The 2005 KDI-KAEA Conference on "Korea's Corporate Environment and Sustainable Development Strategy"

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Foreword

This collection of conference papers is an accumulation of materials from *"The 2005 KDI-KAEA Conference on, Korea's Corporate Environment and Sustainable Development Strategy"* held on July 15, 2005 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 2005 major research agenda such as Corporate Environment, SMEs Policy, Productivity, Financial and Fiscal Reforms, and Others. While the first year's joint conference in 2003 invited only experts from KDI and KAEA, this year's conferences were open to both domestic and international academia and professional circles. It is our hope that the conference provided a venue to exchange ideas on the future policy direction for Korea to leap into 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 *Korea Development Review.*

The conference was double sessions. The Venue A offered three sessions: Session I-***Empirical Financial Market Analysis***; Session II-***Financial and Fiscal Reforms***; Session III-***Evidence on Banking System***. On the other hand, the Venue B included: Session I-***Corporate Environment and Performances***; Session II-***SMEs Policy in the Globalization Era***; Session III-***Productivity and Growth Accounting***. This volume comprises of papers that have already been revised by the authors by reflecting the pertinent discussion notes, 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 Professor Hak Youn Kim, Vice President of KAEA for assisting in the preliminary paper selection. Moreover, I would like to extend my gratitude to Ms. Sang Hee Hong, Mr. Dong Jin Shin, and for their hard work and overall coordination of the conference. Also, I thank Ms. Dong-Young Shin for her excellent administrative support.

Sangdal Shim

Chief Editor

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Foreign Exchange Rate and Stock Price

by
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Abstract

In financial crises, it is widely observed that stock prices and exchange rates tend to crash at the same time. Is it possible to identify the cause and effect? This paper tests the empirical significance of causal relations between foreign exchange rates and stock prices, using daily data for Korea (1990-2004) and the U.S (1995-2004). The empirical results are mixed, varying with the period of observation and the lag order of the model. For Korea, bidirectional causality is significant only during the crisis period (1997-2001). For the post-crisis period (2001-2004), the evidence tends to support the stock-market cause theory. For the U.S., the Granger causality test also tends to support the stock-market-cause theory.

JEL classification: *C32, F31, G15*
Keywords: *Unit root, Cointegration, Error-correction model, Granger causality test*

I. Introduction

The most common view of the effect of depreciation on the stock prices is the export-import effect. There are two possible contradicting effects of currency depreciation. First, exports will rise, profits from exports and GDP will rise, and stock prices will increase. On the other hand, imports will fall, profits from imports and GDP will decrease, and stock price will fall. Thus, the net effect of depreciation will depend on the size of each effect: The net effect on the trade balance is defined by the Marshall-Lerner condition (see **appendix note 1**). To support this hypothesis, assuming a net positive effect on profits and GDP, the exchange rate is the cause, and the stock price is the effect. That is, depreciation of home currency should be correlated to rising domestic stock prices.

Another argument that the exchange-rate is the cause is from the foreign investors' point of view. Let us assume that international capital markets are under perfect competition. That is, there are many domestic and foreign buyers and sellers in the financial markets in each country; there is free entry and exit to the international financial

markets without any legal barriers. Further, assume that all other factors, such as tax rates and interest rates, are held constant. If the exchange rate depreciates, what would be the impact on domestic stock prices? For example, if the Korean *won* depreciates, the Korean stock prices will become cheaper for foreign investors, so demand for Koran stocks will rise, and the Korean stock prices will go up. In such a case, depreciation of the won should be associated with rising Korean stock prices.

However, if the expectations of investors are taken into consideration, the impact of a change in the exchange rate on the stock market is not so simple. The rate of return in the Korean stock market for a U.S. investor can be expressed as

$$r = \frac{E(1+k)}{F} - 1 = \frac{E(1+k) - E(1+e)}{E(1+e)} = \frac{(k-e)}{(1+e)} \tag{1-1}$$

$$\frac{\partial r}{\partial k} = \frac{1}{(1+e)} > 0, \ \frac{\partial r}{\partial e} = \frac{-(1+k)}{(1+e)^2} < 0 \tag{1-2}$$

where r = expected return for a foreign or a U.S. investor in the stock market in Korea, E = the spot exchange rate in the Korean currency units per dollar, F = the expected future rate (or the forward rate) in terms of the Korean currency units per dollar, $F = E(1+e)$; where $e = dE/E$, the rate of change in the exchange rate (i.e., the rate of depreciation of the won, if $e > 0$; and the rate of appreciation of the won, if $e < 0$), and k = the average annual rate of stock return in Korea.

Equation (1-1) states that if the stock return k in the stock market in Korea is constant, the stock return r depends upon both the current spot rate and the future expected or forward rate of the Korean won for the U.S. investor. The U.S. investor converts the dollars into E *won* at the spot rate and invests in the stock market in Korea to get the annual rate of return k. At the end of the 1 year investment horizon, the Korean currency is converted into the U.S. dollar at the future rate or the forward rate F. Equations (1-2) state that the rate of return rises for the U.S. investor when the Korean stock return rises, and the rate of return falls when the future Korean currency depreciates. Thus, the current depreciation of the won should be associated to rising stock prices in Korea, but the expected future depreciation of the won should be associated to falling Korean stock prices.

As an alternative hypothesis, reversing the causation, let us consider the case in which changes in the stock prices cause changes in the exchange rate. Assume that stock prices fall in Korea for some reasons, such as a drop in the industrial production and consumer spending, and rises in the inflation rates. If the drop in the stock prices is expected to continue over the investment horizon, U.S. and foreign investors in the Korean stock market will want to pull out from the Korean stock market, and they will try to convert the Korean won into foreign currencies. As a result, the Korean won will depreciate. In such a case, falling stock prices in Korea should be associated to depreciation of the won and rising stock prices should be associated to appreciation of the won. In this scenario, stock prices and appreciation of the won should have a positive correlation.

Thus far, we have briefly stated two possible causal relations, namely, from foreign exchange rates to stock market and from stock market to foreign exchange rates. As a third possible relation, a spurious relation may exist between the two markets; that is, the two variables may be affected by a third variable. For instance, rises in the inflation rates can depress stock prices on the one hand and can depreciate the Korean won on the other

hand. In such a case, depreciation of the dollar will be correlated to falling stock prices, even though there may be no direct causal relations between the two variables (see **appendix note 2**)

This paper tests whether there are statistically significant relations, such as causal, interdependent, and independent relations between the stock market and the currency market, using the traditional Granger-causality test. The rest of this paper is presented as follows. In the following section II, some previous empirical studies are briefly reviewed. In sections III, general determinants of the exchange rate and stock prices are briefly stated. In section IV, data and methodology are explained, and empirical results are presented in sections V and VI for the U.S. and Korea with respect to the unit root test, cointegration test, and the Granger causality test. In the last section VII, findings and conclusions are summarized.

II. Review of Previous Studies

In the 1970's and 1980's, there were very few empirical studies on the causal relations between foreign exchange rates and stock prices. In the 1990's, however, many empirical studies were done on the determinants of stock prices and foreign exchange rates. As determinants of stock prices, the following variables have been examined: the money supply, the interest rate, the real GDP growth rate, and the inflation rate. As determinants of the foreign exchange rate, there are established variables of exchange rate determination: the inflation rate, interest rates, the real GDP growth rate, and the trade balance.

The studies on the link between the stock market and exchange rates were very scarce in the past, but after the publication of Granger's articles of causality, a growing number of studies have been published on the causal relations between exchange rates and stock prices. Below, some widely quoted studies are selected and reviewed briefly in chronological order.

Franck and Young (1972) selected the 280 largest U.S. corporations, and divided them into 2 groups. Those companies which have over 50% of sales, assets, or earnings in areas outside the U.S. were categorized as "high international-intensity (H)" corporations, while those corporations which had less than 5% of any of these variables placed internationally were designated as "low internal-intensity (L)" corporations. Then, they compared the direction of earnings of these corporations before and after each of 6 devaluation events, such as the British devaluation (1967), the French devaluation (1969), the German revaluation (1969), U.S.-Phase I (Aug. 15, 1971), the Agreement of the Group 10 (Dec. 3, 1971), and the U.S. Phase 2 (Dec. 18, 1971). In general, the results did not show any consistent performance before and after devaluation or revaluation (5-days before or 5-days after, 1-month before or after). In the Wilcoxon signed-rank sum test for matched pairs, both H and L companies were matched with the Standard and Poor's Industrial Average, respectively. They concluded that there were no significant differences between the two matched pairs. In addition, they constructed two portfolio returns for H and L corporations, and the returns were compared with the SP and Dow-Jones returns. There were no significant differences before and after exchange realignment.

Ang and Ghallab (1976) selected 15 multinational firms. Using the monthly data for the period 1969 - 73, they calculated the abnormal return as the actual return minus the CAPM predicted return. The abnormal return is cumulated and plotted for the period January 1969 - December 1973. In the U.S., there were two devaluations during the period,

namely, December 1971 (Smithsonian Agreement) and February 1973. The cumulative abnormal return fell from November 1970 to August 1971, and again it fell in February 1973, and went up within a month. From these results they conclude that stock prices adjust with a minimum time lag.

Aggarwal (1981) used monthly data for the period 1974-1978. He concludes that U.S. stock prices are positively correlated with decreases in the value of the U.S. dollar.

Soenen and Hennigar (1988) used monthly data for the period 1980-1986. They tested two types of stock indexes, namely, the SP500 stock index and NYSE indexes as dependent variables. They concluded that the value of the U.S. dollar is negatively correlated. That is, depreciation of the U.S. dollar increases the U.S. stock price indexes.

Jorion (1990) calculated monthly stock returns for 287 multinational corporations for the period 1971-1987 (Value Line database). He constructed 5 portfolios by the degree of foreign involvement, and regressed the portfolio returns of each group on the rate of change in a trade-weighted exchange rate and the rate of return on the CRSP value-weighted market index. The deprecation of the U.S. dollar was negatively related to portfolio returns for the portfolio of minimum involvement, but it was positively correlated with the returns of the portfolios of maximum involvement. He states that the value of the dollar affects U.S. stocks differentially. In effect, the impact of the change in the exchange rate was generally insignificant on stock returns.

Bahmani-Oskoogee and Sohrabian (1992) used monthly data for the period 1973-1988 to test the relationship between the SP500 stock price index and the effective exchange rate of the U.S. dollar. He applied cointegration and Granger-causality tests. He concludes that there is a dual causal relationship between the SP500 stock price index and the effective exchange rate of the U.S. dollar in the short-run. However, the cointegration test did not show any long-run relationship between the two variables.

Roll (1992) observed daily stock returns of   stock market indices for 24 countries for a 3 year period, 1988-91, using the London *Financial Times* data. He regressed the dollar-denominated stock returns of each country on 7 industry factors, Monday dummy variables, and the percentage change in the exchange rate (spot rate/dollar). The stock returns were negatively correlated with the percentage change in the exchange rate.   The Monday coefficients had   significant negative signs for France and the U.K.; significant positive signs for Australia, Germany, and Spain; and the coefficients were not significant for all other countries.

Bartov and Bodnar (1994) selected 208 firms that reported significant foreign currency gains or losses on their annual financial statements for the period 1978 – 90. The daily stock return was aggregated across a 60-trading day window. They regressed beta-risk adjusted abnormal stock returns on the contemporaneous and lagged changes in the trade-weighted value of the U.S. dollar. They found that the contemporaneous percentage change in the U.S. dollar was not significant, but the lagged percentage change in the U.S. dollar had a highly significant negative sign.

Donnely and Sheely (1996) used monthly data for the period 1980 – 92 to examine the causal relationship between foreign exchange rates and abnormal returns of exporting firms in the U.K. They regressed the abnormal returns on the changes in the natural log of the foreign exchange rates. They found a significant negative regression coefficient. That is, appreciation of the U.K. sterling was negatively associated with the abnormal returns.

Adrangi and Ghazanfari (1996) start with an exchange rate function, using a variation of the Dornbusch (1976) and Meese and Rogoff (1983) models. The bilateral exchange rate is expressed as a function of the following factors: relative money supply (ratio of domestic and foreign money supply), relative industrial production, nominal interest rate differential,   inflation rate differential, relative accumulated trade balance, and stock

return differential in domestic and foreign stock markets. Using monthly data for the period 1978-1991, they applied the Granger-causality tests for the relationship between the dollar-mark exchange rate and the differences in stock returns between Germany and the U.S. They conclude that stock returns cause the changes in the exchange rate of the dollar, and there is no evidence that exchange rates of the dollar Ganger-cause the differences in the stock returns.

Mukherjee and Naka (1995) used monthly data for the period 1971-1990. The Japanese yen per U.S. dollar and stock had significant positive relations with the Tokyo stock price index. Kearney (1998) used monthly data for the period, 1975-1994. He found a positive sign for the Irish punt/British sterling exchange rate.

Ajayi and Mougoue (1996) used daily data for the period 1985-1991 to estimate relations between the currency index and the stock price index for Canada, France, Germany, Italy, Japan, the Netherlands, the U.K., and the U.S. They conducted a unit root test, cointegration test, causality test, and calculated the error-correction models. The aggregate domestic stock price had a negative short-run effect on domestic currency value, and currency depreciation had negative short-run and long-run effects on the stock market.

He and Ng (1998) selected 171 Japanese multinational corporations whose exports form at least 10% of their total sales. Using the monthly data obtained from the Pacific Basin Capital Markets database for the period 1979-1993, they tested the following regression model: $r_{it} = \beta_{i0} + \beta_{xt} r_{xt} + \beta_{im} r_{mt} + \varepsilon_{it}$, where r_{it} = the monthly percentage change in the stock price of i th corporate stock, r_{xt} = the percentage rate of change in exchange rate (trade-weighted yen), and r_{mt} = the market portfolio return. They found that only 25 % of the firms had significant positive correlations with the appreciation of the U.S. dollar but that the lagged rate of change in the exchange rate was not significant.

Chow, Lee, and Solt (1997) used the monthly returns of the New York Stock Exchange Index for the period 1977-89. They used both the value-weighted index return and equal-weighted index return in their regression equations. They regressed the stock returns on the percentage change in the real exchange rate, dividend yield, default risk premium, term premium, and a dummy variable for January. For both the value-weighted and equal-weighted stock returns, the percentage change in the real exchange rate was not significant for the short-run horizon, but they had positive and significant signs for the long-run horizon. In their paper, the trade-weighted exchange rate index was constructed such that a rising index indicates depreciation of the U.S. dollar. They also tested the long-term corporate and government bond rates. The results showed that depreciation of the real exchange rate is positively related to bond yield for both types of bond interest rates for both short-term and long-term changes.

Hwang (1999) used monthly data for the period 1973-1996 to test the relationship between the Canadian dollar and the Toronto Stock Exchange 300 Index. He found that the two variables are cointegrated. He concludes that the stock price index has no great influence on exchange rates in the short-run and long-run but that the Canadian currency devaluation has a significant positive effect on the stock price index in the long run. Still the short-run effect was not significant between the two variables.

Ibrahim (2000) also used monthly data for the period 1970-1996 to test the relationship between the value of the ringgit and stock price index for Malaysia. He applied the cointegration test and the Granger causality test. He used three exchange rates, namely, the nominal effective rate, real effective rate, and the ringgit per U.S. dollar. He found there is no significant cointegration between the stock price index and any of the 3 exchange rates. In addition, by the Granger causality test, he found a unidirectional

causality from the stock market index to the exchange rates, but he observed some feedback effect from the ringgit rate to the stock market.

Pan, Fok, and Liu (2001) used daily data for the foreign exchange rates and stock market indexes for the period 1988-1998 for 7 Asian countries, namely, Hong Kong, Korea, Malaysia, Singapore, Taiwan, Thailand, and Japan. According to the Dickey-Fuller and Phillips-Perron unit root tests, the time series data were all unit roots in log levels, but they were stationary in log differences. Using the Johansen cointegration test, only the Hang Seng stock market index (Hong Kong) was cointegrated with foreign exchange rates, but no cointegration was found for the other 6 countries. The Granger causality test showed no causal relation between the foreign exchange rates and stock market indexes for Japan and Taiwan, but there were significant causal relations from exchange rates to stock markets for Hong Kong, Korea, Malaysia, Singapore, and Thailand (1% level). There were significant bidirectional causality relations for Korea and Malaysia (1% level), but the F-statistic indicated that the causal relation was much stronger from exchange rates to stock prices than from stock prices to exchange rates for these countries.

Finally, they applied the nonlinear Granger-causality analysis (Hiemstra and Jones, 1994). They found a highly significant causal relation from stock markets to exchange rates for Japan. They also found significant bidirectional relations for Korea and Malaysia, but the causality relations from stock markets to exchange rates were more significant than the causality relations from exchange rates to stock markets. These are reversed relations of the linear causality test. However, the causality relations from exchange rates to stock markets were also significant for Hong Kong, Singapore, and Thailand, and these results are the same as those obtained by the linear causality test.

Phylaktis and Ravazzolo (2001) use monthly data for the period 1980-98, for Malaysia, Thailand, Hong Kong (1980-98), Indonesia (1983-1998), the Philippines (1986-98), and Singapore (1986-98). A unique feature of their model is that each country's stock market index is a function of the real exchange rate and U.S. stock market prices (SP500 index). Except for Hong Kong, there was no cointegration between exchange rates and stock prices when the U.S. stock variable was not included. But when the U.S. stock variable was included, the trivariate cointegration was significant. When the multivariate Granger causality test, suggested by Dorado and Lutkepohl (1996), was applied, the causal relations from the foreign exchange rate to the local stock markets were significant.

Fang and Miller (2002) use daily data for the Korean stock price index and the won/dollar exchange rate for the period 1997–2000. They find the two times data are unit roots and not cointegrated. Using the first-difference data, they find that the stock price index and the exchange rate have bidirectional Granger causality.

Lean, Halim, and Wong (2003) use weekly data for the period, 1991-2002 for 7 Asian countries, namely, Hong Kong, Indonesia, Japan, Korea, Malaysia, the Philippines, Singapore, and Thailand. The sample period is divided into 3 subperiods. During the pre-Asian financial crisis (1991-1996), except for the Philippines and Malaysia, there was no cointegration and no Granger causality. But, during the period of the Asian crises (Jan. 1, 1997- Sept. 10, 2001), all countries showed causality from exchange rates to stock markets, but not cointegration. During the period of the post-New York Trade center attack (Sept. 11, 2001-Dec. 31, 2002), except for Korea, the Asian countries went back to normal as in the pre-Asian crisis period; that is, no link between exchange rates and stock markets was found.

Mishra (2004) uses monthly data for India for the period 1992–2002, and finds no Granger causality between the exchange rate return and the stock return. But he finds there exists a unidirectional causality between the exchanger rate and interest rate and between the exchange rate and demand for money. Using the VAR model, he argues that interest rate affects the demand for money and the exchange rate, both of which in turn

affect the stock return. Thus, he concludes that by controlling exchange rate management, the policy makers can prevent stock market crises.

The above studies can be summarized as follows:

(1) Stock prices cause exchange rates: Adrangi and Ghazanfari (1996), Ajayi and Mougoue (1996), and Ibrahim (2000) applied causality test and found stock prices cause exchange rates.

(2) Exchange rates cause stock prices: Depreciation and stock prices are positively correlated. Ang and Ghallab (1976), Aggarwal (1981), Soenen and Hennigar (1988), Roll (1992), Bartov and Bodnar (1994), Mukherjee and Naka (1995), Donnely and Sheely (1996), He and Ng (1998), Kearney (1998), Hwang (1999), Pan, Fok, and Liu (2001), Phylaktis and Ravazzolo (2001).

(3) Interdependent relations, causality runs both ways: Bahmani-Oskoogee and Sohrabian (1992), Ajayi and Mougoue (1996), Fang and Miller (2002).

(4) No relations: Franck and Young (1972), Jorion (1990); Chow, Lee, and Solt (1997), Ibrahim (2000); Lean, Halim, and Wong (2003), Mishra (2004)

In effect, the differences in the above empirical studies are apparently caused by differences in methodology, such as microeconomic or macroeconomic analysis; the data, such as daily, monthly, and annual data, the period of observation, and the countries of observation.

III. Determinants of Stock Prices and Exchange Rates

The possible relationships between the foreign exchange rates and stock prices may be expressed in the following functions:

$$S_t = f_1(E_t, P_t, i_t, M_t, Y_t, ..., e_{1t}) \tag{3-1}$$

$$E_t = f_2(S_t, P_t, i_t, M_t, Y_t, ..., e_{2t}) \tag{3-2}$$

where S = stock price, E = foreign exchange rate (expressed in foreign currency per US dollar), P = the price level, money stock, i = nominal interest rate, Y = real GDP; and e$_i$ = the error terms. The above equations can be expressed in terms of percentage growth rates:

$$dS / S = f_3(dE / E, dP / P, i, dM / M, dY / Y, ..., e_3) \tag{3-3}$$

$$dE / E = f_4(dS / S, dP / P, i, dM / M, dY / Y, ..., e_4) \tag{3-3}$$

where *dS/S, dE/E, dM/M,* and *dY/Y* are the percentage rate of change in stock prices, foreign exchange rates, price level, the supply of money, and the growth rate of real GDP respectively.

The above functions can be rewritten in the framework of the international portfolio balance model, following Dornbusch (1976, 1981), Meese and Rogoff (1983), and Adrangi and Ghazafari (1996). The domestic variables in the above 2 functions can be expressed in relative terms with regard to the foreign variables:

$$dE / E = f_5[(S^e / S_0), (m*-m), (i^* - i), (\pi^* - \pi), (r^* - r), (B^* - B), (g^* - g)..., e_5] \tag{3-5}$$

$$dS/S = f_6[(E^e/E_0),(m^* - m),(i^* - i),(\pi^* - \pi),(r^* - r),(B^* - B),.(g^* - g),.,e_6] \quad (36)$$

where m = growth rate of money supply, r = rate of return on stocks, π = inflation rate, B = trade balance or current account balance, and g = growth rate of real GDP. The variables for foreign countries are indicated by asterisks *; E^e/E_0 = the ratio of expected exchange rate to the current exchange rate, S^e/S_0 = the ratio of expected stock price to the current stock price; other variables were defined before.

If the relevant variables were available, the first step of common methodology would be to perform multiple regression analysis. However, in the absence of such data, particularly for the daily data, we cannot use multiple regression analysis; and in such a case, simple regression analysis would increase the chances of spurious regression.

IV. Data and Methodology

Since the Granger causality test procedure varies with the type of the data, that is, whether the data are stationary, unit root, cointegrated, or non-cointegrated, naturally we have to start an examination of the data with respect to these properties:

4-1. The Data:

The Federal Reserve Board data are used for the foreign exchange rates. For the U.S. dollar, the Federal Reserve Board releases both nominal indexes and real indexes. The daily indexes are available only for the nominal indexes, and the monthly data are available for the real and nominal indexes.

Stock price indexes and currency indexes are available for daily, monthly, and annual bases. In this study, we have selected daily data on the assumption that daily data will reflect a more direct relationship between the two variables than weekly, monthly and annual data, which are more likely to be influenced by other factors during the week, month, and the year.

The nominal currency indexes published by the Federal Reserve Board are divided into 4 types: broad index, major currencies index, OITP (other important trading partners), and G-10 index, which was discontinued after December 1998. In this paper, the major currencies index is used. It is "a weighted average of the foreign exchange values of the U.S. dollar against the currencies of a large group of major U.S. trading partners. The index weights, which change over time, are derived from US export shares and from US and foreign import shares." Thus rising currency indexes reflect appreciation of the U.S. dollar. A disadvantage of using the daily exchange rate is that no other daily data are available, such as price level and GDP, etc. and so the real exchange rates cannot be calculated. Deleting the missing data values for Saturdays, Sunday, and holidays, a net total of 2296 observations are used for the SP500 stock index and the major currency index for the period, January 4, 1990 to March 23, 2004..

For the Korean data, the exchange rate represents the *won* units per U.S. dollar. Thus, rising *won* units mean depreciation of the won. For the Korean stock price index, the KOSPI (Korean Stock Price Index) is used. The data cover the period January 3, 1990 to April 16, 2004, a net 3382 observations excluding non-trading days of stocks and currencies. Usually, the annual holding period return is defined as $r_t = (P_t - P_{t-1} + D_t)/P_{t-1}$, where P_t = stock price index at time t, D_t = dividend

during period t. For daily data, $D_t = 0$, and thus the rate of change in the stock price index is defined as the stock return. In this paper, the daily return is calculated as the first difference in log prices: $r_t = \ln P_t - \ln P_{t-1}$ (see **appendix note 3**).

4-2 Unit Root and Cointegration

Our objective is to estimate the following simple regression equations:

$$S_t = a_1 + b_1 E_t + u_t \tag{4-1}$$
$$E_t = a_1 + b_1 S_t + v_t \tag{4-2}$$

For daily stock prices and exchange rate (major currency index), the Dickey-Fuller and Phillips-Perron Tests were performed. Before we present the test results, it may be useful to briefly review the meaning and methodology of such tests. Economic time series data can be divided into two types: stationary time series and non-stationary time series (i.e., unit root, random walk). Non-stationary time series can be divided into the following three types: (1) simple random walk with no constant and no trend, (2) random walk with a constant (drift), and (3) random walk with a constant and a stochastic trend. These 3 types of series can be expressed by the following 3 equations:

$$y_t = y_{t-1} + e_t \tag{4-3}$$
$$y_t = y_{t-1} + \alpha_0 + e_t \tag{4-4}$$
$$y_t = y_{t-1} + \alpha_0 + \alpha_1 t + e_t \tag{4-5}$$

Two tests are most widely used to test the unit root process: the augmented Dickey-Fuller test and the Phillips-Perron test. Though it is often unnecessary to show the Dickey-Fuller equations, it is useful to represent the Dickey-Fuller equations for easy reading of the statistical results. For the Dickey-Fuller test, the following two test-regression equations are used: one with a constant and no-trend, and the other with a constant and trend.

$$\Delta Y_t = \alpha_0 + \alpha_1 Y_{t-1} + \sum_{j=1}^{p} \gamma_j \Delta Y_{t-j} + \varepsilon_t \tag{4-6}$$

$$\Delta Y_t = \alpha_0 + \alpha_1 Y_{t-1} + \alpha_2 t + \sum_{j=1}^{p} \gamma_j \Delta Y_{t-j} + \varepsilon_t \tag{4-7}$$

where Y = stock price index, α_0 = constant, and t = time trend. The null hypothesis is that $\alpha_1 = 0$ for the unit root process. If $\alpha_1 < 0$, we would accept the alternative hypothesis that the series is a stationary series. The lag-terms ΔY_{t-j} are added to correct the problem of serial correlation in the regression equations. In the Phillips-Perron test, a non-parametric correction method , that is, the Newey-West method, is used to estimate the error variance to correct the problem of serial correlation in the error terms..

In the Dickey-Fuller test of cointegration, two types of cointegration regression equations are first calculated, as shown by equations (4-8) and (4-9).

$$Y_t = \beta_0 + \sum_{j=1}^{M} \beta_j X_{t,j} + u_t \tag{4-8}$$

$$Y_t = \beta_0 + \beta_1 t + \sum_{j=1}^{M} \beta_j X_{t,j} + u_t \tag{4-9}$$

where X is taken as the independent variable, M = the number of independent variables. Then the residuals are tested by the unit root test procedure:

$$\Delta u_t = \alpha_t u_{t-1} + \sum_{t=1}^{p} \alpha_i \Delta u_{t-i} + v_t \tag{4-10}$$

where $\alpha = 1$ is the null hypothesis that the error series is unit root.

The difference between the Dickey-Fuller method and the Phillips-Perron method concerns the correction method of serial correction, as mentioned before. If the residual series is not unit root, we accept that the residual series is stationary, and we accept the alternative hypothesis that the two variables are cointegrated. If the two variables are not cointegrated, differenced variables should be used for regression analysis to avoid spurious correlation. However, if the two variables are cointegrated, the level variables can be used for regression analysis without the problem of spurious correlation (Fuller, 1976; Phillips, 1988, 1989; Phillips-Ouliars, 1990; Phillips and Perron, 1988; Johansen, 1988; see **appendix note 4**).

The next step is to conduct a cointegration test to find whether the two or more time series are cointegrated. Even if individual time series may not be stationary series, a linear combination of two or more time series can be stationary (cointegrated). If two or more series are cointegrated, OLS can be used in level values instead of using differenced values. If the times series are cointegrated, we can estimate both the long-run and short-run relationships (error-correction models) using OLS. The long-run and short-run relationships can be stated below:

$$S_t = a_0 + a_1 E_t + u_t \tag{4-11}$$
$$\Delta S_t = \alpha_0 + \alpha_1 \Delta E_t + \alpha_2 \hat{u}_{t-1} + \varepsilon_t \tag{4-12}$$
$$\hat{u}_{t-1} = S_{t-1} - a_0 - a_1 E_{t-1} \tag{4-13}$$

where S = stock price index, and E = exchange rate, u and ε are the error terms. Equation (7-1) states the long-run relationship and Equation (7-2) is the short-run relationship (error correction model).

If the time series are unit roots and cointegrated series, the OLS results in levels are expected to represent the long-run equilibrium relations, and the short-run relations are represented by the so-called error correction model (Engle and Granger, 1987):

The long-run equilibrium relations:

$$S_t = a_0 + a_1 E_t + u_t \tag{5-1}$$

$$E_t = b_0 + b_1 S_t + v_t \tag{5-2}$$

The short-run relations (error-correction models):

$$\Delta S_t = a_0 + \sum_{k=0}^{p} b_k \Delta S_{t-k} + \sum_{k=1}^{q} c_k \Delta E_{t-k} + \lambda_1 u_{t-1} + e_{1t} \tag{5-3}$$

$$\Delta E_t = \alpha_0 + \sum_{k=1}^{p} \beta_k \Delta E_{t-k} + \sum_{k=0}^{q} \lambda_k \Delta S_{t-k} + \lambda_2 v_{t-1} + e_{2t} \tag{5-4}$$

where u and v are the error terms in the long-run relations, e_1 and e_2 are the error terms in the error-correction models.

4.3 Granger Causality Test

- *Granger Causality Test When Time Series are Stationary*

Assume that there are two time-series variables, S and E, and we want to detect which variable is a cause or an effect:

$$S_t = a_0 + a_1 E_t + u_t \tag{6-1}$$

$$E_t = b_0 + b_1 S_t + v_t \tag{6-2}$$

In applying the Granger causality test, there are three common cases. (1) If the two variables are stationary series and cointegrated, the Granger causality test can be performed in level values instead of differenced values. (2) If the time series are unit roots and cointegrated, differenced variables should be used with a lagged error-term u_{t-1}, as shown in Equations (6-3) ~(6-6). (3) If the time series are unit roots and not-cointegrated, differenced variables should be used without the lagged error term u_{t-1}.

