.28**		
Varible	Estimates	P -value	Varible	Estimates	P -value	Varible	Estimates	P -value
C	0.86	0.24	C	0.94	0.57	C	-2.68	0.85
M(t-1)	0.71	0.00	M(t-1)	0.14	0.74	T	0.12	0.06
M(t-2)	-0.30	0.06	M(t-2)	0.20	0.54	I	-1.82	0.00
M(t-12)	0.08	0.45	M(t-12)	-0.24	0.36	CPI	-1.71	0.30
CPI(t-1)	-0.42	0.08	CPI(t-1)	2.49	0.00	EXCH	0.50	0.03
CPI(t-2)	-0.71	0.00	CPI(t-2)	0.58	0.32	M	0.18	0.81
CPI(t-12)	0.22	0.18	CPI(t-12)	-0.14	0.76	F	0.06	0.82
F(t-1)	0.13	0.06	F(t-1)	-0.57	0.00	UM	4.38	0.00
F(t-2)	0.12	0.03	F(t-2)	-0.40	0.00	UM(t-1)	6.81	0.00
F(t-12)	0.11	0.02	F(t-12)	0.38	0.00	UM(t-2)	-0.38	0.67
GDP(t-1)	-0.67	0.00	GDP(t-1)	0.59	0.23	UM(t-3)	-5.12	0.00
GDP(t-2)	0.54	0.01	GDP(t-2)	0.19	0.68	UF	0.49	0.30
GDP(t-12)	-0.56	0.00	GDP(t-12)	-0.64	0.13	UF(t-1)	1.66	0.00
I(t-1)	-0.08	0.44	I(t-1)	-0.37	0.15	UF(t-2)	2.58	0.00
I(t-2)	-0.55	0.00	I(t-2)	1.20	0.00	UF(t-3)	1.42	0.01
U(t-1)	20.18	0.27	U(t-1)	89.54	0.02			
U(t-2)	0.50	0.10	U(t-2)	0.71	0.36			
U(t-12)	-2.02	0.00	U(t-12)	3.06	0.02			
EXCH(t-1)	0.00	0.85	EXCH(t-1)	0.00	0.06			
EXCH(t-2)	0.13	0.00	EXCH(t-2)	-0.33	0.00			
EXCH(t-12)	-0.18	0.00	EXCH(t-12)	-0.23	0.01			

F : Fiscal Policy, M : Monetary Policy
U : Unemployment Rate, CPI: consumer price index
I : Interest rate , GDP: Gross Domestic Product
EXCH : Exchange Rate, UM: Monetary shock, UF:Fiscal shock
T : Month

4. Conclusion

This paper investigated the efficiency of the Korean capital market with respect to fiscal and monetary policies. For this purpose, the paper applied FIML technique to a set of monthly data over the period 1982.01 to 2000.12. The model was particularly designed to take into the problems of generated regressors and simultaneous equation bias in the test of market efficiency. The overall results indicate that the Korean stock market is efficient with respect to monetary policy. However, the result with fiscal policy is inconclusive. The study also found that market participants reacted to the macro-economic shocks more sensitively after the recent foreign currency crisis in Korea. However, there is no concrete evidence that the stock market opening contributed to the market efficiency.

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Comments on "The Dynamics of Korean Stock Market in Response to Fiscal and Monetary Shocks Around Foreign Currency Crisis"

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This paper tests the semi-strong form efficient market hypothesis (EMH) in Korean stock market for the period 1982 -2000. The study has two novel features. First, the author employs full information maximum likelihood estimation (FIML) in order to improve upon the consistency and asymptotic efficiency over the conventional two-step estimation procedure. Second, the author explicitly considers fiscal policy in addition to monetary policy as a potential component of the information set embedded in the stock return.

The empirical findings in this paper can be summarized as follows. First, the Korean capital market is overall efficient with respect to the information on monetary policy whereas the efficiency test is not determinate with respect to a fiscal policy measure. Second, the market opening did not contribute the efficiency of Korean Stock market. Third, the stock market has been more responsive to the macroeconomic shocks after the foreign currency crisis.

I will discuss several points about validity and potential modifications of the EMH, and the specification of the stock return equation. Next, I present some new results by modifying the EMH and show that the empirical findings may be altered in favor of market efficiency. The empirical findings in this paper would be strengthened if such modifications were implemented as proposed. It is not clear in the paper exactly what variables are meant by fiscal (F) and monetary (M) policy measures. These two key variables must be clearly defined and it must be checked whether these variables represent the historical monetary and fiscal policies well. Let me guess that the growth rate of M2 and the budget deficit denote the monetary and fiscal policies in what follows.

The Efficient Market Hypothesis and the Stock Return Equation

For the ease of exposition, let me reintroduce Equation (6) in a simplified form such that:

$$R_t = \alpha' V_t + \beta_0' (X_t - E_{t-1} X_t) + \sum_{s=1}^{n} \beta_s' (x_{t-s} - E_{t-s-1} X_{t-s}) + \varepsilon_t \qquad (1)$$

where $\alpha' V_t$ captures the required return, X_t denotes the vector of information, β_s is the coefficient vector on X_t and $E_{t-1}\varepsilon_t = 0$. Then the efficient market hypothesis is to test the following.

$$\beta_s = 0\,,\ s = 1,2,\ldots,n \qquad (2)$$

for each element of β_s.

First, the EMH must be modified. The hypothesis in the paper includes the condition $\beta_s \neq 0$. There is no reason why this must be a part of the EMH. The EMH requires that $x_t - E_{t-1}X_t$ is orthogonal to the information available at time $t-1$, whether it is significant or not. In this case, the empirical results must be reinterpreted as I will discuss below.

Second, the contemporaneous interest rate I_t in V_t must be projected on the variables, M_{t-1} and F_{t-1} in order to isolate the unanticipated components of monetary and fiscal policies from the required return. In this paper, however, it seems that I_t in X_t is treated as above, which is not necessary. I now assume that I_t is the projection of the interest rate onto the space generated by M_{t-1} and F_{t-1}.

Third, if the above argument is true, then, both M_t and F_t must be excluded in V_t because its predictable components are already embedded in the interest rate and its unanticipated components are already in Equation (1). If these two variables are replaced by their anticipated components, then we have additional testable restrictions: According to the EMH, since the anticipated components of the policies must be reflected in the required return, the stock return should not be responsive to the anticipated policies. Specifically, let M_t^A and F_t^A denote the anticipated components of the monetary and fiscal policies, respectively, and α_M and α_F be the corresponding coefficients. Then the EMH includes the following:

$$\alpha_M = 0,\ \alpha_F = 0 \tag{3}$$

Modified Results and Prediction

Suppose Equation (2) is the EMH. Then the test is to check whether the coefficients UM(t-s) and UF(t-s) are for s=1,2,3 in the stock return equation. (An alternative test would be to test whether the coefficients are jointly zeros.) Then the empirical findings can be modified as follows. First, for the whole sample (Table 1), the EMH is not rejected with respect to the information in monetary and fiscal policies. Second, before the stock market opening in 1992 (Table 3), the EMH is not rejected with respect to M and F except the unanticipated monetary policy at $t-1$. To this end, it is likely not to reject the EMH if the joint test I just proposed is applied. After 1992 (Table 4), the EMH is rejected overall. This is quite a counterintuitive result in that the market opening had worsen the efficiency of the Korean stock market. But such interpretation can be largely misleading because the financial crisis occurred in the middle of post-1992 period. Indeed, before the crisis (Table 2), the EMH is not rejected. As the author claimed, this result implies that the capital market opening has been implemented gradually and market participants seem to have been aware of the process. On the contrary, The financial crisis hit the Korean economy as an unanticipated shock and according to the result, the crisis seems to be a structural break in Korean capital market. Therefore it would be suggestive to test the

EMH after the crisis and see if the market has been efficient. The data should be extended up the most recent date.

Under the additional components of the hypothesis in Equation (2), the results seem mixed and often contradictory. I refrain from judging the EMH in this case because the results would be relevant only if M_t and F_t in V_t represent the anticipated policies.

Final Remarks

Other minor things are pointed out as follows. First, GDP and budget deficit are converted into monthly data. If the so-called SAS EXPAND procedure is the purely statistical smoothing technique, the generated monthly data would not reflect the real-time variation of the data. If GDP is used to represent the real activity, then monthly industrial production can be used instead. Second, Korea began to focus on the short term interest rate as the major monetary policy instrument since 1997 because the monetary aggregate has been less effective as the intermediary target of monetary policy. Therefore, monetary policy equation can be modified to reflect this historical fact and applied for the post financial crisis period. Third, in this paper, inflation, output growth and the unemployment rate are treated as exogenous. But in fact all these variables are sensitive to policy variables. Therefore, it is suggestive to project all these variables on the fiscal and monetary policy variables in order to isolate the effects of unanticipated policy shocks. Fourth, the analysis of the effects of contemporaneous monetary and fiscal policy shocks on the stock return is a very important topic in the context of understanding the channels through which policies are transmitted to the financial market as well as the real side of the economy, but it may be less relevant in testing the EMH.

Overall, this paper analyzes an important topic with innovative methodology and the major empirical findings would be strengthened once the proposed modifications are implemented.

CHAPTER 6-2

Dynamics of Business Cycles in Korea: The Role of External Shocks

by
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Abstract

Using a multi-sector dynamic stochastic general equilibrium model, we investigate the dynamic effects of a variety of shocks to a small open economy. In particular, we calibrate the model to match the main characteristics of business cycles in Korea and analyze the effects of external shocks: the terms of trade and world real interest rate shocks. The simulation results suggest that an improvement in the terms of trade has positive impact on investment, output and consumption, while a decrease in the world interest rate has a significant and positive effect on investment. This paper concludes that external shocks significantly influence business cycle fluctuations in Korea.

1. Introduction

External shocks, such as shocks on the world interest rate, exchange rate, and the terms of trade, can notably influence business cycles in small open economies. Many researchers have empirically examined the effects of external shocks on business cycles using various time series estimation methods including the Vector Autoregressive (VAR) estimation. However, the estimation analysis lacks a systematic and theoretical interpretation of estimation results, which necessitates an analysis based on dynamic stochastic general equilibrium (DSGE) models. A number of papers have examined business cycle properties of developed countries using DSGE models.[1] However, there are few serious studies on Korean business cycles using DSGE models.[2]

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[1] For DSGE models on small open economies, see, among others, Mendoza (1991), Cardia (1991), Kollmann (1995, 1998, 2001). Two-country DSGE models include Backus et. al (1995), Baxter (1995), Kim (1997), and Kose (2002).

[2] There are a number of empirical papers on business cycles in Korea. Yoo (1990) employed VAR and Yoo (1992, 1995), Park (1997), and Kim (1994) used Structural VAR models to analyze the effects on macroeconomic variables induced by real shocks to the Korean economy. Some employed closed-economy

This paper constructs a fully expanded DSGE model for a small open economy and calibrates the model to match business cycle statistics in Korea. We aim to explain the dynamic effects of internal and external shocks on key macroeconomic variables in Korea. In particular, we address the following questions: (1) What are the dynamic effects of sectoral productivity shocks on aggregate output, consumption, investment, and external accounts?; (2) How do macroeconomic variables respond to changes in the U.S. interest rate and in the terms of trade? Answering these questions is essential to formulating policies to stabilize the economy in a volatile economic environment.

The model used in this paper reflects several key characteristics of small open economies. First, we specifically consider three goods in the model—exportables, importables and nontraded goods. Second, production activities take place in the exportable and nontraded sectors, where each sector has its own physical capital accumulation process. Third, the production in the export sector uses imported intermediate goods. Fourth, the model explicitly formulates world financial markets where domestic households can trade risk-free international bonds (incomplete markets economy). Finally, agents in the model face several stochastic shocks. Domestic shocks are represented by changes in government spending and movements in productivities in the exportable and nontraded sectors. There are two external shocks in the model: the terms of trade shocks (or real exchange rate shocks) and the world real interest rate shocks.

Due to the highly nonlinear nature of the model, it is impossible to solve it directly using nonlinear solution methods. We therefore solve this model by applying a numerical approximation method suggested by Sims (2002) which is based on the linearization of the first-order conditions around the steady-states. The simulation results suggest that an improvement in the terms of trade has positive effects on investment, output and consumption, while a decrease in interest rate has a significant and positive effect on investment. External shocks significantly impact business cycle fluctuations in Korea.

The remaining sections are organized as follows. In section 2, we document the main characteristics of business cycles in Korea and compare them with other Asian and G7 countries. In section 3, we construct the model and provide a detailed solution. Section 4 explains how we calibrate the model parameters using the Korean data. In section 5, we compare the properties of the business cycles generated by the model with those actually observed in Korea in order to find the fit of the model. In section 6, we analyze the impulse responses of key macroeconomic variables to exogenous shocks, in particular, productivity, the terms of trade and world interest rate shocks, to study the propagation mechanisms generated by these shocks. Finally, section 7 offers the conclusion of the paper.

2. Properties of Business Cycles in Korea

In this section, we document the main characteristics of business cycles in Korea and compare them with those in OECD and other Asian countries. In particular, we

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DSGE models to explain business cycles in Korea, including Jo (1991, 1997) and Lee (1996). Using a simple open economy setup, Park (1999) analyzed the role of external shocks on business cycles in Korea. Existing real business cycle studies on other open economies include Correia et al. (1992) for Portugal, Bruno and Portier (1995) for France, Harjes (1997) for Germany, and Tantitemit (2001) for Thailand.

investigate the second moments of main macroeconomic variables: volatility, persistence and co-movement with output. Volatility measures the amplitude of fluctuations; persistence indicates the amount of inertia in business cycles; and co-movement provides information on whether a series behaves pro-cyclically or counter-cyclically.

We use data from 1960 to 1996. We do not include data between 1997 and 2001 since the Asian crisis in 1997 makes the data during 1997-2001 outliers of the sample and the inclusion of this period would distort the statistics. We also present the statistics of the second half of the sample period from 1985 to 1996 because of potential structural changes in the Korean economy.[3] All of the data are properly treated and detrended. We use the Hodrick-Prescott filtering for detrending.[4]

Table 1 reports the business cycle statistics of Korea. In general, Korea's business cycle statistics match the main characteristics of business cycles reported in the literature[5]: (1) consumption is less volatile and investment is more volatile (three to four times more) than output. Both exports and imports are more volatile than output; (2) All macroeconomic series are highly persistent; (3) Consumption and investment are procyclical. There are some exceptions: the correlation between consumption and output is quite small and the correlation between net export and output is positive. Usually, net export and output are negatively correlated as can be seen in the statistics for other countries in Table 2. [6]

Comparing the statistics from the whole period with those from the second half of the sample periods 1985-1996, we make several important observations. In particular, volatility of all macroeconomic variables significantly decreased in the second period. Several factors provide the explanation: first, the measures of fiscal and monetary policy variables, such as government expenditure and money stock, appear to be less volatile in the second period, suggesting a higher degree of stabilization in economic policy formation. Second, as financial markets have developed in Korea, the set of financial instruments used for hedging against different types of shocks and for providing a variety of risk-sharing opportunities has expanded. This, in turn, has reduced the volatility of business cycles. Third, global economic shocks, such as the global expansion in the 1960s, breakdown in the international financial order, oil price shocks in the 1970s, and the debt crisis in the early 1980s, were much stronger in the first period.

In Table 2, we compare the main characteristics of business cycles in Korea with those of Asian and G7 countries. We select seven Asian countries—Indonesia, Korea, Malaysia, the Philippines, Singapore, Taiwan, and Thailand—to derive the average business cycle statistics for Asian countries.[7] Note that all the statistics in Table 2 are from the 1985-1996 period.

In terms of output volatility, Korea and other countries (both Asian and G7 countries) are similar with a standard deviation of approximately 2%.[8] However, other variables show that the volatilities are much lower in the G7 countries than in Asia. We find that

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[3] A significant shift in policies towards capital flows occurred in the mid-1980s due to capital account liberalization (Kim et al. 2003).

[4] We set the value of smoothing parameter at 100, which is the conventional value used for annual data in the literature.

[5] See Backus and Kehoe (1992) for the stylized facts on business cycles in major economies.

[6] This result is sensitive to the selection of estimation period. Using data in different periods, we find that the net export-output correlation can be negative in some cases.

[7] These statistics are taken from Kim, et al. (2003). The appendix also explains the detailed sources of data.

[8] In the 1960s and 1970s data, output is less volatile in G7 countries than in Asia.

the statistics of Korea are more similar to those of the G7 countries than with the Asian countries. In particular, consumption volatility in Korea is very low at approximately 0.8, which is almost at the level of the G7 countries (around 0.91), whereas the average volatility in Asia is high (1.84).

Concerning co-movements with output, G7 countries show a very high correlation between output, consumption and investment (around 0.9), while Korea and other Asian countries show a low correlation of approximately 0.4-0.5. One distinctive feature, mentioned previously, is that the correlation between net exports and output is negative in other Asian and G7 countries, while it is positive in Korea. An increase in output (a boom in the economy) usually worsens the trade balance by increasing investment or spending on imported goods.

3. Model

There are three goods consumed in this small open economy: exportables (*x*), importables (*m*), and nontraded goods (*n*). Two goods (exportables and nontraded goods) are domestically produced. A representative agent solves

$$\max E_0 \sum_{t=0}^{\infty} \beta^t U_t, \text{ and } U_t = \frac{\left(c_t - \frac{(1-l_t)^\theta}{\theta}\right)^{1-\sigma}}{1-\sigma}, \qquad (1)$$

where l_t is leisure and c_t is a composite consumption good that consists of the three goods.

Our momentary utility formulation implies that the elasticity of substitution associated with leisure is zero. This utility function (hereafter "GHH preference") is introduced by Greenwood, Hercowitz, and Huffman (1988) and is widely used in open economy DSGE models.[9]

We can separate the nontraded good out of the budget constraint. We use the importable good as a numeraire. Then the budget constraint with incomplete financial markets becomes

$$B_{t+1} + \frac{\Phi}{2}(B_{t+1} - \overline{B})^2 = nx_t + (1+r_t)B_t, \qquad (2)$$

where B_t is international bond with interest rate r_t and nx_t is net exports, which is described below. $\overline{B}$ is the steady state bond holdings. B_t is denominated in terms of import good.

We assume that there is an adjustment cost in asset holdings which is proportional to the amount of international lending or borrowing. Using the bond holding adjustment costs allow us to avoid the nonstationarity problem in the small open economy model with incomplete markets.[10] We also assume that this bond holding adjustment cost is

[9] See Correia, et al. (1995) and Crucini (1999) for the comparison of dynamic implications of the GHH utility function with those of the Cobb-Douglas utility function.

[10] See Mendoza (1991) and Kim and Kose (2003) for a detailed discussion on this issue.

paid to a certain international institution and therefore disappears from the national budget constraint.[11]

The net exports can be expressed as

$$nx_t = p_{xt} y_{xt} - p_{xt} c_{xt} - c_{mt} - i_{xt} - i_{nt} - s_t , \tag{3}$$

where p_{xt} is the price of exportables and s_t is the imported intermediate input that is used to produce an exportable good. We assume that the production of exportables and nontraded goods requires imported capital goods. That is, both i_{xt} and i_{nt} are imported.

The resource constraint in the nontraded sector becomes

$$y_{nt} = c_{nt} + G_{nt} , \tag{4}$$

where G_{nt} is government spending in nontraded goods. The price of a nontraded good is denoted as p_{nt}.

Composite good c_t consists of consumption on three goods, c_m, c_n, and c_x as follows:

$$c_t = \left[b_x c_{xt}^{1-\gamma} + b_m c_{mt}^{1-\gamma} + b_n c_{nt}^{1-\gamma} \right]^{\frac{1}{1-\gamma}}, b_x + b_m + b_n = 1 . \tag{5}$$

Total expenditure on consumption can be expressed as the sum of expenditure on each good:

$$p_t c_t = c_{mt} + p_{nt} c_{nt} + p_{xt} c_{xt} , \tag{6}$$

where p_t is the price of composite good c_t. All the prices are normalized in terms of importables (p_{mt})--which means that p_{xt} is the price of exportables in terms of importables.

Maximizing (5) subject to (6) yields an equilibrium expression for relative demand for each consumption good and the price of the composite consumption good:

$$\frac{c_{xt}}{c_t} = b_x^{\frac{1}{\gamma}} \left(\frac{p_{xt}}{p_t} \right)^{-\frac{1}{\gamma}} , \tag{7}$$

$$\frac{c_{mt}}{c_t} = b_m^{\frac{1}{\gamma}} \left(\frac{1}{p_t} \right)^{-\frac{1}{\gamma}} , \tag{8}$$

$$\frac{c_{nt}}{c_t} = b_n^{\frac{1}{\gamma}} \left(\frac{p_{nt}}{p_t} \right)^{-\frac{1}{\gamma}} , \tag{9}$$

$$p_t = \left[b_x^{\frac{1}{\gamma}} p_{xt}^{\frac{\gamma-1}{\gamma}} + b_m^{\frac{1}{\gamma}} + b_n^{\frac{1}{\gamma}} p_{nt}^{\frac{\gamma-1}{\gamma}} \right]^{\frac{\gamma}{\gamma-1}} . \tag{10}$$

Production functions for the exportable and nontraded goods are

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[11] In the closed economy, one should have the bond holding adjustment costs transfer back to the household to close the national accounting system.

$$y_{xt} = A_{xt} h_{xt}^{\omega} \left[a(k_{xt})^{1-z} + (1-a)(s_t)^{1-z} \right]^{\frac{(1-\omega)}{1-z}}, \tag{11}$$

$$y_{nt} = A_{nt} h_{nt}^{\alpha_1} \ (L_t)^{\alpha_2} \ (k_{nt})^{1-\alpha_1-\alpha_2}, \tag{12}$$

where L_t is land that is exogenously given.

Capital accumulation equations are

$$k_{x,t+1} = (1-\delta_x)k_{xt} + k_{xt}\phi\left(\frac{i_{xt}}{k_{xt}}\right), \tag{13}$$

$$k_{n,t+1} = (1-\delta_n)k_{nt} + k_{nt}\phi\left(\frac{i_{nt}}{k_{nt}}\right), \tag{14}$$

where δ denotes depreciation rate and $\phi(.)$ represents the standard adjustment cost function with $\phi(.) > 0$, $\phi(.)' > 0$, and $\phi(.)'' < 0$ (see Baxter and Crucini 1993).

Labor hours are subject to the following constraint, in which the sum of working hours and leisure is normalized to one:

$$h_{xt} + h_{nt} + l_t = 1. \tag{15}$$

There are five exogenous shocks that we can incorporate into the model. They are sectoral productivity shocks (A_{xt}, A_{nt}), government spending shock (G_{nt}), the world real interest rate shock (r_t), and the terms of trade shock (p_{xt}).

Since the model cannot be solved analytically, we solve the model numerically using linearization.[12] The linearized equation system can be cast into the set matrix system,

$$\Gamma_0 \hat{x}_{t+1} = \Gamma_1 \hat{x}_t + \Gamma_2 \varepsilon_{t+1} + \Gamma_3 (\hat{x}_{t+1} - E_t \hat{x}_{t+1}), \tag{16}$$

where the hat variable is the percentage deviation from its steady state. Note that the coefficient matrices, (Γ_0,Γ_1,Γ_2,Γ_3), are nonlinear functions of the deep parameters. The system is solved following Sims (2002), whose method is a generalization of Blanchard and Khan (1980).[13]

If there is a unique equilibrium, the solution takes the following form:

$$\hat{x}_{t+1} = \Psi_1 \hat{x}_t + \Psi_2 \varepsilon_{t+1}. \tag{17}$$

where there is no expectations term. The coefficient matrices (Ψ_1 ,Ψ_2) are functions of the deep parameters and thus, the solution is a restricted VAR.

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12 The detailed sets of first order conditions, steady state equations and the linearized first order conditions are explained available upon request.

13 We use a modified version of the MATLAB program gensys. The program reads (Γ_0,Γ_1,Γ_2,Γ_3) as inputs and writes (Ψ_0,Ψ_1) as outputs.

4. Calibration

We calibrate the structural parameters to correspond to the existing real business cycle literature and to be consistent with the long-run features of the Korean economy. We fix the value of β at 0.954 to match the annual steady state world real interest rate at 4.8 % which is the average rate calculated using the U.S. three-month T-Bill rate deflated with CPI inflation. Following Mendoza (1991), the elasticity of substitution, w, is set to 1.455. The value of risk aversion parameter σ is set at 2.61 following Ostry and Reinhart (1992).

The value of γ is set at 0.93 to match the elasticity of substitution in the aggregate consumption function at 1.07 which is the average value used in Ostry and Reinhart (1992). As γ decreases, consumption responds more to the changes in relative prices. The bond holding adjustment costs is set to match the volatility of the trade balance (or the current account). Shares parameters (b_m, b_n, b_x) in the CES form consumption function are set to match the actual consumption shares in the data. The data show that the export good share is 11%, import good share is 21% and the nontraded good share is 68%.[14]

We set the depreciation rate at 13% for both production sectors, which is estimated by the Bank of Korea and also within a range of commonly used values in the literature. Labor share in the export good production ω is set at 0.48 following the Bank of Korea Annual Statistics. Others have used numbers ranging from 0.12 to 0.45 (Kouparitsas, 1997). Share of capital against the imported intermediate good is set at 0.55 (Kose, 2002). Elasticity of substitution between capital and imported intermediate good z is set at 1.35 following Kose (2002). Labor share in nontraded good production α_1 is set at 0.38 and the share of capital in nontraded good production is set at 0.4, following Kose (2002).

The adjustment cost parameters in capital accumulation equations are chosen so that the steady state of the model is the same as one without adjustment costs. This implies that $\phi(i/k) = i/k$ and $\phi'(i/k) = 1$. The steady state value of i/k is equal to the depreciation rate δ. The elasticity of the marginal adjustment cost function, $\eta = -(\phi'/\phi'')(i/k)^{-1}$, is set to 10, to match the volatility of investment in the data (cf. Baxter and Crucini 1993). We set the steady state land share in terms of nontraded output at 25% and the share of government expenditure in terms of nontraded output at 20%.

The next step is to calibrate the shocks. For the productivity measures for the exportable and nontraded sectors, we use the Solow residuals derived from the Cobb-Douglas production function without capital input following Backus et al. (1992) and Glick and Rogoff (1995).[15] For the elasticity of substitution in production function, we use the value from Stockman and Tesar (1995) and Park (2000). For other shock variables, we follow the standard definitions. Detailed descriptions of the data are in the appendix.

All five shocks that we consider in the model are assumed to follow an AR(1) process. We estimate the AR(1) coefficients from OLS regressions of the shock variables,

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[14] We take the averages of the shares between 1985 and 1996 to be consistent with the sample period in the stylized facts section. Details of how we construct the sectoral production and employment data are reported in the appendix.

[15] Glick and Rogoff (1995) argued that adjusting for capital inputs should not produce radically different results since, if one explores the U.S. data, short-term movements in capital are small relative to short-term movements in labor. One might argue that the problems in constructing comparable capital stock measures in cross-country data are so severe that attempts to adjust for capital inputs are not that reliable.

which are reported in Table 4. We calculate the correlation coefficients-standard deviation matrix of the five shocks and they are also reported in the table.

5. Comparing the second moments

In this section, we compare the business cycle moments generated by the model with the actual statistics from the data reported in section 2. We simulate the model for 50 periods with our benchmark parameterization and report the average moments over 500 simulations. All results refer to the moments of Hodrick-Prescott (HP 100) filtered variables (cf. Hodrick and Prescott, 1997).

Table 5 reports the statistics from the data and the model. In general, the model successfully matches the moments. In relative volatility, the model produces more volatile investment (relative volatility of 3.52) and less volatile consumption (relative volatility of 0.98) than output, which correctly captures the data statistics in Korea. The export series from the model (and therefore net exports as well) are not as volatile as in the data, partly because of the GHH preference structure where the amount of production and export are directly determined by the amount of labor input. However, these statistics are consistent with the stylized fact that export and import series are more volatile than output in general.

In terms of persistence, the model matches the data very well. For co-movements with output, the model predicts an excessively high correlation between consumption and output, and between export and output. Again, this is due to the GHH preference structure as explained above. One advantage of adopting a GHH preference is that it generates a negative correlation between output and net exports. Even though the Korean data shows a positive correlation between the two variables, it is an exception. As seen in Table 2, all other Asian and G7 countries show a significantly negative correlation between output and net exports. Even for the Korean data, using different sample periods produces a negative correlation.

In conclusion, we can safely argue that this model explains the main statistical properties of Korea's business cycles and we can use this model to perform our main analysis of the study—impulse responses to external shocks—in the next section.

6. Impulse Responses

In this section, we analyze the effects of each shock in the model on aggregate and sectoral variables. We use the same model and parameter specification and investigate how each macroeconomic variable responds to shocks.

6.1. Productivity shocks

Figure 1 presents the impulse responses to productivity shock in the exportable sector, a 1% increase in productivity at the initial period with $\rho = 0.95$ (persistence). We trace the responses up to 50 periods. The first set of graphs shows the responses of aggregate variables and price variables: output, consumption, investment, trade balance, current account, price level, real exchange rate and interest rate differentials. Aggregate variables are constructed by taking a weighted average of the sectoral variables. The real exchange rate is represented by the general price of the economy (p_t) because foreign price is the numeraire of the economy. In this case, an increase in the real exchange rate denotes a real appreciation of domestic currency.

The model economy responds to a positive productivity shock by increasing investment, consumption and output. With temporary but persistent productivity shocks, households, knowing that positive productivity shocks are short-lived, work and produce more in the present. Although consumption grows, it does not grow as much as the increase in output and households save the remaining output by accumulating bonds over time. The net exports (or trade balance) decrease at impact because the agent borrows from the rest of the world to increase its capital stock and, in turn, utilizes the increase in productivity. In other words, the pro-borrowing effect initially dominates the pro-saving effect inducing a fall in the net exports. As the agent starts accumulating foreign assets, the net exports increase, but then decrease in the long run. This is because in the new steady state, agents enjoy interest income from holding foreign bonds and this allows them to have deficits in trade balance. Since the current account reflects income from asset holdings, it follows similar steps as the trade balance during the transitional period but it converges to zero in the long run.

An increase in the production of exportables increases the relative price of nontradables because of the relative scarcity of nontradables produced. The graph shows that the increase is around 1.5% during the initial period. An increase in the price of nontradables also increases the real exchange rate, indicating a real appreciation in the domestic currency.

The second set of graphs in Figure 1 shows the responses of sectoral output, investment, consumption and labor input. Since the positive productivity shock is in the export sector, all four variables in the export sector increase. In particular, the response of the investment is the largest, showing an initial increase of approximately 7%. Because of the income effect, there is a complementarity in the production of exportables and nontraded goods. Therefore, the production and consumption of nontraded goods increase as well. Note that the impulse responses can be sensitive to certain parameter values such as the discount rate and shock persistence, in particular, under the current incomplete financial market structure (see Kim et al., in press).

Figure 2 shows the impulse responses to a 1% increase in productivity in the nontraded sector. The graph of aggregate variables shows a similar response to the case of productivity shock in the exportable sector. The only difference is the magnitude of change: the size of increase in this case is smaller than in the case of the exportable sector shock. Since the price of nontradables also decreases with the impact, the weight of the nontraded good in deriving the aggregate variables decreases. An important difference is observed in the responses of the price variables. An improvement in productivity lowers the price of nontradables and therefore depreciates the domestic currency in real terms. As the nontraded sector output increases, its price decreases.

The graphs for sectoral variables show that output and consumption in the nontraded sector increase more than those in the tradable sector, which is obvious from the fact that productivity increases in the nontraded sector. In particular, consumption of nontradables dramatically increases because of the additional favorable price effects. However, the responses of factor inputs, in particular labor, reveal that the exportable sector responds more than the nontraded sector. This is due to the shape of the production function and parameter values.

6.2. Terms of trade (TOT) shock

Figure 3 shows the impulse responses to a 1% increase in the terms of trade (TOT) with ρ = 0.55 (persistence). This implies an improvement in the terms of trade meaning that the relative price of exportables increases. The graphs show that there are favorable effects on aggregate variables. All aggregate variables positively respond to an improvement in the TOT. Because of the increase in the price of exportables, agents produce more exportable goods, which generates similar responses of aggregate variables as in the case of a positive productivity shock in the exportable sector. It increases the price of nontraded good and the real exchange rate. The difference is that the trade balance shows an improvement. Although the amount of exports decreases, the total value of exports increases because of an increase in the price of exportables. One notable observation is that consumption of importables sharply increases during the first several periods due to the decrease in the relative price of importables. As imported capital goods become cheaper, investment in both sectors increases.

This result is consistent with the proposition called the Harberger-Laursen-Metzler effect. Introduced in the 1950s, this proposition postulates that real income and savings fall with TOT deterioration. However, more recent papers based on the intertemporal approach with forward-looking savings behavior suggest a different story. By adopting a Uzawa-type utility function, Obstfeld (1982) shows that the deterioration of the TOT can increase savings. Svensson and Razin (1983) analyze the effects of the TOT of final and intermediate goods on savings and investment. A temporary deterioration in the TOT of final goods lowers the discount factor. The lower discount factor, in turn, increases investment but has ambiguous effects on consumption. The deterioration in the TOT also reduces the real value of domestic output in terms of consumption and eventually lowers consumption. However, the theoretical predictions are inconclusive because the results depend greatly on the specifications of shocks and the structure of the model economy.

6.3. World interest rate shocks

In figure 4, we examine the impulse responses of the model variables to a 0.25% increase in the world real interest rate. The persistence is set at 0.7. Since capital stock is predetermined in the period of impact, labor supply does not respond immediately, and output remains constant. Changes in investment and consumption in the first period trigger changes in output, labor input and capital stock in the following period. The most significant impact is on investment, where investment decreases approximately 4% with a quarter point increase in the interest rate. Correspondingly, output decreases by 0.5% and consumption decreases less than that. An increase in the interest rate provides an incentive for domestic agents to accumulate foreign assets. Combined with a decrease in investment demand, asset accumulation corresponds with an increase in net exports. Since the interest rate affects both sectors to a similar degree, there is not much change in the relative price and exchange rate, as can be seen in the figure 4. The sectoral responses reveal that both sectors respond negatively to an increase in the interest rate. A decrease in investment is observed equally in both sectors but the amount of output loss is more severe in the exportable sector.

7. Conclusion

In this paper, we constructed a multi-sector dynamic stochastic general equilibrium model that can be readily used to analyze business cycles in a small open economy. We calibrated the model to match the main characteristics of business cycles in Korea. Using this model, we examined the dynamic effects of various shocks on the macroeconomic variables, in particular external shocks such as the terms of trade and world real interest rate shocks.

Korea's business cycle statistics match most of the stylized facts: consumption is less volatile than output and investment and external balances are more volatile than output. Consumption and investment are procyclical. The statistical analysis also reveals that the pattern of business cycles in Korea is more similar to the patterns in the G7 countries than in the Asian countries. We also investigate the fit of the model by comparing the second moments from the data with those from the model simulations. In general, this model does a good job of matching the second moments. However, the results are sensitive to the parameter values and model specifications.

Impulse response analysis provides several interesting findings. First, compared to other studies that have analyzed business cycles in a single-good framework, this model provides important insights regarding the responses of the economy to productivity shocks. Although the aggregate variables respond in a similar manner to the productivity shocks in the exportable and nontraded sectors, the price variables respond in a totally opposite manner. A positive productivity shock in the exportable sector increases domestic price and appreciates real exchange rate. However, when a positive shock occurs in the nontraded sector, then the domestic price decreases and the real exchange rate depreciates. This feature cannot be captured in a single-good model. Second, an improvement in the terms of trade has positive effects on investment, output and consumption. The current increase in world oil price can be viewed as a negative TOT shock and this model predicts that one percent decrease in the TOT initially decreases output and consumption about 1.5% and investment about 0.7%. These negative effects last at least for one year. Finally, a decrease in the world interest rate has a significant and positive impact on investment. A quarter percentage point decrease in world interest rate immediately increases investment about 4%, while output and consumption increase with some time gap (two-four quarters) by about 0.5% and 0.25%, respectively.

These simulation results can provide important policy implications by providing some quantitative analysis on the responses of the Korean economy to changes in external economic environments such as changes in world interest rate and oil price. Appropriate monetary and fiscal policies can reduce the negative effects from adverse external shocks, which should be based on the accurate structural analysis of the Korean economy. The current model in this paper is not complete in the sense that it simplifies many diverse aspects of the Korean economy. However, this model can serve as a basic framework for further modeling works for a small open economy such as Korea.

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Appendix. Data Sources and Definitions

Most data series are taken from the International Financial Statistics (IFS). Unless indicated, the data series are from 1960 to 1996.

Output: Output is measured as Gross Domestic Product (GDP) at 1990 prices (*line 99b.p or 99b.r*). Gross Domestic Product (*line 99b*) is generally presented in the IFS as the sum of final expenditure.

GDP Deflator: GDP deflator is the ratio of nominal GDP *(line 99b)* to real GDP (*line 99b.p or 99b.r*). All the nominal variables are deflated by the GDP deflator.

Private Consumption: Private consumption series are from the IFS (*line 96f*).

Investment: Investment is measured as gross fixed capital formation (*line 93e*).

Government Consumption: Government consumption series are from the IFS (*line 91f*).

Exports: Exports are measured as exports of goods and services of national accounts (*line 90c*).

Imports: Imports are measured as imports of goods and services of national accounts (*line 98c*).

Money: We use M2 which is is defined as M1 plus quasi-money.

CPI: Consumer Price Index (CPI) series are from the IFS (*line 64*). The CPI series of Korea starts from 1963.

Export Price: Index for unit value of exports is Laspeyres with weights derived from the data for transactions (*line 74*). The export and import price series of Korea are from 1963 to 1996.

Import Price: Index for unit value of imports is Laspeyres with weights derived from the data for transactions (*line 75*).

Terms of Trade: Terms of trade is defined as export price divided by import price.

Sectoral data for output, consumption, investment, labor, and capital stock are collected from the annual report on the survey of service industries and to classify the tradables and nontradables, we utilize the study of Sang-Yirl Nam (2001)[1], which presents tables on the share of total trade in domestic consumption in the manufacturing sectors. We define tradables as the manufacturing sectors where the share of total trade in domestic production is greater than 30 percent. Nontradables are defined as the manufacturing sectors where the share is below 30 percent and also include the agricultural and service sectors. Importables are defined as the manufacturing sectors where the share of imports on domestic consumption is greater than 50 percent. Exportables are defined as the manufacturing sectors where the share is below 50 percent.

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[1] Nam's study (2001) follows the classification of Korea standard Industry Classification (KSIC) where the Industries are classified as 2 digit, 36 sectors. The manufacturing consist of 23 sectors. Before 1990, manufacturing industries were classified in 2digit 9 industries. Therefore, we made an appropriate adjustment to match the new classification system.