Starting with case 2, where the two times series data are unit-roots and cointegrated, the following two equations are estimated for each of the above two cointegrating equations: the full-unrestricted regression equation and the short restricted regression equation.

$$\Delta S_t = \sum_{i=1}^{p} \alpha_{1i} \Delta S_{t-i} + \sum_{i=1}^{q} \beta_{1j} \Delta E_{t-i} + \lambda_1 u_{t-1} + w_{1t} \tag{6-3}$$

$$\Delta S_t = \sum_{i=1}^{p} a_{1j} \Delta S_{t-i} + w_{2t} \tag{6-4}$$

$$\Delta E_t = \sum_{i=1}^{p} \alpha_{2i} \Delta E_{t-i} + \sum_{i=1}^{q} \beta_{2j} \Delta S_{t-i} + \lambda_2 v_{t-1} + w_{2t} \tag{6-5}$$

$$\Delta E_t = \sum_{i=1}^{p} a_{2j} \Delta E_{t-i} + w_{2t} \tag{6-6}$$

where the variables are expressed in the first differences so that the variables are stationary series, and the lagged error term u_{t-1} is added as an error-correction term if the two variables are cointegrated. If the time series are unit roots and not cointegrated, the lagged error terms are not dropped. If the cointegration equations are stationary series, the level variables should be used instead of differenced variables, as mentioned before

The null hypothesis is that $\beta_{11} = \beta_{12} = ... = \beta_{1q} = 0$ for Equation (6-3), which implies that ΔE does not cause ΔS. For Equation (6-5), the null hypothesis is that $\beta_{21} = \beta_{22} = ... = \beta_{2q} = 0$, which implies that ΔS does not cause ΔE. These two hypotheses are tested using the joint F-test for each pair of the equations, i.e., (6-3) and (6-4), and (6-5) and (6-6).

$$F = \frac{(ESSR - ESSU)/q}{ESSU/(n - p - q)} \qquad\qquad (6\text{-}7)$$

where n = total number of observations used in the unrestricted equation, p = the order of lag for stock prices (S), q = the order of lag for currency index (E), $ESSR$ = the error sum of squares of restricted model, $ESSU$ = the error sum of squares of unrestricted model.

If the joint F statistic, Equation (6-7), is less than the critical value of F distribution for the numerator degrees of freedom q and the denominator degrees of freedom $n\text{-}p\text{-}q$, we accept the null hypothesis that ΔE does not cause ΔS. If both α and β coefficients jointly do not equal zero, it is said that a bidirectional causality or a feedback relationship exists. It should be noted that the Granger causality test is sensitive to the choice of lag length p and q (Granger, 1969; 1981,1986,1988; Sims, 1972; Engle and Granger, 1987; Hamilton, 1994) (see **appendix note 5**)

V. Empirical Results for the U.S.

Before any statistical analysis was performed, a graphical review of the data was made. The daily data for the SP500 index and currency index were drawn for the period Jan. 4, 1995 - March 23, 2004 (see **Figure U-1**). In the level variables, the two series show trends, but in terms of log differences (the rate of change), they appear to be stationary series

5.1 Unit Root and Cointegration Tests

The statistical results of the Dickey-Fuller and Phillips-Perron tests are summarized in **Table U-1** for the U.S. data. We note the following: the computed test statistics are less than the critical values (in absolute values), and the results support the null hypothesis that the SP500 and currency indexes are unit roots. The results of the cointegration tests are summarized in **Table U-2**. The Dickey-Fuller and Phillips-Peron test statistics (in absolute values) do not exceed the critical values, which indicate that the results do not reject the null hypothesis that the SP500 and currency indexes are not cointegrated.

The Dickey-Fuller test is a parametric test, while the Johansen cointegration test is a nonparametric test and uses the maximum likelihood procedure for estimation. In the Dickey-Fuller and Phillips-Perron tests of cointegration, software is available for selection of the lag orders based on AIC and SIC, but not for the Johansen test. Since no such software was available for this author, several lag orders were arbitrarily selected by this author. In panel C, Table U-2, the results of the Johansen test are summarized. The results are mixed: the null hypothesis of no cointegration is supported for lags of 2 –7 days, but at lags of 40 and 45 days, the trace test and maximum likelihood test reject the null hypothesis of no-cointegration either at the 10% or 5 % level

5.2 Granger Causality Test

Before we proceed the Granger causality test, we have estimated the relationships between the stock price index and the exchange rate in log levels for the U.S. The estimated simple OLS regression equations are given below for $\ln S$ and $\ln E$ for the entire sample period 1995.1.4 - 2004.3.23: are given below:

$ln\ S_t = -4.7447 \quad + \quad 25472\ ln\ E_t + u_t \quad \overline{R}^2 = 0.5094 \quad SEE = .2122 \quad F = 2383.89$
$\quad\quad (-19.93)^* \quad\quad (48.83)^* \quad\quad\quad D\,W = 0.0047$

$ln\ E = \quad 3.1868 \quad + \quad 0.2001\ ln\ S \ + v_t \quad \overline{R}^2 = 0.5094 \quad SEE = 0.0595 \quad F = 2383.89$
$\quad\quad (112.98)^* \quad\quad (48,83)^* \quad\quad\quad DW = 0.0053$

The numbers in parentheses are the t-ratios, * = significant at the 1% level. The above 2 equations are supposed to represent the long-run equilibrium relations, only if the 2 time series are cointegrated.

In the above OLS regression results, we note the following. First, the adjusted R^2 values are high and the F values are highly significant, but the DW statistics are very low, indicating serial correlation or specification errors. Second, the stock price index and the currency index have positive signs and the regression coefficients are highly significant. Since the rising currency index means appreciation of the dollar, the positive regression correlation indicates that the results are consistent with the stock market theory that rising stock prices cause appreciation of the dollar, though we cannot make a definite statement due to the specification errors.

The Ganger causality test can be "surprisingly sensitive to the choice of lag length (p) and the methods used to deal with potential nonstationarity of the series" (Hamilton, 1994, p.305). As was the case for the Johansen test, the software that selects an optimal lag order was not available to this author for the Granger causality test. Thus, several lag orders were selected by this author. So we have tested lag orders 1, 2, 4, 10, 34, and 41 as shown in **Table U-3** (A ~ B). The results vary with the lag order and whether or not the error-correction term is added. The null hypothesis that changes in the exchange rate do not cause changes in the stock price index is accepted in all models. But, in one model in Table U-3, B-2, without the error-correction term, the F-value rejects the null hypothesis that changes in the stock prices do not cause changes in the exchange rate. This is the only case where the null hypothesis is rejected.. However, the adjusted R^2 of the model is very small, 0.0016, and not significant, even though the joint F-statistic is significant.

In Table U-3, panels C-1 and C-2, the results of the Granger causality test with varying lag orders are summarized with and without the error-correction terms. The null hypothesis that changes in the exchange rate do not cause changes in the stock prices is accepted for all lag orders even at the 10% level. However, the null hypothesis that changes in the stock prices do not cause changes in the exchange rate is rejected at the 5 % level for the lag order = 2. If the α level is increased to 10%, the null hypothesis is rejected at the lag order = 4, 34, and 41 in the results with the error-correction model, and at the lag order = 2, 34, and 41 in the results without the error-correction model. These results tend to support the stock-market cause theory.

VI. Empirical Results for Korea

Similar statistical methods were applied to the Korean daily data to examine the relationships between the Korean stock price index (KOSPI) and the foreign exchange rate (won/dollar) for the period January 3, 1995 – April 20, 2004 (**Figure K-1)**. When the exchange rate and KOSPI were plotted in log differences (rates of changes), both indexes showed sharp fluctuations during the financial crisis, but they were quite stable thereafter

6.1 Unit Root and Cointegration tests

The Dickey-Fuller and Phillips-Perron unit root tests are summarized in **Table K-1.** The sample period is divided into 3 subperiods: pre-crisis (1997 financial crisis), 1990.1.3 – 1996.12.27, crisis period 1997.1.3 –2000.12.26, and post-crisis period 2001.1.3 – 2004.4.16.

The computed test statistics are generally less than the critical values (in absolute values), and support the null hypothesis that the two time series are unit roots.

The results of the cointegration tests are summarized in **Table K-2**. As for the Dickey-Fuller and Phillips-Perron tests, the computed test statistics are less than the critical values (in absolute values), and thus we accept the null hypothesis that there is no cointegration between the two series. As stated before with respect to the empirical results for the U.S. data, we have tested several arbitrary lag orders for the Johansen tests. The Johansen cointegration test results are mixed   First, for the entire sample period, the null hypothesis of no cointegration is rejected for the cointegration equations   with short lags, 3 –5 days,   but the null hypothesis is accepted for longer lags. Second, with the subperiods, cointegration is supported for the crisis period, but it is rejected for the pre-crisis and post-crisis periods.

6.2 Granger Causality Test

Before we proceed the Granger causality test, we have estimated the relationships between the stock price index and the exchange rate in log levels for Korea.   The entire sample period is divided into 3 subperiods. The estimated OLS regression equations for the $ln\ E$ and $ln\ S$ are given below for the entire sample period and 3 subperiods.

6.2.A. Stock price index (KOSPI):

(1) Entire sample period (1990.1.3 – 2004.12.27):

$$\ln\ S_t = 9.6135 - 0.4455\ \ln E_t + u_t \qquad \overline{R}^2 = 0.1739 \quad SEE = 0.2296 \quad F = 712.71$$
$$(83.79)^* \quad (-26.70)^* \qquad\qquad\qquad DW = 0.0076$$

(2) Pre-crisis period   (1990.1.3. – 1996.12.27):

$$ln\ S_t = 1.6434 + 0.7512\ ln E_t + u_t \qquad \overline{R}^2 = 0.0371 \quad SEE = 0.1852 \quad F = 64.72$$
$$(2.65)^* \quad (8.04)^* \qquad\qquad\qquad DW = 0.0024$$

(3) Crisis period (1997.1.3. – 2000.12.27):
$$ln\ S_t = 13.4436 - 0.9955\ ln E_t + u_t \qquad \overline{R}^2 = 0.2386 \quad SEE = 0.2930 \quad F = 296.46$$
$$(32.98)^* \quad (-17.22)^* \qquad\qquad\qquad p = 0.00 \qquad DW = 0.0097$$

(4) Post-crisis period (2001.1.3. – 2004.4.16):
$$ln\ S_t = 17.1244 - 1.4895\ ln E_t + u_t \qquad \overline{R}^2 = 0.1612 \quad SEE = 0.1541 \quad F = 150.88$$
$$(2.65)^* \quad (0.09)^* \qquad\qquad\qquad DW = 0.0163$$

6.2.B. Exchange Rate (won/dollar):

(1) Entire sample period (1990.1.3 – 2004.12.27):
$ln \ E_t = 9.4316 - 0.3909 \ ln \ S_t + u_t$ $\overline{R}^2 = 0.1739$ $SEE = 0.2151$ $F = 712.71$
     (83.79)*   (-26.70)* $DW = 0.0024$

(2) Pre-crisis period   (1990.1.3. – 1996.12.27):
$ln \ E_t = 6.3188 + 0.0501 \ ln \ S_t + u_t$ $\overline{R}^2 = 0.0371$ $SEE = 0.0478$ $F = 64.72$
     (152.75)*   (8.04)* $DW = 0.0017$

(3) Crisis period (1997.1.3. – 2000.12.27):
$ln \ E_t = 8.5941 - 0.2405 \ ln \ S_t + u_t$ $\overline{R}^2 = 0.2386$ $SEE = 0.1440$ $F = 296.46$
     (95.61)*   (-17.22)* $DW = 0.0113$

(4) Post-crisis period (2001.1.3. – 2004.4.16):
$ln \ E_t = 7.8302 - 0.1089 \ ln \ S_t + u_t$ $\overline{R}^2 = 0.1612$ $SEE = 0.0417$ $F = 150.88$
     (135.28)*   (-12.28)* $DW = 0.0152$

The numbers in parentheses are the t-ratios, * = significant at the 1% level. The above 2 equations are supposed to represent the long-run equilibrium relations, only if the 2 time series are stationary and cointegrated. It should be noted that the level variables are non-stationary and that differenced variables are stationary. For the log-differenced variables, the null hypothesis of no-cointegration was accepted by the Dickey-Fuller test and the Phillips-Perron test, but rejected by the Johansen test.

In reading the above results, it should be noted that for the Korean data, the value of the won is measured by the Korean currency units per U.S. dollar. Thus, rising currency units means depreciation of the won, and falling won means appreciation of the won. In the above OLS regression results, we note the following. The adjusted R^2 values are high and the *F* values are highly significant, but the DW statistics are very low, indicating serial correlation or specification errors.

First, for the pre-crisis period, the stock price index and the currency index have positive signs and the regression coefficients are highly significant in spite of the fact that the Korean won was under the managed fixed exchange rate system. The positive regression coefficient is consistent with the exchange-rate-cause theory.

 Second, for the crisis-period and post-crisis period, the regression coefficients are negative, and these are consistent with the stock-market cause theory. That is, the stock price index rises first, and the exchange rate appreciates as a result. However, the above interpretation is tentative, since the low DW statistics indicate specification errors, such as missing variables and errors in the functional forms of the relationships.

Now we may perform the Granger causality test. As stated before, no software that selects an optimal lag order was available to this author. So, we have tested several lag orders with and without error-correction terms. Also, we have applied the Granger causality test for the 4 periods. (1) For the entire sample period, 1990-2004, (2) Pre-crisis period, 1990.1.3 -1996.12.26, (3) Crisis period, 1996.1.3-200.12.26, and (4) Post-crisis period, 2001.1.3 - 2004.4.16. Since the cointegration results were mixed, we have tested both models with the error-correction term and without the error-correction term. The results are summarized in **Table K-3**:

Lag order = 1:
First, for the Ganger model of lag order 1, there are bidirectional causal relations between stock price index and the exchange rate during the crisis period.

Second, there are unidirectional causal relations by which changes in the stock price index cause changes in the exchange rate in both models, with and without the error-correction terms only during the post-crisis periods. In the pre-crisis period, there is no significant relations between the two variables.

Lag order = 10:

First, for the 3 subperiods, changes in the stock price index cause the changes in the exchange rate. This result is supported for the Granger models with or without error correction terms (Equations C-2 and D-2) .

Second, there are unidirectional causal relations in which changes in the stock price index cause the changes in the exchange rate in both models with and without error-correction terms in the pre-crisis and post-crisis periods, as well as during the crisis period..

Lag orders = 22, 45

In both models of lag orders 22 and 45, there are bidirectional causal relations between the stock price index and the exchange rate only during the crisis period, and no significant causal relations exist in the pre-crisis and post-crisis periods.

So, which results should we trust in the presence of conflicting theories? There is no simple answer. But, we can think of   a few criteria. First, a model is better if the penalty-adjusted residual sum of squares, such as AIC, SIC, finite prediction error, and adjusted R^2,   is small (see **appendix note 5**). Second, a model is better if the empirical results are consistent with the theory. Third, if conflicting empirical results are obtained, and if there are conflicting theories, then the results may be inconclusive. Because the conflicting empirical results support conflicting theories, we cannot tell which theory is correct.

In effect, the empirical results of Granger models of lag orders 1 and 10, compared with the Granger models of lag orders 22 and 45, tend to support the following conclusions:

(1) The stock price index and the exchange rate have bidirectional causal relations during the crisis period. (2) During the pre-crisis period, there are no significant causal relations between the two. (3) During the post-crisis period, there tends to be a one-way causal relation from the stock price index to the exchange rate. This causal relation from the stock price index to the exchange rate is consistent with the empirical results for the U.S., but they are contradictory with the empirical results of the Granger models of lag orders 22, 28, and 45, which find no Granger causal relations.   It should be noted that the adjusted R^2 values are not always higher in the Granger models of lag orders 1 and 10 than in the models of   lag order 22. But the F values of the Granger models of lag order 1 and 10 tend to be larger than those for the models with lag order 22.

6.3 Efficient Market, Cointegration, and the Granger Causality

Granger (1986) made two hypotheses. (1) If x and y are unit roots and cointegrated, there must be Ganger causality in at least one direction." (2) If x and y are a pair of prices from a jointly efficient, speculative market, they cannot be cointegrated; one can be used to help forecast the other, and this would contradict the efficient market hypothesis. The above empirical results are consistent with Granger's first hypothesis, but our results do not necessarily support Granger's second hypothesis.

Our results show the existence of cointegration and Granger causality. In Granger (1986), efficient market is defined as the absence of predictability. In a random walk series, current and past values are independent of future values. Then, current and past values are not useful to predict future values. However, if there is an interdependent

relationship between two random variables, cointegration may possibly exist, but it would not necessarily imply one-way predictability because the interdependent relationship can take place simultaneously. Also, in Granger definition, predictability should be consistent. The presence of the empirical Granger   causality would not necessarily guarantee consistent predictability. Also, an efficient market can be defined as an asset market where investors cannot predict future asset prices consistently and cannot make abnormal returns consistently using the rules of prediction and trading rules. Under this definition, cointegration, causality, and efficient market can coexist. Also, it should be noted that there are studies that do not necessarily support the efficient market hypothesis (Lo and MacKinlay, 1988; 1989, 1999)

VII. Summary and Conclusions

To evaluate the possible causal relationships between the foreign exchange rates and stock prices, we have applied various statistical methods, using the U.S. daily data for the period January 4, 1995 – March 21, 2004, and using the Korean daily data for the period January 3, 1990 – April 16, 2004.

First, we have applied the Dickey-Fuller and Phillips-Perron tests for unit roots. The test results show that both the currency index and the SP500 stock price index are unit roots. Also, the test results show that the Korean stock price index and the exchange rate are unit roots.

Next, we have applied the cointegration tests. The results of the Dickey-Fuller and Phillips-Perron tests indicate that the currency index and stock price indexes are not cointegrated for the U.S. data. However, the results of the Johansen test are mixed. Both the trace test and the maximum eigenvalue test support cointegration for the U.S. data at the 10% level. For the Korean data, the results are also mixed. For the entire sample period, both the trace and eigenvalue tests support cointegration at lags ranging from 2 to 5 days. But the entire sample period is divided into 3 subperiods, cointegration disappears.

Third, the Granger causality test was applied to detect whether there are significant causal relations between the currency index and the stock price index. For the U.S. data, the results for the causal relationships are mixed. In all the models the causality test accepts the null hypotheses that the exchange rates do not cause the stock prices. However, the Granger test reject the null hypothesis that stock market does not cause the exchange rate, in one model with a lag order = 2 at the 5% level.   If the α level is increased to 10%, the above null hypothesis is rejected at lag orders = 4, 34, and 41 in the error-correction model, and at lag orders = 2, 34, and 41 in the model without error-correction terms. These results tend to support the stock-market cause theory.

For Korea, bidirectional causal relations are significant for the entire sample period. When the entire sample period is divided into subperiods, there was no causality during the pre-crisis period obviously due to the managed fixed exchange rate system. The relationship was bidirectional during the crisis-period, and this must have aggravated the financial crisis in Korea.   For the post-crisis period, the Granger causality was from the stock prices to the exchange rate. These results contradict the common view that the exchanger rate causes fluctuations in the stock market. It is interesting to note that the results tend to support the stock-market cause theory for both Korea and the U.S.

Finally, we may derive the following policy implications. First, the relationship between the exchange rate and stock prices may not remain constant, there may be no simple permanent strategy for controlling both exchange rates and stock prices by

controlling only one variable. The impact of a change in one variable may depend upon the magnitude of the change in the variable. Second, in the post-crisis period, the empirical results suggest that in forecasting the foreign exchange rates and financial crises, and in establishing the foreign exchange rate policies, the stock market variable should be taken into consideration as one of the major determinants of the exchange rates and financial crises.

Appendix A   Notes:

Note A-1: Marshall-Lerner Condition: Given $B = Q_x P_x - Q_m P_m$, using total differential, we can derive $dB = (dP_x / P_x)[Q_x P_x (E_x + E_m - 1)]$, which indicates that $dB > 0$ if $E_x + E_m > 1$,

where B = trade balance, Q_x = quantity of exports, Q_m = quantity of imports, P_x = price of exports, and P_m = price of imports; $E_x = (dQ_x / dP_x)(P_x / Q_x)$, the price elasticity of exports, and . $E_m = (dQ_m / dP_m)(P_m / Q_m)$, the price elasticity of imports. The Marshall-Learner condition states that the net export effect of depreciation of domestic currency depends on the sum of export and import elasticities. To begin with the equilibrium condition, if the sum is greater than 1, depreciation will improve the next exports (see Salvatore, 2004, pp. 573-575 and Krugman and Obstfeld, 1997, pp. 483-485).

Note A-2: Spurious Correlation

Granger and Newbold (1974)   found "in a small simulation that if two independent integrated series were used in a regression, one chosen as the dependent variable and the other the explanatory variable, the standard regression computer package would very often appear to find a relationship, whereas in fact there was none… Putting the analysis in the form of an error-correction model resolves many of the difficulties found with spurious regression"(Granger, 2004. p. 423). There are at least two cases of spurious correlation or regression. One is when the relationship is significant due to the method of estimation. Even if two variables may not be significant, transformed variables may be significant. Given y = a + bx, for instance, the relationship between x and y may not be significant, but when the equation is expressed by *y/x = a/x + b*, the two ratio variables y/x and a/x may be found significant (Gujarati, 2003, p. 422).

The second case of a spurious correlation or regression is when a third variable z is related to both x and y variables. In such a case, the relationship between x and y may be found significant. Assume that y = a + bx, and x = c + dz. Then z = x/d - c/d, and   y = a + b(x/d - c/d) = a + b x/d - bc/d = (a -bc/d) + (b/d) x. In such a case, a multiple regression equation   can remove the spurious regression. Let y = a + b x + c z. Then the coefficient of x will be not significant if   x and y have a spurious regression (Wooldridge, 2003; Stewart, 2005).

Assume that inflation rate (z) affects both stock prices (y) and foreign exchange rates (x). Then stock prices and the exchange rates can have a significant correlation. But if the stock price is regressed on the foreign exchange rate and the inflation rate, y = a + bx + cz, the exchange rate x can be not significant,   if y and x have a spurious correlation.

Note A-3: Currency Index for the dollar, Exchange rate for the won, and Stock Price Indexes.   The Federal Reserve Board publishes various exchange rate indexes, daily, weekly, monthly, annual indexes. The nominal exchange rate index is given by

$$I_t = I_{t-1} \Pi(e_{j,t} / e_{j,t-1}) w_{j,t}$$

where $e_{j,t}$ is the price of the U.S. dollar in terms of foreign currency at time t, and $w_{j,t}$ is the weight of currency j at time t in the total competitiveness index for the U.S. dollar. The base period index I_0 is assumed to take an arbitrary value , 100. The real exchange rate index is given by

$$I_t = I_{t-1} \prod_j [(e_{j,t} P_t / P_{j,t}) / (e_{j,t-1} P_{t-1} / P_{j,t-1})] w_{j,t}$$

where P_t = the consumer price index for the U.S. at time t, $P_{j,t}$ = the consumer price index for country j at time t.

The broad index includes the currencies of all foreign countries or regions that had a share of U.S non-oil imports or nonagricultural exports of at least 1/2 % in 1997

The major currency index includes the currencies of the G-10 countries and other countries of the euro area and the Australian dollar (Leahy, M.P., "New Summary Measures of the Foreign Exchange Value of the Dollar," *Federal Reserve Bulletin*, Oct. 1998, pp. 811-812).

In this paper, we have used the major currency index on the assumption that investors in the major currency countries may be more susceptible to exchange rate changes than investors in the other countries. The foreign exchange rates are the noon buying rates in New York City for cable transfers payable in foreign currencies (the Federal Reserve Bank of New York). Rates in currency units per U.S. dollar except as noted. Thus, a rising currency index represents appreciation of the dollar. For the value of the won the won units per dollar is used, such as 1000 won/dollar. Thus, a rising won means depreciation of the dollar.

For the stock price index the SP500 index is used, and for the Korean stock price index, KOSPI (Korean stock price index) is used. Both indexes are value-weighted indexes.

.**Note A-4**:   **The Johansen Cointegration Test** Assume that there are two variables and they are cointegrated. Then, letting $y \equiv (S, E)$, the vector error correction model (VECM) can be expressed as

$$\Delta Y_t = \mu + \sum_{i=1}^{k} G_i Y_{t-i} + G_k Y_{t-1} + \varepsilon_t$$

μ = 2 x 1 vector of drift, G = 2 x 2 matrices of parameters, k = number of lags, ε = 2 x 1 white noise vector. (For 3 variable case, μ = 3 x 1 vector of drift, G = 3 x 3 matrices of parameters, ε = 3 x 1 white noise vector).

There are two test statistics for the Johansen test of cointegration: trace test and maximum eigenvalue test.   (1)   The null hypothesis for the trace test is that there are at most r-cointegrating vectors $0 \le r \le n$,   and thus there are   n-r common stochastic trend is given by:

$$\text{Trace} = -T \sum_{i=h+1}^{n} \ln(1 - \lambda_i),$$

where T = the number of observations used for estimation, n = the number of variables in the system, h= the number of cointegrating vectors, and λ_i = eigenvalues, i.e., *n-r* smallest squared canonical correlations of Y_{t-1} with respect to ΔY_t, corrected for lagged differences,

(2)   The null hypothesis for the maximum eigenvalue test is that there are *r+1* cointegrating vectors given *r*-cointegrating vectors:

$$\text{Maximum eigenvalue} = -T \ln(1 - \lambda_{h+1}),$$

where λ_{r+1} = (r+1)th largest eigenvalue. The critical values are given in Johansen and Juselius (1990) and   Hamilton (1994). Also, see Johansen (1988), Phylaktis and Ravazzolo (2001), Pan, Fok, and Liu (2001). The SHAZAM program gives both the trace test and the maximum eigenvalue test with critical values.

Using the Johansen test without drift, Baillie and Bollerslev (1989) find that 7 nominal daily spot exchange rates are cointegrated: the Canadian dollar, French franc, Deutsche Mark, Italian lira, Japanese yen, Swiss franc, and British pound.   Using the Johansen test with drift, Diebold, Gardenzabal, and Yilmaz (1994) find no cointegration among the 7 spot currency values. They used the same data set used by Baillie and Bollerslev. Diebold et al., and tested 5 lag orders, 1 to 5, and selected lag order p=2, at which AIC was a minimum.

A problem with the Johansen test is that it is sensitive to lag order, and   a VAR lag order must be specified and the lag parameters must be estimated. The lag length "should be high enough to allow to ensure that the errors are approximately white noise, but small enough to allow for estimation" (Ghali, 1999). Some authors use AIC or SIC in selecting lag length. Bierens (1997) has proposed a nonparametric procedure that can also detect and estimate multiple vectors and no lag structure or deterministic terms need be estimated. A comparison of the two procedures is given in Cushman (2003). Some software selects the optimal lag length based on AIC and SIC. However, such software and Bierens' procedure were not available for this author, using the software SHAZAM, we applied several lag orders, such as from 2 to 7, 32, 40, and 45 days, as shown in Tables U-2 and K-2.

Note A-5.   Granger Causality Test

A5-1. When Time Series are not Stationary and not Cointegrated

It should be noted that the traditional Granger causality test requires the times series to be stationary series. If the time series are not stationary, then differenced data, such as log-differenced data, should be used to avoid spurious correlation. If the time series are not cointegrated, the error-correction models should not include the error-correction term, u_{t-1}.

If time series are unit roots and not cointegrated, the short-run regression equation should be estimated by differenced data, such as

$$\Delta S_t = a_0 + a_1 \Delta E_t + u_{1t} \tag{8}$$

$$\Delta E_t = b_0 + b1 \Delta S_t + u_{2t} \tag{9}$$

The unrestricted equation and restricted equations for variable S are

$$\Delta S_t = \alpha_0 + \sum_{k=0}^{p} \beta_k \Delta S_{t-k} + \sum_{k=1}^{q} \gamma_k \Delta E_{t-k} + e_{1t} \tag{10}$$

$$\Delta S_t = a_0 + \sum_{k=0}^{p} b_k \Delta S_{t-k} + u_{1t} \tag{11}$$

The unrestricted and restricted equations for variable E are

$$\Delta E_t = \alpha_0 + \sum_{k=1}^{p} \beta_k \Delta E_{t-k} + \sum_{k=0}^{q} \gamma_k \Delta S_{t-k} + e_{2t} \tag{12}$$

$$\Delta E_t = a_0 + \sum_{k=1}^{p} b_k \Delta E_{t-k} + v_{2t} \tag{13}$$

In Equations (10) and (11), the null hypothesis is that $\gamma_1 = \gamma_2 = ... = \gamma_q = 0$, which implies that E does not Granger-cause S. In Equation (12) and (13), the null hypothesis is that $\gamma_1 = \gamma_2 = ... = \gamma_q = 0$, which implies that S does not Granger-cause E (note that the same symbols are used for the coefficients). The hypotheses are tested by the joint F-ratio (Equation 7)..

A5-2. Granger-causality test when time series are not stationary and cointegrated

Assume that there are two time series variables, S and E, we want to detect which variable is a cause or an effect:

$$S_t = a_0 + a_1 E_t + u_t \tag{14}$$
$$E_t = b_0 + b_1 S_t + v_t \tag{15}$$

To review the Granger causality test procedure, assume that the two variables are unit roots and cointegrated series, then following two equations are estimated for each of the above two cointegrating equations: the full-unrestricted regression equation and the restricted regression equation:

$$\Delta S_t = \sum_{i=1}^{p} \alpha_{1i} \Delta S_{t-i} + \sum_{i=1}^{q} \beta_{1j} \Delta E_{t-i} + \lambda_1 u_{t-1} + w_{1t} \tag{16}$$

$$\Delta S_t = \sum_{i=1}^{p} a_{1j} \Delta S_{t-i} + v_{1t} \tag{17}$$

$$\Delta E_t = \sum_{i=1}^{p} \alpha_{2i} \Delta E_{t-i} + \sum_{i=1}^{q} \beta_{2j} \Delta S_{t-i} + \lambda_2 v_{t-1} + w_{2t} \tag{18}$$

$$\Delta E_t = \sum_{i=1}^{p} a_{2j} \Delta E_{t-i} + v_{2t} \tag{19}$$

where the variables are expressed in the first differences so that the variables are stationary series, and the lagged error term u_{t-1} is added as an error correction term if the two variables are cointegrated. If not, the lagged error terms are not necessary. Also, if the cointegration equations are stationary series, there is no need to use differenced variables.