<Table A.1> Sectoral Composition of Industries

Exportables (8)	Textiles, Except Sewn Wearing Apparel (17), Sewn Wearing Apparel & Fur Articles (18), Tanning & Pressing of Leather (19), Computers and Office Machinery (30), Radio, TV and Communication Equipment (32), Medical, Precision & Optical Investments (33), Manufacture of other Transport Equipment (35), Furniture; Articles n.e.c (36)
Importables (6)	Wood Products of Wood & Cork (20), Coke, Refined Petroleum Products (23), Chemicals and Chemical Products (24), Manufacture of Basic Metals (27), Manufacture of other Machinery (29), Electrical Machinery n.e.c (31)
Nontraded goods (8)	Manufacture of Food Products & Beverage (15), Manufacture of Tobacco Products (16), Pulp, Paper & Paper Products (21), Publishing, Printing & Reproduction (22), Rubber and Plastic Products (25), Non-metallic Mineral Products (26), Fabricated Metal Products (28), Motor Vehicles & Trailers Manufacturing (34), Service, Agriculture, Mining Sectors.

Note: The classification is based on Korea Standard Industry Classification (KSIC) revised in 1991.

Table 1. Business cycle statistics of Korea

	Volatility		Relative Volatility		Persistence		Co-movement with Y	
	1960-96	1985-96	1960-96	1985-96	1960-96	1985-96	1960-96	1985-96
Y	3.05	2.14	1	1	0.55	0.57	1	1
C	2.27	1.71	0.74	0.80	0.44	0.51	0.38	0.41
I	11.36	6.50	3.72	3.03	0.56	0.63	0.45	0.60
G	7.86	2.38	2.58	1.11	0.59	0.50	0.23	0.21
EX	10.96	9.14	3.59	4.27	0.35	0.54	0.22	0.32
IM	8.71	5.09	2.86	2.38	0.40	0.46	0.11	0.24
NX	10.48	7.58	3.43	3.54	0.31	0.41	0.14	0.22
CPI	6.58	2.03	0.66	0.54	*	*	-0.63	-0.40
M	14.62	2.09	4.79	0.98	0.71	0.52	0.33	0.70

Notes: (1) Y: output, C: consumption, I: investment, G: government spending, EX: exports, IM: imports, NX: net exports, CPI: consumption price index, and M: money supply.

(2) All data in the tables are real at 1990 prices and logged and detrended using the Hodrick-Prescott filter with the smoothing parameter set at 100. Volatility is measured by the standard deviation and persistence is measured by the first order autocorrelation coefficient of the filtered series. Contemporaneous co-movement with output is measured by the correlation between the filtered series and filtered output. The reported statistic of persistence for the 60-96 period is significant at the 5% level if it lies outside of [-0.32 , 0.32].

Table 2. Comparison with other countries

<Relative volatility>

	Korea	Asian average	G7 average
Y (volatility)	2.14	2.00	2.16
C	0.80	1.84	0.91
I	3.03	4.39	3.33
G	1.11	2.97	0.98
EX	4.27	3.62	3.08
IM	2.38	3.69	3.41
NX	3.54	2.95	2.45
CPI	0.54	0.54	0.73
M	0.98	2.35	2.34

<Correlation with output>

	Korea	Asian average	G7 average
C	0.41	0.46	0.90
I	0.60	0.58	0.92
G	0.21	0.25	0.10
EX	0.32	0.32	0.19
IM	0.24	0.49	0.55
NX	0.22	-0.24	-0.57
CPI	-0.40	-0.05	0.06
M	0.70	0.39	0.41

Note: refer to table 1 for definition of variables. Data period is 1985-96. For Y, the numbers reported are actual volatility (standard deviation), not relative volatility.

Table 3. Calibration

Parameter	**Description**	**Parameter Values**
Preferences		
β	Discount factor, $r=(1/\beta)-1$	0.954
r	Real interest rate	4.8%(annual)
γ	Coefficient of intratemporal elasticity of substitution between consumption goods	0.93
σ	Coefficient of relative risk aversion	2.61
θ	Intertemporal elasticity of substitution in labor supply	1.455
b_m	Weight of imported goods (in consumption)	0.21
b_x	Weight of exported goods	0.11
b_n	Weight of nontraded goods	0.68
Technology		
Export Goods Sector		
ω	Share of labor income	0.48
z	Coefficient of intratemporal elasticity of substitution between capital and imported intermediate inputs	1.35
a	Weight of capital input in the CES composite	0.55
δ_x	Depreciation rate	0.13 (annual)
η_x	Elasticity of marginal adjustment cost function $\eta_x = -(\phi' / \phi'')/(i_x / k_x)$	10
Nontraded Goods Sector		
a_1	Share of labor income	0.38
a_2	Share of land income	0.22
δ_n	Depreciation rate	0.13 (annual)
η_n	Elasticity of marginal adjustment cost function $\eta_n = -(\phi' / \phi'')/(i_n / k_n)$	10
Other steady state values		
yn	Share of land in y_n	0.25
g_{yn}	Share of government expenditure in y_n	0.20
b_{yx}	Share of initial financial asset position in y_x	0
p_x	Initial terms of trade (index)	1
Φ	Adjustment cost of asset holdings	1e-4

Table 4. Characteristics of exogenous shocks

Persistence (AR(1) Coefficients)

Productivity shock (export sector) : A_{xt}	0.95
Productivity shock (nontraded sector) : A_{nt}	0.96
Terms of trade shock : p_{xt}	0.55
World real interest rate shock : r_t	0.70
Government spending shock : G_{nt}	0.95

Standard deviation (correlation coefficient)

	A_{xt}	A_{nt}	p_{xt}	r_t	G_{nt}
A_{xt}	0.0824				
A_{nt}	0.8727	0.0112			
p_{xt}	0.3520	0.2210	0.0137		
r_t	-0.4113	-0.5145	-0.5639	0.0127	
G_{nt}	0.0037	-0.1954	-0.0167	-0.0830	0.0094

Note: The diagonal terms are standard deviations and the off-diagonal terms of correlation coefficients.

Table 5. Simulated Second Moments

	Relative Volatility		Persistence		Co-movement with Y	
	Data	Model	Data	Model	Data	Model
Y	1	1	0.57	0.61	1	1
C	0.80	0.98	0.51	0.54	0.41	0.98
I	3.03	3.52	0.63	0.22	0.60	0.54
EX	4.27	1.03	0.54	0.68	0.32	0.98
IM	2.38	2.28	0.46	0.34	0.24	0.71
NX	3.54	1.30	0.41	0.57	0.22	-0.24

Comments on "Dynamics of Business Cycles in Korea: the Role of External Shocks"

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This paper addresses the important issues about the shock propagation mechanism in a small economy. The model Specification of the paper is particularly interesting because it can have rich simulation results. The model reflects key characteristics of small open economies. There are three goods: exportables, importables and nontraded goods. This specification can help us to handle the effects of open economic shocks such as shocks in terms of trade and shocks in the sectoral productivity and to investigate the responses of real exchange rate. It also assumes that domestic households can trade risk free international bonds with adjustment costs. This assumption allows us to avoid the complex monetary aspects in a small open economy. Without adjustment costs, however, the model may show larger volatility. I do not worry about the validity of these assumptions. Instead, I think that these model specifications will be something that we should explore to handle more issues related with international economies.

The objectives of the model are to understand business cycles in Korea through calibrating the model to fit the second moments of the real data. It does give a good fit, and the simulation results are very standard. It shows that consumption is less volatile than output and that investment and external balances are more volatile than output. The shock propagation mechanisms are also standard. There are four major findings regarding the shock propagation mechanism. First, a positive productivity shock in the exportable sector increases domestic price and appreciate real exchange rate. Second, a positive productivity shock in the nontraded sector, instead, shows the opposite price movements. The domestic price decreases, and the real exchange rate depreciates. Third, an improvement in the terms of trade has positive effects on investment(0.7%), output, and consumption (1.5%). Lastly, a decrease in the world interest rate (25bp) will give a positive impact on investment (4%).

Out of these results, I would like to pay a special attention to the third result. Recently, Korean economy experienced the reduction in investment and the sluggish movements in consumption. The main reason behind these movements may be partly explained by the recent movements in a term of trade. In Korea, the term of trade of 2000 was 100, and then it decreased to 86.1 in May, 2004. Even though the theoretical prediction about the impact of shocks in terms of trade is inconclusive, the proposed model has the possibility to explain the recent economic slowdown.

Even though the paper has many interesting things with promising model, the calibration and the parameters that the paper used are not convincing. First of all, the standard parameter values are different from the values that the Korean data set can support. For example, the labor share in the export good production used for the calibration is 0.429. but the actual labor share of the manufacturing sector is 0.481 in 2003. The depreciation rate of the model was 10% for both production sectors, but the actual value of manufacturing sector's depreciation in 2003 was 13.27%.

Second, the paper states that using the bond holding adjustment costs allow us to avoid the nonstationarity problem. I am not able to understand this statement. It may reduce the volatility, but the shock will persistently remain in the system. In this sense, intuitively the assumption is not directly related with nonstationarity problem, even acknowledging the fact that it increases the persistency of the shock generating process in the simulation according to Mendoza (1991, AER).

Third, the sectoral classification of industries is not intuitively right. Intraindustry trade is common. Even in the same industry, there are importable goods and exportable goods. The paper assumes that 'chemicals and chemical products' are importable. But I am not convinced by this classification, because 'chemicals and chemical products' are very important exportable goods.

Finally, as one of stylized facts, the paper listed the empirical result that net export is procyclical, but this is partly due to the data set. If the time span of the data set changes, then I think that the empirical result will change.

Even though the model needs a slight revision, I think that the model is promising in the sense that it can give us answers about the old issues by changing the model a little bit; 1) Is the correlation between investment and saving related with capital mobility? 2) Is current account countercyclical? More importantly, the model can be modified to answer the question of "Can the exportable sector lead the business cycles?" This issue is important because the Korean government tried to boost the economy by using the exportable sectors. Hopefully, the model can give some policy implications about the issue.

CHAPTER 7-1

A New Look at Development Economics through Korea's Experience

- The Paradox of Economic Development -

by
Sung-Hee Jwa[♣] *and Yong Yoon*[♦]

Abstract

Why have economists given up their search to discover the "secrets" of economic development? Is economic development too complex that there are really no discernable truths that might be useful when thinking about the subject? Through the reflection of economic life and the experiences of Korea's modernization, we take on the challenge to discover the principles of development economics. Specifically, "discrimination", we find, is the key to economic development, which we discuss thoroughly to build a discrimination-verticalism framework. On the other hand, we contrast this with its anti-thesis, the egalitarian-horizontalism world, which can be seen as the theory of economic digression.

The development paradigm presented in this paper is applied more concretely not only to help us understand better Korea's development experience of the past 40 years, but also to clear some perennial issues in development economics: namely, 1) the meaning of markets, 2) the roles of government and markets in economic development, 3) the dilemmas presented by democracy and positive economics, 4) the questions of income distribution, and 5) the controversies of conglomeration in economics and development. The discussions here are far-reaching, not only in the scope of socio-economic issues it attempts to address, but also in its highly philosophical attitude, which questions the very foundations of human existence and beliefs and, above all, the possibilities of economic progress.

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1.0 Introduction

It would not be far from the truth to claim that the birth of economics as an academic discipline begins with the ambition of man to find the "magic formula" towards building and sustaining a developed economy—an economy where every member of society would be free to explore life with minimal material constraints. Adam Smith (1723-1790) published *The Wealth of Nations* in 1776 with an appropriate title that reflected such an ambition. He set himself to understand how nations would acquire wealth and economic prosperity. Behind much of his writing was the perennial question: What is the secret of economic development? This fundamental question has over the decades continued to evade even the most brilliant minds, and it remains a sad fact that even after more than 200 years of rigorous academic discussions among scholars, policy makers, and others having set their minds to figuring out how an economy should be properly managed, a large part of the world's population remains bounded in the grips of poverty. Poverty, rather than wealth, it would seem, is an inescapable feature of the human existence.

The "dismal" science has not been completely devoid of usefulness, however. Adam Smith, the father of modern economics, wrote about the merits of the market system at a time when the world believed that a societies could function properly only under the diligent attention of political rulers needed to prevent a society from degenerating into disorder and poverty. *The Wealth of Nations*, provided a drastic different view of the world, an alternative to the Hobbesian understanding of the human condition, clearly demonstrating that self-interest and the exchange of goods and services do actually result in socially desirable outcomes, under the guidance of what he called the "invisible hand". Adam Smith's insight into the workings of the "lassez-faire" surely has proved to be one of the greatest intellectual contributions not only to economics, but also to humanity as a whole. Much of the truth behind his writings has been repeatedly demonstrated throughout the course of modern history.

Despite continued work by eminent economists and other scholars, many of them having helped deepen our understanding of the market economy, theoretically and in the real world, the market system has been far from being the panacea to many economic problems, especially, of the less developed countries in Africa, Asia and Latin America. Neo-classical economics, the reigning branch of the discipline, somewhat is turning out to have a dangerous impact in misguiding thinking in development economics. One purpose of this paper is to demonstrate how many contemporary concepts in economics, including the neo-classical paradigm itself, can be highly misleading, which has resulted in unrealistic objectives and the implementation of harmful policies.

At the turn of the new century, with still many countries lagging showing little signs of development, it would seem that a new paradigm shift in the discipline is warranted. This is not an easy task, as there remains strong skepticism regarding whether an alternative way to view the economy beyond what has already been demonstrated by Adam Smith is indeed possible. Irma Adelman, who has been thinking about economic development throughout most of her academic career, has a few interesting conclusions about the state of the subject in the 20th century. Adelman (1999) has presented four principles regarding the development process, namely: 1) The development process is highly non-linear, 2) Development paths are not unique, 3) Initial conditions shape subsequent development, and 4) The development path of countries is not only non-unique but also malleable. Points 1 and 2 are quite reasonable observations about the development process, and remind us that economic development differs much from, say, the (physical) growth or simple elongation or expansion of typical animals or plants. Surely enough, things are much more complex when it comes to the interplay of conscious beings. Point 3 is somewhat controversial, and seems to lose its punch in light of point 4. The debates surrounding point 4, the malleability of development continues to enjoy considerable attention by development economists. The debate between the efficacies of policy versus institutions as the primary cause of development is a recent example,[1] which echoes the debate between the roles of government versus markets in economic management. Sometimes, it might be puzzling why economists are so split on the issue of governments and markets, or regarding the role of institutions and policy, and so on. Is the discipline just going in circles? Surely, although such distinctions may have analytic conveniences, it often clouds the fact that the human interaction takes place in a highly complex and a tightly intertwined social fabric, which often are better understood jointly rather than separately.

To be sure, we adopt a more holistic approach to understanding the economic development process. In this paper, we ask some very old questions about economic development, and try as best to give answers from the principles of development economics presented here. Be warned that some of the results will have very surprising and non-standard interpretations. Yet, this paper is simple and non-technical: the only pre-requisite to reading and understanding what follows is an open mind.

2.0 The failure of development economics

Perhaps, it would be useful to summarize the evolution of the discipline of development economics such that whatever following discussions might be placed into proper context. The beginnings of modern development economics can be traced to around the mid-1940s,[2] when the economic problems of newly de-colonized countries in Asia and Africa brought the attention of economists of former colonial powers, perhaps by a sense of "obligation" to help "develop" the newly independent states. At about that time a consensus appeared that there was need to better our understanding of the forces of development to help, above all, the design of appropriate policies to achieve economic development in the former colonies.

Under the influence of the neo-classical school, the term economic development was constituted to mean the increase in per capita income. Solow (1956, 1957) is the hallmark of the neo-classical growth model which argues that economic growth consists of 1) growth in the labor force and stock of capital, 2) improvements in efficiency with which capital is applied to labor through greater division of labor and technological progress, and 3) foreign trade that widens the markets and reinforces the other two sources of growth. Hence, as long as growth favored income-generation, savings were guaranteed and additional capital accumulation helped cause growth. And with capital accumulation, demand for labor would rise and the growing labor force would be absorbed in productive employment. Beyond the technicalities of the Solow model, the primary mechanism driving growth has been the market, including foreign markets, which is to be seen as most important factor promoting the division of labor and driving economic growth.

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[1] Glaeser, Edward L., Rafael La Porta, Florencio Lopez-de-Silanes, and Andrei Shleifer (2004).

[2] See, for example, Meier and Seers (1984) and Arndt (1989) for a lively discussion of the development of development economics.

The neo-classical doctrine was not fully accepted by all countries. In fact, in the 1950s and early 1960s, development policies of many countries began to emphasize the maximization of national income through capital accumulation and industrialization based on import substitution. Some governments even turned to central planning in view of a distrust of markets and a belief in the pervasiveness of market failure. Bhagwati (1984) vividly described the general optimism of what could be accomplished by emphasizing planned investment in new physical capital, utilizing reserves of surplus labor, adopting import substitution industrialization strategies, embracing central planning, and relying on foreign aid. Policymakers were adopting such policies not simply because of advice from economists, but also because of ideological and political reasons.[3]

As history progressed, and regressed for quite a proportionately more number of countries, pessimism about the neo-classical view of economic growth began to appear. Scholars created the new endogenous growth models, which extends the Solow model from its diminishing returns to capital and labor formulation by allowing for increasing returns due to specialization and investment in "knowledge" capital, and by doing so claimed better conformation to evidences in diversity of growth rates among countries in the world.[4] All the technical advances aside, the new growth theories were far removed from answering the perennial questions of what caused growth, and more importantly, economic development.

With no clear answer in sight, from the 1980s onwards, economists began to approach development economics with different areas of focus, and at times, with little consensus between different views. The World Bank, for example, emphasized redistribution with growth; the IMF looked to financial stability; the ILO concentrated on basic human needs; development debate in general seemed to move away from industrialization to rural development issues; social issues were juxtaposed with economics ones (e.g. feminism, AIDS, child labor, etc). For better or for worse, development economists today can be found addressing a wide range of socio-economic issues.

Development is undoubtedly a complex phenomenon. As is evident from the discussion so far, there seems little hope in finding the "right" answer not only to why some countries remain underdeveloped, but also how countries might realize sustained development into the future. If development economics cannot become a coherent and consistent branch of knowledge, then there is reason to question its very existence as a separate discipline. This is even more critical, if we consider the fact that the goals of economics and that of development economics are in fact the same—that is the improvement of society's material well being. In this case, one may ask whether in fact it is the whole of economics that is at stake. Before we lose all hope, we invite the reader to go over the next few pages, which lay out what we think to be the positive theory of development economics. We in no manner pretend to try rescue the "dismal" science. That is not the task of a single person, but this paper, we hope, will help further discussions about development economics along a slightly, and hopefully, better path.

3.0 Fundamental principles of economic development

Before we present the principles and corollaries of development economics, it should be useful to start by discussing what economic development means. For one, as is

[3] See for example Hirschman (1968).

[4] See for example Romer. (1994).

commonly understood, economic growth and economic development can be quite different things. The former often emphasizes mainly a quantitative change, while the latter emphasizes both qualitative as well as quantitative change. In the literature, there are many terms that have been associated with economic development such as the "increase in economic wealth", "reduction of poverty", "improvement of material well-being", "improvement of the quality of life", and so on. Many of these are left purposely very general and are often subject to different interpretations. For the purposes of this paper, without any intention to add to controversy, we will try and pin down the definition of development as follows:

Definition: Development is the state in which every member of society is getting successful.