The null hypothesis is that $\beta_{11} = \beta_{12} = ... = \beta_{1q}$ =0 for Equation (16), which implies that ΔE does not Granger-cause ΔS; $\beta_{21} = \beta_{22} = ... = \beta_{2q}$ =0 for Equation (18), which implies that ΔS does not Granger-cause ΔE. These two hypotheses are tested using the joint F-test for each pair of the equations, i.e., (16) and (17), and (18) and (19).

$$F = \frac{(ESSR - ESSU)/q}{ESSU/(N-p-q-1)} \quad \sim \quad F(p,N\text{-}p\text{-}q\text{-}1) \tag{20}$$

where N = total number of observations used in the unrestricted equation, p = the order of lag for stock prices (S), q = the order of lag for currency index (E), $ESSR$ = the error sum of squares of restricted model, $ESSU$ = the error sum of squares of unrestricted model.

$$ESSU = \sum_{t=1}^{N} w_t^2 \quad \text{and} \quad ESSR = \sum_{t=1}^{N} v_t^2$$

If the joint F statistic, Equation (20),   is less than the critical value of F distribution for the numerator degrees of freedom q and the denominator degrees of freedom N-p-q, the null hypothesis that ΔE does not cause Granger-cause Δ S. If both α and β coefficients are jointly not equal to zero, it is said that bidirectional causality or feedback relationship exists. It should be noted that the Granger causality test is sensitive to the choice of lag length p and q.

With the lagged variables as in the above Granger -causality regression, the F-test is valid only in asymptotically. An asymptotically equivalent test statistic is given by the chi-square statistic:

$$\chi^2 = \frac{N(ESSR - ESSU)}{ESSU} \quad \sim \quad \chi^2(q) \tag{21}$$

(Granger, 1969, 1988; Sims, 1972; Engle and Granger, 1987; Hamilton, 1994, p. 305).

Given the F value, the corresponding χ^2 value can be calculated by

$$\chi^2 = \frac{N \cdot F \cdot q}{(N - p - q - 1)}$$

The χ^2 value and its significance   probability can be computed using the SAS software.

A5-3. Long-Run Non-Causality Test (Toda-Yamamoto Procedure for Non-stationary Data)

An alternative test procedure of the Granger causality test is the long-run non-causality test developed by Toda and Yamamoto (1995).   Under Toda-Yamamoto procedure, a VAR model is constructed in levels in the presence of non-stationary data with a total of $k+d_{max}$ lags, where d_{max} is the maximum of suspected order of integration, and k = lag order of the initial VAR model without d_{max}. Using the log stock price $ln\ S$ and the log exchange rate $ln\ E$, the augmented Granger causality test equations can be stated as

$$\ln S_t = a_0 + + \sum_{i=1}^{k+d} b_i \ln S_{t-i} + \sum_{i=1}^{k+d} c_i \ln E_{t-i} + u_t \tag{21}$$

$$\ln E_t = \alpha_0 + \sum_{i=1}^{k+d} \beta_i \ln S_{t-i} + \sum_{i=1}^{k+d} \gamma_i \ln E_{t-i} + v_t \tag{22}$$

The optimal lag length *k* may be set by AIC, SCI, or Hsiao (1981) procedure that minimizes the mean squared prediction error. The null hypothesis is: $c_i = \beta_i = 0$ for all *i*'s. The alternative hypothesis is: $c_i \neq 0$ and $\beta_i \neq 0$ for at least some *i*'s. If the coefficient c_i's are significant but β_i's are not, then *ln E* causes *ln S.* If the coefficient β_is are significant, but c_i's are not, then *ln S* causes *ln E.* If both c_i's and β_i's are significant, then there is bi-directional causality.

In the above equations, if the variables are I(0), a standard *t*-test or *F*-test is not valid. The procedure utilizes the Modified Wald test statistic λ_w^* for testing linear restrictions of the coefficients of the model:

$$\lambda_w^* = T \tilde{\alpha}' R' (R \sum{}_{\tilde{\alpha}} R')^{-1} R \tilde{\alpha} \tag{23}$$

where T = sample space size, $\tilde{\alpha}$ = OLS estimator of α, $\sum$ = consistent and estimator of the variance-covariance matrix of α, *R.* .Stationarity insures that the Modified Wald test statistic is asymptotically distributed as a χ^2 random variable with degrees of freedom equal to the number of restrictions imposed, regardless of whether y_t may be stationary around a deterministic trend, I(0), I(1), or I(2), non-integrated or cointegrated of an arbitrary order. Quintos (1998) further develops a fully modified vector autoregressive procedure that does not required correct specification of lagged variables in the VAR model.

A good application is given in Bhattacharya and Mukherjee (2002). Using the above Toda and Yamamoto procedure, Bhattacharya and Mukherjee test the causal relations between stock market and 5 macroeconomic variables. They used Hsiao's procedure to find the optimal lag structure. In many studies, the lag order found in the unit root test is used for the cointegration test and the Granger causality test should be the same, but in our paper, this procedure is not taken since the lag orders were not necessarily consistent in each test. For India, they found no causal relations between stock prices and money supply, stock prices and national income, stock prices and interest rate, and stock prices and industrial production, but found a two-way causal relation between stock prices and inflation rate. They did not test the causal relations between stock prices and exchange rates. In this paper, we have not used the Toda and Yamamoto procedure because the software was not available. We have used the RATS software (Version 6.0) that contains only the traditional Granger causality test. It is left to a future study to compare the results of the two procedures.

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Comments on "Foreign Exchange Rate and Stock Price"

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The paper studies possible causal relations between the exchange rate(s) and stock prices for data from Korea and the U.S. The following results are obtained: There is no causal relation for the U.S. data. However, there exists bilateral causality for Korean data in the period of financial crisis. The topic is an interesting one as the two assets of a currency and a stock are closely related to each other in the international financial markets. In particular, in the period of financial crisis the relation of the two assets might be different from the usual period. There, however, several parts in the paper that have to be clarified and/or corrected. Some specific comments are provided in the following.

The analysis of the paper is based on a bivariate vector error correction model (VECM)

$$\Delta s_t = \sum_{i=1}^{p} \alpha_{1i} \Delta s_{t-1} + \sum_{j=1}^{q} \beta_{1i} \Delta e_{t-j} + \lambda_1 u_{t-1} + w_{1t}$$

$$\Delta e_t = \sum_{i=1}^{p} \alpha_{2i} \Delta e_{t-i} + \sum_{j=1}^{q} \beta_{2j} \Delta s_{t-j} + \lambda_2 v_{t-1} + w_{2t}$$

with the null hypothesis

1. $H_0 : \beta_{k,j} = 0, \quad j = 1,.....,q, \quad for \quad k = 1, \ 2, \quad Respectively.$

1. It should be $p = q$ for the correct Granger-representation of a bivariate ECM in (1). A VECM is derived from a vector auto-regression (VAR).
That is, from

$$VAR(p) \ : \ Y_t = c + \phi_p Y_{t-p} + \cdots + \phi_p Y_{t-p} + \varepsilon_t$$

We get

$$Y_t = c + \xi_0 Y_{t-1} + \xi_p \Delta Y_{t-1} + \cdots \xi_{p-1} \Delta Y_{t-p+1} + \varepsilon_t$$

Where $\xi_0 = \sum_{j=1}^{p} \Phi_j, \xi_i = -\sum_{j=1}^{p} \Phi_j, \quad i = 1, \cdots, p-1.$

2. The hypothesis to be tested should be

$$H_0 = \Phi_{i,12} = 0, \quad i = 1, \cdots, p$$

for a bivariate VAR for Y_t, or

$$H_0 : \quad \xi_{0,12} = 0 \quad \text{and} \quad \xi_{i,12} = 0, \quad i = 1, \cdots, p-1.$$

Hence, by (1) we can only test for non-casuality of ΔY's in the absence of ointegration $(\lambda_i = 0)$. Note that the coefficient $\xi_{i,12}$ has information on ointegration relation(s).

3. In the presence of a unit root the behavior of the Wald statistic is non-standard in many cases, where the non-standard behavior is characterized by nuisance parameters. Therefore, analysis based on the asymptotic χ^2 distribution of the Wald statistic may be incorrect, misleading the inference.

4. Interpretation of a spurious regression is meaningless (in the sections of Granger-causality test (Sections 5.2 and 6.2)). The following model

$$\ln S_t = \alpha_0 + \alpha_1 \ln E_t + u_t, \quad \text{etc.}$$

is estimated. It is confirmed that $\ln S$ and $\ln E$ are not cointegrated (Sections 5.1 and 6.1). However, the paper goes ahead with estimation and tries to interpret the results. In this case, interpretation of the results about significance of α_1, $\bar{R}^2$, etc., are meaningless, that is, they are not possible to interpret.

5. For Korean data

In fact, no cointegration found for the crisis period (Table k2). Therefore, there exists bilateral causality, if any, only in differences because of the reason explained in 2 above.

6. Existence of Granger-causality implies existence of predictable information in the causing variable for the caused variable. In turn, it implies that there might be some

arbitrage opportunity, contrary to the efficient market hypothesis. The paper has the result that there exists bilateral causality for Korean data in the period of financial crisis. Some additional explanation on this result would be helpful, especially regarding the relationship between Granger-causality and possibility of arbitrage opportunity in the Korean financial market in the period of financial crisis.

Economic Fundamentals on Exchange Rates under Different Exchange Rate Regimes: Recent Experiences from the Korean Exchange Rate Regime Change

by
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Abstract

This paper examines the macroeconomic structural differences of the free floating exchange rate regime and the managed float exchange rate regime focusing on the Korean economy. Korea has shifted her exchange rate regime from the managed float to the free floating after the 1997 economic crisis. It is well documented that the exchange rate is very difficult to predict using any theoretical models for the exchange rate determination. Korean exchange rates provide one of the unique opportunities to study the different behaviors or roles, if any, of managed float and free floating exchange rate regimes. Based on the simple monetary model, we found that the Korean exchange rates are more sensitive to the economic fundamentals under the free floating regime than under the managed float regime. Exchange rate pass-through into domestic variables, especially inflation rate, has become more direct and statistically significant under the floating regime than under the managed regime. This finding is consistent with the views that the managed (or fixed) regime provides the domestic price stability necessary for the economic growth for the developing countries. Exchange rate volatilities under the flexible regime could be reduced with the development of well-functioning currency futures market.

I.   Introduction

After the recent Asian economic crisis of 1997, many Asian countries including Thailand, Malaysia, Indonesia and Korea among others, were forced to devalue their local currencies and resorted to the free floating exchange rate system. They abandoned the hard or soft peg exchange rate systems to adopt the free floating exchange rate system mainly because of their inability to maintain the pegs. It is widely believed that the fixed or pegged exchange rate regimes are ultimately destined to collapse, thus resulting in the economic crisis. Therefore, the solution to the economic crisis lies in the increased exchange rate flexibility in the long term (Obstfeld and Rogoff 1995, Larrain and Velasco 2001).

Even with the possibility of the ultimate failure of the fixed exchange regime, many developing and emerging countries still favor fixed exchange rate regime to the flexible

exchange regime. The advantages of the fixed regime, especially for the developing countries, are well summarized in Frankel (2003). They are: providing a nominal anchor to monetary policy, encouraging trade and investment, precluding competitive depreciation and avoiding speculative bubbles. In short, the fixed exchange regimes provide the stability that the developing countries need desperately to maintain their economic growth. However, as the countries manage to maintain fixed exchange rate with occasional interventions, it is inevitable that there is a large gap between the fixed exchange rate and the economic fundamentals such as expansionary monetary policy, low foreign reserves and current account deficits to support the fixed rate. When this gap finally collapses, it brings the sudden and violent currency depreciation and results in the economic crisis. This line of reasoning is the basis of numerous analysis of the economic crisis such as Flood and Garber (1984) for the first generation crisis model, Obstfeld (1994) for the second generation crisis model, and Flood and Marion (2002) for the third generation or twin crisis model. Frankel (2003) also provides four advantages of the free floating exchange rate regime: independent monetary policy, automatic adjustment to trade shocks, seigniorage and lender of last resort ability, and ability to avoid the bad speculative attack. However, as Frankel points out, it is not all clear whether the majority of the developing countries can or willing to take advantages of the free floating exchange rate regime.

There is an increasing trend after the recent economic crisis that many developing countries adopt the free floating exchange rate regimes, but in reality, the officially declared exchange rate regimes are not what they really claim to be. Calvo and Reinhard (2002) investigated the 39 countries of wide geographic differences for the period of January 1970-November 1999, and found that countries that claims their exchange rates to float mostly do not. It is the so-called phenomena of the "fear of floating." From this evidence, it is clear that many of the developing countries prefer to have their exchange rates stable regardless of their officially declared exchange rate regimes. Then, it begs the next question why they prefer to have fixed exchange rate regime to the flexible regime? It is widely believed that the fixed exchange rate regime will provide the domestic relative price stability and thus promote the higher economic growth. However, Levy-Yeyati and Sturzenegger (2003) show the results quite to the contrary. They found that the floating exchange rate regimes, other things being equal, actually yield higher economic growth than either the intermediate regimes or the fixed regimes do. Dissatisfied with the official *de jure* IMF classifications of exchange rate regimes for each country, they developed their own exchange rate regime classification, *de facto* classification, for the period 1974-2000, and found that among the non-industrialized countries, the flexible exchange rate regime provides the higher economic growth while among the industrialized countries, exchange rate regimes do not appear to explain the economic growth one way or another in a statistically significant manner.

This paper investigates the macroeconomic structural differences of Korean economy under the free floating exchange rate regime after the economic crisis compared to the managed float exchange rate regime before the economic crisis. More specifically, we are interested in whether the Korean exchange rates are more closely following economic fundamentals by comparing two different exchange rate regimes in recent years. Even with the well-documented difficulties of explaining exchange movement, there are at least two reasons that it is worthwhile effort to study Korean exchange rate based on the standard monetary model of the exchange rate determination. First, this paper focuses on the Korean exchange rate regimes. Korean economy has grown so fast in the last 30 years, and even with the recent economic crisis and setbacks, Korea is the 12th largest economy in the world and has become one of the model economies achieving greater economic success. Korea attained the world's exclusive economic status by joining the

OECD in 1996, and has become one of the key players in international trade. Most of the exchange rate determination analysis mentioned so far focused on the developed countries' major currencies. Major currencies of the developed countries are mostly freely determined by the market after the collapse of the Bretton Woods accord in 1973, and their data is readily available. This paper investigates the similar exchange rate behavior focusing on the small developing Korean *Won*-U.S. Dollar nominal exchange rates. Second, Korean exchange rate regimes provide one of the recent opportunities to study the different behaviors or roles, if any, of managed float regime and free floating regime. Since the regime change has occurred in relatively recent period, it provides the unique opportunity to empirically verify the advantages or disadvantages of different regimes postulated by Frankel (2003). More specifically, one of the advantages of the fixed rate regime is the stability of the domestic price level, thus achieving high economic growth. We will investigate the effect of exchange rate pass-through to the domestic variables such as inflation rate under two different regimes. The results of this paper provide the useful guideline for the emerging economies to properly set their exchange rate system for the stable economic growth.

Next section introduces a simple monetary model of exchange rate determination based on the purchasing power parity. Section 3 describes the data set and presents empirical results. Section 4 concludes the paper with some suggestions on the future direction of the current study.

II.   Theoretical framework of exchange rate determination

It is well documented that the exchange rate is very difficult to predict using any theoretical models for the exchange rate determination. It was first documented by Meese and Rogoff (1983). They tested 1970s floating exchange rates for three major currencies, and found that none of the theoretical exchange rate determination models outperform simple random walk model in the root mean square criteria. In short, what they found is that exchange follows closely random walk process, and is unpredictable during their sample period. A recent study by Cheung, Chinn and Pascual (2002) affirms Meese and Rogoff (1983) result that any specific model or theory is not very successful to improve the exchange rate predictability. There have been other studies, such as Mark (1995), Chinn and Meese (1995) and MacDonald and Taylor (1994), claiming modest success to predict the exchange rate movements, but their results are largely limited to particular periods or particular currencies. None of their results are robust to predict exchange rates consistently. Engel and West (2003) approached the exchange rate determination from the reverse causation, and they claim that they were able to predict the economic fundamentals using the exchange rates for the G7 countries. Viewing the exchange rate as the asset price influenced by the future expectations, they demonstrated that exchange rate follows a process arbitrarily close to the random walk if (1) at least one underlying fundamental variables is I(1), and (2) the discount factor is near one. If expectations reflect information about the future fundamentals, the exchange rate will likely be useful in predicting the future economic fundamentals.

The theoretical framework of our model is based on the simple monetary model used by various authors, among others, MacDonald and Taylor (1994), Mark (1995), Obstfeld and Rogoff (1996), Mark and Sul (1999), and Wu and Chen (2001). This model consists of four behavioral equilibrium equations: domestic and foreign money market equilibrium, purchasing power parity condition and uncovered interest parity condition.

(1) $m_t - p_t = \lambda y_t - \phi i_t$ domestic money market equilibrium

(2) $m_t^* - p_t^* = \lambda y_t^* - \phi i_t^*$ foreign (ROW) money market equilibrium

(3) $s_t = p_t - p_t^*$ purchasing power parity (PPP)

(4) $i_t - i_t^* = E_t s_{t+1} - s_t$ uncovered interest parity (UIP)

where,

$m_t\left(m_t^*\right)$: domestic (foreign) money supply in natural log

$p_t\left(p_t^*\right)$: domestic (foreign) price level in natural log

$y_t\left(y_t^*\right)$: domestic (foreign) GDP in natural log

$i_t\left(i_t^*\right)$:   domestic (foreign) interest rate

s_t : nominal exchange rate (local currency price of one foreign currency) in natural log

$E_t s_{t+1}$: expectation of s_{t+1} at time *t*.

$0 < \lambda < 1$: income elasticity to money demand

$\phi > 0$: interest semi-elasticity to money demand

From equations (1) to (3), we have

(5) $s_t = m_t - m_t^* - \lambda\left(y_t - y_t^*\right) + \phi\left(i_t - i_t^*\right) = f_t + \phi\left(i_t - i_t^*\right)$

where $f_t = m_t - m_t^* - \lambda\left(y_t - y_t^*\right)$ is the economic fundamentals consisting of domestic and foreign countries.

By substituting the UIP equation (4) into equation (5), the equilibrium condition is:

(6) $s_t - f_t = \phi\left(i_t - i_t^*\right) = \phi\left(E_t s_{t+1} - s_t\right)$

Under the rational expectations hypothesis with no bubble solutions for the exchange rate process, we will have the fundamental solution for s_t as:

(7) $s_t = \dfrac{1}{1+\phi} E_t\left(\displaystyle\sum_{j=0}^{\infty}\left(\dfrac{\phi}{1+\phi}\right)^j f_{t+j}\right)$

Exchange rate is expressed as the discounted value of the future economic fundamentals. This is the characteristics of the monetary model viewing the exchange rate as the asset price of the future economic fundamentals. Assume that the economic fundamentals series $\{f_t\}$ follows a driftless random walk process, $I(1)$. Then, we have $s_t \sim I(1)$, $\Delta s_t \sim I(0)$. Since $s_{t+1} = E_t s_{t+1} + v_t$, where v_t is a white noise forecasting error, nominal exchange rate and fundamentals, $\{s_t, f_t\}$, must be

cointegrated by equation (6). Rearrange equation (6) to construct the econometric model of the exchange rate changes and fundamentals such that:

$$(8) \qquad \Delta s_{t+1} = \beta_0 + \beta_1 z_t + \varepsilon_t$$

where $z_t = s_t - f_t = \phi(i_t - i_t^*)$ is the nominal exchange rate deviations from the economic fundamentals. We expect $\beta_1 < 0$ because when s_t is undervalued relative to the economic fundamentals ($(s_t - f_t)$ increases), nominal exchange rate should correct downward (appreciation: Δs_t decreases) to restore equilibrium.

This is the basic model used to perform the exchange rate forecasting ability based on the monetary model. This model has been used by MacDonald and Taylor (1994), Mark (1995) to test the predictability of exchange rates. They claimed the modest success in predicting exchange rates for a longer horizon. Mark and Sul (2001) use panel data set of 19 industrialized countries while Wu and Chen estimated equation (8) using nonlinear Kalman filter allowing time-varying nature of the slope parameter.

In this paper, I adopt the same model for the purpose of linking economic fundamentals to the exchange rates. However, I would like to extend my analysis to examine equation (8) on how economic fundamentals explain exchange rates on the different exchange rate regimes. Korea is an ideal candidate of my study in a reasoning that I provided in the introduction.

III. Korean Exchange Rate Regimes

Korean exchange rate system has evolved through several stages in recent history. Until 1980, the government strictly regulated foreign exchange transactions, and the Korean Won was pegged to the U.S. dollar. From 1980, as a result of the introduction of a multiple-basket pegged exchange rate system, the Korean *Won* started to float in reflection of general trends in the international foreign exchange markets, even though it was still tightly managed by the government. The market average exchange rate (MAR) system, as a variant of managed floating exchange rate regime, was first adopted in March 1990. Since then, the Korean *Won*-U.S. dollar rate began to be determined on the basis of underlying demand and supply conditions of the interbank market, although daily fluctuations were limited within certain bands. However, the frequent interventions by the Bank of Korea were also common phenomena, and the exchange rate was still not completely determined by the market. In late 1997, the Korean economic crisis broke out and Korea turned to the IMF for rescue. Taking advantage of the opportunities presented by the economic crisis, Korea has accelerated the speed of the economic restructuring including the capital account liberalization. Korea has shifted to a free-floating exchange rate system on December 1997. The ceiling on foreign investment in Korean equities was entirely abolished in May 1998, and the local bond markets and money markets were completely opened to foreign investors. In June 1998, the Korean government announced a plan to liberalize all foreign exchange transactions in two stages. The first stage of liberalization took effect on April 1, 1999 with introduction of the new Foreign Exchange Transaction Act. The second stage of

liberalization took effect on January 2001. The remaining ceilings on current account transactions by individuals have been eliminated.

3.1 Data Description

All our data come from the IMF International Financial Statistics (IFS) CD-ROM. Data frequency is monthly except GDP and GDP deflator series which are available only the quarterly basis.　We converted the quarterly series into the monthly frequencies by linearly interpolating quarterly observations into monthly observations.

We used the bilateral nominal exchange rates per U.S. Dollars for Australia, Japan and South Korea for the period of January 1980 to December 2003.　These exchange rates are nominal domestic currency prices per US dollar at the end of each month.　Japan Yen and Australia Dollar are introduced here as a bench mark to the Korean exchange rate regimes.　Japan is one of the largest trading partners of Korea, and Korea sustained a chronic trade deficit with Japan.　In addition to the close economic relationship between Korean and Japan, Japanese Yen is freely floating after the collapse of the Bretton Woods Accord.　As Calvo and Reinhart (2002) observed, Japanese Yen serves as one of the reserve currencies of the world, therefore, its characteristics of free floating regime may be different from those of small developing economies.　In this regard, Australia is chosen because Australian Dollar is also freely floating, but Australian economy is much smaller than that of Japan, and it resembles closely to the typical small developing economies.　In Calvo and Reinhart (2002) study, Australian Dollar is used as a bench mark currency for the floating exchange rate regimes.　Calco and Reinhart (2002) report that the probability of Australian Dollar fluctuates within the prescribed 2.5% band for the free floating regime is about 70% during the monthly period of January 1984 to November 1999.　Therefore, we also used the Australian Dollar as the bench mark currency for a small open economy to study the characteristics of the free floating exchange rate of the Korean *Won*.

Other economic variables in our analysis are as following: Money supply: M2 measure of nominal money supply.　Interest rate: short term government bond rates for Australia and Japan, short term (90 day) deposit rate for Korea, and 3 month treasure bill rate for U.S.　General price level: manufacturing output prices for Australia, consumer price indices for Japan, Korea and U.S.　Reserves are measured as total reserves minus gold in U.S. dollar terms.

We divide our data into three periods.　The first period is from January 1980 to the beginning of the Korean economic crisis, September 1997 (period 1).　During this period, Korean exchange rates have been managed and controlled by the Bank of Korea.　The second period is the crisis period, October 1997 to September 1998, when the first round of financial restructuring completed following the IMF recommendations to recover from the economic crisis.　During the crisis period, nominal exchange rates were unstable and fluctuated widely, and we exclude this period for our analysis.　The last period, starting October 1998 to the end of sample period, December 2003, is the post crisis free floating exchange rate regime (period 2).　Korean exchange rates are allowed to move freely during this period with minimal market intervention from the banking authority.

3.2. Exchange Rates and Economic Fundamentals

First, we will examine the volatilities of two closely related variables for the exchange rate regimes, the nominal exchange rate and the foreign reserves.　We compare the rate of return volatilities measured as the standard deviation of the percentage change of the

bilateral nominal exchange rates and foreign reserves ($\log S_t - \log S_{t-1} = s_t - s_{t-1} = \Delta s_t$, $\log R_t - \log R_{t-1} = r_t - r_{t-1} = \Delta r_t$), where s_t is the natural log of the nominal exchange rate S_t, and r_t is the natural log of foreign reserves, R_t. Table 1 compares the return volatilities of three exchange rates for two distinct periods, before the Korean economic crisis for the managed float regime and after the economic crisis for the free floating regimes. Volatility is measured as the standard deviation of each variable. This table also provides three different, yet similar test statistics to test the equality of the variance of the returns of nominal exchange rates during this period. These statistics are for the three way equality tests.

Table 1. Volatilities for nominal exchange rates and reserves for each period

	Managed Float Regime, Period1 January 1980 – September 1997		Free Floating Regime, Period2 October 1998 – December 2003	
	Δs_t	Δr_t	Δs_t	Δr_t
Australian Dollar	2.8541	9.4771	3.2037	7.3335
Japanese Yen	3.3865	3.4587	3.4807	2.4418
Korean Won	0.8685	7.5047	2.6289	1.6631
	Test Statistics for $H_0 : \sigma_{AS}^2 = \sigma_J^2 = \sigma_K^2$			
Bartlett	313.920(0.0000)	185.963(0.0000)	4.4275(0.1093)	126.71(0.00)
Levene	80.4854(0.0000)	32.3659(0.0000)	1.4095(0.2471)	25.3006(0.00)
Brown-Forsythe	72.1956(0.0000)	32.2831(0.0000)	1.4737(0.2320)	20.5717(0.00)

Test statistics are for the null hypothesis that volatilities are the same for all three countries. *p*-values are in the parenthesis.

Table 1 clearly shows that the Korean *Won* is much less volatile during the managed float regime, and its volatility is much smaller than that of Australian Dollar and Japanese Yen. During the free float regime, Korean *Won* is still less volatile than those other exchange rates, but their difference is now statistically insignificant with *p*–values ranging from 0.11 to 0.25. All three test statistics reject the equivalence of return variances during Korean *Won*'s managed float regime, while all three statistics accept that their volatilities are statistically equivalent under the free floating regime. Korean *Won* fluctuates as freely as other floating exchange rate currencies after adopting the free floating regime in period 2. Korean foreign reserve holdings are much more volatile under the managed float than those of free floating period. This is an expected result that under the managed float, reserves are often used to maintain stable nominal exchange rates (Interest rate is another policy tool to manage exchange rates). Therefore, by comparing the reserve volatilities of two periods, we can show that the reserves have become much more stabilized under the recent free floating exchange regime, especially for Korea.

We can observe from this table that the nominal exchange rates for all three countries have become more volatile in recent years than in the 1980s and the late 1990s, while the volatilities of foreign reserves shows the opposite trend. Korean exchange rates have become more volatile and reserves have become more stabilized because of her exchange rate regime changes. In order to investigate whether there have been any other

macroeconomic regime shift to cause other currencies as well as Korean *Won* more volatility in recent years, we compared the equivalence of return volatility for two periods.   Table 2 reports the test statistics for the volatilities for nominal exchange and foreign reserve before and after the Korean economic crisis.

Table 2. Volatilities for different periods for nominal exchange rates and reserves ($H_0 : \sigma_{i,1}^2 = \sigma_{i,2}^2$)

	Australia		Japan		Korea	
	Period 1	Period 2	Period 1	Period 2	Period 1	Period 2
Δs_t	2.8541	3.2037	3.3865	3.4807	0.8685	2.6289
F-test	1.2600(0.3082)		1.0563(0.8298)		9.1617(0.0000)	
Bartlett	1.2268(0.2680)		0.0669(0.7959)		141.4332(0.0000)	
Δr_t	9.4771	7.3335	3.4587	2.4418	7.5047	1.6631
F-test	1.6700(0.0109)		2.0063(0.0005)		20.3638(0.0000)	
Bartlett	5.1377(0.0234)		9.1142(0.0025)		106.8419(0.0000)	

Test statistics are for the null hypothesis that volatilities are the same for all three countries. p-values are in the parenthesis.

Table 2 shows the expected results.   Japanese Yen, serving as the reserve currency for the world shows little change in its volatility during these two periods even with the recent Asian economic crisis.   Test statistics also show little evidence of changes of the Yen volatility.   Australian Dollar also shows that the volatilities remain the same between two periods.   Korean *Won*, on the other hand, shows strong evidence of volatility change during this period.   Table 2 also reports foreign reserve volatilities for each country for two periods, and its test statistics.   We reject the null hypothesis that reserve volatilities remain the same for entire period for all three countries.   We can see that the reserves for all three countries have become much more stable in recent years than in the 1980s and early to mid 1990s.   We can also notice that the reduction of the reserve volatility is much more noticeable for Korea than for other two countries.   The main reason for the stability of the reserves for Korea is the exchange rate regime changes from the actively managed regime to the free floating regime.

The exchange rate volatilities can be best illustrated using the figures.   To avoid the cluttering the figures, Figure 1 plots the nominal exchange rate returns for two currencies, Korean *Won* (solid line) and Japanese Yen (broken line) against U.S. Dollars for the entire sample period.   Australian Dollar returns could also be plotted in the same figure, but it is not included in Figure 1 to simplify the presentation.

(Figure 1 Here)

Japanese Yen is more volatile during the period 1 when Korean *Won* was under the managed float regime.   During period 2 when Korean *Won* is under the floating

exchange rate system, the currency volatilities of two countries appear to be quite similar, and they are not statistically different as seen from Table 1.

(Figure 2 Here)

Another measure of contrasting different exchange rate regimes is the change of the reserves.   Reserves are often used to control and manage nominal exchange rates under the fixed and managed exchange rate regimes.   Figure 2 plots the volatility of reserve changes for Japan (broken line) and Korea (solid line).   It is very clear that the Korean reserves were much more volatile than that of Japan during the managed float regime of period 1, and they are also more volatile under the managed float regime than under the free floating regime.   This shows the clear evidence of exchange rate management schemes.   While there are criticisms that Korean exchange rates are still managed and controlled by the central bank, the reserve volatility tells otherwise.   The recent volatility of Korean nominal exchange rate shows very similar characteristics of other free floating exchange rates.   In fact, Korean reserves remain relatively stable and exchange rates are comparably more volatile during this period.   Australia has relatively volatile reserve changes throughout the period.   In fact, even with the free floating exchange rate regime, the probability of reserve changes stay within 2.5% band is only about 50% by Calvo and Reinhart (2002).   According to their study, Japan maintains the most stable reserves together with Singapore.   Korean reserve levels were highly volatile during the managed regime, but her reserve volatility has decreased significantly under the free floating regime.   Korean reserve volatility is even more stable than those of Japan after the economic crisis of period 2.   Table 1 also reports the test statistics for the equality of reserves volatilities for three countries, but they are all rejected for all period.   Korean reserves remain more stable than those of free floating regimes of Australia.   Absolute comparison of the reserve volatilities does not seem to be a good measure of distinguishing exchange rate regimes for these three countries.

Instead of comparing the volatilities of different countries, it is more meaningful to compare the reserve volatilities for the different time period.   From Table 2 statistics, we can see that the reserve volatilities have been reduced significantly in period 2 compared to those of period 1 for all three countries.   Since Korea has changed her exchange regime from period 1 to period 2, the reserve volatility of Korea has reduced most dramatically.

Exchange rates, like many other assets prices, often show the pattern of ARCH behavior in their evolutions.   Before we specify and estimate the econometric model of equation (8), we need to investigate the behavior of our sample currencies.   Table 3 is a summary statistic for the ARCH residuals for the three currencies.

Table 3. Exchange rate behavior (Δs_t):   ARCH(1) LM test

Country	Australia	Japan	Korea		
Period	All	All	All	Period 1	Period 2
F-statistic	0.3684 (0.5444)	0.9362 (0.3341)	27.4152 (0.0000)	6.3088 (0.0128)	0.7890 (0.3783)
Asymptotic χ^2	0.3705 (0.5427)	0.9398 (0.3323)	25.0881 (0.0000)	6.1825 (0.0129)	0.8064 (0.3692)

This table reports only ARCH(1) LM tests.   Different lag lengths of ARCH model produce qualitatively similar results. p-values are in the parenthesis.

Korean *Won* shows the ARCH residuals for period 1 and for the entire period, while there is no evidence of ARCH residuals during the free floating period 2.   Even though the analysis periods exclude crisis period of October 1997 to December 1998, there are several episodes of ARCH residuals (persistent volatilities) under the managed float regime during the late 1980s and the middle of 1990s leading to the economic crisis. Australian Dollar and Japanese Yen do not show the ARCH residuals either for the entire period or for two periods separately.   It is interesting to observe that the ARCH residuals appear only during the managed exchange rate regime.

The following two figures, Figures 3 and 4, show that the exchange rates are widely fluctuating around the deviations from the economic fundamentals (z_t is standardized to have mean zero) for Korea and Japan, and it is not an easy task to predict the exchange rates using economic fundamentals.   The relationship between exchange rates and the fundamentals for Australia show similar patterns as other countries, but it is not shown here to conserve spaces.   Meese and Rogoff (1983) have shown that none of the theoretical exchange rate determination models outperform simple random walk model in the root mean square criteria.   Our objective here is not to predict the exchange rate using the economic fundamentals, but to investigate the causal relationship of the economic fundamentals to the nominal exchange rates focusing on the exchange rate regime shifts of the Korean *Won*, and compares it to other flexible exchange rate regimes.

(Figure 3 & Figure 4 Here)

The basic econometric model to examine the relationship between exchange rates and economic fundamentals is the equation (8) from the monetary model introduced in section 2.   Table 4 shows the OLS estimation results for three countries.   Since the Korean *Won* shows the ARCH(1) behavior from Table 3, we also estimated the equation (8) for Korea by GARCH(1,1) model and present the results in Table 5.

Table 4. OLS estimation: $\Delta s_{t+1} = \beta_0 + \beta_1 z_t + \varepsilon_t$

		Korea	Japan	Australia
Period 1 (210)	β_0	7.6374 (1.8104)***	20.3091 (9.7455)**	-4.8247 (4.0508)
	β_1	-1.2151 (0.2961)***	-1.8436 (0.8696)**	-0.6741 (0.5890)
	SSR	146.7716	2345.6732	1706.1781
Period 2 (55)	β_0	37.3255 (18.7351)**	55.6487 (32.9761)*	-12.8023 (20.3014)
	β_1	-6.2151 (3.0986)**	-5.4044 (3.1894)*	-1.6037 (2.5256)
	SSR	358.8634	640.8513	546.2578
Both periods (265)	β_0	8.8816(2.9107)***	8.3921 (5.3762)	-2.8878 (2.2715)
	β_1	-1.4375(0.4772)***	-0.7903 (0.4873)	-0.3869 (0.3184)
	SSR	535.4058	3042.1483	2258.0679
F-statistic		7.6836 (0.0006)	2.4306 (0.0900)	0.3263 (0.7219)

Standard errors in the parenthesis.   *, **, *** indicate statistical significance at 10%, 5% and 1%, respectively.   *F*- statictic tests the structural equivalence of two periods.   *p*- values in the *F*- statistics.

Table 5: GARCH(1,1) estimation for Korean Won; $\Delta s_{t+1} = \beta_0 + \beta_1 z_t + \varepsilon_{t+1}$, $\sigma_t^2 = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \gamma_1 \sigma_{t-1}^2$, where $\sigma_t^2 = Var(\varepsilon_{t+1}|\Omega_t)$ and Ω_t is an information set at time t.

	Period 1	Period 2	Both periods
β_0	7.1091 (1.4024)***	37.2016 (19.3518)*	5.2785 (1.3142)***
β_1	-1.1248 (0.2287)***	-6.2259 (2.1939)*	-0.8339 (0.2151)***
α_0	0.1240 (0.0410)***	0.8855 (0.3568)**	0.0851 (0.0259)***
α_1	0.6537 (0.1519)***	-0.2240 (0.0828)***	0.9226 (0.0937)***
γ_1	0.3405 (0.0972)***	1.0821 (0.1020)***	0.3997 (0.0370)***

Standard errors in the parenthesis. *, **, *** indicate statistical significance at 10%, 5% and 1%, respectively.

From these results, Korean *Won's* fluctuation in response to the deviations from the economic fundamentals has increased significantly from period 1 to period 2 (-1.22 vs -6.22). Estimates of both OLS and GARCH show qualitatively similar results. In addition, we can see that the impacts of the deviations from the fundamentals to the nominal exchange rates are much bigger in magnitude during period 2 than during period 1. From the OLS results, this appears to be common phenomena for all three currencies (-6.22 vs -1.22 for Korea, -5.40 vs -1.84 for Japan, and -1.60 vs -0.67 for Australia) even though the response to the Australian Dollar is not statistically significant for all periods. This shows that the speed of the nominal exchange rate adjustments to the deviations from the economic fundamentals has increased in recent years for all three countries. Since $z_t = s_t - f_t = \phi(i_t - i_t^*)$ from equation (6), β_1, the slope parameter of z_t to Δs_{t+1}, can also be interpreted as the sensitivity of the nominal exchange rates to the interest rate differentials. From Table 4, we can see that the Korean exchange rates respond to the deviations from the economic fundamentals and interest differentials much more sensitively under the free floating regime than under the managed regime. During period 1 when the Korean *Won* was under the managed regime, Japanese *Yen* had been more sensitive to the economic fundamentals and interest rate differentials (-1.22 vs. -1.84). However, when Korean *Won* has become freely floating during period 2, Korean *Won* has been more sensitive to the economic fundamentals (-6.22 vs -5.40). Table also shows that the Korean exchange rate has the greatest sensitivity to the interest rate differentials among all three countries.

This table reports test statistic for the structural relationship between the change of the exchange rates and the deviations from the economic fundamentals. Chow test statistics are calculated for each country, and as we have expected, we reject the null hypothesis of the parameter stability between two periods for the Korean *Won* due to the regime change in these periods. The structural relationship between nominal exchange rates and the fundamentals has not significantly changed during these periods for Japan and Australia.

3.3. Exchange Rates and Inflation

We now turn our attention to investigate the impact of the exchange rate path-through to the domestic economic variables. From the purchasing power parity condition (PPP) of equation (3), there is a one-to-one relationship between the domestic inflation rate and the nominal exchange rate assuming the constant foreign inflation. Therefore, we

would like to see how the change of the nominal exchange rate affects the domestic inflation rate. We will specifically focus on the effects of the exchange rate regimes into the domestic inflation rate for Korean economy. One of the important objectives of the fixed exchange rate regime for the developing economy is to maintain stable domestic price levels so that it will help to increase foreign trade. However, the intended objective could also prove to be wrong for the developing country. The rigid exchange regime may drain foreign reserves excessively, and it may bring the further pressure for the depreciation and domestic inflation. The vicious cycle may ultimately result in the economic crisis. First, we will examine the relationship between inflation and the change of exchange rates since 1990s. Figure 5 plots these two variables on the time span, inflation (solid line) and the return of the nominal exchange rate (broken line). Figure 6 is a scatter gram of these two variables. In Figure 6, the circle represents the plots under the managed exchange regime (1990:03-1997:09) period before the economic crisis, while the square represents the plots for the free floating regime (1998:10-2003:12) after the economic crisis.

(Figure 5 & Figure 6 Here)

As we can see from these figures, exchange rates became much more volatile while the inflation rate has become more stable under the free floating regime than under the managed regime. For the statistical regression analysis, I will limit my data for two distinctive periods of exchange rate regimes, from March 1990 to September 1997 for the market based managed exchange rate regime (MAR system) and from October 1998 to December 2003 for the free floating exchange rate. We selected the post crisis period starting from October 1998 when the turmoil of the economic crisis has settled down a little bit. Inflation and exchange rates are analyzed using bivariate VAR model focusing on the purchasing power parity of equation (3) with additional exogenous lagged variables of the percentage change of money supply (Δm_t) and the real GDP growth rate ($\Delta rGDP_t$). Lag length of two for the endogenous variables was chosen according to the Schwarz criteria. Other lag length selection did not change the qualitative relationship between these variables. Inflation rate appears to show strong time trend, but Dickey-Fuller test with time trend rejects the unit root hypothesis for period 1, period 2 and two periods combined. Bivariate VAR model may be too simple to analyze the complete exchange rate determination model introduced in section 2, but the main objective of this analysis is focusing on the pass-through of the exchange rate to the inflation contrasting two different exchange rate regimes. Therefore, the estimated bivariate VAR model is:

$$\Delta s_t = \beta_{10} + \beta_{11} Infl_{t-1} + \beta_{12} Infl_{t-2} + \beta_{13} \Delta s_{t-1} + \beta_{14} \Delta s_{t-2} + \beta_{15} \Delta m_{t-1} + \beta_{16} \Delta rGDP_{t-1} + \varepsilon_{1t}$$

$$Infl_t = \beta_{20} + \beta_{21} Infl_{t-1} + \beta_{22} Infl_{t-2} + \beta_{23} \Delta s_{t-1} + \beta_{24} \Delta s_{t-2} + \beta_{25} \Delta m_{t-1} + \beta_{26} \Delta rGDP_{t-1} + \varepsilon_{2t}$$

where $\varepsilon_{1t}, \varepsilon_{2t}$ are uncorrelated white-noise random shocks.

This model is estimated for two periods separately, and both periods combined. The following table presents estimation results.

Table 6.1. Exchange Rate Equation

	Period 1	Period 2	Both periods
β_0	0.1872 (0.2625)	1.1456 (0.8856)	0.0319 (0.3665)
$Infl_{t-1}$	0.0672 (0.1472)	-0.7207 (0.6001)	-0.0587 (0.2570)
$Infl_{t-2}$	-0.0835 (0.1481)	0.4550 (0.5528)	0.0848 (0.2534)
Δs_{t-1}	0.1791 (0.0998)*	0.2126 (0.1431)	0.2243 (0.0867)**
Δs_{t-2}	0.2110 (0.1023)**	-0.1027 (0.1491)	-0.1556 (0.0866)*
Δm_{t-1}	0.1424 (0.0562)**	-0.4882 (0.2738)*	-0.0552 (0.1069)
$\Delta rGDP_{t-1}$	-0.1548 (0.0701)**	0.1218 (0.1754)	0.0082 (0.0942)
$Adj\ R^2$	0.1600	0.0473	0.0222

Standard errors in the parenthesis. *, **, *** indicate statistical significance at 10%, 5% and 1%, respectively.

Table 6.2. Inflation Equation

	Period 1	Period 2	Both periods
β_0	0.2559 (0.1790)	0.5415 (0.2037)***	0.2213 (0.1007)*
$Infl_{t-1}$	1.3297 (0.1004)***	1.0951 (0.1383)***	1.2768 (0.0800)***
$Infl_{t-2}$	-0.3724 (0.1001)***	-0.2710 (0.1272)***	-0.3258 (0.0789)***
Δs_{t-1}	0.1423 (0.0681)**	0.1040 (0.0329)***	0.1219 (0.0270)***
Δs_{t-2}	-0.0784 (0.0698)	0.0469 (0.0343)	0.0128 (0.0270)
Δm_{t-1}	-0.0086 (0.0383)	-0.0391 (0.0630)	-0.0100 (0.0325)
$\Delta rGDP_{t-1}$	-0.0287 (0.0478)	-0.0229 (0.0403)	-0.0205 (0.0293)
$Adj\ R^2$	0.9390	0.8578	0.9518
D-F	-5.9601 (0.0000)***	-3.6254 (0.0364)**	-3.8386 (0.0172)**

Standard errors in the parenthesis. *, **, *** indicate statistical significance at 10%, 5% and 1%, respectively.   D- F is Dickey- Fuller statistics for the inflation rate. p- value is in the parenthesis.

From these results, it is clear that the exchange rate has a large and significant impact on the domestic inflation rate (Table 6.2), but the money supply the real GDP growth rate do not appear to contribute the inflation rate.   Granger causality test confirms the causal relationship between inflation and exchange rate.   Table 6.3 reports Granger causality test statistics for each period and two periods combined.

Table 6.3. Granger Causality Test Statistics (*F*-statistics)

Null Hypothesis	Period 1	Period 2	Both Periods
Δs_t does not Grange cause $Infl_t$	2.5374(0.0850)	7.3884(0.0015)	11.7043(0.0000)
$Infl_t$ **does not Grange cause** Δs_t	0.2255(0.7986)	0.6218(0.5410)	0.1558(0.8559)

* Vaules in the parenthesis are *p*-values for *F*-statistic.

It is interesting to observe that the domestic money supply and the real GDP growth rate do not have statistically significant impact on the inflation rate, and Korean *Won* depreciation has positively contributed to the inflation rate throughout the entire sample period (crisis period is excluded from our analysis). From the VAR estimates, we can infer that one percent depreciation of the one period lagged Korean *Won* (Δs_{t-1}) contributes about 0.12% increase of the inflation rate for the entire period. This could be an unfortunate consequence of the small open economy which is heavily dependent on the intermediate goods import to promote export. Currency depreciation should improve the terms of trade, but the burden of intermediate goods imports appears to dominate the export advantages by the currency depreciation. It is more evident that the export boosting policy through the managed exchange rate regime was pursued at the expense of the domestic inflation. The impact of the currency depreciation to the inflation has been reduced to 0.10% under the free floating regime from the 0.14% under the managed float regime. Changing various lag length of the Δs_t did not alter the qualitative relationship between the inflation and the exchange rate change.

Once we established the causal relationship between exchange rate and inflation, we would like to see the impact of external shocks of one variable to one another. Figure 7 and 8 are impulse response functions (IRF) and accumulated response functions (ARF) for period 1 and period 2 using the Cholesky decomposition for two years (24 months). Since Cholesky decomposition is sensitive to the order of shocks to the VAR system, we produced two sets of IRF and ARF by rotating shock orderings. These two sets of response functions are remarkably similar and they are virtually identical.

(Figure 7 & Figure 8 Here)

Figure 7 and 8 are IRF (upper panel) and ARF (lower panel) using the shock ordering of $\left(\Delta s_t, Infl_t\right)$. The lower-left corner of IRF and ARF are responses of inflation to the one standard deviation shock of the nominal exchange rates. Under the managed exchange rate regime (Figure 7), the impulse responses and accumulated responses are quite mild in magnitude, and they are statistically insignificant. Under the free-floating regime (Figure 8), the initial impact is relatively large and statistically significant for two to five months. The accumulated impulses remain positive and statistically significant in the long-term. This shows that under the managed exchange rate regime, the exchange rate shock does not directly transmit to other macroeconomic variables, especially the inflation rate. Under the floating exchange rate regime, the nominal exchange rate depreciation directly passes through the domestic price level. This result is quite a contrast to the one observed from Figure 6. Even though the inflation has become much more stable under the floating exchange rate regime, exchange rate depreciation is now directly and immediately passed onto the inflation rate. Exchange rate change has much more positive and statistically significant impact on the inflation rate during the post-crisis free floating exchange rate regime than during the managed

exchange rate regime.   The upper-right corner of IRF and ARF are the responses of exchange rate to the external shock of inflation factors.   As we demonstrated previously by VAR results and Granger causality tests, the impact of the inflation shock to the exchange rates are statistically insignificant for both periods.

IV. Conclusion

This paper investigated the role of the economic fundamentals on the exchange rate determination on different exchange rate regimes focusing on the Korean economy. This paper found that the economic fundamentals have influenced exchange rates much more significantly under the flexible regime than under the managed exchange rate regime.   Korean exchange rates under the floating regime are more sensitive on the economic fundamentals than those of Japan and Australia.   Exchange rate pass-through into the domestic variable, especially inflation rate, has become more direct and statistically significant under the floating regime than under the managed regime.   This finding is consistent with the traditional arguments for the managed regime.   In short, the movements of the exchange rates under the free floating regime directly reflect the underlying economic fundamentals.

It is true that the exchange rate has become more volatile under the flexible exchange rate system than under the managed regime.   While the flexible regime may help to promote healthy economic growth in the long-run, the exchange rate volatility may prevent foreign investment or stable growth in the short run.   To reduce these short-run volatilities of the flexible exchange rate system and to promote the stable economic growth, Korean government needs to develop the credible futures exchange market. Volatility of exchange rate under the flexible regime could be significantly reduced under the well-developed futures market.

It is still an open question regarding which exchange rate regime is better for economic growth in the long-run especially for the developing economies.   My future research expands the current topic to investigate the relationship between different exchange rate regimes and other macro economic performances, especially the economic growth.

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Figure 1. Monthly percentage changes of the nominal exchanges per U.S. Dollar

Monthly Changes of Nominal Exchange Rates for Korean Won and Japan Yen
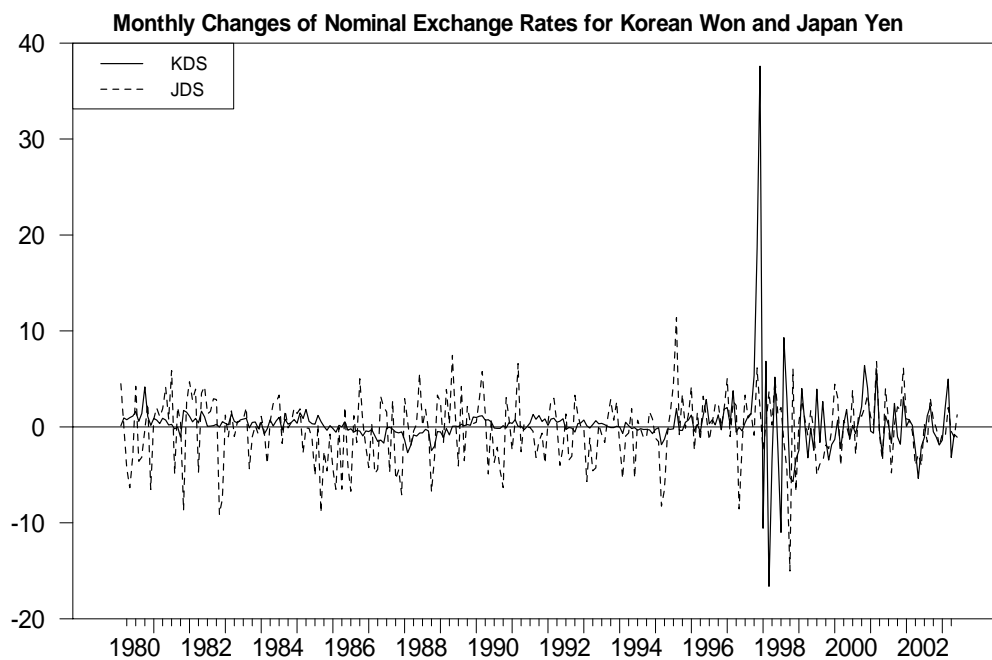
Figure 2. Monthly percentage changes of the reserves for Korea and Japan

Monthly Reserve Changes for Korea and Japan
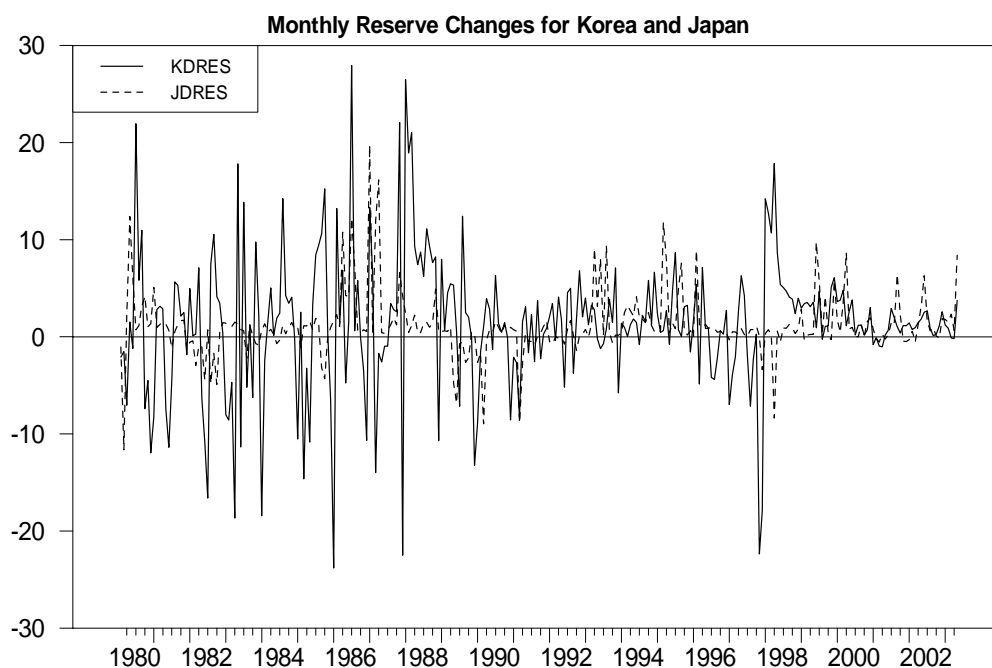
Figure 3. Economic fundamentals and the nominal exchange rates for Korea

Relationship between Economic Fundamentals and Exchange rates for Korea
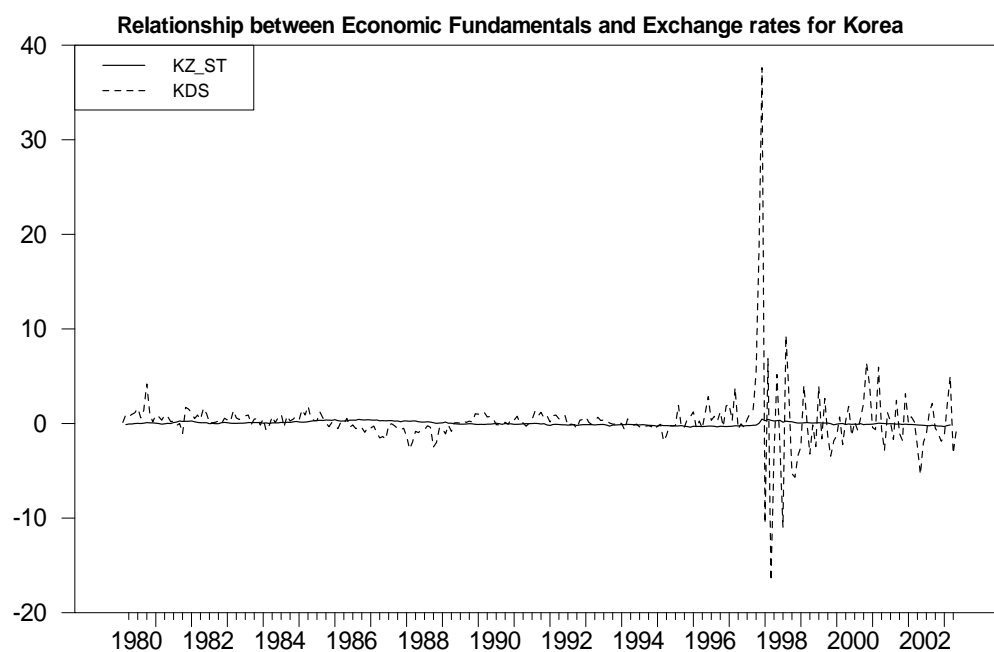
Figure 4. Economic fundamentals and the nominal exchange rates for Japan

Relationship between Economic Fundamentals and Exchange rates for Japan
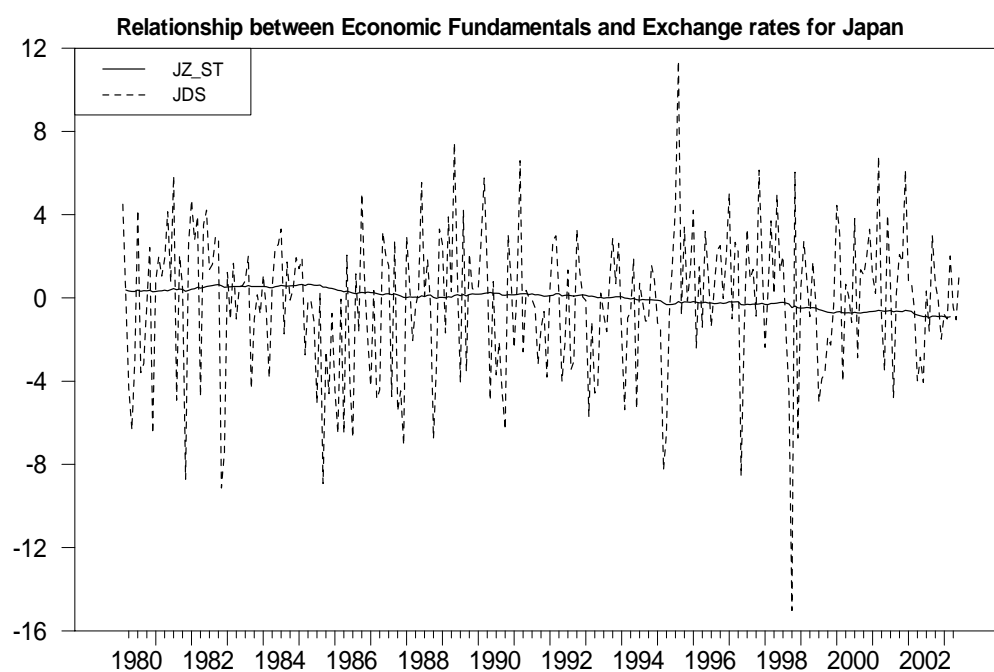
Figure 5. Inflation and the changes of the Korean exchange rates
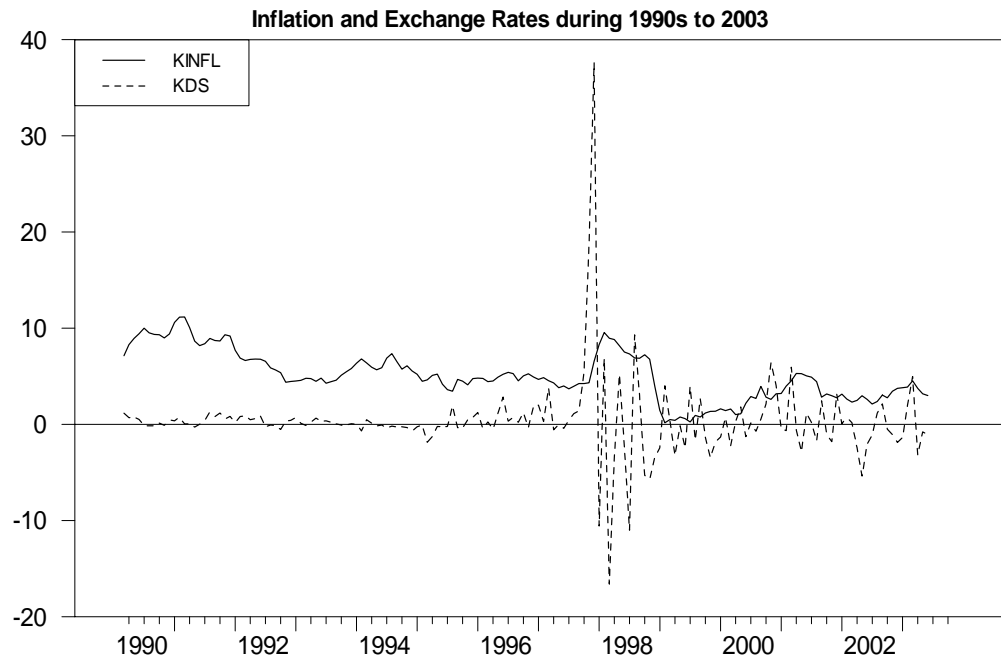
Figure 6. Scattergram of the inflation and the exchange rate changes
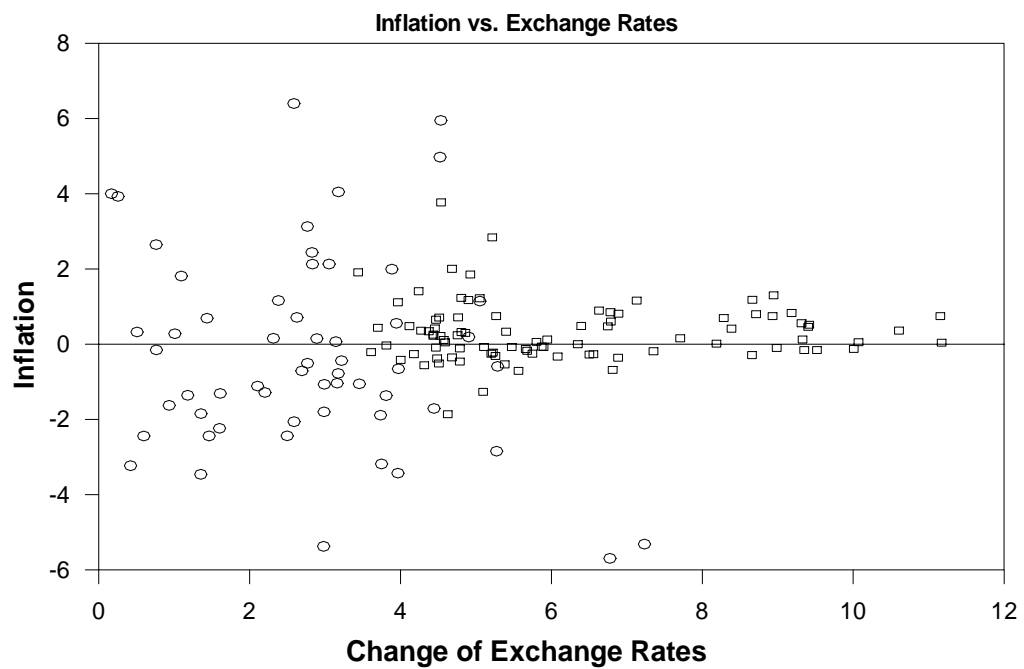
Figure 7 (Period 1). IRF and ARF

Impulse Response to Cholesky One S.D. Innovations ± 2 S.E.