Development, we believe is a dynamic process, and not a terminal state, of progress. The notion of development embodies movement towards an improved state, whichever way defined. It is in this sense that being "successful", which is usually defined by the individual in the context of prevailing social norms under formal and informal constraints, describes best the process of development. It is the spirit or perceived and realized potential for betterment of oneself and/or one's society that fuels or motivates people to pursue their respective goals in life. Simply put, without such energy or spirit to better oneself, society is likely not to experience any kind of progress at all. We further elaborate that such desire to move forward is subject to whether the society has in itself the in-built mechanisms that will allow for success.

To help us understand the message of this paper, perhaps it would be helpful to start by keeping at the back of one's mind the idea that progress, or economic development, is only possible if some in-built ladder is placed firmly in the country's social and economic system. This ladder in its vertical position should allow individual economic actors to progress (move up the ladder) or to regress (move down the ladder). Overall, as each actor rivals each other to gain a better position over his/her competitors, the whole of society should move upward, or more precisely, advance to a higher stage of development.

One important implication, and this will be explained more fully later, is that there will be individuals at the very top of the ladder as well as individuals at the very bottom. Naturally, those at the top will benefit more, as they are the ones contributing more to the economy compared to their neighbors, for whatever reasons. This asymmetry of economic reward should however not pose as a problem as long as there is social mobility and every capable individual is in fact on the ladder, such that through one's ability and effort, each can reap their economic fruits depending on their contribution to the economy.[5] We will more formally state this fundamental economic process shortly.

Unfortunately, not everyone swallows such simple reasoning, and it can be observed that many often favor a ladder in the lying down position. The idealism of egalitarianism, much of it propagated by great thinkers themselves, has become increasingly discernable in the modern society, especially with the popular spread of democracy as the most favorable political arrangement. Political philosophy in many democracies across countries, including Korea, has increasingly tended to seek the equalization of outcomes of individuals in society. Furthermore, it is hardly an exaggeration to say that much of the egalitarianism that derives from modern political philosophy has permeated into

[5] Interestingly, throughout the course of history, there are numerous examples of the rise and fall of certain people, countries, organizations, empires and even ideas. Being a leader or follower has never been permanent, and change is inevitable.

economic thought and policy, which has dangerously tended to oppose the spirit of rivalry for success in society.

Thinking about how to establish the vertical ladder into a society's socio-economic fabric is therefore indispensable when thinking about economic development. Interestingly, all societies tend to have, albeit in varying degrees or intensity, an inbuilt ladder that allows for progress. However, we need to understand the intricacies that promote or diminish the efficacy of development.

It might help to look around and make some very general observations. In everyday life, it is easily observed that each and every person interacts with others in many ways through different institutions to various extents. For example, in the economy, consumers buy different kinds of goods and services; the worker participates in the labor market selling his or her labor and skills, and different employers purchase labor of different quality; the saver and investor interact through the country's financial system providing funds for loans, investment, and so on. All such activities take place in what are known as markets. Markets come into existence in space and time with the simultaneous interaction of people with each other. Note however that markets need not be confined to the simple exchange of economic goods and services. Rather, the market should be understood in a broader context involving all types of human interaction. For example, we have voters voting for their favorite politicians in the "political" market, which is conditioned by the country's parliamentary and judicial systems, and, we can also observe family members interacting within the family, and so on. This broad concept of markets is akin to Hayek's interpretation of the market order as the most advanced and sophisticated aspect of social order.[6]

Without disregarding the important insights of Hayek's work as well as of many other scholars, we believe that still a more fundamental point needs to be emphasized. This is the fact that in every human interaction of whatever kind, what is absolutely fundamental is the exercising of one's discriminatory power. This is easily understood if we recognize that whatever types of social interactions, the multifaceted process of making everybody's business everybody else's business is unanimously present. Personal as well as peer judgment is embodied in social interactions, which should be seen as exercising one's discriminatory power. This discrimination, which occurs through social interaction, is what helps us "select" one thing over other alternatives. Put simple, human interaction in the market place is nothing more than the practice of discrimination.[7]

After all, the consumer by choosing to purchase a certain product over other alternatives is in fact exercising his or her discrimination power. That is, consumers are choosing a particular supplier (or producer) over another, say, with their "purchasing power". Similarly, an investor choosing to buy stocks of a certain company is exercising his or her discrimination power by favoring that particular company's stock over other securities available in the market place. By exercising individual preferences, certain things are favored or selected over others, i.e. an act of pure discrimination. Outside of the economy, other examples are plentiful: a student choosing to register for a certain course exercises his or her discrimination power over other courses offered in the semester; parents and their children interact to decide whether the child gets to go to summer camp or to summer school; citizens in a democratic society, we might say,

[6] Hayek goes further to put it that the market order is often the spontaneous and unplanned consequence of the interactions of dispersed individuals with limited knowledge, and not the work of a single designer.

[7] The use of the term discrimination in the context of this paper first appeared in Jwa (2002).

exercise their “voting power” to keep a certain party in power over an opposing party, and so on and so forth.

At this stage of the discussion, we could possibly state the Law of economic discrimination, namely, “God helps those that help themselves”.[8] Consequently, economic discrimination[9] has far reaching implications in that it decides what in the economy is selected, and which will enjoy sustaining power, versus those that are simultaneously not selected, and which are set quickly on their path to extinction if they do not improve or adjust promptly. Since, by definition, “successful” economies come into existence with “successful” economic items,[10] sustaining “successful” economic items through discrimination allows for economic progress. In sum, the interaction of economic actors involves the exercising of economic discrimination power, and this is both ubiquitous and vital for the survival and progress of economies. This discrimination, in effect, helps erect the vertical socio-economic ladder that allows for development. This is summarized as Principle 1 as follows:

Principle 1: Economic discrimination is a necessary condition for economic development.

We have already mentioned that defining “successful” and “unsuccessful” economic actors and their behavior is subjective and often endogenously defined. To add one more aspect regarding success, we might say that on the minimum, “successful” economic actors should be serving to their societies under the Law of economic discrimination, and since every market order has its set of objectives, norms, and way of operation, we can assume that constant evaluation with respect to some socio-economically defined benchmark is fundamental to make judgment about “success” and “failure”. The bottom line is that an economy that refuses to discriminate between viable and non-viable economic entities and their behavior is bound for failure, while one that is constantly evaluating performance and rewarding “successful” economic behavior (while correcting “unsuccessful” ones) is quickly set on their development paths. Put succinctly, “differences should be treated as differences” and never as equals.

The importance of differences cannot be over-emphasized. By differences, we implicitly acknowledge diversity, which is a natural and important feature of existence. If positive change can only be initiated through economic discrimination, then diversity is absolutely required. This is stated in Corollary 1:

Corollary 1: Diversity of economic actors allows for the functioning of the discrimination mechanisms. Economic discrimination cannot happen without diversity.

In economics, this means at least some difference should be maintained between any two economic things. Diversity with respect to some economic criteria allows for the discrimination mechanism to function. This may look like trying to split hairs, but we are

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[8] This is quite a universal saying, which can be found in many societies. In the East, Heaven replaces the notion of God: so we have, “Heaven helps those that help themselves.”

[9] Perhaps, we should warn that economic discrimination, which makes rewards on the basis of economic contribution, be distinguished from political discrimination, which is based on political criteria such as race, social class, sex, and so on. Many authors including economist such as the Nobel laureate Gary Becker have studied political discrimination extensively.

[10] Of course, there are exceptions. Even Brazil with the best soccer players in the world, occasionally loses against other national teams. On the other hand, societies with “poor” economic actors cannot be a “good” economy.

not actually far from describing reality—it is easily observed in the real world that differences exist everywhere. What we are emphasizing is the importance of economic diversity; say, between goods and services, across laborers, firms, banks, incomes, economic functions, and so on.

At this point, one might ask: What comes first, discrimination or diversity? To us, this is just the chicken and egg question. Interestingly, the concept of diversity, which is a fundamental concept in Darwinian evolution, has nothing to say about progression or regression. Diversity alone cannot explain economic development. In contrast, economic development, which is only possible among conscious human beings acknowledges the notions of progression as well as regression, can only be explained by the Law of economic discrimination. Hence, we might choose to place discrimination "before" diversity to crown it as the first fundamental principle of development economics. Diversity would in our context remain as the canvas upon which discrimination draws its picture.

The other side of the coin of economic discrimination is the reward to "successful" actors for their effort and contribution to the economy. If we are to "reap what we sow", then the discrimination mechanism will reward as well as sustain the most "successful" economic actors, many of who, over time, will quite naturally receive the bulk of the economic reward. Furthermore, since efficiency drives further efficiency, "successful" economic actors will then tend to attract and command increasingly more resources, often further increasing not only its economic size, at least up to the point when diseconomies of scale might be realized, but also its role in the economy as well.[11] Returning to our analogy of the ladder introduced earlier, it is easy to see that those at the top of the economic ladder will tend to command greater amounts of resources associated with higher productivity and economic reward (profit). This is what we call the "conglomeration effect" of economic development. The sharpness of economic discrimination can help speed up conglomeration and development. And, as we have just argued, since conglomeration is nothing but the other side of the coin of economic discrimination, we can conclude that the more "successful" the economic agent, the more the economic reward and the greater the control of resources. That is, the more intense the economic discrimination mechanism, the greater the conglomeration effect and the faster the economic development process. We summarize the conglomeration process of economic discrimination as Principle 2:

Principle 2: Conglomeration or the amalgamation of economic resources and activities is a natural process of economic development, which is intricately tied to the speed of economic development.

Interestingly, the two principles of development economics mentioned thus far inevitably imply an economy having "unequal" economic outcome. This has given birth to the idea that we need to pursue a more "balanced" growth, that is, growth that would mitigate disparities in economic outcome, whether it be in terms of income, wealth, and so on. In our view, "balanced" growth cannot be divorced from the vertical ladder that must be present for development to happen, and as such, whatever disparities along the

[11] One might ask then whether there are no limits to growth. For example, we would like to believe that efficiency would eternally drive further efficiency. But in real life, growth and development are hardly regular or linear processes, and are subject to many uncertain factors that might stunt or even reverse development. But at the same time, true to our definition of development given earlier, there is no reason to believe that development has any upper limit.

vertical ladder need not make one to associate economic discrimination with "unbalanced" growth. Rather, the concept of "balanced" growth should be placed in its vertical position to mean economic development guided by the Law of economic discrimination, which also implies that disparities of economic outcomes are inevitable. We shall elaborate this aspect further when we return to issues of income distribution. For now, we summarize what we understand to be balanced growth as Corollary 2.

Corollary 2: Balanced growth is not a "horizontal" but "vertical" notion.

To contrast with Principles 1 and 2, we establish the concept of "equalization" as the anti-thesis of discrimination and conglomeration. Interestingly, the concept of equalization is intricately associated with "horizontalism", which can be understood by more technical terms such as homogeneity.[12] This can be simply seen as the position in which the ladder is in fact lying down. The upshot is that equalization although acknowledging differences does not treat differences as differences, but rather motivates deliberate action towards mitigating or nullifying differences in favor of creating equal outcomes. It is not difficult to see that equalization then is also not supportive of diversity. With equalization, which is diametrically opposed to discrimination and diversity and conglomeration, an economy is quickly set on its path to digression. This is stated as Principle 3:

Principle 3: Equalization is the first step towards economic digression.

When speaking of development, it is critical that at the very least a 2-dimensional framework be kept in mind—assign a hypothetical "vertical" position as "discrimination" with its orthogonal "horizontal" position as "equalization". Note also that we have already mentioned these aspects in Corollary 2. "Vertical" and "horizontal" are relative notions in respect to the developmental space. The aforementioned analogy of a ladder "standing" and "lying down" is again quite useful. In order to reach a higher plane, the ladder must be standing, that is, it must assume the vertical position so that "higher" levels become reachable. On the other hand, a lying ladder is akin to no ladder at all—being parallel to the "horizontal" axis, it does not span the development space. Keep in mind that development is a "vertical" concept with progress being possible through discrimination afforded by the in-built ladder. We summarize the concept of "verticalism" in relation to the development process as Corollary 3:

Corollary 3: "Verticalism" is to development as "horizontalism" is to digression.

We have established the two opposite forces of economic development—discrimination and equalization. Armed with these two concepts and the three corollaries established in this section, we further investigate their meaning by looking back over Korea's development experience over the past 40 years. We chose Korea, not only because it is convenient to apply the principles of development economics stated above, but also because we wish to take up the challenge of explaining Korea's economic growth and stagnation, something that existing development paradigms unsatisfactorily explained.[13]

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[12] Other terms with similar connotation are "egalitarianism", "equality", "socialism", "uniformity", "collectivity", and so on.

[13] The same seems true when looking at Africa. Many scholars have spent much time trying to

4.0 Re-interpretation of Korea's economic development

4.1 Act A. Economic discrimination in action (1): Korea's economic policy in the 1960s/1970s

Korea's export development strategy of the 1960s and the Heavy and Chemical Industries drive of the 1970s are well documented. How do our principles of development economics fare in the early two decades of Korea's modernization? What were the discriminatory features of these economic policies? For one, the export-oriented policy was based on a comprehensive incentive system that introduced and channeled important resources into the best performing export sectors. All exporters, regardless of what they exported, were eligible for preferential access to foreign loans and to preferential interest rates, and were allowed also to import, usually on preferential terms, machinery and intermediate inputs needed for manufacturing export products. In a sense, it can be argued that industrial policy involved neither "functional intervention" (addressing only specific types of market failure) nor "selective intervention" (influencing the industry-specific composition of the economy). True, but behind the apparently "neutral" export-oriented policy, there was much preparation and work involving regular meetings for evaluation and rewarding of good business performance (measured in terms of exports) carried out by the government personnel. At the end of each month, and even more dramatically at the end of the year, the Export Promotion Committee headed by the President reviewed progress of specific firms and industries, and prepared necessary measures toward meeting export targets. Moreover, public recognition was also bestowed on successful exporters by awarding them with achievement medals—a citation that provided entrepreneurs with enormous social prestige, as well as further tax and financial support. Financial resources, in particular, were allocated to successful firms not only as a result of the government's industrial policy, but also as voluntary response by banks that reacted to favorable signals from the evaluations and outcomes of the export meetings. The upshot is that the government through such "export contests" placed discrimination at the center of industrial policies.

In the period of the Heavy and Chemical Industry drive, the discrimination process was hardly toned-down. For example, HCI support was directed at those firms that had a certain minimum base to participate in the HCI package. The Promotion Plan for Heavy and Chemical Industries specifically stated that companies wishing to enter the HCIs must procure at least 30% of total investment with their own capital. In this way, mainly enterprises that had grown in the 1960s were selected again, because these companies were the only ones able to put out such a large amount of capital, which they acquired under the export wave of 1960s.[14] This is evidently a highly discriminatory system, which aims to build upon the capacities of firms that had grown in the 1960s. Arguably, if the potential enterprises were neglected, the HCI plan would have taken an even longer time to achieve its policy objectives, or might not have been successful at all. Although the

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understand Africa's economic problems and dilemmas—many "solutions" by "experts" have been suggested; yet economic development remains evasive for many African countries to this day.

[14] One more reason was that the heavy and chemical industries required a large production scale and therefore large amounts of money, giving a relative advantage to the big enterprises that had financial and managerial experience and ability.

HCI drive pushed for rapid conglomeration, there were negative consequences such as the so-called chaebol problems.[15]

4.2 Economic discrimination in action (2): Korea's social transformation policy of the 1970s

Policy in the 1970s not only attempted to speed up economic development, but also aimed at modernizing society on the whole. In the rural areas, for example, under the Saemaul Undong (New Community Movement), the Ministry of Home Affairs aimed to modernize rural villages. Villages throughout the country were classified on the basis of performance and level of development into three categories: 1) basic (underdeveloped) village. 2) self-help (developing) villages, and 3) self-reliant (developed) villages. This ranking of villages, through recognizing differences as differences, was augmented by an objective rewarding system—the government adopted a different approach for each class of village. Most importantly, higher assistance (not lower assistance) went to higher-level villages. This discrimination spurred competition among villages particularly stimulating the lower villages to exert more effort towards advancing to a higher-level village in order to benefit from government support. The Saemaul Undong is a clear example of the discrimination principle at work.

Given that Korea is well known for her strong Confucian ethos that tends to stress egalitarian principles, it may be somewhat surprising that such a highly discriminatory policy, which proved to be very decisive in placing competitive entrepreneurs and firms as well as the successful Saemauls into the forefront of Korea's economy, as well as transforming the rural areas, was to become instrumental in driving social, as well as economic progress for nearly two decades.

4.3 Quick recap (1): The growth decades—1960s/70s

In our discrimination-verticalism framework, we have shown that Korea's economic development over the two decades of the 1960s and 1970s has been possible because of highly discriminatory policies—"government-led discrimination" seems to be an appropriate term to describe this era. The export-orientation policy, the HCI drive and the Saemul Undong movement, each contained a consistent economic criteria backed by regular evaluation and reward of superior performance. Principle 1, in short, was fundamental to realizing the growth "miracle" of the 1960s and 1970s.

Result 1: Korea's export-promotion strategy and the Heavy and Chemical Industry Drive were highly discriminatory policies.

The "conglomeration" process on the other hand with respect to the HCI drive is consistent with Principle 2 of development economics laid out earlier, which argues that conglomeration is a natural result of economic progress.[16] What the HCI plan demonstrates is that developmental constraints can be overcome and the "catch-up" phase considerably shortened through the sharpening of the discrimination process. The result is increased amalgamation of economic resources, for the better or for the worse.

Result 2: The degree of conglomeration can help speed up economic progress.

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[15] For a discussion of the chaebol problem, see Chapters 1 and 3 in Jwa (2002)

[16] It seems impossible to site any contrary evidence.

At this stage of our discussion, one could also ask what the term "neutrality" means in regards to economic policy. Can and should government policy be "neutral"? Contemporary literature points out that the export-oriented strategy was "neutral", and according to the usage of the term, being contrasted with "sector-specific" policies of the HCI drive, "neutrality" seems to mean not-sector-specific. We ask whether there is need to differentiate between "neutral" and "sector-specific"? The answer is simply, No. It was indeed because of the inbuilt discriminatory mechanism of the export-orientation policy and the HCI drive, and not its "neutrality" or "sectoral-bias" that stimulated Korea's economic growth and development in the 1960s and 1970s. Also, we warn that it is easy and dangerous to misinterpret or confuse "neutrality" as meaning "non-discriminatory":

Result 3: Policy need not be "neutral" or "sectoral-specific" to be successful. Discrimination, rather, is the key to economic development.

4.4 Digression: Was there a break around the mid-1980s?

We interrupt our policy discussion at this stage to present some empirical investigation for structural break around the mid-1980s. A series of popular tests for structural breaks exist in the economics literature. In the econometrics literature, structural breaks may be modeled assuming continuous or discrete change. The F-test for parameter stability by Chow (1960) and the CUSUM test of Brown, Durbin and Evans (1975) are perhaps the most representative of discrete-time and continuous-time change, respectively. Recent state-of-the art econometrics techniques in searching for structural shifts are capable of tackling non-linear time series and include the markov-chain model (MSM) for regime switching for discrete change and the time varying parameter state-space models for continuous change.