Accumulated Response to Cholesky One S.D. Innovations ± 2 S.E.
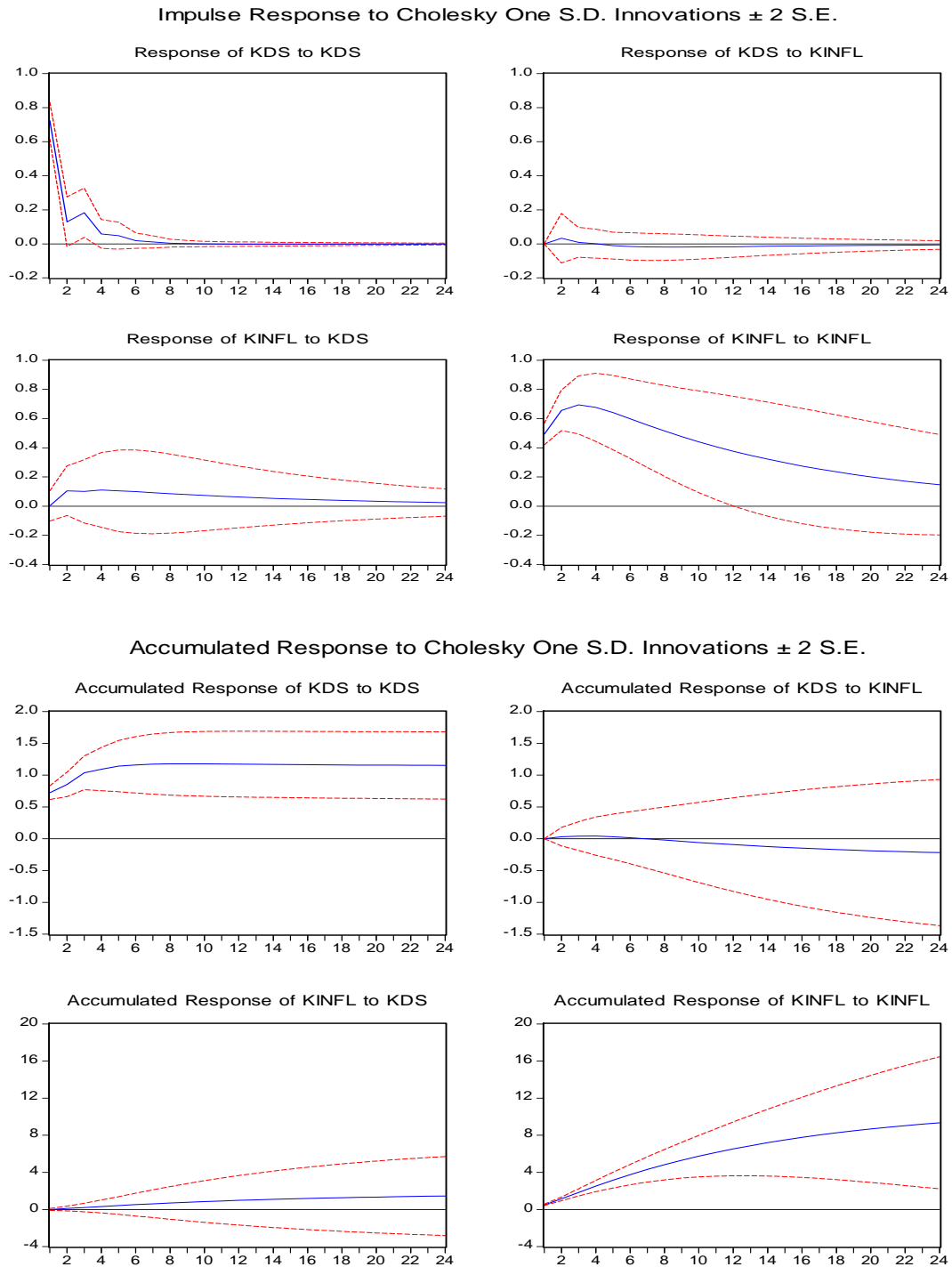
Figure 8 (Period 2). IRF and ARF

Impulse Response to Cholesky One S.D. Innovations ± 2 S.E.

Accumulated Response to Cholesky One S.D. Innovations ± 2 S.E.
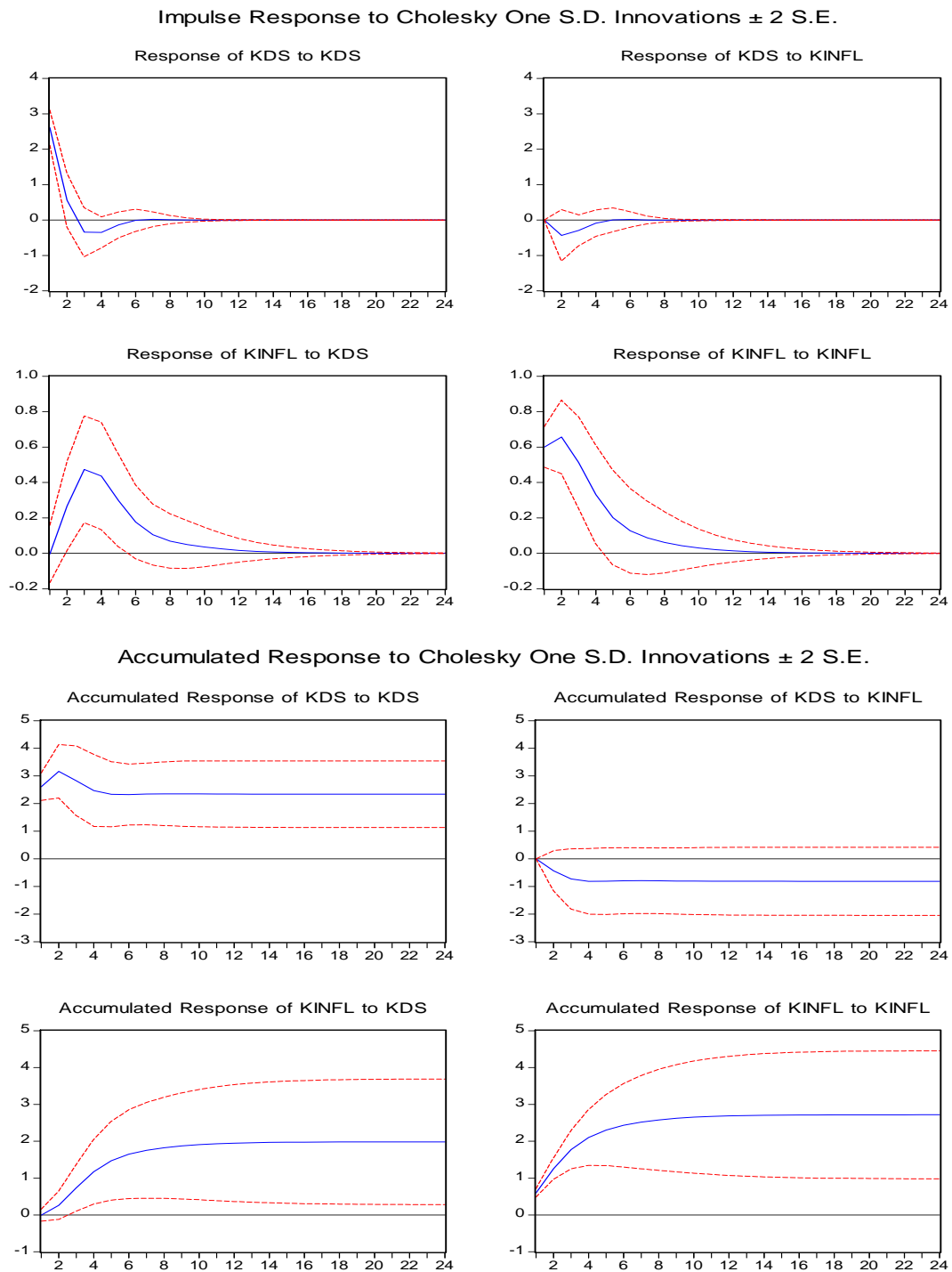
Comments on "Economic Fundamentals on Exchange Rates under Different Exchange Rate Regimes: Recent Experiences from the Korean Exchange Rate Regime Change"

Jaeuk Khil,
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Title of the paper: Economic fundamentals on exchange rates under different exchange rate regimes: Recent experiences from the Korean exchange rate regime change

I. Major comment

This paper deals with the issue of the traditional question " How's the economic fundamentals related to the exchange rate regimes? And which exchange regime between the fixed vs. floating is more appropriate for the developing countries or industrialized countries? " Conventional wisdom says that there is no absolute answer to the above questions. It depends on the situation. However, in general, it can be argued that the fundamental shock can be managed more effectively under the floating system, while the non-fundamental shock can be appropriately handled under the fixed system. This paper tries to investigate this issue using the Korea's recent crisis experience of 1997. More specifically, this paper found that the economic fundamentals affected exchange rates more significantly under the floating regime after the crisis than under the managed floating regime before the crisis. And the exchange rate pass through is also more significant under the floating regime. This supports the traditional view regarding the exchange regime that the fixed regime is more helpful in keeping with the stability in the economy.

This paper is also using the Japanese and the Australian data for the purpose of providing the benchmark case to the Korean data. However, the empirical results of these two countries add some ambiguities in explaining the case of Korea. Specifically, the Austrailan reserve turned out to be more volatile than Korea, which needed some explanation because the author argued that the volatility in reserve is directly related the fixed system in Korea. OLS analysis in the case of Japan raises the same concern. During the sample period, Japan maintained the floating regime, but the data showed that the economic fundamentals play more significant roles in determining the exchange rate in the period of pre-crisis than in the period of post-crisis. As we all know, Japan has no crisis in the exchange rate history, but the data shows the qualitatively different relation between the economic fundamentals and the exchange rate. More appropriate explanation should be followed.

II. Minor comment:

The author argue that the volatility of exchange rate under the floating regime could be reduced by the well-developed futures market.   But this is not the case sometimes. Without any empirical evidence, we cannot decisively say that the futures market help reducing the volatility in the underlying spot market.

Effects of Stock Attributes, Market Structure, and Tick Size on the Speed of Spread and Depth Adjustment

by
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Abstract

Liquidity providers on the NYSE make faster quote adjustments toward equilibrium spreads and depths than they do on NASDAQ. Both NYSE specialists and NASDAQ dealers make faster spread and depth adjustments for stocks with more frequent trading, greater return volatility, higher prices, smaller market capitalizations, and smaller trade sizes. We find that stocks with greater information-based trading and in more competitive trading environments exhibit faster quote adjustments toward equilibrium spreads and depths. The speed of quote adjustment is faster after decimalization in both markets. These results are robust and not driven by differences in stock attributes between the two markets or time periods. We interpret these results as evidence that segmented dealer markets and large tick sizes slow liquidity providers' quote adjustments to new information.

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I. Introduction

Traders pay the ask price when they buy shares from marketmakers and receive the bid price when they sell shares. The difference between the bid and ask prices is an important measure of market quality because it represents in part the cost of trading in securities markets. Marketmakers adjust the bid-ask spread in response to newly-placed limit orders as well as new information embedded in order flow, trades, and return volatility, among other factors. Despite its obvious importance to traders, we know very little about the dynamics of the bid-ask spread.[1] Prior studies offer little evidence as to the speed at which new information is impounded into the bid-ask spread. There is also limited evidence regarding how market structure and trading protocol, such as tick size, affect the speed at which new information is incorporated into the bid-ask spread.

In this study we address the following questions using a large sample of New York Stock Exchange (NYSE) and NASDAQ stocks: (1) How quickly do specialist/dealer quotes incorporate new information? Do specialist quotes reflect changes in stock attributes more quickly than dealer quotes? (2) How is the speed of quote adjustment related to stock attributes? For example, do stocks with greater information-based trading exhibit faster quote adjustments toward equilibrium spreads and depths? Do stocks that are traded in less competitive markets (e.g., fewer dealers) exhibit slower quote adjustments? Do liquidity providers move more quickly to equilibrium spreads and depths for stocks with more frequent trading and higher return volatility? (3) Do smaller tick sizes result in faster quote adjustments to new information? (4) What is the relation between quote adjustment speeds and variable measurement intervals? Answers to these questions would be of significant interest to market regulators because they could help design better market structures. Because marketmaker quotes (i.e., bid-ask spreads) determine trading costs, the speed at which specialists/dealers adjust quotes to new information is also of concern to traders.

Hasbrouck (1988, 1991a, 1991b) examines how marketmakers adjust quote midpoints to signed trades. Hasbrouck and Sofianos (1993) show that the trades in which the specialist participates have a greater immediate impact on quote midpoints than those without specialist participation. Madhavan and Smidt (1993) find that quote revisions are negatively related to specialist trades and positively related to the information conveyed by order imbalances. Dufour and Engle (2000) extend Hasbrouck's (1991a) vector autoregression model by incorporating the time interval between trades into empirical estimation.

While these studies focus on how marketmakers adjust *quote midpoints* to signed trades, our study examines how quickly marketmakers adjust *quote width* (i.e., the bid-ask spread) and *depth* (i.e., number of shares at the bid and ask) to their *equilibrium* values in response to new information. Because the determinants and information content of quote widths and depths are likely different from those of quote midpoints, our study helps us better understand the price discovery process. For instance, quote midpoint reflects the expected value of an asset whereas quote width and depth reflect uncertainty about the value of an asset or adverse-selection risks. Quoted depths are an important metric to

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[1] In a recent study, Engle and Patton (2004) show that a high spread leads to a decrease in the ask price and an increase in the bid price, moving the spread toward its equilibrium value. The authors also find that the speed of adjustment is faster for frequently traded stocks than infrequently traded stocks.

traders because they are the guaranteed quantities that can be bought or sold at quoted prices.

Numerous studies examine the effects of market structure on market quality. Huang and Stoll (1996), Barclay (1997), Bessembinder (1999, 2003c), and Chung, Van Ness, and Van Ness (2001) compare the execution costs of dealer and auction markets. Others (e.g., Amihud and Mendelson, 1987; Stoll and Whaley, 1990; Masulis and Ng, 1995) investigate the impact of market structure on return volatility. Affleck-Graves, Hedge, and Miller (1994) compare components of the bid-ask spread between auction and dealer markets. Heidle and Huang (2002) examine the impact of market structure on the probability of trading with an informed trader. Garfinkel and Nimalendran (2003) compare the impact of insider trading on effective spreads between NYSE and NASDAQ stocks. However, none of these studies examine how market structure affects quote adjustment speeds on the NYSE and NASDAQ.

Damodaran (1993) estimates the speed of price adjustment for a sample of NYSE and NASDAQ securities using the partial adjustment model of Amihud and Mendelson (1987). Damodaran shows that prices adjust more slowly for smaller firms. Brisley and Theobald (1996) show that Damodaran's estimator of price adjustment speed is incorrect and the magnitude of error is greater for shorter differencing intervals. Thoebald and Yallup (2004) develop an estimator of price adjustment speed that accounts for thin trading. They show that the price adjustment speed for small-capitalization stocks is slower than that for large-capitalization stocks even after corrections for thin trading. Again, the main focus of these studies has been the speed of price adjustment, not of spread and depth adjustments. More importantly, while these studies assume that the intrinsic value of a security follows a random walk process, we explicitly model the equilibrium spread and depth toward which the actual spread and depth gravitate. Likewise, although Damodaran (1993) and Thoebald and Yallup (2004) examine the cross-sectional variation in price adjustment speed, their analyses are limited to firm size. We shed further light on this issue by investigating cross-sectional relations between quote adjustment speed and various stock attributes, such as adverse-selection risks, dealer competition, trade frequency, trade size, return volatility, and share price.

Jones and Lipson (1999) compare the price impact of trades between dealer and auction markets using a sample of stocks that moved from NASDAQ to either the NYSE or the American Stock Exchange (AMEX). The authors find that quotes in NYSE- and AMEX-listed stocks adjust more quickly to the information contained in order flow than quotes in NASDAQ-listed stocks. Theissen (2000) conducts market experiments to compare call, continuous auction, and dealer markets and finds that transaction prices in call and continuous auction markets are more efficient than prices in dealer markets. In contrast, Masulis and Shivakumar (2002) show that price adjustments are faster by as much as one hour on NASDAQ using a sample of seasoned equity offering announcements by NYSE/AMEX and NASDAQ companies. The authors show that the result is not due to differences in issuer characteristics or announcement effects across the markets, but rather to differences in market structures. We provide additional evidence regarding quote adjustment speed by analyzing how quickly NYSE specialists and NASDAQ dealers adjust quote widths and depths in response to the information contained in order flow.

One of the important protocols of securities markets is the size of minimum price variation (i.e., tick size). Although numerous studies examine the effect of tick size on trading costs and return volatility,[2] none of them examine how tick sizes affect quote

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[2] See, for example, Harris (1994, 1997), Ahn, Cao, and Choe (1996), Bacidore (1997), Porter and Weaver (1997), Ahn, Cao, and Choe (1998), Griffiths et al. (1998), Bollen and Whaley (1998), Goldstein and

adjustment speeds. To the extent that the minimum price variation creates friction in exchange markets, we conjecture that it has an impact on the speed of quote adjustment. In the present study, we analyze the effect of tick size on the informational efficiency of price and depth quotes by comparing the quote adjustment speed before and after decimal pricing.

We employ a simple model of partial adjustment to analyze how quickly liquidity providers on the NYSE and NASDAQ adjust spread and depth quotes in response to changes in trading environments. We find that the speed of quote adjustment on the NYSE is faster than the speed of quote adjustment on NASDAQ, and that the result cannot be explained by differences in stock attributes between the two markets. In both markets, quote adjustment speed is faster for stocks with a larger number of trades, higher share prices, greater return volatility, smaller market capitalizations, and smaller trade sizes. Our results also indicate that stocks with greater information-based trading and in more competitive trading environments exhibit faster quote adjustments. The speed of quote adjustment after decimal pricing is significantly faster than the corresponding figure before decimal pricing in both markets, indicating that larger tick sizes slow price discovery. Finally, our results indicate that quote adjustment speed increases with the length of variable measurement intervals. On the whole, our study provides evidence that stock attributes, market structure, and tick size exert a significant impact on the speed of quote adjustment.

The remainder of the paper is organized as follows. In Section 2, we discuss how market structure affects quote adjustment speed. Section 3 explains data sources and presents descriptive statistics for our study sample of stocks. Section 4 explains our methodology and presents empirical findings on how market structure affects the speed of spread quote adjustment. Section 5 examines how quote adjustment speed is related to stock attributes, adverse-selection costs, probability of information-based trading, and competition. Section 6 shows how decimal pricing affects the speed of spread adjustment. Section 7 examines how the speed of depth adjustment is related to both stock attributes and tick size. Section 8 discusses how the length of variable measurement intervals affects quote adjustment speed. Section 9 presents concluding remarks.

II. Market structure and the speed of quote adjustment

In this section, we describe various institutional/regulatory constraints and market structures that are likely to affect quote adjustment speed on the NYSE and NASDAQ. Prior studies offer conflicting views on the relative speed of quote adjustment on the NYSE and NASDAQ. Masulis and Shivakumar (2002) hold that quote adjustment speed is likely to be slower on the NYSE for several reasons. First, limit orders on the NYSE cannot be updated instantaneously or conditioned on public information (such as the stock's last transaction price) and this slow updating of limit orders can delay revisions in the specialist's bid and ask quotes. Second, NYSE specialists may buy stocks when prices are falling because of their affirmative obligation to stabilize prices and this behavior can slow quote adjustment process. The specialists' obligation to provide price continuity can reinforce this effect because it requires them to go tick by tick through the limit order book. In addition, opening prices on the NYSE are set according to a call-auction process which, when combined with the specialists' obligation to stabilize prices, also slows

Kavajecz (2000), Bessembinder (2000), Van Ness, Van Ness, and Pruitt (2000), and Ronen and Weaver (2001).

quote adjustments. Based on these observations and the fact that NASDAQ is essentially an electronic market in which dealers do not have affirmative obligations, Masulis and Shivakumar conjecture that quote adjustments on the NYSE are likely to be slower than those on NASDAQ.

However, the speed of quote adjustment on the NYSE could be faster than that on NASDAQ for several reasons. As shown in Chung, Chuwonganant, and McCormick (2004), a large portion of order flow on NASDAQ is either internalized or preferenced based on payment for order flow agreements. NASDAQ dealers have little incentive to compete with quotes because aggressive quotes do not necessarily increase market share when a significant portion of the order flow is already internalized or preferenced.[3] As a result, NASDAQ dealers do not have strong incentives to make quick quote adjustments in response to information shocks. Although a part of the NYSE volume is also routed to regional exchanges according to preferencing agreements between brokers and dealers, prior studies (see, e.g., Blume and Goldstein, 1997; Bessembinder, 2003b) show that NYSE specialists almost always post the most competitive quotes. Consequently, order preferencing among brokers and regional dealers is unlikely to significantly compromise quote adjustment speeds on the NYSE. These considerations suggest that quote adjustment speed on the NYSE might actually be faster than that on NASDAQ.

In a recent study, Garfinkel and Nimalendran (2003) examine the degree of anonymity–the extent to which a trader is recognized as informed–in alternative market structures. The authors find evidence that there is less anonymity on the NYSE specialist system compared to the NASDAQ dealer system. Specifically, they find that when corporate insiders trade medium-sized quantities, NYSE-listed stocks exhibit larger changes in proportional effective spreads than NASDAQ stocks. The authors interpret this result as evidence that insider trades are more transparent on the NYSE specialist system than on the NASDAQ dealer system. Garfinkel and Nimalendran's findings support the hypothesis advanced by Benveniste, Marcus, and Wilhelm (1992) that the unique relationship between specialists and floor brokers on the NYSE results in less anonymity.[4] These considerations suggest that liquidity providers on the NYSE may respond more quickly to information-based trading than those on NASDAQ.[5]

Overall, prior studies offer conflicting predictions regarding the relative speed of quote adjustment between auction and dealer markets. There are numerous structural differences between the two markets that could affect quote adjustment speed. Because different forces are at work, it is unclear *a priori* whether the NYSE or NASDAQ exhibits faster quote adjustments. Ultimately, the relative speed of quote adjustment between the two markets is determined by the relative strength of these different forces. In the following sections, we perform empirical analyses of the relative quote adjustment speeds on the NYSE and NASDAQ using a large sample of stocks.

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[3] Klock and McCormick (2002) find a positive correlation between dealer market share and quote aggressiveness on NASDAQ, despite the fact that the large portion of NASDAQ order flow is preferenced.

[4] Benveniste, Marcus, and Wilhelm (1992) note that specialists on the NYSE have continuous face-to-face contact with floor brokers while such contact is not available to NASDAQ dealers because NASDAQ operates on an electronic screen-based system.

[5] Although several prior studies (see, e.g., Benveniste, Marcus, and Wilhelm, 1992; Battalio and Holden, 2001; Battalio, Jennings, and Selway, 2001) suggest that NASDAQ dealers utilize broker identity to distinguish between informed and uninformed order flow, the effect of such behavior on quote adjustment speed has not been shown in previous studies.

III. Data source and sample characteristics

We obtain data from the NYSE's Trade and Quote (TAQ) database.   We use the trade and quote data for the three-month period from September 2002 to November 2002. We omit the following trades and quotes to minimize data errors: quotes with an ask price or bid price less than or equal to zero; quotes with an ask size or bid size less than or equal to zero; quotes with bid-ask spreads greater than $5 or less than zero; quotes associated with trading halts or designated order imbalances; before-the-open and after-the-close trades and quotes; trades and quotes involving errors or corrections; trades with price or volume less than or equal to zero; trade price, p_t, if $|(p_t - p_{t-1})/p_{t-1}| > 0.10$; ask quote, a_t, if $|(a_t - a_{t-1})/a_{t-1}| > 0.10$; and bid quote, b_t, if $|(b_t - b_{t-1})/b_{t-1}| > 0.10$.

We measure share price by the mean value of quote midpoints and return volatility by the standard deviation of quote-midpoint returns. We measure trading frequency by the average daily number of transactions and trade size by the average dollar transaction size during the study period. We measure firm size by the average market value of equity during the study period.

Panel A of Table 1 shows descriptive statistics for our study sample of 2,233 NYSE stocks and 2,888 NASDAQ stocks that have the complete data required for our empirical analyses. The average share price is $20.89 for the NYSE sample and $10.49 for the NASDAQ sample. The average trade size and average daily number of transactions are $14,674 and 483 for the NYSE sample, and $4,471 and 423 for the NASDAQ sample. The average standard deviation of quote midpoint returns is 0.0014 for the NYSE sample and 0.0058 for the NASDAQ sample. The average market capitalizations for our NYSE and NASDAQ stocks are $3,759 million and $372 million, respectively. On the whole, NYSE stocks have higher share prices, larger trade sizes and number of trades, lower return volatility, and larger market capitalization.

IV. Market structure and the speed of spread adjustment: Empirical results

This section describes how we measure the speed of quote adjustment and examines how market structure affects quote adjustment speed.

4.1 Measurement of the speed of spread adjustment

We estimate the following partial adjustment model for each stock to measure quote adjustment speed:

$$\$SPREAD_{i,t} - \$SPREAD_{i,t-1} = a_{1i}[\$SPREAD^*_{i,t} - \$SPREAD_{i,t-1}] + \varepsilon_{1i,t}; \qquad (1)$$

where $\$SPREAD_{i,t}$ is the dollar spread of stock i at time t, $\$SPREAD_{i,t-1}$ is the dollar spread of stock i at time t–1 (which we define as the most recent quote-update point prior to time t), $\$SPREAD^*_{i,t}$ is the equilibrium (desired) dollar spread of stock i at time t, and $\varepsilon_{1i,t}$ is an error term.   As explained earlier, we conjecture that marketmakers may not always

instantaneously move toward equilibrium spreads (i.e., $a_{1i} < 1$) because either they are unable to do so due to institutional/regulatory constraints or they have little incentives to do so due to large preferenced orders. Our goal is to estimate and compare the speed of quote adjustment between samples of NYSE and NASDAQ stocks.

Prior studies suggest that marketmakers incur order-processing, inventory-holding, and adverse-selection costs.[6] These studies show that the costs of marketmaking and, by implication, equilibrium spreads, vary with select stock attributes such as trade size, number of trades, share price, and return volatility. Accordingly, we assume that the equilibrium spread at time t is a function of four stock attributes in the following manner:

$$\$SPREAD^*_{i,t} = \beta_{0i} + \beta_{1i}\log(NTRADE_{i,t}) + \beta_{2i}\log(TSIZE_{i,t}) + \beta_{3i}\log(PRICE_{i,t}) + \beta_{4i}RISK_{i,t}; \qquad (2)$$

where $NTRADE_{i,t}$ is the number of transactions between time t and t–15 minutes for stock i, $TSIZE_{i,t}$ is the size of the trade executed at or just prior to time t for stock i, $PRICE_{i,t}$ is the quote midpoint at time t for stock i, and $RISK_{i,t}$ is the standard deviation of quote midpoint returns between time t and t–15 minutes for stock i.[7]

Our study differs from prior studies (e.g., Damodaran, 1993; Brisley and Theobald, 1996) in one important respect. These studies assume that $P_t – P_{t-1} = g[V_t – P_{t-1}] + \varepsilon_t$; where P_t and P_{t-1}, respectively, are the observed prices at time t and t–1, V_t is the intrinsic value at time t, g is the price adjustment coefficient, and ε_t is a noise term. Furthermore, they assume that the intrinsic value (V_t) process is independently and identically distributed and follows a random walk, ε_t and V_t are independent, and g approaches one as the return interval is extended. Then, based on the observation that return variance is smaller when prices adjust more slowly to new information, these studies calculate the price adjustment coefficient using information contained in the time-series of unit-interval return data. In contrast, our model assumes that marketmakers constantly move toward equilibrium liquidity positions in response to new information embedded in the four stock attributes (i.e., NTRADE, TSIZE, PRICE, and RISK).

Prior studies show that the above stock attributes explain a significant portion of cross-sectional variation in the spread. For instance, Stoll (2000) and Chung, Van Ness, and Van Ness (2001) show that they explain about 65% to 85% of cross-sectional variation in the spread. However, prior studies offer little guidance as to how much of the intertemporal variation in the spread of a given stock can be explained by intertemporal variation in these stock attributes. Because our empirical model is concerned with intertemporal variation in the equilibrium and actual spreads and the speed at which the actual spread approaches the equilibrium spread, the validity of our partial adjustment model (i.e., Eq. (1)) is likely to depend on the explanatory power of the equilibrium spread model (i.e., Eq. (2)). As a crude test of the empirical aptness of Eq. (2), we regress the observed spread at time t ($\$SPREAD_{i,t}$) on $\log(NTRADE_{i,t})$, $\log(TSIZE_{i,t})$, $\log(PRICE_{i,t})$, and $RISK_{i,t}$ for each NYSE and NASDAQ stock. We find that about 25% to 35% of intertemporal variation in spreads can be accounted for by intertemporal variation in these variables. These results suggest that Eq. (2) is a reasonable model of the spread.

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[6] See, e.g., Stoll (1978), Ho and Stoll (1980, 1981), Glosten and Harris (1988), McInish and Wood (1992), Chung, Van Ness, and Van Ness (1999), Stoll (2000), and Chung, Van Ness, and Van Ness (2001).

[7] Our model is analogous to the following partial adjustment model of consumer expenditure behavior (see Judge et al., 1985): $Y_t – Y_{t-1} = \lambda(Y_t^* – Y_{t-1}) + \varepsilon_t$; where $Y_t^* = \alpha + \beta X_t$, Y_t = the actual expenditure in period t, Y_t^* = the optimal expenditure in period t, X_t = the disposable income in period t, λ = the adjustment coefficient, and ε_t is a random component. Lintner (1956) and Fama and Babiak (1968) employ similar models to analyze corporate dividend policy.

Prior studies usually include measures of competition (e.g., number of dealers, Herfindahl index, or number of markets) and information environment (e.g., firm size) in the spread model.[8] We do not include these variables in our model because we focus on intertemporal variation in the spread (not on inter-stock difference) and these variables are unlikely to vary materially between short time intervals.[9]

Substituting Eq. (2) into Eq. (1) and after rearrangement, we obtain

$$\$SPREAD_{i,t} - \$SPREAD_{i,t-1} = \beta_{0i}\,a_{1i} - a_{1i}\$SPREAD_{i,t-1} + \beta_{1i}\,a_{1i}\log(NTRADE_{i,t})$$
$$+ \beta_{2i}\,a_{1i}\log(TSIZE_{i,t}) + \beta_{3i}\,a_{1i}\log(PRICE_{i,t}) + \beta_{4i}\,a_{1i}RISK_{i,t} + \varepsilon_{1i,t}. \qquad (3)$$

We then estimate the following regression model for each stock using the time-series observations of the variables explained above:

$$\$SPREAD_{i,t} - \$SPREAD_{i,t-1} = \alpha_{0i} + \alpha_{1i}\$SPREAD_{i,t-1} + \alpha_{2i}\log(NTRADE_{i,t}) + \alpha_{3i}\log(TSIZE_{i,t})$$
$$+ \alpha_{4i}\log(PRICE_{i,t}) + \alpha_{5i}RISK_{i,t} + \varepsilon_{1i,t}. \qquad (4)$$

From Eq. (3) and Eq. (4), we note that $\alpha_{0i} = \beta_{0i}a_{1i}$, $\alpha_{1i} = -a_{1i}$, $\alpha_{2i} = \beta_{1i}a_{1i}$, $\alpha_{3i} = \beta_{2i}a_{1i}$, $\alpha_{4i} = \beta_{3i}a_{1i}$, and $\alpha_{5i} = \beta_{4i}a_{1i}$. We measure the speed of quote adjustment by the estimate of $-\alpha_{1i}$.

Similarly, we measure the speed of adjustment ($-\omega_{1i}$) in the percentage spread using the following regression model:

$$\%SPREAD_{i,t} - \%SPREAD_{i,t-1} = \omega_{0i} + \omega_{1i}\%SPREAD_{i,t-1} + \omega_{2i}\log(NTRADE_{i,t})$$
$$+ \omega_{3i}\log(TSIZE_{i,t}) + \omega_{4i}(1/PRICE_{i,t}) + \omega_{5i}RISK_{i,t} + \varepsilon_{2i,t}; \qquad (5)$$

where $\%SPREAD_{i,t}$ is the percentage bid-ask spread (i.e., the ratio of the dollar spread to quote midpoint) of stock i at time t. We include the inverse of share price instead of the log of share price in the regression model because the spread is measured as a fraction of share price.

4.2. Speed of quote adjustment: NYSE vs. NASDAQ

To determine whether the speed of quote adjustment varies with market structures, we calculate the mean values of quote adjustment coefficients ($-\alpha_{1i}$ and $-\omega_{1i}$) for our NYSE and NASDAQ stocks, together with t-statistics for testing the equality of the mean. Because estimates of quote adjustment speed (i.e., regression coefficients) for certain stocks are less meaningful (i.e., smaller t-values) than those for other stocks, we also calculate the weighted average of quote adjustment coefficients using the reciprocal of the standard error (SE) of each estimated coefficient as weight. Specifically, we multiply each estimated coefficient by the ratio of its own 1/SE to the sum of 1/SE across all NYSE (or NASDAQ) stocks in our study sample and then add up these 'weighted' coefficients across stocks in each market. We consider this approach sensible because it assigns

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[8] See, e.g., McInish and Wood (1992) and Chung, Chuwonganant, and McCormick (2004).

[9] Marketmakers are likely to post larger spreads when the probability of information-based trading (PIN) is higher. We do not include PIN in our spread model because the estimation of PIN requires a time interval that is much longer than 30 minutes. We consider PIN later in the paper (Section 5) when we analyze inter-stock differences in quote adjustment speed.

greater weight to the more precise estimates, thereby reducing the effect of measurement errors associated with $-\alpha_{1i}$ and $-\omega_{1i}$ on our inferences.

We show the results in Table 2, Fig. 1, and Fig. 2. The first three columns of Table 2 show the 1/SE-weighted mean values of quote adjustment coefficients for our NYSE and NASDAQ samples, respectively, together with t-statistics for testing the quality of the mean. The next three columns show the results for the simple (non-weighted) average of quote adjustment coefficients.

The weighted mean value of quote adjustment coefficients for NYSE stocks is approximately 0.24 and the corresponding value for NASDAQ stocks is 0.17-0.18 for both dollar and percentage spreads. The results of t-tests indicate that the differences in quote adjustment speed between our NYSE and NASDAQ samples are significant at the 1% level. The non-weighted mean value of quote adjustment coefficients for the NYSE sample is 0.26 and the corresponding value for the NASDAQ sample is 0.20.   Again, the differences are significant at the 1% level.

Although our results suggest that NYSE specialists make faster quote adjustments than NASDAQ dealers in response to changes in stock attributes, the results could also be driven by differences in the stock attributes between our NYSE and NASDAQ study samples. As shown in Panel A of Table 1, NYSE stocks have larger average transaction sizes than NASDAQ stocks. Furthermore, NYSE stocks have much larger market capitalization than NASDAQ stocks. Thus, differences in quote adjustment speeds could be due to differences in stock attributes. In the next section, we address this issue.

4.3. Results from the matched samples of NYSE and NASDAQ stocks

To compare the speed of quote adjustment between NYSE and NASDAQ stocks after controlling for differences in their attributes, we obtain matched samples of NYSE and NASDAQ stocks that are similar in trade size, price, return volatility, and market capitalization.[10] We first calculate the following matching score (MS) for each NYSE stock against each of the 2,888 NASDAQ stocks in our study sample: $MS = \Sigma[(X_k^N - X_k^Y)/\{(X_k^N + X_k^Y)/2\}]^2$, where X_k represents one of the four stock attributes, superscripts N and Y, refer to NASDAQ and NYSE, respectively; and Σ denotes the summation over $k = 1$ to 4.   Then, for each NYSE stock, we select the NASDAQ stock with the smallest MS. Once we match a NASDAQ stock with a NYSE issue, that particular NASDAQ stock is no longer considered for subsequent matches. This procedure results in 539 pairs of NASDAQ and NYSE stocks with similar attributes.[11]

Panel B of Table 1 shows descriptive statistics for the matched samples of NYSE and NASDAQ stocks. The average share price of the NYSE sample is $14.46 and the corresponding figure for the NASDAQ sample is $14.62.   The average daily number of transactions and trade size for the NYSE sample are 155 and $6,867, respectively, and the corresponding figures for the NASDAQ sample are 162 and $6,624. The mean values of the standard deviation of quote midpoint returns for our NYSE and NASDAQ stocks are

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[10] We note that although NASDAQ uses the same volume counting rules as the NYSE, the reported number of trades on NASDAQ is not directly comparable to that on the NYSE because there are many interdealer trades and dealer-to-customer interactions on NASDAQ.   Hence, we do not use the number of trades as one of the matching variables.

[11] We find that differences in one or more stock attributes between NASDAQ and NYSE stocks become considerable when MS exceeds three.   Hence, to ensure the quality of our matching sample, we include only those pairs (539 pairs) with a MS of less than three in our study sample.

0.0030 and 0.0031, respectively. The average market values of equity (MVE) for our NYSE and NASDAQ firms are $354 million and $346 million, respectively. The results of t-tests show that the mean values of these stock attributes are not significantly different between our NYSE and NASDAQ study samples.[12]

Table 2, Fig. 1, and Fig. 2 show the results from the matched sample of NYSE and NASDAQ stocks. The weighted mean value of quote adjustment coefficients for the NYSE sample is approximately 0.27 and the corresponding figure for the NASDAQ sample is 0.16. Similarly, the non-weighted mean value of quote adjustment coefficients for the NYSE sample is 0.29 and the corresponding figure for the NASDAQ sample is 0.18. For both weighted and non-weighted means, the differences between the NYSE and NASDAQ samples are significant at the 1% level. Hence, we conclude that our results are not driven by differences in the attributes of NYSE and NASDAQ stocks.

V. Speed of quote adjustment and stock attributes

In this section, we examine whether differences in quote adjustment speed across stocks can be explained by differences in stock attributes. We also perform an alternative test to determine whether differences in quote adjustment speed between the two markets (NYSE and NASDAQ) can be attributed to differences in stock attributes.

5.1. Statement of hypotheses

Easley and O'Hara (1992) and Harris and Raviv (1993) analyze the role of trades in the determination of asset prices and show that the number of transactions is positively related to absolute price changes (i.e., return volatility). In Easley and O'Hara (1992), the total number of trades is informative with respect to price changes because trades and the lack thereof are both informative to marketmakers. In Harris and Raviv (1993), trading occurs if and only if cumulative information for a particular type of trader switches from favorable to unfavorable or vice versa.

Jones, Kaul, and Lipson (1994) find that the positive relation between volatility and volume shown by numerous researchers reflects the positive relation between volatility and the number of trades. They show that the occurrence of transactions *per se* contains all of the information pertinent to pricing securities. This result is in line with the findings of Dufour and Engle (2000) that the speed of price adjustment in response to trade-related information increases as the time duration between transactions decreases. Insofar as trades convey information on asset values, liquidity providers may update quotes more quickly for stocks that are more actively traded and have greater return volatility. These considerations lead to our first hypothesis:

Hypothesis 1:   The speed of quote adjustment is positively related to both the number of trades and return volatility.

Chung and Chuwonganant (2002) show that low-price stocks exhibit fewer quote revisions involving changes in the spread. They interpret this result as evidence that the minimum price variation is more likely to be a binding constraint on absolute spreads for low-price stocks. Chung, Charoenwong, and Ding (2004) calculate the proportions of quoted and effective spreads that are equal to one penny in order to assess the extent to

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[12] The results are available from the authors upon request.

which the penny tick was a binding constraint after decimalization.[13] The authors find that although these proportions are much smaller under decimal pricing than under $1/16 pricing, the penny tick is still a significant binding constraint for low-price stocks. We conjecture that liquidity providers make slower adjustments toward equilibrium spreads for low-price stocks because the binding constraint prevents them from making such quote revisions. These considerations lead to our second hypothesis.

Hypothesis 2:   The speed of quote adjustment is positively related to share price.

Liquidity providers are likely to make faster quote adjustments to new information (and thereby move more quickly to equilibrium spreads) for stocks with greater adverse-selection risks (and costs). This is because the dealer cost of quoting sub-optimal spreads is probably greater for such stocks. Similarly, we hold that liquidity providers make faster quote revisions to equilibrium spreads when competition is high (e.g., smaller Hirfindahl index or larger number of markets).

Hypothesis 3:   The speed of quote adjustment is positively related to both adverse-selection risks (and costs) and the level of dealer competition.

5.2. Measurement of adverse-selection costs and risks

We use the spread component models developed by Glosten and Harris (1988), George, Kaul, and Nimalendran (1991), and Lin, Sanger, and Booth (1995) to measure adverse-selection cost. We use the algorithm in Easley, Hvidkjaer, and O'Hara (2002) to estimate adverse-selection risk.

5.2.1   Glosten and Harris (GH) model

The GH model uses the following ordinary-least-squares regression to estimate the adverse-selection component of the spread:

$$P_t - P_{t-1} = c_0(Q_t - Q_{t-1}) + c_1(Q_t V_t - Q_{t-1} V_{t-1}) + z_0 Q_t + z_1 Q_t V_t + \varepsilon_t; \qquad (6)$$

where P_t is the transaction price at time t, V_t is the number of shares traded at time t, ε_t is the error term that captures both the rounding error and the arrival of public information, and Q_t equals 1 for buyer-initiated trades and –1 for seller-initiated trades. We use the

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[13] There have been heated debates among regulatory authorities and the investment community on whether decimal pricing provides liquidity suppliers with sufficient freedom in the quote-setting process. In its response to the Securities and Exchange Commission (SEC)'s Concept Release on Sub-penny Trading, Island–an ECN currently operating within the NASDAQ market–casts serious doubt on the adequacy of penny tick increments. Island holds that sub-penny increments provide an opportunity to lower transaction costs and bring further efficiencies to the market. Island advocates that the SEC should not only continue to permit sub-penny trading but should also move forward expeditiously in requiring quotations of at least three decimal places in the publicly disseminated quotation.

Lee and Ready (1991) algorithm as modified by Bessembinder (2003a) to classify a trade as either a buy or sell.[14]

We use the estimates of c_0, c_1, z_0, and z_1 for each stock to calculate the adverse-selection and transitory components. We estimate the adverse-selection component by $Z_0 = 2(z_0 + z_1 V_t)$ and the transitory component by $C_0 = 2(c_0 + c_1 V_t)$. The bid-ask spread in the GH model is the sum of Z_0 and C_0. We use the average transaction volume for stock i, $\overline{V}_i$, to estimate the adverse-selection component, $ADVERSE_i = 2(z_{0,i} + z_{1,i}\overline{V}_i)$ and the total spread, $TOTAL_i = 2(c_{0,i} + c_{1,i}\overline{V}_i) + 2(z_{0,i} + z_{1,i}\overline{V}_i)$. We measure the adverse-selection component (as a proportion of the spread) for stock i by $Z_i = ADVERSE_i/TOTAL_i$.

5.2.2. George, Kaul, and Nimalendran (GKN) model

The GKN model uses the following regression to estimate the adverse-selection component:

$$2(TR_t - MR_t) = \pi_0 + \pi_1 s_q(Q_t - Q_{t-1}) + \varepsilon_t; \tag{7}$$

where TR_t is the transaction return at time t, MR_t is the quote midpoint return calculated from the quote midpoint immediately following the transaction at time t, s_q is the percentage bid-ask spread, Q_t equals 1 for buyer-initiated trades and –1 for seller-initiated trades, π_1 measures the order-processing component, $(1 - \pi_1)$ measures the adverse-selection component, and ε_t is the error term.

5.2.3. Lin, Sanger, and Booth (LSB) model

Lin, Sanger, and Booth (1995) develop a model which shows that quote revisions reflect the adverse information revealed by the trade at time t. We use the following regression model to estimate the adverse-selection component of the effective spread:

$$Quote_t - Quote_{t-1} = \lambda z_{t-1} + \varepsilon_t; \tag{8}$$

where $Quote_t$ is the quote midpoint at time t, z_t is the signed effective half spread defined as the transaction price at time t minus the quote midpoint at time t, and   measures the adverse-selection component (as a proportion of the effective spread). We use logs of the transaction price and quote midpoint in the estimation.

5.2.4. Adverse-selection risks

In a series of papers, Easley, Kiefer, and O'Hara (1996, 1997a, 1997b) and Easley, Hvidkjaer, and O'Hara (2002) employ a comprehensive empirical measure of the probability of information-based trading (PIN) to examine a variety of market

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[14] Bessembinder (2003a) shows that making no allowances for trade-reporting lags is optimal when assessing whether trades are buyer or seller initiated.

microstructure issues. Easley, Kiefer, and O'Hara (1996) find that the information contents of orders executed in New York and Cincinnati are significantly different. Easley, Kiefer, and O'Hara (1997a, 1997b) examine whether large and small trades have different information content. Easley, Hvidkjaer, and O'Hara (2002) analyze the effect of information-based trading on asset returns. We use the algorithm in Easley, Hvidkjaer, and O'Hara (2002) to estimate the adverse-selection risk.

In Easley, Hvidkjaer, and O'Hara (EHO)'s model, marketmakers observe trades, update their beliefs, and establish price quotes. Over time, the process of trading, and learning from trading, results in prices converging to full information values. The EHO model provides the structure necessary to extract information from the observable variables, i.e., the number of buys and sells. EHO show that the structural model can be estimated via the maximum likelihood method, providing a convenient method for determining the value of information parameters (and thus PIN) for a given stock.

The EHO model of the trade process for a trading day is represented by the following likelihood function:

$$L(\theta \mid B,S) = (1-\alpha)e^{-\varepsilon_b}\frac{\varepsilon_b^B}{B!}e^{-\varepsilon_s}\frac{\varepsilon_s^S}{S!} + \alpha\delta e^{-\varepsilon_b}\frac{\varepsilon_b^B}{B!}e^{-(\mu+\varepsilon_s)}\frac{(\mu+\varepsilon_s)^S}{S!} + \alpha(1-\delta)e^{-(\mu+\varepsilon_b)}\frac{(\mu+\varepsilon_b)^B}{B!}e^{-\varepsilon_s}\frac{\varepsilon_s^S}{S!};$$

(9)

where B is the number of buyer-initiated trades for the day, S is the number of seller-initiated trades for the day, is the probability that an event is information based, is the probability that an information event contains good news, 1– is the probability that an information event contains bad news, is the rate of arrival of orders from informed traders, $_b$ is the arrival rate of orders from uninformed buyers, $_s$ is the arrival rate of orders from uninformed sellers, and (, , $_b$, $_s$,) represents the parameter vector.

The likelihood function for the entire study period for each stock is given by:

$$V = L(\theta \mid M) = \prod_{d=1}^{D} L(\theta \mid B_d\, S_d);$$

(10)

where B_d (S_d) is the number of buyer (seller)-initiated trades for day d = 1, 2, ……, D, and M is the data set that contains ((B_1, S_1), ….., (B_d,S_d)). The rate of information arrival for all trades for stock i, ALL_i, is represented by + $_b$ + $_s$ and the rate of arrival for information-based trades for stock i, INF_i, is . We obtain the probability of information-based trading for stock i (PIN_i) by the ratio of INF_i to ALL_i, i.e., INF_i/ALL_i.

5.3. Measures of competition

For NASDAQ stocks, we use the Herfindahl index as a measure of dealer competition and trading concentration. We calculate the Herfindahl index for stock i using the following formula:

$$\text{H-INDEX}_i = \Sigma j[100V(i,j)/\Sigma jV(i,j)]^2;$$

(11)

where V(i,j) is stock i's dollar volume executed by dealer j. The Herfindahl index increases as the number of dealers decreases or as the proportion of leading dealers' volume increases. Thus, a high Herfindahl index is associated with a high concentration of trading. For NYSE stocks, we measure the level of competition by the number of markets in which each stock is traded (see Demsetz, 1968).

5.4. Model specification and estimation

We estimate the following regression model using our study sample of 2,233 NYSE stocks and 2,888 NASDAQ stocks:

$$-\alpha_{1i} \text{ or } -\omega_{1i} = \eta_0 + \Sigma_k \eta_k X_{i,k} + \eta_6 LSB_i \text{ (or } GH_i \text{ or } GKN_i) + \eta_7 PIN_i$$
$$+ \eta_8 NEX_i \text{ (for NYSE stocks) or H-INDEX}_i \text{ (for NASDAQ stocks)} + \varepsilon_i; \qquad (12)$$

where $-\alpha_{1i}$ ($-\omega_{1i}$) is the speed of quote adjustment in the dollar (percentage) spread, $X_{i,k}$ (k = 1 to 5) denotes one of the five stock attributes for stock i (i.e., $NTRADE_i$, $TSIZE_i$, $PRICE_i$, $RISK_i$ and MVE_i), Σ denotes the summation over i = 1 to 5, η_0 through η_8 are the regression coefficients, and ε_i is an error term. LSB_i, GH_i, and GKN_i denote the adverse-selection components of stock i calculated using the methods developed by Lin, Sanger, and Booth (1995), Glosten and Harris (1988), and George, Kaul, and Nimalendran (1991), respectively. PIN_i is the probability of information-based trading for stock i, NEX_i is the number of markets in which NYSE stock i is traded, and H-INDEX$_i$ is the Herfindahl index for NASDAQ stock i.

As noted earlier, the statistical significance of quote adjustment coefficients (i.e., $-\alpha_{1i}$ and $-\omega_{1i}$) varies across stocks; some of these coefficients are highly significant while others are not. To reflect this feature in our second-pass regression, we estimate Eq. (12) using the weighted regression procedure. We use the reciprocal of the standard error of quote adjustment coefficients from the first-pass regressions (i.e., Eq. (4) and Eq. (5)) as weight in the second-pass regression (i.e., Eq. (12)). This approach assigns smaller weights to quote adjustment coefficients that are less meaningful (i.e., smaller t-values).[15] We use the log of share price, number of trades, trade size, MVE, NEX, and H-INDEX in the regression.

Panel A of Table 3 shows the results of the second-pass regressions when we estimate the speed of quote adjustment using the dollar spread (i.e., Eq. (4)). Panel B shows the results when we estimate the speed of quote adjustment using the percentage spread (i.e., Eq. (5)). In both panels, the first three columns show the results for NYSE stocks and the next three columns show the results for NASDAQ stocks.

We find that quote adjustment speed is significantly and positively related to the number of trades, share price, and return volatility on both the NYSE and NASDAQ, regardless of whether we measure the spread in absolute or relative terms.[16] These results are consistent with our hypotheses 1 and 2 and support the idea that trades

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[15] This method minimizes the weighted residual sum of squares $\Sigma w_i(O_i - P_i)^2$, where w_i is the value of the variable used as weight, O_i is the observed value of the dependent variable, and P_i is the predicted value of the dependent variable. If the weights for the observations are proportional to the reciprocals of the standard error of the estimates, the weighted least-squares estimates are best linear unbiased estimators (BLUE).

[16] The positive relation between the speed of quote adjustment and the number of trades is in line with the finding of Nyholm (2002) that private information is incorporated faster in the quotes for high-volume stocks than in the quotes for low-volume stocks.

convey information, and that the penny tick is more likely a binding constraint on spreads for low-price stocks.[17]

The speed of quote adjustment is positively and significantly related to all three measures of the adverse-selection component of the spread (i.e., LSB_i, GH_i, and GKN_i). Likewise, the speed of quote adjustment is significantly and positively related to the probability of information-based trading (PIN_i). These results are consistent with hypothesis 3 and support the notion that liquidity providers make faster quote adjustments in response to new information when they face greater adverse-selection costs (risks).

The speed of quote adjustment is generally negatively related to the market value of equity. We interpret this result as evidence that marketmakers face greater adverse-selection risks in stocks of small companies (because less information is available on such stocks) and thus make faster quote adjustments toward equilibrium spreads. Here, firm size may capture dimensions of adverse-selection costs or risks that are not captured by LSB_i, GH_i, GKN_i, or PIN_i.[18]

We find that quote adjustment speed is positively and significantly related to the number of markets (NEX_i) for NYSE stocks, and negatively and significantly related to the Herfindahl index for NASDAQ stocks. These results are consistent with our conjecture that liquidity providers make faster quote adjustments to new information when quote competition is higher.

Our results show that quote adjustment speed is significantly and negatively related to trade size, indicating that marketmakers update quotes more quickly for stocks with smaller trade sizes. However, because of the ambiguity involved in the relation between trade size and information content, it is unclear what drives this relation. Easley, Kiefer, and O'Hara (1997b) show that trade size provides no information content beyond that conveyed by the underlying transactions. They interpret this result as evidence that informed agents trade both large and small quantities, and therefore trade size is not informative to marketmakers. Such an outcome arises in a pooling equilibrium (see Easley and O'Hara, 1987) in which some informed traders submit small orders and others submit large orders. It is the transaction, not trade size, which conveys information when informed trading occurs in varying quantities.

However, in a separating equilibrium, the preponderance of informed trading in large quantities imparts information content to order size (see Easley, Kiefer, and O'Hara, 1997a). Easley, Kiefer, and O'Hara (1997b) conclude that the role of trade size in information transmission is model-specific. On the other hand, Barclay and Warner (1993) find that informed traders are concentrated in the medium-size category and price movements are due mainly to informed traders' private information. Similarly, Chakravarty (2001) shows that medium-size trades exhibit a larger cumulative price

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[17] If the binding constraint is indeed the main reason why quote adjustment speed is positively related to share price, we would expect to find a stronger impact of share price on quote adjustment speed when the tick size is larger. To confirm this, we replicate Table 3 using pre-decimalization data. Consistent with our expectation, we find that share price has stronger effects on quote adjustment speed and the speed is generally slower during the pre-decimal periods.

[18] Prior studies report that stocks of large companies exhibit faster price adjustments than stocks of small companies (see, e.g., Damodaran, 1993; Thoebald and Yallup, 2004). One possible explanation for the difference between our and their results is that these studies do not control for the effects of stock attributes (e.g., number of trades, trade size, share price, etc.) on price adjustment speed. Indeed, when we regress spread adjustment speed only on MVE, we find that the regression coefficients for MVE are positive and significant for both NYSE and NASDAQ samples, regardless of whether we estimate the speed of adjustment using the dollar or percentage spread.

impact than other trade-size categories. Because it is difficult to establish a clear connection between trade size and information content, it is also difficult to interpret the observed relation between trade size and quote adjustment speed, at least from the perspective of information-based models.

5.5. Relative speed of quote adjustment between NYSE and NASDAQ stocks

Earlier, we showed that the mean value of quote adjustment coefficients for NYSE stocks is greater than the corresponding value for NASDAQ stocks. We attributed this result to differences in market structure between the NYSE and NASDAQ. In this section, we examine whether the result can be explained by differences in stock attributes between the two markets. To the extent that quote adjustment speed is related to stock attributes, a faster speed of quote adjustment observed in one market relative to the other may simply reflect differences in stock attributes between the two markets. For example, stocks in one market may have greater adverse-selection risks or higher share prices, and thus exhibit faster quote adjustments.

To determine whether quote adjustment is faster for NYSE stocks after controlling for the differences in attributes between NYSE and NASDAQ stocks, we estimate the following regression model using the pooled sample of NYSE and NASDAQ stocks:

$$-\alpha_{1i} \text{ or } -\omega_{1i} = \eta_0 + \Sigma_k \eta_k X_{i,k} + \eta_6 LSB_i \text{ (or } GH_i \text{ or } GKN_i) + \eta_7 PIN_i + \eta_8 DNYSE_i + \varepsilon_i; \qquad (13)$$

where $DNYSE_i$ is a dummy variable for NYSE stocks which equals one for NYSE stocks and zero for NASDAQ stocks and the other variables are the same as previously defined.

The last three columns of Table 3 show the regression results. In both panels, estimated coefficients for the NYSE dummy variable are positive and significant in all three regressions. This indicates that NYSE specialists make faster quote adjustments in response to new information than NASDAQ dealers. These results confirm our earlier finding that the greater quote adjustment coefficients for our NYSE stocks (relative to those for NASDAQ stocks) reported in Table 2 are not driven by differences in stock attributes between the two samples. We attribute these results to structural differences (such as centralized versus segmented order flow, order preferencing on NASDAQ, and NYSE specialists' interaction with floor traders) between the two markets, Overall, our results suggest that market structure exerts a significant influence on the informational efficiency of marketmaker quotes.

VI. Does tick size affect quote adjustment speed?

In this section, we examine whether tick size affects quote adjustment speed. The NYSE initiated a pilot decimalization program on August 28, 2000 with seven listed issues, followed by 57 issues on September 25, 2000, and 94 issues on December 4, 2000. The NYSE converted all 3,525 listed issues to decimal pricing on January 29, 2001. The NASDAQ Stock Market began its decimal test phase with 14 securities on March 12, 2001, followed by another 197 securities on March 26, 2001. All remaining NASDAQ securities converted to decimal trading on April 9, 2001. We estimate the speed of quote adjustment using data from before and after decimal pricing in each market and examine whether decimal pricing has any impact on quote adjustment speed.

Tick size is an important protocol of securities markets in that it affects trading costs and market quality. Tick size affects trading costs because it could be a binding constraint on absolute spreads. Also, tick size affects market quality because it limits the prices that marketmakers and traders can quote, thus restricting price competition. Prior studies examine the effects of tick size on trading costs, return volatility, and other aspects of market quality. Ahn, Cao, and Choe (1996) examine the change in liquidity when the AMEX reduced its tick size. Bacidore (1997), Porter and Weaver (1997), Ahn, Cao, and Choe (1998), and Griffiths et al. (1998) examine the impact of the tick-size change on liquidity for stocks listed on the Toronto Stock Exchange.

Bollen and Whaley (1998) and Goldstein and Kavajecz (2000) examine the effects of the tick-size change on the spreads of NYSE-listed stocks. Harris (1994, 1997) holds that the impact of tick size on market quality depends on the price-time priority rule. Simaan, Weaver, and Whitcomb (1998) analyze the quotation behavior of NASDAQ dealers after the tick-size change. Bessembinder (2000) shows that quoted and effective spreads on NASDAQ are two to four cents less when stocks trade below $10 under a smaller tick size. Van Ness, Van Ness, and Pruitt (2000) examine the effect of tick size on volume, volatility, and execution costs for both NYSE and NASDAQ issues. Ronen and Weaver (2001) use the AMEX's May 1997 market-wide adoption of $1/16 ticks to examine the effect of tick size on return volatility, spreads, depths, trader behavior, and specialist profits. Gibson, Singh, and Yerramilli (2003) examine the effect of decimal pricing on the components of the spread. They find that decimal pricing has a significant impact on the order-processing component, but not on the adverse-selection and inventory components.

Although there is extensive literature on the effect of tick size on market quality, there is little evidence as to how tick size affects quote adjustment speed. In this study, we contribute to existing literature by investigating the impact of tick size on quote adjustment speed using data before and after decimal pricing. We conjecture that the speed of quote adjustment during the post-decimal period is faster than the speed during the pre-decimal period. This is because the penny tick size would be a binding constraint less frequently than the pre-decimal tick size (i.e., $1/16), allowing liquidity providers to move toward equilibrium spreads more quickly. Also note that a smaller tick size results in greater price competition because it implies a smaller cost of both front running by sell-side intermediaries (e.g., specialists, marketmakers, and brokers) and stepping ahead of the existing queue by buy-side traders (e.g., pension funds, mutual funds, and hedge funds). This is another reason why we expect faster quote adjustments under decimal pricing. We consider our analysis important because it underscores an issue that has not yet been addressed in the literature: the effect of tick size on the informational efficiency of quoted prices.

For NYSE stocks, we consider the three-month period from May 28, 2000 to August 27, 2000 as the pre-decimal period and January 30, 2001 to April 29, 2001 as the post-decimal period. For NASDAQ stocks, we consider the three-month period from December 12, 2000 to March 11, 2001 as the pre-decimal period and April 10, 2001 to July 9, 2001 as the post-decimal period. For each NYSE and NASDAQ stock, we estimate the quote adjustment coefficients $-\alpha_{1i}$ and $-\omega_{1i}$ during the pre- and post-decimal periods, respectively. We then calculate the mean quote adjustment coefficient for each period within each market.

Table 4 shows that the mean value of the quote adjustment coefficients for NYSE stocks is approximately 0.18 during the pre-decimal period and 0.23 during the post-decimal period. The difference is significant at the 1% level (see also Fig. 3 and Fig. 4).[19]

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[19] We report the 1/SE-weighted mean spreads here. The results for the non-weighted mean spreads are qualitatively similar.

For the NASDAQ sample, the mean value of the quote adjustment coefficients is 0.12-0.13 during the pre-decimal period and 0.17 during the post-decimal period. Again, the difference is significant at the 1% level. Overall, our results indicate that liquidity suppliers on the NYSE and NASDAQ make faster quote adjustments after decimalization.

Although the results reported in Table 4 indicate that liquidity providers make faster quote adjustments after decimalization, it is possible that they are driven by dissimilarities in the trading environments between the two periods rather than different tick sizes *per se*. To examine this possibility, we estimate the following regression model:

$$\Delta(-\alpha_{1i}) \text{ or } \Delta(-\omega_{1i}) = \pi_0 + \Sigma\pi_k\,\Delta X_{i,k} \quad + \pi_6\Delta LSB_i \text{ (or } \Delta GH_i \text{ or } \Delta GKN_i) + \pi_7\Delta PIN_i$$

$$+ \pi_8\Delta NEX_i \text{ (for NYSE stocks) or } \Delta H\text{-}INDEX_i \text{ (for NASDAQ stocks)} + \varepsilon_i; \qquad (14)$$

where Δ indicates the difference between the post- and pre-decimalization values (post – pre) and all other variables are the same as previously defined. If the increases in quote adjustment speed shown in Table 4 are indeed due to the smaller tick size (rather than to concurrent changes in stock attributes), we expect the estimated intercept (i.e., π_0) in regression model (14) to be positive and significant.