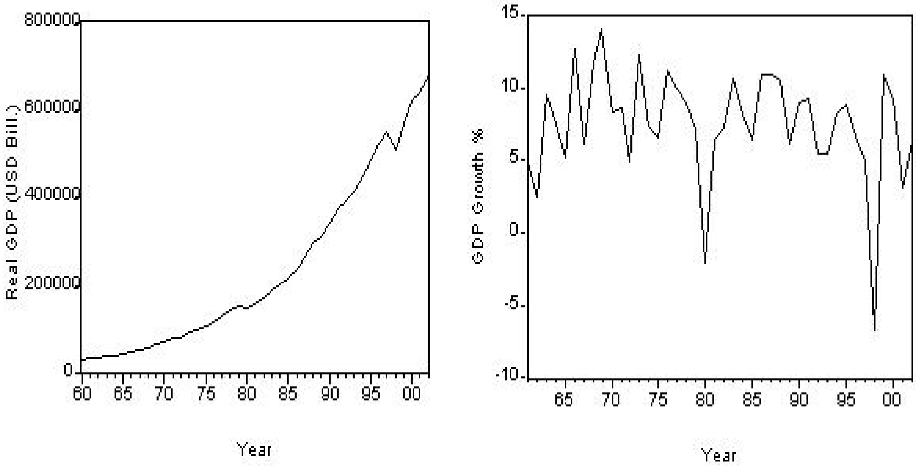
Arguably, discrete change will be picked up by continuous time models most of the time, but the opposite is less true. For example, discrete change methods failed to detect some structural change in the GDP series for Korea prior to the 1997 crisis, particular the gradual change that describes the post 1980s period. The continuous time model did reflect this change. What follows is a summary of results for various tests of structural change for Korea over the past four decades. We apply the various models, both continuous and discrete models, to a selection of time series variables including not only real GDP, but also total factor productivity growth, domestic demand, return on investments, equity and sales, and others.

4.4.1 Detecting continuous or gradual change

According to World Bank statistics, Korea's real GDP in 1995 prices rose from USD 33 billion in 1960 to 680 billion by 2002 (see Fig <1>). Korea once behind in terms of GDP compared to many African and Asian countries in 1960 expanded by 20 times in a little over 4 decades to become the 12th largest economy in the world. In terms of real GDP growth an impressive average of 7.5% growth was maintained. Only one other country in the world, Botswana, managed faster growth of 9.7%.

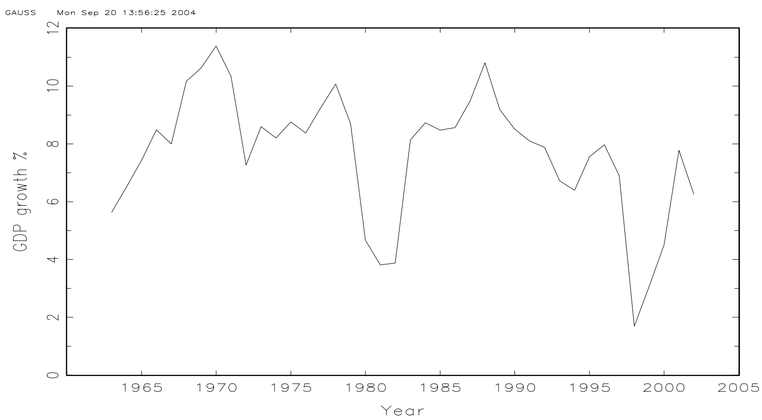
The figure for Korea's GDP below shows two striking negative growth rates in 1980 and 1998. With the exception of 1970, there seem no definite peaks in the GDP growth rates.

Fig 1. Real GDP Level and Growth: 1960-2002



A quick glance at the 3-year moving average for real GDP growth, while continuing to show a peak at 1970 in addition displays two more interesting local peaks in 1978 and 1988 (see Fig. 2).

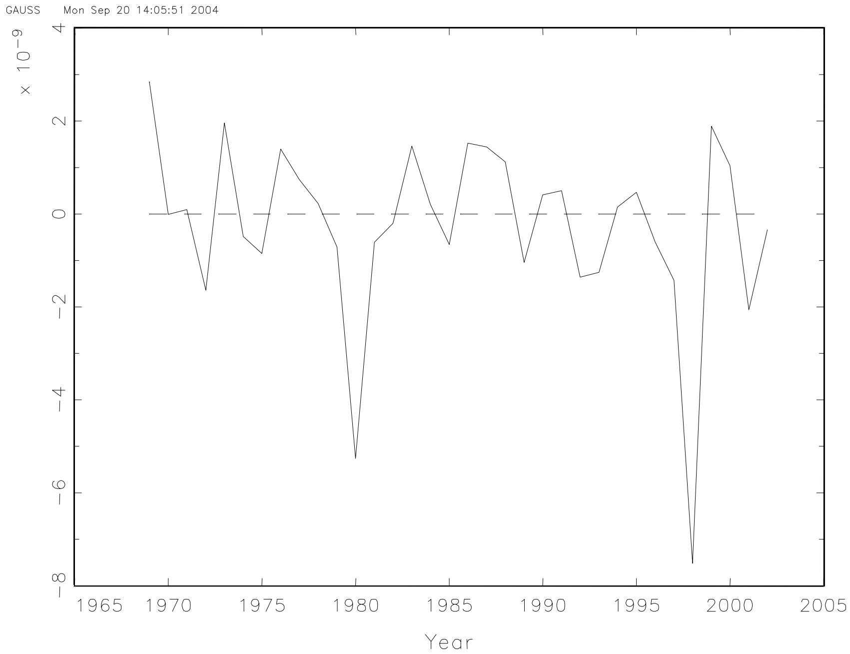
Fig 2. Korea Real GDP Growth 3 YR Moving Average



Although, our cursory look at real GDP suggests some breaks, further empirical testing is required to get more precise understanding. For example, we need to identify in the data, for example, the years for which Korea might have experienced important structural shifts? Also, we could question whether such structural shifts were abrupt or gradual, and also by studying other variables, we might look to see which sectors were most seriously affected.

There is considerable debate whether macroeconomic data should be considered as exhibiting fluctuations around a smoothly growing trend or as Nelson and Plosser (1982) contend, rather than linear detrending, first differencing for nonstationary series would be more appropriate, which means describing data as random walk with drift as opposed to a straight line. To begin with, we use the same method of Clark (1987) to decompose the GDP series for the period 1960 to 2002 using the Kalman filter into a random walk (stochastic trend) component and a stationary (cyclical) component. The cyclical component for the log of real GDP is presented below. As expected the crisis periods of 1980 and 1997 are shown.

Fig 3. Cyclical Component for Real GDP



Removing the cyclical component, we are left with the time-varying coefficient as shown below. What is clear is that there is a drop in the coefficient as from 1978/79 onwards. The recovery between 1981 and 1987/8 never quite reaches the previous peak. From around the 1990s onwards, there is quite a distinct decline culminating in the 1997 economic crisis. The test for continuous change shows a gradual structural shift in the 1979/80 and 1987 onwards.

Fig 4. Stochastic Trend for Real GDP

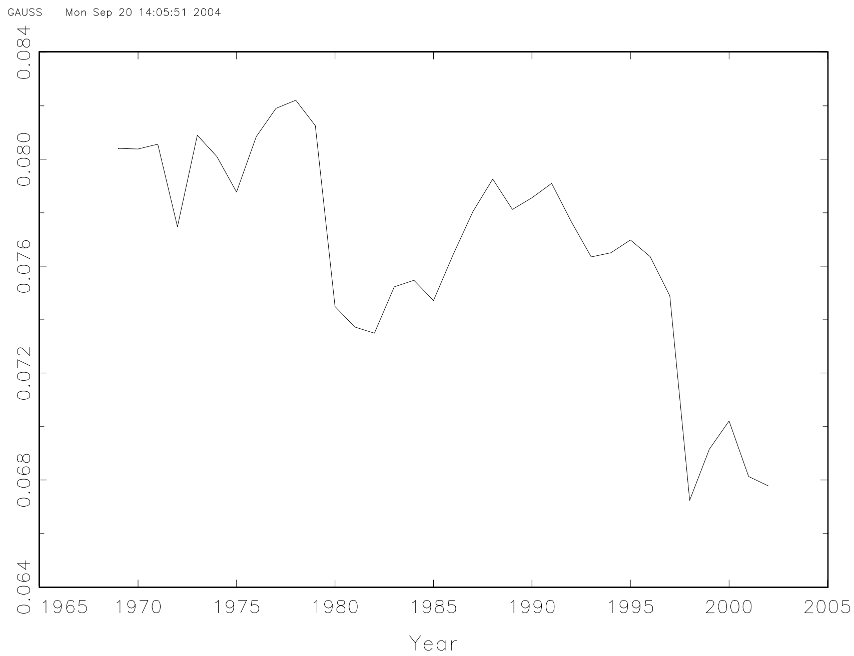


Table 1. Output for TVP model

Likelihood value is 63.206198

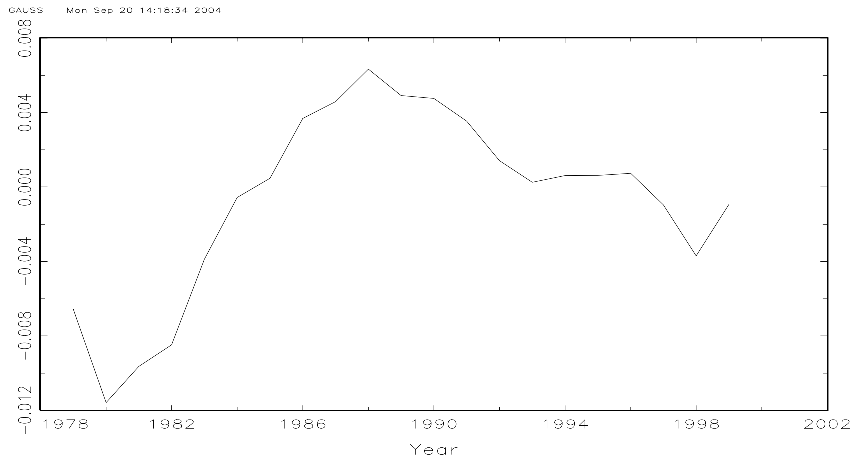
Estimated parameters (standard errors) are:

σ_v	σ_e	σ_w	ϕ_1	ϕ_2
1.009922	9.366428	3.959105	0.036440	-0.035159
(0.00470)	(0.000873)	(0.004509)	(0.019512)	(90.005529)

Besides GDP, data on total factor productivity (TFP) growth show that the average for 1988 to 1997 was significantly lower at –0.97% compared to 0.61% for the earlier 1971 to 1987 period.[17] The same Kalman filter method was used to decompose TFP into a random walk (stochastic trend) component and a stationary (cyclical) component. We show below the stochastic trend for Korea's total factor productivity; a noticeable decline form mid-1980s to 1992 can be observed, which is followed by a small improvement up until mid-990s, but this never reaches the level of the early 1980s.

[17] If we break down the TFP figures into their constituent parts such as efficiency of resource allocation, economies of scale, and so on, a similar declining rate is observed.

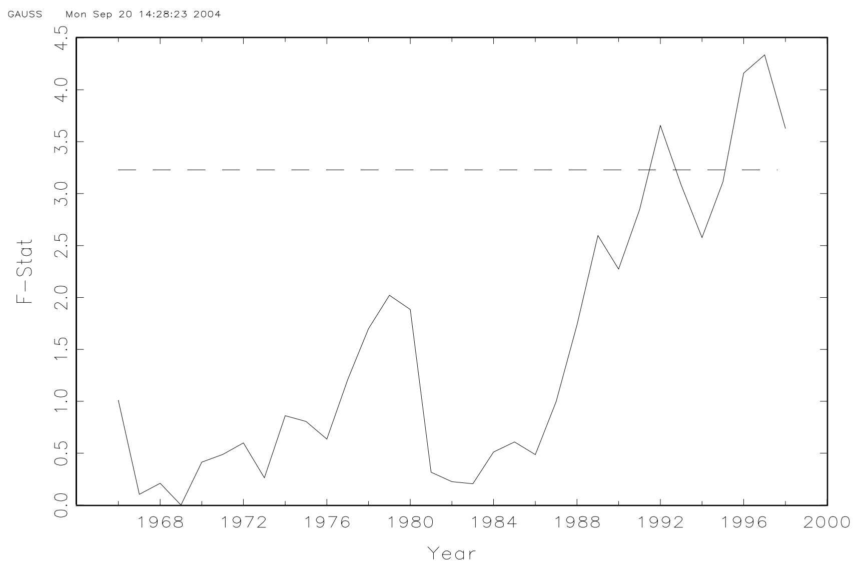
Fig 5. Stochastic Trend for TFP



4.4.2 Detecting discrete structural change

We also carried out a number of tests for discrete structural break (see the Appendix for details of the various econometrics techniques investigated). For GDP growth, structural breaks can be dated at 1992 and 1997/8, but the period around the 1980 is not picked up as strongly (see diagram below).

Fig 6. F-Stat for Max-Chow Test on Real GDP



We also applied the Max-Chow test on a number of other economic variables, the results of which are provided below (also see the Appendix).

Table 2. The Max-Chow on Other Economic Variables

Other Variable	Break Years	F-stat
Domestic Demand	1993, 1995, 1996	3,1, 3.7, 3.7
Return on Equity	1979, 1990, 1997 (local max)	18.1, 20,2 and 18
Fixed Investment	1991, 1997	7.2, 7.3

The table above shows the results of the Max-Chow test on other economic variables for which breaks are statistically significant. The CUSUM, MSM and Dummy-regression models give more or less the same results (see Appendix for further information).

From our empirical analysis, we conclude that there is consistent empirical evidence to believe that the Korean economy changed gears around the period 1979/80, 1988/90 and 1997/8. We now return to explain why there was a change around the mid-1980s under the development economics framework presented earlier.

4.5 Act B. The revenge of egalitarianism (1): Korea in the post mid-1980s

In the late-1970s, the government became concerned with economic stabilization and welfare issues as resistance to Park Chung-hee's 18 years rule intensified. A stabilization plan was announced in April 1979, and following the assassination of Park Chung-hee on October 26, 1979, the central focus on HCI within government policy was quickly removed. Inflation concerns following the "high-investment" in HCIs and the expansionary monetary policy, as well as the poor export performance and harvest failure in 1980, became the main concern of economic policy.[18] The government went further than simply refraining from HCI policies, and redirected policy more broadly and "equally", for example, to support technology-intensive industries. Although government involvement in the HCI sector did not stop here—the government throughout most of the 1980s closely interfered in industrial and corporate restructuring—from the 1980s the amalgamation of resources into certain firms and industries were certainly discouraged. In a sense, de-concentration of economic entities became increasingly popular, as if to reverse the policy effects of the 1960s and 1970s.

Leipziger and Petri (1994) place the principal reference date and period when Korea's industrial policy shifted when support for HCI was replaced by support for research and technology, which was clear articulation in the Fifth Five-Year Plan (1982-86).[19] They

[18] The international economic environment in the early 1980s was extremely unfavorable—a situation that further restricted Korea's exports, and encouraged the new government to concentrate on stabilization, and in its first two years on controlling inflation.

[19] The Plan specifically emphasized the establishment of institutions to train scientists and to conduct basic and applied research so as to advance technology development. Institutions such as the National Project for Research and Development, in 1982, were established to fund public as well as public-private R&D products in the fields of electronics, chemistry and engineering. Furthermore, new tax incentives under the Technology Development Promotion Act were strengthened in 1981.

write that, "Korea's new industrial policy was formalized by the Industrial Development Law of 1985 and the simultaneous repeal of selective industrial promotion laws."[20] Obviously, different dates could be considered as candidates, but we chose Korea's 29 June 1987 democratization pledge as the turning point in the country's economic history. We do not dismiss this era as purely negative. The political change is most welcome, but good politics should not necessarily be interpreted as good economics. Most critical was the amendment in 1987 of Paragraph 2, Article 119 of the Korean constitution that reads, "the state may regulate and coordinate economic affairs in order to maintain the balanced growth and stability of the national economy, to ensure proper distribution of income, to prevent the domination of the market and the abuse of economic power and to democratize the economy through harmony among the economic agents". Quite significantly, many of the ideals of what a modern society should be can be literally read of this Act: Economic policy, and Korea's public policy at large, has since come under the influence of such terms as "regulation", "balanced growth", "proper income distribution", "domination of market", "abuse of economic power", "economic democratization", and so on and so forth, which are accepted as "norms" even by the general public and media.

At this point of our discussion, we need to bring in the political world, specifically, egalitarianism, which can be seen as the political expression of equalization (referred to Principle 3). Egalitarianism is a contested concept in social and political thought. The Stanford Encyclopedia of Philosophy puts it that egalitarianism is a trend in political philosophy, that favors equality of some sort—people should get the same, or be treated the same, or be treated as equals, in some respect. That is, egalitarianism is a protean doctrine, because there are different types of equality that might be thought to be desirable. Most relevant to our discussion on economic development is that the term "egalitarianism" is often used to refer to a position that favors, for any of a wide number of reasons, a greater degree of equality of income and wealth across persons than currently exists. To bring the conclusion of this paper forward, we warn against egalitarianism, which is obsessed with the "equality of outcomes", and as suggested by Principle 3, a system that stresses equalization of economic outcomes tends to destroy the very incentives to better oneself: economic actors already doing well and those that are struggling to do better, sooner than later, become discouraged as they find that despite their efforts, results or outcomes are to be homogenized artificially (by a third party) at the end.

A prime economics example in Korea is the pressure to mitigate economic concentration of corporations under uniform regulation over the past 15 years or so. Korea's industrial organization has been affected by the Fair Trade Laws,[21] which with the backing of the "economic democracy" doctrine, as well as the almost atavistic fear of big businesses, has taken on as its responsibility to check corporate expansion and growth. The Korea Fair Trade Commission (KFTC) is the main body that carries out these laws and, until recently, classified on an annual basis the top 30 *chaebols* to which special regulation, much of it aimed at de-concentrating economic power of large corporations, were uniformly applied.[22] This is a direct reversal of Principle 3 stated above. If successful

[20] Leipziger and Petri (1994, p. 593). The Industrial Development Law became effective from July 1986, replacing seven individual industry promotion laws.

[21] The Monopoly Regulation and Fair Trade Law was set up in 1980.

[22] Recently, as Jwa (2003) warns, another type of regulation imposed is the blind pursuit of "global standards". The dangers of uniform regulation, whether to check the growth of the top 30 chaebols or to force the adoption of Anglo-American business practices, has in it much potential to destroy corporate

companies are stripped of their resources or if amalgamation is restricted, the result will be nothing more than a loss to society.

Efforts at restricting economic concentration of large corporations have however been ineffective, and have not equalized outcomes. For example, the proportion of value-added for the 30 largest *chaebols* and 5 largest corporations actually increased from 39.3% and 21.7% in 1986, to 51.5% and 25.0% in 2001, respectively. The share of value-added of Samsung Corporation (currently the no. 1 corporation in Korea) to total national product increased from 4.7% to 9.0% over the same period. More worryingly, regulations have adversely distorted the economy's incentive structure. In fact there are two forces at work here—on the one hand, regulation adversely affected large corporations, which resulted in reduced risk-taking, entrepreneurship, investments, profitability, and so on, while on the other hand, despite efforts to support smaller enterprises (as we argue shortly), the small and medium enterprises (SMEs) did not show any signs of significant improvement or growth because, after all, there was "easier" access to privileges that were somewhat divorced from their economic performances. Interestingly, not a single "new" SME has grown into a large corporation over the past couple of decades.