The left half of Table 5 shows the results of regression model (14) when we estimate quote adjustment speed using the dollar spread. The right half shows the results when we estimate quote adjustment speed using the percentage spread. As in Table 3, we estimate the model using the weighted regression procedure, in which the weight is the mean of the reciprocal of the standard error of quote adjustment coefficients from the pre-decimal period and the corresponding value from the post-decimal period. In both halves, the first three columns show the results for NYSE stocks and the next three columns show the results for NASDAQ stocks. The results show that the estimated intercepts are all positive and significant at the 1% level for both NYSE and NASDAQ samples, regardless of whether we use dollar or percentage spreads. Thus, faster quote adjustments after decimalization cannot be accounted for by differences in stock attributes between the pre and post decimal periods.

VII. Speed of depth quote adjustment

Marketmakers post both the price (i.e., the bid and ask prices) and the quantity (i.e., the bid and ask depths) of shares that they are willing to trade. To the extent that marketmakers have control over both variables and manage them strategically, the analysis of price quotes alone is likely to show an incomplete picture of marketmaker behavior.[20] In this section, we analyze how adjustment speed in depth quotes varies with stock attributes and tick size.

Lee, Mucklow, and Ready (1993) examine intraday variation in the spread and depth of NYSE-listed stocks and find that spreads widen and depths drop before quarterly earnings announcements. Harris (1994) analyzes the effect of tick size on NYSE specialist quotes and finds that the tick size affects depths when it is larger than the spread that dealers would otherwise quote (i.e., when the tick size is a binding constraint). Kavajecz

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[20] Most previous studies focus only on the price quote. See, e.g., Tinic (1972), Tinic and West (1972), Stoll (1978, 1989), Cohen, et al. (1981), Ho and Stoll (1981), Copeland and Galai (1983), Glosten and Milgrom (1985), Glosten and Harris (1988), Glosten (1989), Foster and Viswanathan (1991), and Huang and Stoll (1997).

(1996) suggests that NYSE specialists use depth as a strategic variable to reduce adverse selection risks. Kavajecz (1999) shows that both specialists and limit-order traders quote smaller depths around earnings announcements. Goldstein and Kavajecz (2000) find that both quoted spreads and depths declined after the NYSE's tick size changed from eighths to sixteenths.

Although prior studies underscore the importance of recognizing the quantity dimension of quotes, there is little evidence as to how depth adjustment speed is related to stock attributes and tick size. The TAQ database reports only the largest, not the aggregate, depth at the inside for NASDAQ issues, whereas it reports the aggregate depth (specialist depth plus all the limit orders at the quoted price) for NYSE issues. As a result, the cross-market comparison of quoted depths is not meaningful. For the same reason, the cross-market comparison of depth adjustment speed is less meaningful than that of spread adjustment speed. Hence, we focus on the cross-sectional determinants of depth adjustment speed and the effects of decimal pricing on depth adjustment speed within each market.

Harris (1994) shows that variables which explain the spread also explain the depth. Hence, we use the method described in Section 4.1 to estimate the speed of depth adjustment. Specifically, we estimate the following regression model for each NYSE and NASDAQ stock in our study sample using data for the three-month period from September 2002 to November 2002:

$$\log(DEPTH_{i,t}) - \log(DEPTH_{i,t-1}) = \tau_{0i} + \tau_{1i}\log(DEPTH_{i,t-1}) + \tau_{2i}\log(NTRADE_{i,t})$$
$$+ \tau_{3i}\log(TSIZE_{i,t}) + \tau_{4i}\log(PRICE_{i,t}) + \tau_{5i}RISK_{i,t} + \varepsilon_{3i,t}; \tag{15}$$

where $DEPTH_{i,t}$ is the depth (the combined depth at the bid and ask) of stock i at time t, $DEPTH_{i,t-1}$ is the depth of stock i at time t–1, and all other variables are the same as previously defined.

We then estimate the following second-pass regression model to determine how depth adjustment speed is related to stock attributes:

$$-\tau_{1i} = \eta_0 + \Sigma\eta_k X_{i,k} + \eta_6 LSB_i \text{ (or } GH_i \text{ or } GKN_i) + \eta_7 PIN_i$$
$$+ \eta_8 NEX_i \text{ (for NYSE stocks) or } H\text{-}INDEX_i \text{ (for NASDAQ stocks)} + \varepsilon_i; \tag{16}$$

where $-\tau_{1i}$ is the estimate of depth adjustment speed from regression model (15) and all other variables are the same as previously defined in Eq. (12).

Table 6 shows that depth adjustment speed is positively and significantly related to the number of trades, share price, and return volatility, and negatively related to trade size and MVE on both the NYSE and NASDAQ. We also find that in both markets, liquidity providers make faster depth adjustments for stocks with greater adverse-selection costs (risks) and dealer competition. These results are all qualitatively identical to those reported in Table 3 on cross-sectional relations between spread adjustment speed and stock attributes. These findings indicate that if liquidity providers make faster price adjustments to new information for a given stock, they are also likely to make faster depth adjustments for that stock.

Our explanatory variables account for nearly 50% of the cross-sectional variation in depth adjustment speed on the NYSE. In contrast, the same variables explain only 22% to 24% of the cross-sectional variation in depth adjustment speed on NASDAQ. The lower

explanatory power of our regression model for NASDAQ stocks may, at least in part, be attributed to the fact that the depth figures for NASDAQ stocks reported in the TAQ database are incomplete measures of actual liquidity at the inside.

To determine how decimal pricing affects the speed of depth adjustment, we estimate regression model (15) for each NYSE and NASDAQ stock using data from before and after decimalization, respectively, and then calculate the cross-sectional mean of depth adjustment coefficients (i.e., $-\tau_{1i}$). As in Section 6, we define the three-month period from May 28, 2000 to August 27, 2000 as the pre-decimal period and January 30, 2001 to April 29, 2001 as the post-decimal period for the NYSE sample. For NASDAQ stocks, we consider the three-month period from December 12, 2000 to March 11, 2001 as the pre-decimal period and April 10, 2001 to July 9, 2001 as the post-decimal period.

Table 7 shows that the weighted mean value (0.2642) of depth adjustment coefficients after decimal pricing is significantly greater than the corresponding value (0.2056) before decimal pricing for our NYSE stocks. Similarly, the depth adjustment speed (0.2349) after decimal pricing is significantly greater than the corresponding value (0.1862) before decimal pricing for our NASDAQ stocks.

To examine the effect of decimal pricing on depth adjustment speed after controlling for concurrent changes in stock attributes, we estimate the following regression model:

$$\Delta(-\tau_{1i}) = \Phi_0 + \Sigma \, \Phi_k \, \Delta X_{i,k} \quad + \Phi_6 \Delta LSB_i \text{ (or } \Delta GH_i \text{ or } \Delta GKN_i) + \Phi_7 \Delta PIN_i$$

$$+ \Phi_8 \Delta NEX_i \text{ (for NYSE stocks) or } \Delta H\text{-}INDEX_i \text{ (for NASDAQ stocks)} + \varepsilon_i; \qquad (17)$$

where Δ indicates the difference between the post- and pre-decimalization values (post – pre) and all other variables are the same as previously defined. If the increases in depth adjustment speed shown in Table 7 are due to the smaller tick size (rather than to concurrent changes in stock attributes), we expect the estimated intercept (i.e., Φ_0) in regression model (17) to be positive and significant.

Table 8 shows that the estimated intercepts are all positive and significant at the 1% level for both NYSE and NASDAQ samples, regardless of how we estimate the adverse-selection component of the spread. This indicates that the smaller tick size results in quicker depth adjustments for both NYSE and NASDAQ stocks. Overall, our results indicate that tick size is an important factor in determining quote adjustment speed, and that the smaller tick size steps up the informational efficiency of price and quantity quotes in U.S. securities markets.

VIII. Variable measurement intervals and quote adjustment speeds

In this section we examine the effect of variable measurement intervals on quote adjustment speed. First, we partition each trading day into 13 successive 30-minute intervals and calculate the variables used in the study during each interval. We then estimate regression models (4), (5), and (16) using the 30-minute interval data and reproduce the results reported in Table 4 and Table 7. Similarly, we calculate daily values of the variables and reproduce the results.[21]   Panel A of Table 9 shows the results based the 30-minute interval data and Panel B shows the results based on the daily data.

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[21] The study sample consists of 2,081 NYSE listed-stocks and 2,613 NASDAQ listed-stocks.

The results show that the mean values of quote adjustment coefficients for the post-decimal period are all significantly greater than the corresponding values for the pre-decimal period on both the NYSE and NASDAQ, regardless of measurement intervals. For example, according to the results from the 30 minute interval data, the mean adjustment speed in the dollar spread during the pre-decimal period is 0.5696 (0.4904) whereas the corresponding figure during the post-decimal period is 0.6512 (0.5634) for NYSE (NASDAQ) stocks. Similarly, the mean value of depth adjustment coefficients during the pre-decimal period is 0.5450 (0.5316), whereas the corresponding figure during the post-decimal period is 0.6380 (0.5820) for NYSE (NASDAQ) stocks. We obtain qualitatively similar results from the daily data. Table 9 also shows that the speed of quote adjustment for NYSE stocks is consistently faster than that for NASDAQ stocks. These results confirm our earlier findings that smaller tick size results in faster quote adjustments, and that liquidity providers on the NYSE make faster quote adjustments than those on NASDAQ.

Our results also show that the quote adjustment coefficients estimated from the 30-minute interval data are all greater than those from the quote-to-quote data for both NYSE and NASDAQ stocks. Likewise, the quote adjustment coefficients estimated from daily observations are all greater than those from 30-minute intervals. For example, when we estimate quote adjustment speed using the quote-to-quote data, the mean adjustment speed in the dollar spread during the post-decimal period is 0.2341 for NYSE stocks and 0.1679 for NASDAQ stocks (see Table 4). The mean adjustment speed during the same period jumps up to 0.6512 (0.8298) for NYSE stocks and 0.5634 (0.7595) for NASDAQ stocks (see Table 9) when we estimate it using the 30-minute interval data (the daily data). Similarly, when we estimate quote adjustment speed using the quote-to-quote data, the mean depth adjustment speed during the post-decimal period is 0.2642 for NYSE stocks and 0.2349 for NASDAQ stocks (see Table 7). The mean adjustment speed during the same period jumps up to 0.6380 (0.8271) for NYSE stocks and 0.5820 (0.7550) for NASDAQ stocks when we estimate it using the 30-minute interval data (the daily data). These results should not come as a surprise since marketmakers are more likely to make full adjustments in quotes given longer adjustment periods.

IX. Summary and concluding remarks

Numerous studies have examined the effects of market structure and tick size on measures of market quality such as execution costs, return volatility, and adverse-selection risks. The present study complements these studies by providing further evidence on how market structure and tick size affect quote adjustment speed. Understanding the speed of quote adjustment is important because it most likely mirrors the informational efficiency of quoted prices and depths.

Our results show that market structure exerts a significant impact on the speed of quote adjustment, thereby explaining why liquidity providers on the NYSE react more quickly to new information than liquidity providers on NASDAQ. We find strong cross-sectional regularities in quote adjustment speed. Liquidity providers make faster quote adjustments in response to new information for stocks with greater adverse-selection costs and quote competition. The speed of quote adjustment is also strongly related to stock attributes. For example, stocks with a greater number of trades, greater return volatility, higher prices, smaller market capitalizations, and smaller trade sizes exhibit faster quote adjustments to new information. Liquidity providers on both the NYSE and

NASDAQ react more promptly to new information after decimalization. We interpret the latter result as evidence that large tick sizes create friction in exchange markets, and thus delaying price discovery. Finally, we find that quote adjustment speed increases with variable measurement intervals.

Although the present study offers new insight on the effects of market structure and tick size on the informational efficiency of market quotes, there are limitations to our approach and interpretation. For example, we assume that equilibrium spreads and depths are determined by four stock attributes and that liquidity providers make quote adjustments accordingly. To the extent that equilibrium spreads and depths are also functions of other variables, our empirical models are subject to misspecification.

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Table 1.   Descriptive statistics

Panel A shows select attributes of our study sample of 2,233 NYSE stocks and 2,888 NASDAQ stocks, respectively, during the three-month period from September 2002 to November 2002.   Share price is measured by the mean quote midpoint.   Number of trades is the average daily number of transactions. Trade size is the average dollar transaction size. Risk is measured by the standard deviation of quote midpoint returns. Firm size is measured by the market value of equity. Panel B shows attributes of 539 matched pairs of NYSE and NASDAQ stocks that are similar in trade size, share price, return volatility, and market capitalization. For this, we first calculate the following matching score (MS) for each NYSE stock against each of 2,888 NASDAQ stocks in our sample: $MS = \Sigma[(X_k^N - X_k^Y)/\{(X_k^N + X_k^Y)/2\}]^2$; where X_k represents one of the four stock attributes, the superscripts, N and Y, refer to NASDAQ and NYSE, respectively; and Σ denotes the summation over $k = 1$ to 4. Then, for each NYSE stock, we select the NASDAQ stock with the smallest MS.

Variable	Exchange	Mean	Standard deviation	Percentile				
				5	25	50	75	95
Panel A: Whole study sample								
Share price ($)	NYSE	20.89	22.21	2.70	9.41	16.55	27.89	49.61
	NASDAQ	10.49	12.56	0.43	2.02	6.22	15.62	32.47
Number of trades	NYSE	482.98	610.90	6.67	39.86	191.97	687.37	1,904.11
	NASDAQ	422.67	1,961.15	1.97	8.57	36.75	188.40	1,600.11
Trade size ($)	NYSE	14,674	15,417	2,780	6,115	10,158	16,717	42,931
	NASDAQ	4,471	4,165	529	1,541	3,367	6,215	11,637
Risk	NYSE	0.0014	0.0024	0.0003	0.0005	0.0008	0.0013	0.0045
	NASDAQ	0.0058	0.0061	0.0004	0.0014	0.0036	0.0084	0.0178
Market cap (in $ millions)	NYSE	3,759	14,637	32	179	603	1,987	14,921
	NASDAQ	372	2,545	4	22	68	228	1,217
Panel B: Matched sample								
Share price ($)	NYSE	14.46	11.89	1.38	4.40	10.26	18.84	36.07
	NASDAQ	14.62	12.07	1.31	4.96	11.78	20.27	38.11
Number of trades	NYSE	154.54	247.67	3.65	15.25	55.17	182.30	691.98
	NASDAQ	161.70	306.74	3.68	15.95	57.84	192.19	730.65
Trade size ($)	NYSE	6,867	4,659	1,516	3,463	5,618	9,190	15,941
	NASDAQ	6,624	3,966	1,425	3,426	5,653	8,370	13,838
Risk	NYSE	0.0030	0.0038	0.0005	0.0009	0.0015	0.0030	0.0107
	NASDAQ	0.0031	0.0036	0.0005	0.0010	0.0017	0.0033	0.0108
Market cap (in $ millions)	NYSE	354	595	15	58	153	398	1,264
	NASDAQ	346	493	14	57	152	395	1,285

Table 2. Comparisons of speed of quote adjustment between NYSE stocks and NASDAQ stocks

In this table, we compare the speed of quote adjustment between NYSE and NASDAQ stocks. We calculate quote adjustment coefficients using the following regression models: $\text{\$SPREAD}_{i,t} - \text{\$SPREAD}_{i,t-1} = \alpha_{0i} + \alpha_{1i}\text{\$SPREAD}_{i,t-1} + \alpha_{2i}\log(\text{NTRADE}_{i,t}) + \alpha_{3i}\log(\text{TSIZE}_{i,t}) + \alpha_{4i}\log(\text{PRICE}_{i,t}) + \alpha_{5i}\text{RISK}_{i,t} + \varepsilon_{1i,t}$; and $\%\text{SPREAD}_{i,t} - \%\text{SPREAD}_{i,t-1} = \omega_{0i} + \omega_{1i}\%\text{SPREAD}_{i,t-1} + \omega_{2i}\log(\text{NTRADE}_{i,t}) + \omega_{3i}\log(\text{TSIZE}_{i,t}) + \omega_{4i}(1/\text{PRICE}_{i,t}) + \omega_{5i}\text{RISK}_{i,t} + \varepsilon_{2i,t}$. $\text{\$SPREAD}_{i,t}$ ($\%\text{SPREAD}_{i,t}$) is the dollar (percentage) spread of stock i at time t, $\text{NTRADE}_{i,t}$ is the number of transactions between time t and t–15 minutes for stock i, $\text{TSIZE}_{i,t}$ is the size of the trade executed at or just prior to time t for stock i, $\text{PRICE}_{i,t}$ is the quote midpoint at time t for stock i, $\text{RISK}_{i,t}$ is the standard deviation of quote midpoint returns between time t and t–15 minutes for stock i, and εs are error terms. We measure quote adjustment speed for each stock by $-\alpha_1$ and $-\omega_1$. We show the mean values of quote adjustment coefficients for NYSE stocks and NASDAQ stocks and t-statistics for testing the equality of the mean. Because estimates of quote adjustment speeds (i.e., regression coefficients) for certain stocks are less meaningful (i.e., smaller t-values) than those for other stocks, we also calculate the weighted average of quote adjustment coefficients using the reciprocal of the standard error (SE) of each estimated coefficient as weight. Specifically, we multiply each estimated coefficient by the ratio of its own 1/SE to the sum of 1/SE across all NYSE (or NASDAQ) stocks in our study sample and then add up these 'weighted' coefficients across stocks in each market. We also report the results for 539 matched pairs of NYSE and NASDAQ stocks that are similar in trade size, share price, return volatility, and market capitalization.

	Results from the whole study sample						Results from the matched sample					
	Weighted average			Simple average			Weighted average			Simple average		
	NYSE	NASDAQ	t-value[a]	NYSE	NASDAQ	t-value[a]	NYSE	NASDAQ	t-value[a]	NYSE	NASDAQ	t-value[a]
$SPREAD adjustment	0.2438	0.1761	20.07**	0.2604	0.1985	22.82**	0.2730	0.1632	9.96**	0.2858	0.1788	19.60**
%SPREAD adjustment	0.2434	0.1747	20.36**	0.2602	0.1982	22.26**	0.2731	0.1615	10.15**	0.2856	0.1782	19.27**

**Significant at the 1% level.
[a]The t-statistic testing the equality of the mean between NYSE and NASDAQ stocks.

Table 3. Speed of quote adjustment, adverse-selection risk, and stock characteristics

This table shows the results of the following regression model: $-\alpha_{1i}$ or $-\omega_{1i} = \eta_0 + \Sigma\eta_k X_{i,k} + \eta_6 LSB_i$ (or GH_i or GKN_i) $+ \eta_7 PIN_i + \eta_8 NEX_i$ (for NYSE stocks) or H-INDEX$_i$ (for NASDAQ stocks) $+ \varepsilon_i$; where $-\alpha_{1i}$ ($-\omega_{1i}$) is the estimate of quote adjustment speed in the dollar (percentage) spread, $X_{i,k}$ (k = 1 to 5) denotes one of the five stock attributes for stock i (i.e., NTRADE$_i$, TSIZE$_i$, PRICE$_i$, RISK$_i$ and MVE$_i$), Σ denotes the summation over i = 1 to 5, η_0 through η_8 are the regression coefficients, and ε_i is the error term. LSB$_i$, GH$_i$, and GKN$_i$ denote the adverse-selection components of stock i calculated using the methods developed by Lin, Sanger, and Booth (1995), Glosten and Harris (1988), and George, Kaul, and Nimalendran (1991), respectively. PIN$_i$ measures the probability of information-based trading for stock i. NEX$_i$ is the number of markets in which the NYSE stocks are traded for stock i. H-INDEX$_i$ is the Herfindahl index for stock i. DNYSE is an indicator variable which equals one for NYSE stocks and zero otherwise. We estimate the above regression models using the weighted regression procedure. We use the reciprocal of the standard error of quote adjustment coefficients from the first-pass regressions as weight in the second-pass regression. This approach assigns smaller weights to quote adjustment coefficients that are less meaningful (i.e., smaller t-values). Numbers in parentheses are t-statistics. Panel A (Panel B) reports the results using dollar (percentage) spread.

Panel A: Results using dollar spread

	Results for NYSE stocks			Results for NASDAQ stocks			Results for pooled NYSE-NASDAQ stocks		
Intercept	0.3796**	0.4015**	0.5873**	0.1498**	0.1575**	0.2260**	0.2997**	0.3424**	0.4095**
	(15.95)	(16.39)	(24.66)	(3.25)	(3.23)	(4.87)	(18.87)	(20.62)	(26.67)
log(NTRADE$_i$)	0.0163**	0.0119**	0.0132**	0.0098**	0.0086**	0.0127**	0.0109**	0.0101**	0.0093**
	(6.74)	(4.87)	(5.23)	(6.08)	(5.39)	(7.68)	(10.44)	(9.45)	(8.34)
log(TSIZE$_i$)	-0.0314**	-0.0268**	-0.0422**	-0.0095*	-0.0146**	-0.0137**	-0.0237**	-0.0247**	-0.0313**
	(-9.41)	(-7.65)	(-11.93)	(-2.09)	(-2.94)	(-3.00)	(-9.39)	(-9.31)	(-12.30)
log(PRICE$_i$)	0.0210**	0.0117**	0.0393**	0.0107**	0.0107**	0.0123**	0.0100**	0.0099**	0.0212**
	(7.46)	(3.46)	(14.25)	(3.24)	(2.67)	(3.69)	(5.10)	(4.31)	(11.13)
RISK$_i$	8.7193**	5.9474**	10.8220**	2.1358**	2.1527**	2.4840**	4.1219**	3.2818**	4.4454**
	(4.71)	(3.11)	(5.60)	(3.01)	(3.01)	(3.52)	(6.94)	(5.29)	(7.31)
log(MVE$_i$)	-0.0036*	-0.0043*	-0.0054**	-0.0053**	-0.0046*	-0.0042*	-0.0037**	-0.0056**	-0.0063**
	(-1.98)	(-2.33)	(-2.84)	(-2.66)	(-2.32)	(-2.14)	(-2.80)	(-4.11)	(-4.63)
LSB$_i$	0.2264**			0.1055**			0.2079**		
	(14.80)			(3.95)			(15.66)		
GH$_i$		0.2076**			0.0782**			0.1093**	
		(12.22)			(3.37)			(8.15)	
GKN$_i$			0.0637**			0.0891**			0.0443**
			(4.37)			(7.88)			(5.43)
PIN$_i$	0.0174**	0.0167**	0.1998**	0.0177*	0.0211**	0.0187**	0.0127**	0.0132**	0.0138**
	(2.67)	(2.53)	(2.94)	(2.41)	(2.88)	(2.58)	(2.58)	(2.63)	(2.73)
log(NEX$_i$)	0.0225**	0.0239**	0.0249**						
	(2.74)	(2.88)	(2.89)						
log(H-INDEX$_i$)				-0.0179**	-0.0164**	-0.0179**			
				(-3.65)	(-3.36)	(-3.69)			
DNYSE							0.0302**	0.0724**	0.1039**
							(5.65)	(15.56)	(37.90)
F-value	91.22**	80.67**	58.95**	25.12**	23.29**	31.29**	259.19**	229.22**	218.11**
Adjusted R²	0.244	0.222	0.172	0.063	0.058	0.077	0.288	0.263	0.253

**Significant at the 1% level.
*Significant at the 5% level.

Table 3 (continued). Speed of quote adjustment, adverse-selection risk, and stock characteristics

Panel B: Results using percentage spread

	Results for NYSE stocks			Results for NASDAQ stocks			Results for pooled NYSE-NASDAQ stocks		
Intercept	0.3814**	0.4051**	0.5930**	0.1800**	0.1761**	0.2280**	0.2983**	0.3453**	0.4174**
	(15.79)	(16.30)	(24.53)	(3.73)	(3.45)	(4.67)	(18.19)	(20.13)	(26.32)
$\log(NTRADE_i)$	0.0159**	0.0115**	0.0128**	0.0105**	0.0092**	0.0128**	0.0111**	0.0102**	0.0092**
	(6.51)	(4.64)	(5.00)	(6.24)	(5.46)	(7.33)	(10.30)	(9.27)	(7.96)
$\log(TSIZE_i)$	-0.0317**	-0.0272**	-0.0427**	-0.0117*	-0.0111*	-0.0147**	-0.0233**	-0.0245**	-0.0313**
	(-9.38)	(-7.64)	(-11.91)	(-2.45)	(-2.13)	(-3.05)	(-8.91)	(-8.93)	(-11.90)
$\log(PRICE_i)$	0.0206**	0.0113**	0.0391**	0.0119**	0.0145**	0.0116**	0.0074**	0.0077**	0.0194**
	(7.19)	(3.28)	(13.99)	(3.45)	(3.48)	(3.31)	(3.66)	(3.22)	(9.87)
$RISK_i$	8.3490**	5.5494**	10.4919**	1.6314*	1.6478*	1.9133**	3.9923**	3.1365**	4.3501**
	(4.43)	(2.85)	(5.32)	(2.18)	(2.19)	(2.56)	(6.46)	(4.86)	(6.87)
$\log(MVE_i)$	-0.0040*	-0.0055**	-0.0053**	-0.0053**	-0.0054	-0.0056**	-0.0037**	-0.0057**	-0.0064**
	(-2.19)	(-2.94)	(-2.74)	(-2.54)	(-2.57)	(-2.71)	(-2.72)	(-4.06)	(-4.56)
LSB_i	0.2308**			0.1241**			0.2186**		
	(14.88)			(4.39)			(15.90)		
GH_i		0.2099**			0.0866**			0.1115**	
		(12.17)			(3.56)			(8.05)	
GKN_i			0.0701**			0.0775**		0.0415**	
			(4.73)			(6.50)		(4.91)	
PIN_i	0.0193**	0.0198**	0.0182**	0.0161*	0.0209**	0.0166**	0.0141**	0.0149**	0.0123*
	(2.92)	(2.96)	(2.64)	(2.11)	(2.73)	(2.18)	(2.78)	(2.87)	(2.35)
$\log(NEX_i)$	0.0239**	0.0232**	0.0235**						
	(2.87)	(2.75)	(2.69)						
$\log(H\text{-}INDEX_i)$				-0.0150**	0.0133**	-0.0146**			
				(-2.93)	(-2.60)	(-2.87)			
DNYSE							0.0286**	0.0738**	0.1065**
							(5.16)	(15.35)	(37.63)
F-value	90.83**	79.78**	58.31**	29.70**	27.44**	32.78**	254.45**	223.11**	212.57**
Adjusted R²	0.244	0.220	0.170	0.074	0.068	0.081	0.284	0.258	0.248

**Significant at the 1% level.
*Significant at the 5% level.

Table 4. Comparisons of the speed of quote adjustment between the pre- and post-decimal periods for NYSE stocks and NASDAQ stocks

In this table, we compare the speed of quote adjustment between the pre- and post-decimal periods. For NYSE stocks, we consider the three-month period from May 28, 2000 to August 27, 2000 as the pre-decimal period and January 30, 2001 to April 29, 2001 as the post-decimal period. For NASDAQ stocks, we consider the three-month period from December 12, 2000 to March 11, 2001 as the pre-decimal period and April 10, 2001 to July 9, 2001 as the post-decimal period. For each sub-period, we calculate quote adjustment coefficients using the following regression models: $\$SPREAD_{i,t} - \$SPREAD_{i,t-1} = \alpha_{0i} + \alpha_{1i}\$SPREAD_{i,t-1} + \alpha_{2i}\log(NTRADE_{i,t}) + \alpha_{3i}\log(TSIZE_{i,t}) + \alpha_{4i}\log(PRICE_{i,t}) + \alpha_{5i}RISK_{i,t} + \varepsilon_{1i,t}$; and $\%SPREAD_{i,t} - \%SPREAD_{i,t-1} = \omega_{0i} + \omega_{1i}\%SPREAD_{i,t-1} + \omega_{2i}\log(NTRADE_{i,t}) + \omega_{3i}\log(TSIZE_{i,t}) + \omega_{4i}(1/PRICE_{i,t}) + \omega_{5i}RISK_{i,t} + \varepsilon_{2i,t}$. $\$SPREAD_{i,t}$ ($\%SPREAD_{i,t}$) is the dollar (percentage) spread of stock i at time t, $NTRADE_{i,t}$ is the number of transactions between time t and t–15 minutes for stock i, $TSIZE_{i,t}$ is the size of the trade executed at or just prior to time t for stock i, $PRICE_{i,t}$ is the quote midpoint at time t for stock i, $RISK_{i,t}$ is the standard deviation of quote midpoint returns between time t and t–15 minutes for stock i, and εs are error terms. We measure quote adjustment speed for each stock by $-\alpha_1$ and $-\omega_1$. Because estimates of quote adjustment speeds (i.e., regression coefficients) for certain stocks are less meaningful (i.e., smaller t-values) than those for other stocks, we calculate the weighted average of quote adjustment coefficients, where we use the reciprocal of the standard error (SE) of each estimated coefficient as weight.

	NYSE			NASDAQ		
	Pre-decimalization	Post-decimalization	t-value[a]	Pre-decimalization.	Post-decimalization	t-value[a]
$SPREAD adjustment	0.1840	0.2341	9.95**	0.1220	0.1679	9.03**
%SPREAD adjustment	0.1844	0.2348	9.96**	0.1254	0.1702	8.60**

**Significant at the 1% level.
[a]The t-statistic testing the equality of the mean between the pre- and post-decimal periods.

Table 5. Effects of decimalization on the speed of spread adjustment for NYSE stocks and NASDAQ stocks

This table shows the results of the following regression model: $\Delta(-\alpha_{1i})$ or $\Delta(-\omega_{1i})$ $= \pi_0 + \Sigma\pi_k \Delta X_{i,k} + \pi_6\Delta LSB_i$ (or ΔGH_i or ΔGKN_i) $+ \pi_7\Delta PIN_i + \pi_8\Delta NEX_i$ (for NYSE stocks) or $\Delta H\text{-}INDEX_i$ (for NASDAQ stocks) $+ \varepsilon_i$; where Δ indicates the difference between the post-decimalization value and the pre-decimalization value (post – pre), $-\alpha_{1i}$ ($-\omega_{1i}$) is the estimate of quote adjustment speed in the dollar (percentage) spread, $X_{i,k}$ (k = 1 to 5) denotes one of the five stock attributes for stock i (i.e., $NTRADE_i$, $TSIZE_i$, $PRICE_i$, $RISK_i$ and MVE_i), Σ denotes the summation over i = 1 to 5, and ε_i is the error term. LSB_i, GH_i, and GKN_i denote the adverse-selection components of stock i calculated using the methods developed by Lin, Sanger, and Booth (1995), Glosten and Harris (1988), and George, Kaul, and Nimalendran (1991), respectively. PIN_i measures the probability of information-based trading for stock i. NEX_i is the number of markets in which the NYSE stocks are traded for stock i. $H\text{-}INDEX_i$ is the Herfindahl index for stock i. We estimate the model using the weighted regression procedure, in which the weight is the mean of the reciprocal of the standard error of quote adjustment coefficients from the pre-decimal period and the corresponding value from the post-decimal period. Numbers in parentheses are t-statistics.