Under egalitarian motives, a counterpart to the regulation of large corporations has been the "need" to address the troubled small- and medium-sized enterprises (SMEs), which has since taken a central role in the new balanced growth strategy. The government since the 1980s turned to promoting SMEs, not only by establishing SME sanctuaries, but also by requiring banks to comply with a compulsory lending ratio program. Some of the objectives related to supporting SMEs have included efforts to improve the sector's industrial competitiveness, to reduce trade deficits with Japan, and to improve foreign exchange earnings power of Korea's exports. The results of government efforts have, however, been largely unsuccessful: Trade deficits of SMEs in intermediate capital goods and parts industries with Japan has continued to increase in the past decade;[23] the intermediate capital goods and parts enterprises continue to rely on foreign imported parts, the foreign-exchange earnings rate decreased from 69.8% in 1995 to 63.3% in 2000, thereby falling back to the levels of 20 years ago (63.1% in 1980), and so on. We explain this as follows: Typical of populist policies, SME policy packages set a general and uniform criterion, which allowed SMEs (irrespective of their capacity and potential) access to governmental support and privileges, and in this sense, policy was uniformly applied (non-discriminatory). Moreover, policy was static in that constant evaluation of those SMEs receiving support was largely absent or, at least, highly politicized—the evaluation and reward system was never as rigorous or as strict or as objectively carried out, as the earlier two decades of Korea's economic modernization.

Thus, given the widespread egalitarian ethic that continues to this day, the highly government-initiated "discriminatory" system characterized by a constant evaluation and reward system of the best performers gradually lost favor with consecutive governments. Economic policies since the mid-1980s, under the weight of democracy, became more cautious and sensitive to popular opinion, particularly refusing to bias itself to a specific group or sector. Without the discrimination mechanism largely absent, the economic incentive structure became distorted; breeding complacency and moral hazard behavior and encouraging waste as well as corruption.

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entrepreneurship, investment and innovation.

[23] The deficit reduced somewhat right after the financial crisis in 1997, but has increased again recently.

4.6 The revenge of egalitarianism (2): The "egalitarian trap"

To help identify egalitarian policy that seeks equality, we have coined the term the "egalitarian trap" in line with Principle 2 of section 3, which states that equalization is the first step towards economic digression. In Korea, what we observed is that public policy, under the influence of egalitarian sentiments, has increasingly been applied to the economy and to society in a uniform and equality-seeking manner. The public and many of the democratic political leaders, to be sure, have frowned upon discrimination.

Egalitarianism can be instrumental or noninstrumental. Given a specification of some aspect of people's condition or mode of treating them that should be equal, one might hold that the state of affairs in which the stated equality obtains is morally valuable either as a means or as an end. Instrumental egalitarianism values equality as a means to some independently specifiable goal, while noninstrumental egalitarianism values equality for its own sake—as an end, or as partly constitutive of some end.[24] In Korea, aruguable, egalitarianism has been largely the nonstrumental kind. Political leaders and policymakers assume that ALL members of society should and can benefit equally from policy measures—this is clearly a "horizontal" principle of which we had mentioned earlier. Be as it may, public policy over the past 15 years or so, has sought to equalize outcomes across various individuals. This is what brings the economy and society into what we call the "egalitarian trap", which has become quite widespread in Korean society, as can be observed in the country's R&D policy, urban policy, rural income policy, and so on. Let us look at some further examples:

Korea's focus on R&D might have replaced the HCI drive of the 1970s, but with the exception of information technology, particularly, the mobile and wireless communication sector, there has been little success elsewhere. On the surface, R&D policy might seem not much different from the export-orientation policy of the 1960s. A trained eye however reveals that implementation of policy, for one, became more and more uniform and diffused, corresponding with the country's move towards egalitarianism. Economic policies, as we have seen above with the corporate sector, became less and less discriminatory. They were instead made available to a wider audience, which was assumed to be equal. To be sure, the emphasis on technology lacked the discriminatory strength of the export-promotion policy, as well as the HCI drive. Furthermore, policy after mid-1980 differed from the export-orientation policy in its execution, as there seems to be nothing corresponding to the "export contests" in, say, a form of "technology contests" or otherwise, under which constant evaluation and rewarding takes place.[25] Understandably, the economy had matured considerably in the 1980s, and the "government-led discrimination" *a la* 1960s/70s might have reached its limitations—for sure, economic planning had become a much more complex problem. But this is going a little astray from the point we wish to make. The real change has been the replacement of the strong discriminatory-vertical incentive structure that involved the

[24] For example, someone who believes that the maintenance of equality across a group of people fosters relations of solidarity and community among them, and is desirable for that reason, qualifies as an instrumental egalitarian. Someone who believes that equality of some sort is a component of justice, and morally required as such, would be a noninstrumental egalitarian.

[25] Although export performance was easily measured, usually in sales volume abroad, perhaps, it was not as easy to make a corresponding definite judgment about technological improvement.

constant evaluation and reward cycle, by a diffused-horizontal system that aimed at equalizing outcomes under an egalitarian view of the world.

Another example is Korea's urban policy. Seoul is one of the most densely populated cities in the world, and the government has tried to reduce its concentration. Under the spirit of egalitarianism, the government has aimed to equally upgrade non-metropolitan regions to mitigate the rural-urban divide. Resources were made equally accessible to other regions across the country, but because it was done in a non-discriminatory function, as the principles of development economics would predict, development has evaded rural areas. Statistics shows that, on the contrary, the economic concentration of GDP for Korean metropolitan areas including Seoul in fact rose from 42% in 1985 to 47.7% in 2002. In addition, over the same period, among the total Korean population, those living in the metropolitan area increased from 39.1% and 46.7%.[26] Furthermore, rural incomes have not improves, despite rural support programs worth more than won 52 trillion,[27] and the proportion of income of farm household compared to workers in urban areas has declined from 95.1% in 1995 to 73.0% in 2002. In addition, the debt per farm households increased from won 9 million to 20 million over the same period, with debt ratios to income going up from 42% to 81.3%.[28]

4.7 Quick recap (2): The rise of egalitarianism in the post mid-1980s period

The great English philosophy Samuel Johnson warned that, “Hell is paved with good intentions”. Korea should have taken the warning seriously. To sum up, the attempt to equalize outcomes has meant the erosion of competitiveness in economic life, bringing about many undesirable consequences. We have seen that the attempt to mitigate economic concentration of large corporations has been detrimental to the economy, not only adversely affecting large corporations, but also has not resulted in improvements in SMEs. Despite good intentions, R&D policy has been largely ineffective, Seoul has become an even more densely populated city, and rural areas still remain far behind compared to their urban counterparts in terms of income. Such are the consequences when discrimination mechanisms are ignored or mitigated. Such are the vices of the “egalitarian trap”.

The findings from the discussions of Korea's economic development experience of the 1980s and 1990s is as follows:

Result 4: Egalitarianism, the political view supporting equalization of outcomes, tends towards economic digression.

Result 5: Uniform regulation distorts the economic incentive structure, discouraging capacity building and the pursuit of self-improvement throughout all sectors of the economy.

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[26] Korea National Statistical Office, 2002.

[27] Structural Reform of Rural Areas, for example.

[28] Roh (2003).

5.0 Revisiting some issue and problems in development economics

Earlier on in this paper, we mentioned the hope of discovering the "secret" of economic development, and we went forward to set three fundamental principle and three corollaries. In this section, we further apply the theory to some perennial issues in development economics.

5.1 Reinterpreting the market: Back to the future

It is worth re-interpreting the meaning of markets under the discrimination paradigm presented in this paper. After Adam Smith, Hayek is perhaps the most important figure in economics to show to the world the importance of markets. Throughout much of his career, he was interested in understanding how people's actions were coordinated, and he defined the market as spontaneous order. By spontaneous, he meant unplanned—the market was not designed by anyone but evolved slowly as the result of human actions, and which was beneficial to society—this echoes the "invisible hand" of Adam Smith. Also stressed by Hayek was the information-clearing role of markets. Markets, he argued, could process more information than could possibly be done by any central government, and he strongly argued how decentralized, unorganized individual decision-making through markets could outperform the central planner. It is difficult to improve over Hayek's view of markets, but we wish to highlight one aspect that seems to have been ignored. In our understanding, the market is a tireless discriminator. Indeed, its primary function is to discriminate, that is constantly evaluate and reward market players and their behavior. Here, the market can be seen as impersonally and objectively "treating differences as differences". The market is the ultimate economic discriminator to which we have attached the term "market-led discrimination"—the discrimination of consumers, investors, lenders, managers, laborers and so on.

Our interpretation of markets can be contrasted with the neo-classical framework, which emphasizes the ideals of perfect markets, identical firms, a constant choice set, and so on. The neo-classical method leaves out important aspects, which have more negative implications to our understanding of the economy than might be intended.[29] For one, the neo-classical method tends to disregard differences, and their economists can be heard speaking of identical firms in a perfect competition setting. This disregard of differences is in itself contradictory and tends to miss the main aspect of markets. Contrary to what such a nirvana position might claim, markets cannot exist and cannot function, both theoretically and in practice, in a homogenous world.[30] Simply put, the function of markets is to allow each and every economic actor to exercise their discriminatory power, and it cannot do so if all actors are identical. We summarize this in result 6 below:

[29] Neo-classical economics has been criticized to being somewhat empty in content. For example, it has been known that neo-classical economics can be used to justify socialism as well as capitalism, two quite different economic systems. We will provide a further critique of the neo-classical economics paradigm in a latter section.

[30] The phrase "nirvana world" is borrowed from Demsetz (1969).

Result 6: Markets are (the ultimate) discriminatory mechanism through which the whole collection of economic actors can exercise their discriminatory powers. Markets are in this sense in par with economic development.

5.2 Markets versus governments: Are any panaceas?

Daniel Yergin and Joseph Stanislaw's *The Commanding Heights* is a very readable book about the struggle of markets and governments.[31] A common dilemma of economists and policymakers has been whether to promote the role of markets or of governments to attain certain national goals. With the collapse of the Soviet Union, many economists are quick to champion markets over governments, and today, a minimal government is seen as desirable. This dichotomy of markets versus governments is too simplistic a view, which, although allowing for interesting discussion of world events, can lead to serious mistakes. The battle on the field should not be placed in the context of markets and governments. How then could one explain economic success, such as the case of Korea, where governments have been instrumental?[32] Understandably, it can seem puzzling to the neo-classical economist, many of whom would agree that markets and its "discrimination" function is indispensable for development, to come to terms with the fact that there can exist successful government intervention. This puzzle is however easily resolved if we recognize that not unlike markets, the achievements of a successful economic policy, or "government-led discrimination", can indeed mimic the function of markets. In other words, what government intervention can do is to substitute for market discrimination. The upshot is that discrimination is possible either by governments or by markets, or both.

However, one reason to favor discrimination by markets over discrimination by government is that markets, by their very nature, are often consensus-based and never egalitarian.[33] We have already mentioned that markets are constantly evaluating and discriminating among economic actors and their behaviors. Governments, on the other hand, might be burdened by continuously evaluation, or might choose to turn a blind eye, or simply provide wrongful evaluation intentionally.[34] Government and business relations, after all, has been known to have its own set of problems that includes the contamination of politics and economics, moral hazard behavior, corruption, rent-seeking, sustaining non-viable firms, and resentment by those that are not selected by government. But while we emphasize markets as a "more" viable way forward, the upshot of our argument is that regardless of the discriminator, whether government or market, an economy will only develop if the discrimination mechanism is built firmly into the economic management system. The old age argument between the role of government

[31] A similar type of discussion has taken shape between the importance of policy versus institutions in economic growth. Here, again economists seem to be missing the point.

[32] Chang Ha-Joon (2002) has in fact argued that nearly all countries, at least during the early stages of their development, benefited from government support, in particular protectionist policies, to stimulate economic growth.

[33] By consensus-based, we mean free of value judgment or void of political bias, and the like. In fact, according to our approach, a "free-market" would be one where the discrimination function is allowed to work without interruption or distortion from policy, institutional deficiencies, arbitrary regulation, and other (often man-made) restrictions.

[34] Here, it is interesting to note that wrongful evaluation and rewarding are often not sustainable.

and markets in economic development becomes redundant. Discrimination, rather, is the key to sustainable economic development. And, of course, what we have to watch out for are non-discriminatory mechanisms, of which egalitarianism is happy to endorse, which by mitigating the discrimination process can reverse economic progress.

Result 7: Either markets or governments or both can assume the role of the economy's discrimination mechanism.

5.3 Democracy and the market economy: Are they really sisters?

Democracy has been the catch phrase of many countries in the modern era. Broadly speaking, the ideals of democracy such as the respect for human rights, individual freedom, and equal opportunity, are consistent with the market economy that require the rule of law, secure property right as well as the preservation of economic discrimination. Although the ideals of democracy have been widely professed, the practice and fulfillment have been different in many countries. Our concern, we find, is that the ideals of democracy can get into the way of economic development when egalitarianism takes the center stage.[35] Specifically, as we have elaborated in various parts of this paper, the egalitarian-type democracy has tended to hinder and in some cases reversed the economic discrimination mechanism in favor of equalization of outcomes, which has become a major force behind economic slowdown in many parts of the world. There is need to be cautious about equality-seeking democracy and their potential negative impact of economic development. We do not intend to divorce economics from politics—this is hardly possible in the real world—but, we warn about the pervasiveness of egalitarianism in economic life. The market economy and democracy are compatible, if only the discrimination mechanism is not sacrificed. Result 8 provides a summary:

Result 8: *A democracy seeking equal opportunity is compatible with the market economy, while one seeking equal outcome (egalitarianism) will cause economic digression.*

5.4 Equity versus efficiency: Is there some natural income distribution?

There is a controversial debate in the literature regarding the tradeoff between equity and efficiency. The common argument is that with equity-seeking policies, when the government redistributes income from the rich to the poor, it reduces the reward for working hard and as a result people work less producing less goods and services. That is, efficiency is sacrificed when more balanced distribution of income is sought. Our view is consistent with this view, but we go even further to emphasize that not only are incentives of the most productive actors diminished, incentives of the poor as well are also distorted. With the poor receiving benefits based on their low income, rather than their contribution to the economy, incentive for moral hazard behavior creeps in. Yet, there continues to be much support in developing as well as developing countries for distributive justice. Arguments of distributive justice are often normative, many of which propose some design to allocate goods in limited supply relative to demand, and do vary in numerous dimensions.

A widely held view of distributive justice is that of strict or radical equality. This view says that every person should have the same level of material goods and services, and is

[35] Refer to our discussion on egalitarianism above.

most commonly justified on the grounds that people are “owed” equal respect with equality in material goods and services being the best way to give effect to this ideal. We have so far argued that such egalitarian views are a cause of negation of economic development. Outside the transfers made to the elderly, the disabled, and other members of society that cannot engage in productive activities, income distribution is best left alone.

Given that the discrimination mechanism is allowed to function unhindered, then we can expect that all potential productive members of society be rewarded according to his or her ability and effort. Under a system that “helps those that help themselves”, one can think of a fair pattern of income distribution. For different levels of development, there could of course exist different income patterns, but the point is that if one forcefully interferes with whatever the income distribution results under the economic discrimination system, then although it might have a temporary effect in redistribution, in the long run, everyone is left worse off.

Often, the main cause of dissent regarding income distribution in the modern era has been the quick judgment that follows some observation of a “snapshot” of earning differences at a particular point in time. This is a common mistake, and income patterns rather should be observed over time. With some social mobility in place, or what is the same thing, with an in-built discrimination mechanism, over time, it is possible that individuals (and their family members) will move across income levels. The upshot is that, for a fair income distribution to prevail, the discrimination mechanism should never be sacrificed and the government should be extra careful to correct income distribution artificially.

Result 9: Income distribution patterns should not be deliberately changed outside the dictates of the economic discriminatory mechanism; such actions can destroy economic incentives and make everyone worse off.

A somewhat subtle issue is the implication of conglomeration on income distribution. Principle 2 suggests that conglomeration is a natural feature of discrimination and development. What might be worrying is that more successful economic actors will command more resources, play a bigger role in the economy and receive greater economic reward, thereby skewing the income distribution in their favor. We see no harm in this. Rather, this is viewed positively, not only because it is consistent with the discrimination mechanism, but also because, as we have mentioned repeatedly, artificially changing the distribution pattern will only make everyone worse off. That is, we need not haste and make judgment about the “unfairness” of economic distribution, and rather than being pessimistic about the outcome of the discrimination mechanism, we should appreciate its usefulness in driving development. Result 10 summarizes our view on income distribution.

Result 10: The skewness of income distribution through economic discrimination and conglomeration is quite natural and even “good” for society, and outcomes need not be tempered with outside the confines of economic discrimination.

We understand that this is a very controversial issue. We do not claim that the government can and should do nothing about income earnings and distribution patterns. On the minimum, however, if such actions by government are to mitigate the functioning of economic discrimination, then there can be no guarantee that deliberate action will be neither sustainable nor beneficial to society in the long run.

5.5 To conglomerate or not to conglomerate? That is the question.

Let's address the issue of conglomeration before concluding this section. We have mentioned that it is an important feature of the development process, but throughout much of the experiences of capitalism, conglomeration has been subject of much controversy. But why should conglomeration be worrisome? We have already discussed the dangers of de-concentration policies, particularly when driven by populism and egalitarian motives. The question, however, could still be pressed: How can we properly understand how to treat conglomeration?

As Principle 2 states, the amalgamation of economic resources is important, and can help accelerated development. This is most evident if we look at the development of societies from the beginning of time to the present period while tracing the major events that have allowed for the amalgamation of economic resources. At the beginning, the hunter-gatherer would be more successful if he were able to co-ordinate his activities with others. With the birth of agriculture, man had more time to spend his energies in other economic activities such as craft, which helped him secure a better future. It took quite some time before trade became an important activity, but when it did, it transformed societies, helping to build trade centers and cities.[36] Governments were also quick to gather resources for military, as well as for governance and productive use. Up until the period before the industrial revolution in the 18th century, we can easily find evidence of the importance of the amalgamation of economic resources by early corporate forms and guild in driving exploration, conquest, production and economic development. The most important institution in the modern era, which assumes the role of amalgamating economic resources for productive activities, is undoubtedly the corporation. Economists have elaborated why corporations are important to economic development.[37] Companies are an important way to coordinate economic activity by providing a way of imposing effective management structures on large organizations. Companies also help minimize risk while helping to increase the pool of capital available for productive investment. A cluster of competing companies also makes for a remarkably innovative economy. The corporation through its role in resource gathering for productive use is at the center of the modern economy. De-concentrating corporations is one sure way to halt economic development, usually motivated by the confusion of monopoly and conglomeration. Whatever the arguments against monopoly, it is important to refrain from putting the blame entirely on conglomeration. Surely, the role of corporation in creating the modern era as we know it today has been indispensable. We summarize this concluding section on conglomeration in result 11:

Result 11: Conglomeration (of corporations) is the other side of the economic discrimination coin.

The question of monopoly might need to be mentioned. We do not pretend to have a complete answer, but the research on monopoly by Alchain and Allen (1977) and Demsetz (1974) could prove to be a useful starting point. The views on monopoly, not unlike that on conglomeration, can be seen as either the outcome of government

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[36] See Jacobs (1984).

[37] See for example, Douglass North and R. P Thomas (1973), Nathan Rosenberg and L. E. Birdzell (1986), and also John Micklethwait and Adrian Wooldridge (2003) for an engaging history of the company.

protection[38] or a result of efficiency.[39] An important implication is that in the absence of government protection, there is no presumption that behavior will be monopolistic, or in our context, simply dominant or abusive. Hence, the very notions of "dominant position" and the accompanying fear of "its abuse" tend to be meaningless in an efficient-form conglomeration.[40] Ability should not be confused with incentives.[41] Again, as we have already mentioned, it follows that public policy should refrain from trying to contain the apparent threat of conglomerations. Rather, policy should help create and sustain a competitive environment by re-enforcing the discrimination mechanism in the economy. After all, the threat of market power can be efficiently tackled by the existence of strong competitive pressure of potential as well as actual rivals. In the context of our principles of development economics, the recommendation would be "let discrimination do its work". Conglomeration, again, as we have mentioned is the other side to economic discrimination and should be seen as a natural process of the development process.

6.0 Concluding remarks

This paper has presented three fundamental principles of development economics: 1) Discrimination is a necessary condition for economic development, 2) Conglomeration or the amalgamation of economic resources and activities is a natural process of economic development, and 3) Equalization is the first step towards economic digression.

Using the three principles, we have re-interpreted Korea's development experience from the 1960s to the present time. By doing so, we have not only established the principles of development economics, but have shown its applicability in explaining other perennial dilemmas in development economics including 1) the meaning of markets, 2) the roles of government and markets in economic development, 3) the dilemmas presented by democracy and positive economics, 4) the questions of income distribution, and 5) the controversies of conglomeration in economics and development.

It might be useful to summarize Korea's development experience in the context of the slogan "United We Stand, Divided We Fall". Like all slogans, the context is what gives it substance and meaning. "United We Stand, Divided We Fall" has a dual and opposite meaning in the context of economics and politics. In the economic sense, the principles of development economics would suggest that "united" means conglomeration, while "divided" would mean economic de-concentration. The former being helpful to economic development, while the latter doing just the opposite. In the political sense, which arguably contains the more common meaning, associated "united" with "creating equals", which is thought to be favorable, while "divided" means maintaining differences, which is seen as harmful. As should be quite obvious, this is a highly egalitarian interpretation against which we have argued quite fervently—egalitarianism is an enemy to good economic policy. From the viewpoint of egalitarian politics, "togetherness" often implies equality and the egalitarian trap. At the same time, the meaning of "divided" in

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[38] Demsetz (1974) argues one belief of monopoly is that it is generated by government action that prevents rivals from competing. Alchian and Allen (1977) refer to this as "monopoly power".

[39] Demsetz (1974) argues that the other type of belief about monopoly is that it exists without an explanation of how it came about. We follow more closely the interpretation of Alchian and Allen (1977), where the term "market power price searcher" is used to define efficiency type monopoly.

[40] See also Chapter 5 of Deepak (1999).

[41] Alchian and Allen (1977, p. 306).

egalitarian politics, which has a negative meaning, can, first of all, be stretched too far so as to place suspicion on all kinds of differences, and secondly, to create sentiment for equalization through re-distribution. This, we have argued, are not what the principles of development economics would endorse. We again stress that the handling of the relationships between government and markets and politics is a delicate matter. Whatever systems or institutions in place, what must not be sacrificed is the discrimination mechanism of economic actors. In light of our discussions in this paper, there is urgent need to stir away from political systems that seek equal outcomes, under an egalitarian view of the world, to one that acknowledges difference as differences.

As a last word, somehow, we feel that there is an irony, an almost cruel paradox behind the development economics paradigm of discrimination. In a way, it would seems that we need to be cruel to be kind—the development economics principles laid out here are indeed paradoxical, and rings true to the notion that the unexpected often is the answer to our problems. Such is the paradox of economic development, which asks, "Need we be inhumane to be humane?"

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Appendix on econometrics tests for structural break

1) Time-varying parameter (TVP) model

The time-varying parameter (TVP) model may be represented as a special case of the general state-space model, which is described by a measurement and transition equation:

Measurement equation: $y_t = \beta_t + u_t$
Transition equation: $\beta_t = T_t \beta_{t-1} + v_t$

A recursive prediction error method, for example, based on the Kalman filter, allows us to acquire the one-step ahead prediction error y_t as

$$\hat{u}_t = y_t - X_t b_{t \mid t-1} .$$

Since we can write $y_t = X_t b_{t \mid t-1} + X_t(\beta_t - b_{t \mid t-1}) + u_t$, the variance of the prediction error may be written as $D_t = X_t V_{t \mid t-1} X'_t + R_t$.
Hence Kalman's recurrence relations are

$$b_t = b_{t \mid t-1} + V_{t \mid t-1} X'_t D_t^{-1} (y_t - X_t b_{t \mid t-1}) .$$

The Kalman filter is a recursive procedure that derives the distribution of β_t conditional on y_t .

2) CUSUM test (and CUSUMSQ test)

The CUSUM test (Brown, Durbin, and Evans, 1975) is based on the cumulative sum of the recursive residuals, and is based on the simple statistic:

$$W_t = \sum_{r=k+1}^{t} w_r / s \text{, with } t = t+1, \ldots, T$$

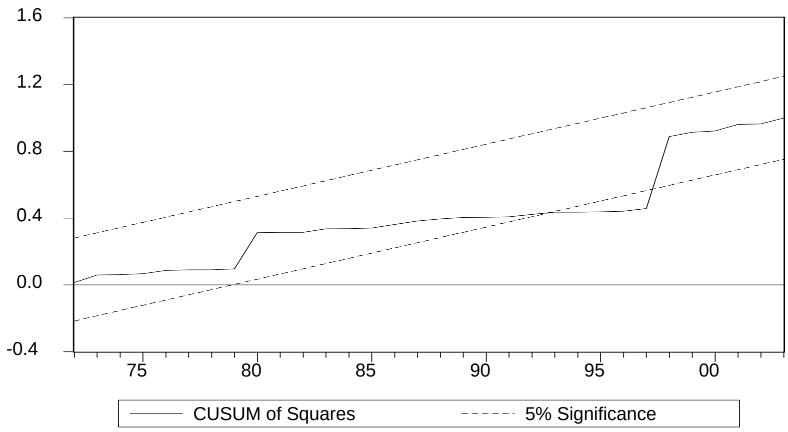
w is the recursive residual, and s is the standard error of the regression fitted to all T sample points. If the β vector remains constant from period to period, $E[W_t] = 0$, but if β changes, W_t will tend to diverge from the zero mean value line. The significance of any departure from the zero line is assessed by reference to a pair of 5% significance lines, the distance between which increases with time.

The CUSUM of squares (CUSUMSQ) test is based on the test statistic:

$$St = \frac{\sum_{r=k+1}^{t} w_r^2}{\sum_{r=k+1}^{T} w_r^2}$$

which has expected value of S under the hypothesis of parameter constancy as $E[St] = (t-k)/(T-k)$, which goes from zero at $t = k$ to unity at $t = T$. As with the CUSUM test, the significance of the departure of S from its expected value is assessed by reference to a pair of parallel lines around the expected values (see, Brown, Durbin, and Evans (1975) or Johnston and DiNardo (1997) for a table of the significance lines for the CUSUM of squares test).

Fig A 1 CUSUMSQ for real GDP growth 1971-2003



3) Max-Chow test

One of the earliest tests for structural breaks is Chow (1960), which are for stationary variables and a single break. Assuming that the dates of break are unknown, we can set up the Max-Chow test.

The generalized form of the model is often depicted as:

$$y = \begin{pmatrix} y_1 \\ y_2 \end{pmatrix} = \begin{pmatrix} X_1 & 0 \\ 0 & X_2 \end{pmatrix} \begin{pmatrix} \beta_1 \\ \beta_2 \end{pmatrix} + \begin{pmatrix} u_1 \\ u_2 \end{pmatrix}$$

And, the null hypothesis to be tested is

$$H_0 : \beta = \beta_1 = \beta_2$$

where is estimated using the first part of the data (regime 1) and is estimated using the second part of data (regime 2).

The F-test statistic with k and $k-1$ degrees of freedom can then be used to test the hypothesis.

$$F(k, n-2k) \sim \frac{(SSE - SSE_1 - SSE_2)/k}{(SSE_1 - SSE_2)/(n-2k)}$$

The general Chow test for means is conducted for n_1 and n_2 observations, starting with n_1 =5 and $n_2 = n - n_1$, and consecutively adding adjacent data to n_1 from n_2 until n_2 =5.

4) Markov-Switching Model

For MSM, we find clear regime switches for fixed investments, returns on equity and sales, as shown below, and these breaks correspond with the break periods defined in this paper.

Fig A 2 Probability of regime 2 in Fixed Investments

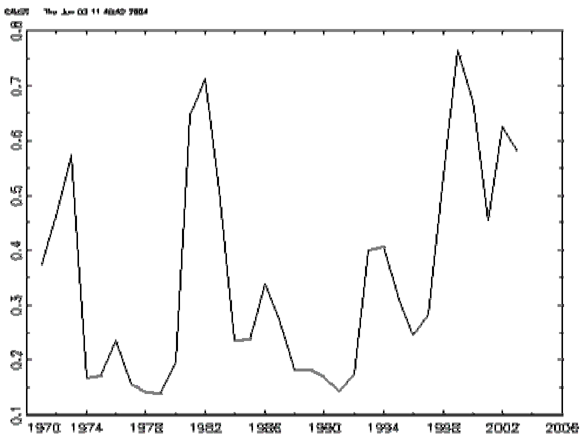


Fig A 3. Probability of regime 2 in Returns on Equity

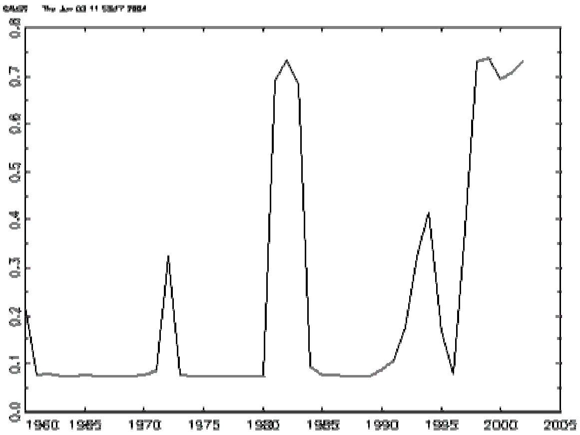
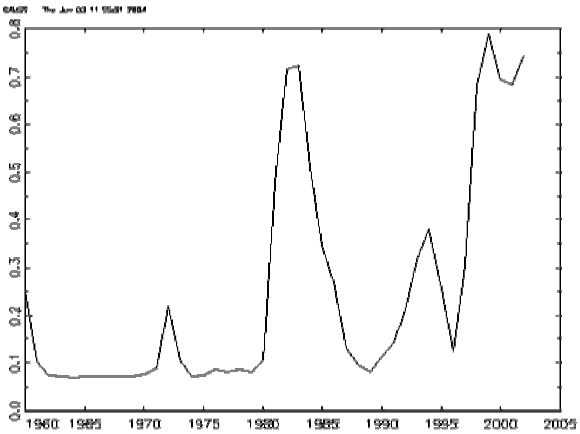


Fig A 4. Probability of Regime 2 in Returns on Sales



A two-state MSM model is applied. Hence, given observed data, $\Delta y_t \ (= y_t - y_{t-1})$, say, GDP growth, equations 1~5 represent the two-state MSM model:

(1) $\Delta y_t = \mu_{st} + e_t, \ t = 1,2,\ldots,T$

(2) $e_t \sim N(0, \sigma^2_{St})$

(3) $\mu_{St} = \mu_0(1 - S_t) + \mu_1 S_t$

(4) $\sigma^2_{St} = \sigma^2_0(1 - S_t) + \sigma^2_1 S_t$

(5) $S_t = 0$ or 1

Given information up to and including $(t-1)$, and knowing the states S_t, the likelihood function for Δy is represented by:

$$f(\Delta y_t \mid S_t, \Psi_{t-1}) = \frac{1}{\sqrt{2\pi\sigma_t^2}} \exp\left(-\frac{(\Delta y_t - \mu_S)^2}{2\sigma_{St}^2} \right)$$

where ψ_{t-1} represents all information up to $(t-1)$.

Since S_t is not observable, we can integrate out S_t and the likelihood function will then be:

$$\begin{aligned} f(\Delta y_t \mid \Psi_{t-1}) &= E_{St \mid \Psi t-1}[f(\Delta y_t \mid S_t, \Psi_{t-1})] \\ &= \sum_{St=0,1} f(\Delta y_t \mid S_t, \Psi_{t-1}) \Pr[S_t \mid \Psi_{t-1}] \end{aligned}$$

Then the log-likelihood function is

(6) $$LnL = \sum_{t=1}^{T} \ln[\sum_{St=0,1} f(\Delta y_t \mid S_t, \Psi_{t-1})] \Pr[S_t \mid \Psi_{t-1}],$$

the marginal densities of Δy_t can be viewed as the weighted sums of the conditional densities of $\Pr[S_t \mid \Psi_{t-1}]$ given states 0 and 1.

For (6), we need to calculate $\Pr[S_t = 0 \mid \Psi_{t-1}]$ and $\Pr[S_t = 1 \mid \Psi_{t-1}]$. We cannot do this without prior assumption about the stochastic behavior of S_t, which we assume follows a first-order Markov process. Then the filtering process consists of 2 steps:

Step 1:
If at t, we have $\Pr[S_{t-1} = i \mid \Psi_{t-1}]$, for $i = 0,1$, then $\Pr[S_t = j \mid \Psi_{t-1}]$ is:

$$\begin{aligned} \Pr[S_t = j \mid \Psi_{t-1}] &= \sum_{i=0,1} \Pr[St = j, S_{t-1} = i \mid \Psi_{t-1}] \\ &= \sum_{i=0,1} \Pr[S_t = j, S_{t-1} = i] \Pr[S_{t-1} = i \mid\mid \Psi_{t-1}] \end{aligned}$$

Step 2:
With Δy_t at t, step 1 gives $\Pr[S_t = j \mid \Psi_t]$, which using Bayes' rule can be updated to

$$\begin{aligned} \Pr[S_t = j \mid \Psi_t] &= \Pr[S_t = j \mid \Psi_{t-1}, \Delta y_t] \\ &= \frac{f(S_t = j, \Delta y_t \mid \Psi_{t-1})}{f(\Delta y_t \mid \Psi_{t-1})} \end{aligned}$$

$$= \frac{f(\Delta y_t \mid S_t = j, \Psi_{t-1}) \Pr[S_t = j \mid \Psi_{t-1}]}{\sum_{j=0,1} f(\Delta y_t \mid S_t = j, \Psi_{t-1}) \Pr[S_t = j \mid \Psi_{t-1}]}$$

where $\Psi_t = \{\Psi_{t-1}, \Delta y_t\}$.

Repeating steps 1 and 2 gives $\Pr[S_t = j \mid \Psi_{t-1}]$, $t = 1,2,\ldots,T$.

Comments on "A New Look at Development Economics through Korea's Experience"

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This paper attempted to interpret Korea's economic development from a somewhat narrow perspective of discrimination vs egalitarian. It derived three fundamental principles of development economics: 1) Discrimination is a necessary condition for economic development, 2) Conglomeration of economic resources and activities is a natural process of economic development, and 3) Equalization is the first step towards economic digression. Although three fundamental principles are contrasted with economic principles frequently cited, such as protection of property rights, market competition, appropriate incentives, sound money and etc., they are indeed closely related to the market-based competition with appropriate incentives.

The paper describes the discrimination as "(E)xercising discriminatory power is fundamental in whatever interaction of individuals, which is nothing more than the "market order" itself." The discrimination could be understood as the market process in which economic actors exercise their discriminatory power and as the market outcome in which the products and firms are discriminated by market forces. The discrimination is intensified with incentives from the government policy to ensure economic development. Therefore it seems to me that the discrimination as the theme of development could be understood in the framework of market competition under appropriate incentives. The author seems to use the 'discrimination' terminology to contend to the egalitarian principle that began to prevail from the democratization movement in 1987 and had been upheld in the current government. However, the discrimination carries bad connotations, especially without the market. Thus it is recommended to use the other words such as 'differentiation' or 'market discrimination.'

Reinterpreting Korea's economic policy in the 1960s/1970s, the author argues that the export-oriented policy was based on a comprehensive incentive system that channeled resources into the best performing export sectors. Again the Heavy and Chemical industry drive was interpreted as a highly discriminatory system that was successful to a large extent. Many papers that emphasize the market failures in developing countries share the same view as this paper, arguing for the role of government. For example, Hausmann and Rodrik(2002) suggest a carrot-and-stick approach to overcome the learning barrier to industrialization, when costs of production in non-traditional activities are uncertain. They argue that East Asian countries were quite good at combining incentives with discipline. While the incentive was provided through subsidies and protection, the government monitored export performance to evaluate the effectiveness of incentives.

Despite these facts, the paper should also admit the government failures and list the government-imposed imperfections. For example, Korea's Heavy and Chemical industry drive had limitations at least for two reasons. First, scale economies in the heavy and chemical industries could not be realized due to the lack of backward and forward industrial linkages and insufficient domestic and foreign demand, particularly with the Second Oil Shock and worldwide recession during 1980-81. Instead, the business-government relationships became too close and the conglomeration of large corporations developed into the well-known form of the ‘Chaebol.’ Second, rapid wage growth was pronounced for skilled labor, indicating that Korea was not a labor surplus economy in the late 1970s. The government intervention in credit allocation distorted the financial market.

Toward the end of the 1970s Korea’s growth strategy fostered inefficiencies in resource allocation, a worsening of the income distribution and high inflation that were aggravated by the Second Oil Shock. President Park had to realign the policy direction of the Big Push and announce the stabilization plan of April 1979. The general consensus at that time was that the shift to the market economy and sound money was needed to remedy a misallocation of resources and excess capacity in the heavy and chemical industries with high inflation, a rising current account deficit, and increasing external debt. Since the shift to the market economy and more balanced approach emphasizing both economic growth and income distribution, it is true that Korea experienced economic slowdown, particularly so with the disappearance of the ‘three lows’ in 1989, and it happened to encounter financial crisis in 1997. It is also true that the egalitarian principle got stronger in the current government. The real question is that how much of economic slowdown since the latter half of the 1980s could be attributed to the pursuit of egalitarian principle. The paper provides some econometric investigations of structural shifts, but they are not enough to prove that the structural shifts were related to the pursuit of the egalitarian principle.

In sum, this paper gives warnings to the proponents of the egalitarian principle. Nonetheless, it should be more sophisticated to look at the development economics through Korea’s experience.

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CHAPTER 7-2

Short-run versus Long-run Income Inequality*

by
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Abstract

Using panel data sets, this paper examines income inequality in Korea during 1988-1997. It shows that income inequality arises from persistent factors such as unmeasured individual characteristics rather than transitory components. In addition, the sources of income variations have systematic patterns among educational groups. When income inequality is compared between 1988-92 and 1993-97, various indices indicate that income inequality has reduced. However little improvement was made in terms of persistency of income inequality. This result may suggest that the attainment of low inequality during the period is not as desirable as it appears once long-run income inequality is taken into account.

I. Introduction

What makes one's income different from others? How freely can one move up and down across socio-economic status? These are the topics of many debates and of interest to both policy-makers and economists in almost all countries. Numerous studies on this topic have been done for U.S. and other developed countries.[1] Surprisingly, studies for developing countries are limited. Despite a growing concern about imbalance between income growth and its distribution, little attempt has been made. The reason is that this type of studies heavily relies on a panel data set, which is not readily available in most developing countries. In this perspective, it is exceptional to have a Korean micro-panel data set which gives us an unique opportunity to understand income inequality and mobility for developing countries such as Korea.

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[*] Research fellow at the Korea Development Institute. I am grateful to Frank Stafford, Lee Lillard, and the staffs at the Korean National Statistical Office for their helpful comments and data preparation. All remaining errors are mine.

[1] For comparative studies on this subject, see Gottschalk (1993) on income inequality in seven industrialized countries, and Baker and Solon (1997) for Canada.

A study on Korean case is particularly interesting. As well-known, Korea has experienced dramatic economic development. From one of the poorest countries in 1960s, it became a member of the Organization for Economic Cooperation and Development (OECD) in 1996. During the period (1988-1997) under the consideration in this paper, Korean economy has grown remarkably: Per capita income (in 1985 constant price) was nearly doubled from $5,607 in 1988 to $10,131 in 1997. This rapid change gives an extraordinary chance to examine the impact of economic growth might have on income distribution and mobility.

This paper is organized as follows. In the next section, previous studies are briefly reviewed and compared with this paper. Section III introduces a simple econometric model for decomposing income inequality by its sources. In section IV, the data issues are addressed and then the results are presented. Section V summarizes and concludes this paper.

II. Previous studies

There has been large volume of studies on income distribution in Korea since late 1970s. Although estimates of income inequality slightly different depending upon the data used (Lee & Hwang, 1998), most studies agree that 1) income inequality increases in 1990s, especially after the financial crisis[2]; 2) wealth is far less equally distributed than income (Lee & Hwang, 1998; Lee, 2000);

There are no consensus on the direction of income inequality over the path of economic growth: rising inequality (Kim & Ahn,1987); inverse-U type (Choo,1993); falling inequality (Kim & Topel, 1995; Fields & Yoo, 2000). Despite the controversy over the direction of income inequality, it is believed that factors such as education, industry, occupation, and experience, are important factors in determining the level of inequality over time.

Most of previous research, however, mainly focuses on income inequality at a point of time measured by inequality indices. Although this snapshot view of income inequality receives attention from the public, it tells us little about the nature and the direction of income inequality. If an increase in income inequality is primarily due to transitory income volatility, current deterioration of income distribution is less serious as the transitory shocks fade away over time. On the other hand, if income distribution becomes less equal due to persistent factors, one should concern about long-lasting income inequality.

Different from the previous studies, this paper attempts to analyze income inequality by its sources. Specifically, an individual's income is decomposed by permanent and transitory parts. Income volatility due to transitory component causes welfare loss to liquidity-constrained workers, but its impact on income inequality is less fundamental. Widening income gap due to persistent factor, however, has a profound impact on income distribution.

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[2] Lee (2000), using the "Family Income and Expenditure Survey" reports the Gini coefficient for 1997 (0.261) and for 1999 (0.286).

III. Econometric model for income inequality

We start our discussion by positing the following simple earnings equation (Solon, 2001):

$$(1) \quad Y_{ibt} = \exp[\delta_i + \beta(t-b) + v_{it}],$$

where Y_{ibt} is the measured real monthly earnings at time *t* of i^{th} worker born in year *b*, δ_i represents the earnings component of individuals due to permanent attributes such as gender, the level of education, motivation and intelligence. The term $\beta(t-b)$ captures the individual's earnings' profile rising with his potential experiences ($x = t - b$). The last term v_{it} is a transitory deviation from the individual's life-cycle earnings trajectory.

By taking logarithm of (1), the earnings model can be written in a simple linear form:

$$(2) \quad \log(Y_{ibt}) = \delta_i + \beta(t-b) + v_{it}.$$

For the model being tractable, let us assume that the variables δ_i, *t-b*, and ε_{it} are mutually independent such that σ_δ^2, σ_b^2, σ_v^2 and $\text{cov}(v_{it}, v_{is}) = 0$ for $t \neq s$. Then, the income inequality at time *t* can be measured by the variance of log earnings across all individuals:

$$(3) \quad \text{var}(\log Y_{ibt}) = \sigma_\delta^2 + \beta^2\sigma_b^2 + \sigma_v^2$$

Equation (3) decomposes income inequality by its sources and it merits to note. First, as appeared in the second term of the right hand side of (3), the cross-sectional demographic structure affects income inequality profoundly. To make this point clear, consider an economy consisting of only two generations, 1 and 2. Total population is normalized to 1 and the shares of each generation are s_1 and s_2=1-s_1. Denote the mean and the variance of log earnings of each generation by μ_g and σ_g^2, where $g\in\{1,2\}$ respectively. Under these settings, income inequality of total population at time *t* can be shown as:

$$(4) \quad \text{var}(\log Y_{ibt}) = s_1\sigma_1^2 + (1-s_1)\sigma_2^2 + s_1 s_2(\mu_1 - \mu_2)^2$$

Total income inequality depends not only on the within-generation income variance, σ_g^2, and the average level of income, μ_g, but also on the shares of generations in the population. A younger cohort being at the different stage of life cycle tends to earn less than the older cohort. As the younger cohort eventually becomes the older cohort, this type of inequality is less serious from each individual's lifetime perspective.

Second, in equation (3), σ_δ^2 and σ_v^2 represent permanent and transitory income variations. While temporal volatility of income captured by σ_v^2 significantly changes the consumption of liquidity-constrained individuals, it has less impact on the income inequality in the long run. Permanent income variation, on the other hand, is persistent and it determines long-run income inequality over time – that is, income mobility.

IV. Data and Results

The empirical analysis is based on the Korean National Statistical Office's "Family Income and Expenditure Survey" (FIES), a national longitudinal survey that began to interview approximately 5,500 households from seventy-two cities since 1963. The FIES contains information on income and expenditure of the same families for five years – i.e., quinquennial panel data[3]. Unfortunately, the FIES excludes households of which the head: i) has no other family members; ii) is self-employed; or iii) works in agriculture or fishery industries. The excluded groups presumably have higher income variations on average than those are included.

The samples are drawn from 1988-1992 FIES (N=425) and 1993-1997 FIES (N=535) of household male heads with the age of 29-58 who reported a positive labor income for all 5 years. By restricting a minimum age at 29, most of individuals in the sample completed their schooling and have positive work experiences. Maximum age is set at 58 in order not to pick up abnormal income variations and mobility typically observed at the time imminent prior to retirement (mostly 60 years old in Korea).

Table 1 describes the summary statistics. Two samples are compatible in many aspects: The average age and experiences are approximately 42 years and 19 years, respectively; the average years of schooling is about 11 years for both samples. The average household head's labor incomes (adjusted by 1995 CPI =100) are 1,161,238 Won in 1988-92 and 1,554,908 Won in 1993-97, respectively. The table also shows that labor income increased substantially during the sample periods (at an average annual rate of 7.7% for 1988-92 and at 6.0% for 1993-97).

Table 1. Summary of statistics

Variable	Mean	Std. Dev.	Min	Max
1988-92:				
age	41.98	7.26	29	58
education	11.66	3.22	0	18
experience	19.32	8.49	3	43
Earnings:	1161238	552899	127132	5476070

Table 1. Summary of Statistics (continued)

Variable	Mean	Std. Dev.	Min	Max
1993-97				
age	42.67	7.40	29	58
education	11.91	3.11	0	18
experience	19.77	8.68	1	41
Earnings:	1554908	674003	162018	6267759

Source: Two samples of FIES for 1988-92 and 1993-97.

Sample is from household male head with age between 29-58.

Experience is calculated as age-schooling-6-3.

Earnings (household head labor income) are in 1995 Won.

Table 2 reports the results from widely used indices such as Gini coefficient, coefficient of variations, and coefficient of deviations[3]. The higher the values of these indices indicate the less equal in the income distribution. All indices shows that income inequality decreased during 1993-97 compared to the previous 5 years.

Table 2. Summary measures for income inequality.

Year	CV	CD	Gini
88-92	0.48	0.39	0.25
93-97	0.43	0.36	0.24

Source: Two samples of FIES for 1988-92 and 1993-97.

CV=coefficient of variations. CD=coefficient of deviation GINI=Gini coefficient

It is important to examine income inequality by the components in the study of income distribution. To remove the income inequality caused by the different stages of individual's earnings profiles, we obtain the residual earnings, y_{it}, by regressing log of earnings on age, age age[2], and other relevant variable that might affect one's earnings. In this case, the residual earnings can be seen as the sum of two components[6]: The permanent component (δ_i) may be thought of unmeasured individual characteristics with its mean zero and the variance equal to σ_b^2. The transitory component (v_{it}) is purely random, having its mean zero and the variance equal to σ_v^2. Thus the variance of the residual earnings, var(y_{it}), can be written as

(5) $\mathrm{var}(y_{it}) = \sigma_\delta^2 + \sigma_v^2$

Following Gottschalk and Moffitt (1994), the permanent component of income can be measured by an average of an individual's income over time (y_i^P) and then the transitory components can be computed as the deviation of current earnings from the permanent components (y_{it}^T). Using this definition, each component of income and the variances can be written compactly as[7]

(6) $y_i^P = \sum_t y_{it} / T$, $\quad y_{it}^T = y_{it} - y_i^P$,

$$\sigma_\delta^2 = \sum_i (y_i^P - \bar{y})^2 / (N-1) - \sigma_v^2 / T, \quad \sigma_v^2 = \sum_t \sum_i (y_{it}^T)^2 / N(T-1)$$

where $\bar{y} = \sum_i \sum_t y_{it} / NT$

The results are presented in Table 3. Several points are worth mentioning.

[3] For extensive discussion for measurement, see Bartholomew (1996)

Table 3. Permanent vs. transitory variance of earnings

	1988-92			1993-97		
	σ_δ^2	σ_v^2	ρ	σ_δ^2	σ_v^2	ρ
Overall	0.160	0.032	0.832	0.116	0.024	0.827
ed<high	0.104	0.046	0.696	0.093	0.038	0.711
ed=high	0.108	0.029	0.786	0.088	0.021	0.810
ed>high	0.084	0.016	0.840	0.068	0.014	0.826

Source: Two samples of FIES for 1988-92 and 1993-97.
Numbers are based on author's calculation

First, the variances of both permanent (σ_δ^2) and transitory component (σ_v^2) are lower in 1993-97 compared to those of 1988-92. However, the fraction of permanent income variance to total variance ($\rho = \sigma_\delta^2 / (\sigma_\delta^2 + \sigma_v^2)$) between two sample periods is very close. Second, a clear pattern is observed along the different education groups: the lower the level of education, the higher overall income variations ($\sigma_\delta^2 + \sigma_v^2$); the lower the level of education, the lower the fraction of permanent income variance to total variance (ρ). This implies that income is more volatile to less educated group due to transitory components.

It is reasonable to think that the impact of the transitory component may last more than a year. If the impact of transitory on income inequality lasts for only a single year, the serial correlation of residual earnings is $\rho = \sigma_\delta^2 / (\sigma_\delta^2 + \sigma_v^2)$, which does not vary over time. On the contrary, if temporary impact persists more than single year, the serial correlation of residual earnings gradually phases out over time. To check this possibility, serial correlation of residual earnings are presented in Table 4.

Table 4. Serial correlation of earnings (residuals)*

year	88	89	90	91	92
88	1				
89	0.88	1			
90	0.83	0.92	1		
91	0.77	0.85	0.93	1	
92	0.70	0.78	0.82	0.87	1

year	93	94	95	96	97
93	1				
94	0.86	1			
95	0.80	0.89	1		
96	0.77	0.85	0.90	1	
97	0.73	0.78	0.82	0.88	1

Source: Two samples of FIES for 1988-92 and 1993-97.
Regressing log of earning on age, age^2, year and industry dummies.

Table 4 supports the notion that the impact of temporary income shock carries over more than a single year. To incorporate this feature into the model, we assume that the transitory component follows an AR(1) process (Lillard and Willis,1978):

(7) $v_{it} = \gamma v_{it\text{-}1} + \eta_{it}$, where $\eta_{it} \sim (0,\sigma_{\eta}^2)$.

With the presence of serial correlation in the residual earnings, the variances of income components σ_{δ}^2 and σ_{v}^2 cannot be obtained directly. In stead, σ_{δ}^2 and σ_{v}^2 can be estimated by fitting a random-effect model with a serial correlation of error component. A standard three-step procedure is used (Hsiao, 1986; Baltagi, 1995; Greene, 1999). In the first step, $\log Y_{it}\text{-}\log Y_i^P$ is OLS-regressed on $\log Y_{it\text{-}1}\text{-}\log Y_i^*$ and $(X_{it}\text{-}X_i^*)$ where X_{it} is a vector of individual characteristics in the earnings equation and $X_i^*=\Sigma_t X_{it\text{-}1}/T$. The coefficient of ($\log Y_{it\text{-}1}\text{-}\log Y_i^*$) is treated as the estimated value of γ (Durbin, 1960)[9]. In the second step, γ from the first step is used in the Cochrane-Orcutt transformation of the original earnings equation.[4] Finally, the equation from the second step is estimated by the random effect method.[5]

The results are presented in Table 5. It shows that: i) overall within year income variance is lower in 1993-97 compared to 1988-92; ii) the same pattern of variances components in each education group appears as observed in Table 3: the lower the level of education, the higher overall income variations ($\sigma_{\delta}^2 + \sigma_{v}^2$); the lower the level of education, the lower the fraction of permanent income variance to total variance (ρ).

A few more points are worth mentioning. First, most of the income difference arises from permanent component difference, which represents approximately 87 percent of total income variance. Purely random stochastic difference explains 12.5 percent (in 1988-92) and 12.2 percent (in 1993-97).

Table 5. Permanent vs. transitory variance of earnings: Serial correlation

	1988-92				1993-97			
	σ_δ^2	σ_v^2	ρ	γ	σ_δ^2	σ_v^2	ρ	γ
overall	0.161	0.024	0.871	0.190	0.126	0.018	0.872	0.135
ed<high	0.114	0.036	0.761	0.133	0.109	0.028	0.793	0.090
ed=high	0.116	0.021	0.848	0.268	0.097	0.016	0.861	0.194
ed>high	0.087	0.012	0.880	0.099	0.080	0.011	0.880	0.029

Source: Two samples of FIES for 1988-92 and 1993-97. Numbers are based on author's calculation

[4] Compared to the Cochrane-Orcutt method, Paris-Winston method causes additional complication in the heterogeneity of error terms

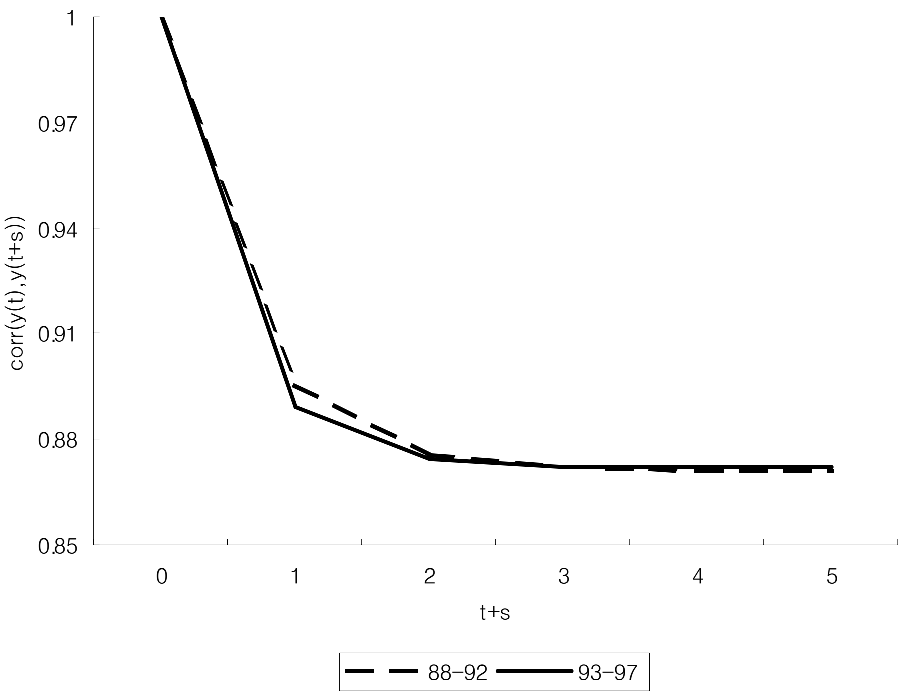
[5] The estimated parameters (standard errors) on age and age^2 are as follows:

For 1988-92: 0.0434503(0.020567) for age and -0.00048(0.000238) for age^2. overall R^2=0.1150.

For 1993-97: 0.0624691(0.012720) for age and -0.0006836(0.000145) for age^2. overall R^2= 0.2386. The regression results show that the maximum labor earnings is achieved at approximately 45-46 years old.

Second, the serial correlation of log of earnings between t and $t+s$ can be shown as $corr(y_{it}, y_{it+s}) = \rho + (1-\rho)\gamma^{|s|}$. Using the value of parameters for ρ and γ, figure 1 shows that 89.6 percent of current income is correlated with the previous years income during 1988-92, and 88.9 percent, and the correlation gradually decreases until 87% as years apart.

Figure 1. Correlation of earnings



V. Discussion and Future Research

Using data sets FIES 1988-92 and FIES 1993-97, this paper analyzes income inequality in Korea. By comparing statistical measures from two samples, it is shown that overall income inequality declines but the persistent component dominantly shapes income inequality. The result shows a systematic pattern between the level of education and the source of income inequality. The lower the education level, most of income inequality stems from transitory income volatility. As the level of education increases income variation increases due to the permanent component.

Several limitations should be taken into account when this result is interpreted. First, the size of each sample used in this paper is relatively small compared to studies done on this topic in other countries. Second, this study does not include the post-period of the recent financial crisis and recovery from it. Socio-economic restructuring during this period must have tremendous impact on income inequality. Further research is clearly warranted on this topic. Third, this research considers only labor income of household male heads. Although labor income is a significant portion of household total income, other sources of income such as capital income may play a very important role in shaping income inequality. Total income inequality rises if a bullish capital market gives the rich a better chance to join and share the capital market benefits while a depressed labor market squeezes the poor's labor earnings.

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Comments on “Short-run versus Long-run Income Inequality”

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This paper analyzes the income inequality in Korea in short-run as well as long-run time period. There have not been many studies on income inequality in Korea, partly due to the lack of appropriate data. This paper, however, uses a national longitudinal survey from the Korean National Statistical Office and decomposes income inequality into permanent and transitory components. Although the work is not complete yet, this is the first attempt to analyze the income inequality using panel data in Korea. The results of the work may provide various information on income redistribution policies as well as macroeconomic policies.

Here are several comments, which would help the author improve the paper. First, the concept of permanent component of individual earning needs to be more clarified. In chapter III, the δ_i represents the earnings component of individuals due to permanent attributes such as gender, the level of education, motivation and intelligence. In the next chapter, the permanent component (δ_i) represents the *unmeasured individual characteristics* with its mean zero and the variance equal to σ_δ^2 . It is not clear whether the δ_i includes the effects of education or not. Moreover, in deriving equation (3), the author assumes that δ_i , *t-b*, and ε_{it} are mutually independent; where the term $\beta(t-b)$ captures the individual's earnings' profile rising with his potential experiences ($x = t - b$) and v_{it} is a transitory deviation from the individual's life-cycle earnings trajectory. The labor market experience accumulates the human capital of the worker through on the job training and the time spent on the job training is very much dependent on the worker's existing stock of human capital, which again depends on the level of education or unobserved ability. Therefore, it is very likely that the δ_i and (*t-b*) are correlated.

Second, the study needs to analyze the determinants of permanent income inequality, as well as the temporary income inequality. Currently, it just decomposes the income inequality into two parts, but the paper would be greatly enhanced if it analyzes the causes of the trends. In addition, it needs to compare this work with the previous studies and need to highlight the distinctive features of this work. It also needs to compare this work with the patterns of income inequality in other countries

Finally, as pointed out by the author, the number of observation used in the analysis is too small for nationwide analysis. The author may need to collect more data as well as to extend the analysis to the recent periods.

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