	Results based on $SPREAD						Results based on %SPREAD					
	NYSE			NASDAQ			NYSE			NASDAQ		
Intercept	0.0338** (8.83)	0.0318** (7.86)	0.0361** (9.08)	0.0245** (7.41)	0.0262** (7.95)	0.0259** (7.92)	0.0341** (8.75)	0.0314** (7.58)	0.0362** (8.91)	0.0236** (7.11)	0.0256 (7.70)	0.0254** (7.71)
$\Delta\log(NTRADE_i)$	-0.0167** (-3.34)	-0.0188** (-3.78)	-0.0184** (-3.66)	-0.0130** (-4.63)	-0.0144** (-5.06)	-0.0133** (-4.72)	-0.0168** (-3.30)	-0.0191** (-3.76)	-0.0187** (-3.65)	-0.0109** (-3.88)	-0.0123** (-4.30)	-0.0114** (-4.01)
$\Delta\log(TSIZE_i)$	-0.0039 (-0.56)	0.0016 (0.23)	-0.0028 (-0.41)	0.0311** (4.39)	0.0305** (4.30)	0.0313** (4.41)	-0.0046 (-0.66)	0.0009 (0.13)	-0.0034 (-0.48)	0.0306** (4.30)	0.0302** (4.22)	0.0308** (4.31)
$\Delta\log(PRICE_i)$	0.0216* (1.97)	0.0137 (1.24)	0.034* (3.19)	-0.0795** (-5.20)	-0.0760** (-4.95)	-0.0774** (-5.06)	0.023* (2.11)	0.0165 (1.46)	0.0372** (3.34)	-0.0796** (-5.17)	-0.0761** (-4.92)	-0.0769** (-4.99)
$\Delta RISK_i$	13.0543** (7.25)	11.8199** (6.51)	14.9830** (8.27)	6.6856** (7.02)	6.6080** (6.92)	6.6310** (6.95)	13.7137** (7.47)	12.5760** (6.78)	15.6514** (8.46)	5.5011** (5.74)	5.4295** (5.65)	5.4350** (5.66)
$\Delta\log(MVE_i)$	0.0242** (2.50)	0.0215* (2.24)	0.0198* (2.04)	0.0285 (1.84)	0.0254 (1.64)	0.0260 (1.68)	0.0248** (2.51)	0.0218* (2.22)	0.0201* (2.02)	0.0281 (1.81)	0.0249 (1.59)	0.0250 (1.61)
ΔLSB_i	0.1247** (6.19)			0.1025** (2.93)			0.1310** (6.38)			0.1274** (3.62)		
ΔGH_i		0.1342** (7.25)			0.0618 (1.53)			0.1329** (7.03)			0.0533 (1.31)	
ΔGKN_i			0.0326* (2.40)			0.0138 (1.42)			0.0286* (2.06)			0.0156 (1.59)
ΔPIN_i	0.0100 (0.78)	0.0091 (0.71)	0.0096 (0.74)	-0.0222 (-1.69)	-0.0195 (-1.49)	-0.0209 (-1.60)	0.0064 (0.49)	0.0055 (0.42)	0.0059 (0.45)	-0.0216 (-1.64)	-0.0208 (-1.58)	-0.0210 (-1.59)
$\Delta\log(NEX_i)$	0.0166 (1.12)	0.0124 (0.84)	0.0177 (1.18)				0.0163 (1.08)	0.0122 (0.81)	0.0173 (1.14)			
$\Delta\log(H\text{-}INDEX_i)$				-0.0006 (-0.08)	-0.0010 (-0.14)	-0.0010 (-0.14)				0.0012 (0.17)	0.0007 (0.10)	0.0007 (0.10)
F-value	15.96**	17.81**	11.71**	28.37**	27.35**	27.48**	16.76**	17.91**	12.01**	24.29**	22.59**	22.88**
Adjusted R²	0.054	0.061	0.040	0.077	0.075	0.075	0.057	0.061	0.041	0.067	0.062	0.063

**Significant at the 1% level.
*Significant at the 5% level.

Table 6. Speed of depth adjustment, adverse-selection risk, and stock characteristics

This table shows the results of the following regression model: $-\tau_{1i} = \eta_0 + \Sigma \eta_k X_{i,k} + \eta_6 LSB_i$ (or GH_i or GKN_i) $+ \eta_7 PIN_i + \eta_8 NEX_i$ (for NYSE stocks) or H-INDEX$_i$ (for NASDAQ stocks) $+ \varepsilon_i$; where $-\tau_{1i}$ is the estimate of depth adjustment speed, $X_{i,k}$ (k = 1 to 5) denotes one of the five stock attributes for stock i (i.e., $NTRADE_i$, $TSIZE_i$, $PRICE_i$, $RISK_i$ and MVE_i), Σ denotes the summation over i = 1 to 5, η_0 through η_8 are the regression coefficients, and ε_i is the error term. LSB_i, GH_i, and GKN_i denote the adverse-selection components of stock i calculated using the methods developed by Lin, Sanger, and Booth (1995), Glosten and Harris (1988), and George, Kaul, and Nimalendran (1991), respectively. PIN_i measures the probability of information-based trading for stock i. NEX_i is the number of markets in which the NYSE stocks are traded for stock i. H-INDEX$_i$ is the Herfindahl index for stock i. We estimate the above regression models using the weighted regression procedure. We use the reciprocal of the standard error of quote adjustment coefficients from the first-pass regressions as weight in the second-pass regression. This approach assigns smaller weights to quote adjustment coefficients that are less meaningful (i.e., smaller t-values). Numbers in parentheses are t-statistics.

	Results for NYSE stocks			Results for NASDAQ stocks		
Intercept	0.2493** (12.59)	-0.2657** (13.19)	0.2518** (13.52)	0.5587** (14.93)	0.3627** (9.30)	0.4401** (11.74)
log(NTRADE$_i$)	0.0133** (5.83)	0.0119** (5.94)	0.0121** (2.85)	0.0038** (3.02)	0.0039** (3.15)	0.0043** (6.48)
log(TSIZE$_i$)	-0.0128** (-5.08)	-0.0148** (-6.66)	-0.0190** (-3.94)	-0.0151** (-2.19)	-0.0089* (-2.46)	-0.0094* (-4.54)
log(PRICE$_i$)	0.0160** (6.17)	0.0170** (7.84)	0.0167** (23.21)	0.0609** (11.79)	0.0375** (19.98)	0.0529** (7.06)
RISK$_i$	6.4909** (4.18)	6.4877** (4.21)	6.4161** (16.43)	9.6033** (15.16)	8.7009** (17.16)	9.8571** (4.27)
log(MVE$_i$)	-0.0039** (-2.56)	-0.0041** (-2.68)	-0.0044** (-2.88)	-0.0220** (-13.47)	-0.0192** (-12.07)	-0.0202** (-12.69)
LSB$_i$	0.0407** (3.16)			0.1080** (4.87)		
GH$_i$		0.0510** (3.58)			0.2401** (12.59)	
GKN$_i$			0.0391** (3.49)			0.0994** (10.72)
PIN$_i$	0.0125* (3.03)	0.0159** (2.28)	0.0119* (2.72)	0.0170** (2.39)	0.0145* (2.62)	0.0160** (2.39)
log(NEX$_i$)	0.0178** (2.59)	0.0181** (2.64)	0.0192** (2.79)			
log(H-INDEX$_i$)				-0.0111** (-2.78)	-0.0109** (-2.60)	-0.0106** (-2.69)
F-value	78.01**	83.14**	86.36**	349.08**	385.95**	375.30**
Adjusted R^2	0.216	0.228	0.235	0.491	0.516	0.509

**Significant at the 1% level.
*Significant at the 5% level.

Table 7. Comparisons of the speed of depth adjustment between the pre- and post-decimal periods for NYSE stocks and NASDAQ stocks

In this table, we compare the speed of quote adjustment between the pre- and post-decimal periods.   For NYSE stocks, we consider the three-month period from May 28, 2000 to August 27, 2000 as the pre-decimal period and January 30, 2001 to April 29, 2001 as the post-decimal period. For NASDAQ stocks, we consider the three-month period from December 12, 2000 to March 11, 2001 as the pre-decimal period and April 10, 2001 to July 9, 2001 as the post-decimal period. For each sub-period, we calculate the speed of quote adjustment coefficients using the following regression model: $\log(DEPTH_{i,t}) - \log(DEPTH_{i,t-1}) = \tau_{0i} + \tau_{1i}\log(DEPTH_{i,t-1}) + \tau_{2i}\log(NTRADE_{i,t}) + \tau_{3i}\log(TSIZE_{i,t}) + \tau_{4i}\log(PRICE_{i,t}) + \tau_{5i}RISK_{i,t} + \varepsilon_{i,t}$; where $DEPTH_{i,t}$ is the quoted depth of stock i at time t, $NTRADE_{i,t}$ is the number of transactions between time t and t–15 minutes for stock i, $TSIZE_{i,t}$ is the size of the trade executed at or just prior to time t for stock i, $PRICE_{i,t}$ is the quote midpoint at time t for stock i, $RISK_{i,t}$ is the standard deviation of quote midpoint returns between time t and t–15 minutes for stock i, and $\varepsilon_{i,t}$ is the error term. We measure the speed of depth adjustment by $-\tau_{1i}$. We show the mean values of depth adjustment coefficients for our NYSE and NASDAQ sample of stocks and t-statistics for testing the equality of the mean between the pre- and post-decimal periods. Because estimates of quote adjustment speeds (i.e., regression coefficients) for certain stocks are less meaningful (i.e., smaller t-values) than those for other stocks, we calculate the weighted average of quote adjustment coefficients, in which we use the reciprocal of the standard error (SE) of each estimated coefficient as weight.

	NYSE			NASDAQ		
	Pre-decimalization	Post-decimalization	t-value[a]	Pre-decimalization.	Post-decimalization	t-value[a]
Speed of depth adjustment	0.2056	0.2642	10.56**	0.1862 0.2349	7.69**	

**Significant at the 1% level.
[a] The t-statistic testing the equality of the mean between the pre- and post-decimal periods.

Table 8. Effects of decimalization on the speed of depth adjustment for NYSE stocks and NASDAQ stocks

This table shows the results of the following regression model: $\Delta(-\tau_{1i}) = \Phi_0 + \Sigma\, \Phi_k\, \Delta X_{i,k} + \Phi_6\Delta LSB_i$ (or ΔGH_i or ΔGKN_i) $+ \Phi_7\Delta PIN_i + \Phi_8\Delta NEX_i$ (for NYSE stocks) or $\Delta H\text{-}INDEX_i$ (for NASDAQ stocks) $+ \varepsilon_i$; where Δ indicates the difference between the post-decimalization value and the pre-decimalization value (post – pre), $-\tau_{1i}$ is the estimate of depth adjustment speed, $X_{i,k}$ (k = 1 to 5) denotes one of the five stock attributes for stock i (i.e., $NTRADE_i$, $TSIZE_i$, $PRICE_i$, $RISK_i$ and MVE_i), Σ denotes the summation over i = 1 to 5, and ε_i is the error term. LSB_i, GH_i, and GKN_i denote the adverse-selection components of stock i calculated using the methods developed by Lin, Sanger, and Booth (1995), Glosten and Harris (1988), and George, Kaul, and Nimalendran (1991), respectively. PIN_i measures the probability of information-based trading for stock i. NEX_i is the number of markets in which the NYSE stocks are traded for stock i. $H\text{-}INDEX_i$ is the Herfindahl index for stock i. We estimate the model using the weighted regression procedure, in which the weight is the mean of the reciprocal of the standard error of quote adjustment coefficients from the pre-decimal period and the corresponding value from the post-decimal period. We use the log of share price, number of trades, trade size, market value of equity, number of markets, and Herfindahl index in the regressions. Numbers in parentheses are t-statistics.

	Results for NYSE stocks			Results for NASDAQ stocks		
Intercept	0.0635** (14.58)	0.0522** (17.34)	0.0615** (13.23)	0.0426** (13.06)	0.0415** (13.25)	0.0419** (18.67)
$\Delta\log(NTRADE_i)$	-0.0167** (-3.76)	-0.0187** (-4.26)	-0.0192** (-4.29)	-0.0267** (-9.83)	-0.0256** (-9.31)	-0.0259** (-9.49)
$\Delta\log(TSIZE_i)$	-0.0103 (-0.93)	-0.0056 (-1.41)	-0.0087 (0.93)	0.0064 (1.01)	0.0069 (0.98)	0.0067 (-1.68)
$\Delta\log(PRICE_i)$	0.0481** (4.93)	0.0370** (3.78)	0.0581** (5.98)	0.0072 (0.49)	0.0045 (0.31)	0.0059 (0.40)
$\Delta RISK_i$	13.8417** (8.64)	12.1760** (7.58)	14.7645** (9.15)	2.8788** (3.13)	2.9446** (3.19)	2.8889** (3.14)
$\Delta\log(MVE_i)$	0.0071 (0.82)	0.0051 (0.60)	0.0013 (0.15)	0.0070 (0.47)	0.0093 (0.62)	0.0079 (0.53)
ΔLSB_i	0.1169** (6.52)			0.0541 (1.59)		
ΔGH_i		0.1514** (9.26)			0.0491 (1.26)	
ΔGKN_i			0.0266* (2.20)			0.0095 (1.01)
ΔPIN_i	0.0033 (0.20)	0.0023 (0.27)	0.0031 (-0.83)	-0.0105 (-0.72)	-0.0091 (-0.73)	-0.0093 (0.29)
$\Delta\log(NEX_i)$	-0.0135 (-1.03)	-0.0183 (-1.40)	-0.0143 (-1.07)			
$\Delta\log(H\text{-}INDEX_i)$				0.0103 (1.50)	0.0106 (1.54)	0.0104 (1.52)
F-value	22.56**	28.32**	17.54**	16.37**	16.24**	16.16**
Adjusted R^2	0.077	0.095	0.060	0.046	0.045	0.047

**Significant at the 1% level.   *Significant at the 5% level.

Table 9. The speed of quote adjustment estimated from 30-minute interval and daily interval observations

In this table, we compare the speed of quote adjustment between the pre- and post-decimal periods. For NYSE stocks, we consider the three-month period from May 28, 2000 to August 27, 2000 as the pre-decimal period and January 30, 2001 to April 29, 2001 as the post-decimal period. For NASDAQ stocks, we consider the three-month period from December 12, 2000 to March 11, 2001 as the pre-decimal period and April 10, 2001 to July 9, 2001 as the post-decimal period. For each sub-period, we calculate the speed of quote adjustment coefficients using the following regression models: $\$SPREAD_{i,t} - \$SPREAD_{i,t-1} = \alpha_{0i} + \alpha_{1i}\$SPREAD_{i,t-1} + \alpha_{2i}\log(NTRADE_{i,t}) + \alpha_{3i}\log(TSIZE_{i,t}) + \alpha_{4i}\log(PRICE_{i,t}) + \alpha_{5i}RISK_{i,t} + \varepsilon_{1i,t}$; $\%SPREAD_{i,t} - \%SPREAD_{i,t-1} = \omega_{0i} + \omega_{1i}\%SPREAD_{i,t-1} + \omega_{2i}\log(NTRADE_{i,t}) + \omega_{3i}\log(TSIZE_{i,t}) + \omega_{4i}(1/PRICE_{i,t}) + \omega_{5i}RISK_{i,t} + \varepsilon_{2i,t}$; and $\log(DEPTH_{i,t}) - \log(DEPTH_{i,t-1}) = \tau_{0i} + \tau_{1i}\log(DEPTH_{i,t-1}) + \tau_{2i}\log(NTRADE_{i,t}) + \tau_{3i}\log(TSIZE_{i,t}) + \tau_{4i}\log(PRICE_{i,t}) + \tau_{5i}RISK_{i,t} + \varepsilon_{3i,t}$; where $\$SPREAD_{i,t}$ ($\%SPREAD_{i,t}$) is the mean dollar (percentage) spread of stock i during time period t (30-minute or daily interval), $DEPTH_{i,t}$ is the quoted depth (the combined depth at the bid and ask) of stock i during t, $NTRADE_{i,t}$ is the number of transactions of stock i during t, $TSIZE_{i,t}$ is the average trade size of stock i during t, $PRICE_{i,t}$ is the average share price of stock i during t, $RISK_{i,t}$ is the standard deviation of quote midpoint returns of stock i during t, and εs are the error terms. We measure the speed of quote adjustment for each stock by $-\alpha_1$ and $-\omega_1$. Because estimates of quote adjustment speeds (i.e., regression coefficients) for certain stocks are less meaningful (i.e., smaller t-values) than those for other stocks, we calculate the weighted average of quote adjustment coefficients, in which we use the reciprocal of the standard error (SE) of each estimated coefficient as weight. Panel A (Panel B) reports the results using 30-minute interval (daily interval) observations.

	NYSE			NASDAQ		
	Pre-decimalization	Post-decimalization	t-value[a]	Pre-decimalization.	Post-decimalization	t-value[a]
Panel A: Results based on 30-minute interval data						
$SPREAD adjustment	0.5696#	0.6512#	12.45**	0.4904# 0.5634#	9.89**	
%SPREAD adjustment	0.5808#	0.6515#	10.61**	0.5027# 0.5689#	7.73**	
DEPTH adjustment	0.5450#	0.6380#	38.16**	0.5316#0.5820#	19.96**	
Panel B. Results based on daily interval data						
$SPREAD adjustment	0.7766#	0.8298#	10.66**	0.7095# 0.7595#	7.36**	
%SPREAD adjustment	0.7802#	0.8341#	10.79**	0.7155# 0.7647#	6.62**	
DEPTH adjustment	0.7517#	0.8271#	16.52**	0.6984#0.7550#	14.73**	

**Significant at the 1% level.

[a]The t-statistic testing the equality of the mean between the pre- and post-decimal periods.

#Denotes that the mean value of the speed of quote adjustment coefficients is significantly (at 1% level) greater than the corresponding value estimated from quote-to-quote data reported in Table 4 or Table 7.

Figure 1.   The speed of adjustment in the dollar spread
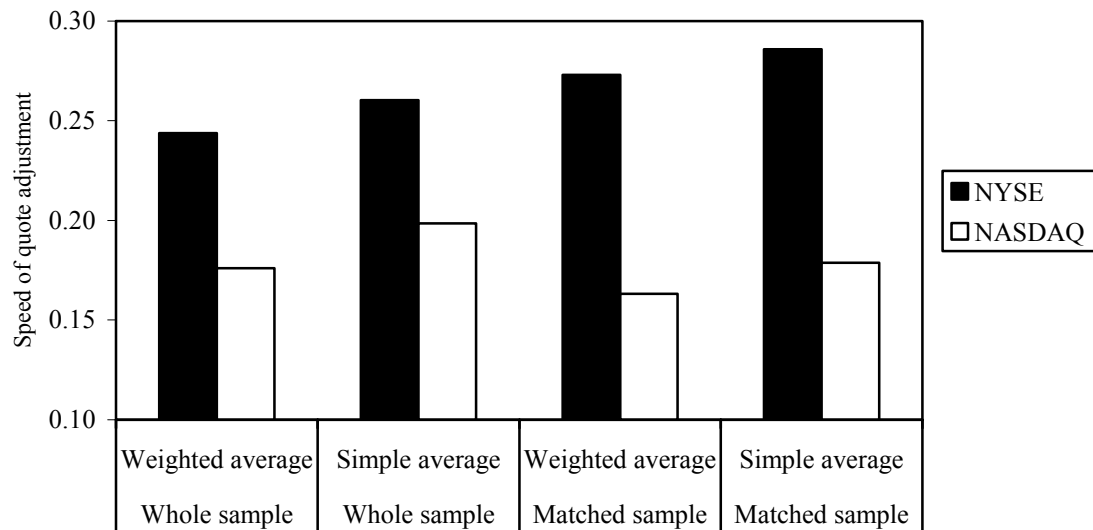
Figure 2.   The speed of adjustment in the percentage spread
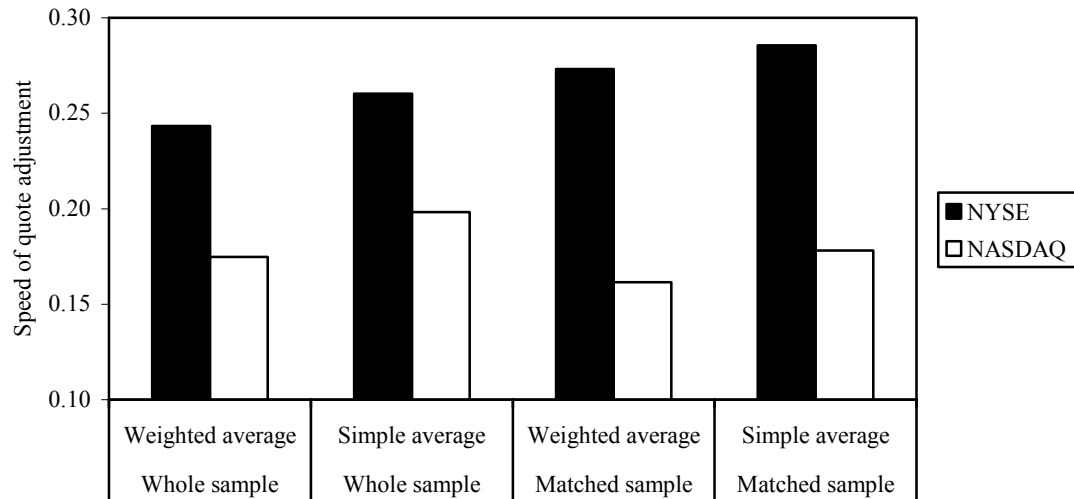
Figure 3. The speed of spread adjustment before and after decimalization for NYSE stocks
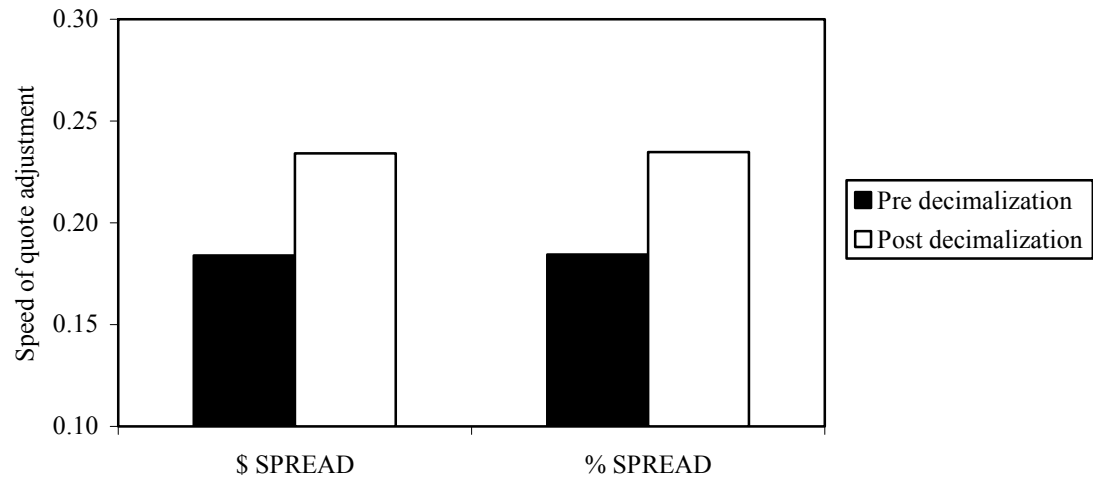
Figure 4.   The speed of spread adjustment before and after decimalization for NASDAQ stocks
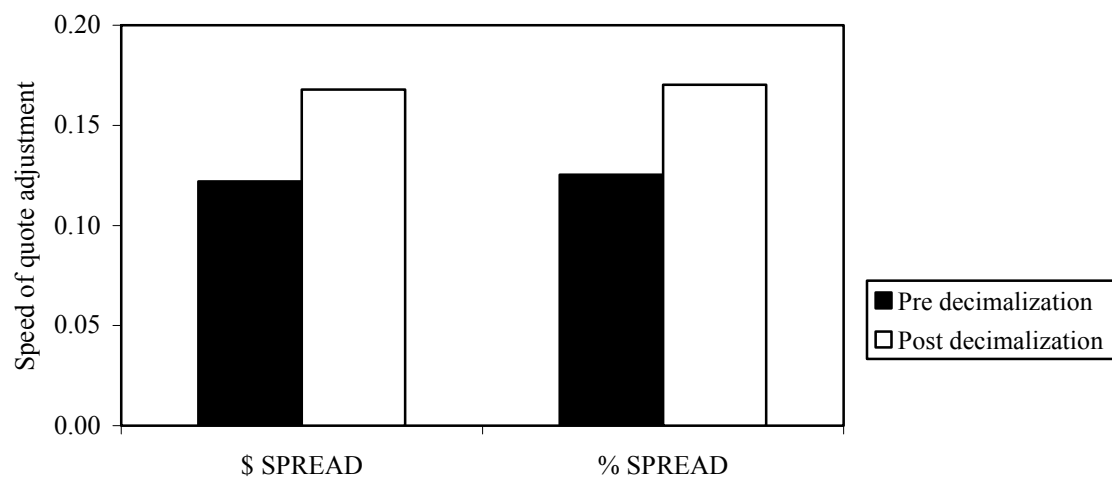
Comments on "Effects of Stock Attributes, Market Structure, and Tick Size on the Speed of Spread and Depth Adjustment"

Junghoon Seon,
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This paper studies how market structure and tick size affect the speed of quote adjustment. Major findings of the paper is as follows. Firstly, market structure plays an important role in determining the speed of quote adjustment. Secondly, liquidity providers make faster quote adjustment for stocks with greater adverse-selection costs and quotes competition. Thirdly, the speed of quotes adjustment is strongly related to stock attributes such as number of trades, return volatility, share prices, market capitalization, and trade size. Finally, liquidity providers on both the NYSE and NASDAQ react more quickly to new information after decimalization.

This paper contributes to existing literature by providing new insight on the concept of market efficiency. Namely, the paper introduces a new measure of market efficiency, the speed of adjustment to equilibrium spread and verifies it's determinants. Even though the paper does not analysis Korean stock market, it gives intuitions on how to improve the quality of the market explicitly. The results of the paper suggest that Korean stock market could improve efficiency of the market by fostering competition, and reducing tick size.

This paper has one limitation. The empirical models of the paper are subject to misspecification assuming that equilibrium spreads and depths are determined by four stock attributes. But it seems not to be serious because the assumption is quite reasonable. In market microstructure study, this kind of assumptions are quite often made, since fundamental asset prices are not known.

Overall, this paper is qualified enough to be published in the journal.

Financial Reform, Institutional Interdependency and Supervisory Failure in the Post-Crisis Korea

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Abstract

In the aftermath of the economic crisis of 1997-98 South Korea undertook a number of reforms in financial supervision. In spite of the reforms doubts have been raised as to whether Korea has in fact succeeded in creating a system of financial supervision capable of dealing with certain risk and responding to new challenges appropriately. This paper examines Korea's recent experience of financial instability resulting from misconduct by credit-card companies as a case in point and argues that the post-crisis reform in financial supervision was limited to changing formal institutions for financial supervision and further reforms will have to be undertaken in other related institutions if Korea is to improve financial supervision.

I. Introduction

In the aftermath of the economic crisis of 1997-98 South Korea (henceforth Korea) undertook a number of reforms in financial supervision: it created the Financial Supervisory Commission (FSC) in April 1998 and established the Financial Supervisory Service (FSS) in January 1999. The former was created to act as an integrated supervisory agency for all types of financial institutions and markets while the latter was established to function as an executive arm of the former. FSC is a state agency whereas FSS is a private corporation in the form of a special legal entity operating in the public domain. Although they are formally separate the two agencies are supposed and expected to operate as a single supervisory authority.

Under this new system of integrated financial supervision FSC/FSS is the sole supervisory agency for banks and non-banks, formerly the charges of the Bank of Korea (BOK) and the Ministry of Finance and Economy (MOFE), respectively. The monetary and credit policy functions, over which MOFE had a considerable leverage, are now wholly vested in BOK with its autonomy to pursue the goal of monetary stability much

strengthened.[1] The Korea Deposit Insurance Corporation (KDIC), which first began its deposit insurance operation for insured banks in January 1997, became an integrated deposit insurance agency in April 1998, taking in as its charge not only insured banks but also insured non-bank financial institutions (NBFIs). With these changes now in place MOFE, FSC/FSS, BOK, and KDIC are the four public agencies that are responsible for keeping Korea's financial system efficient and stable (Kim 2004b).

All these changes clearly attest to the fact that Korea has successfully undertaken a number of major institutional reforms in financial supervision immediately following the economic crisis of 1997-98. In spite of these reforms doubts, however, have been raised as to whether Korea has in fact succeeded in creating a well-functioning system of financial supervision (Kwon 2004). For instance, a World Bank report on Korea's financial sector reform, which seemingly commends Korea for having taken significant steps toward reforming its financial sector, notes that "[d]espite notable progress in prudential supervision, concerns remain about the regulator's ability to supervise certain risks in an integrated, coherent manner and to respond to new challenges" (World Bank 2003: 2). The recent costly financial instability relating to credit-card companies and household debts in Korea is a case in point that renders support to the concerns raised by the World Bank and others about the "success" that Korea has made in reforming its system of financial supervision.

In this paper we argue that the post-crisis reform in financial supervision in Korea has largely been limited to changing formal institutions for financial supervision and that reforms will be needed in other institutions related to their proper functioning if Korea is to further improve its system of financial supervision. Although they were created or reorganized as *independent* agencies in the aftermath of the crisis, FSC/FSS and BOK have not in reality functioned as such due to constraints imposed on them by other extant, formal as well as informal, institutions in Korea. Lacking *de facto* independence the supervisory agencies have failed to properly carry out their statutory responsibilities and prevent the abuses and misconduct by credit-card companies that led to the recent financial instability. In fact, this is a point alluded to by the World Bank (2003: 2) when it recommended that "[t]he division of responsibilities between MOFE, FSC, and the FSS should be made more transparent ... [and] ... [s]teps should be taken to reassure markets that the independence of the regulator is important."

The remainder of the paper is as follows. In section 2 we argue that institutional interdependency affects the outcome of an institutional reform and present a number of cases that exemplify this relationship. In section 3 we then argue that the post-crisis financial reform in Korea has failed to change fundamentally the way financial supervision is carried out due to institutional interdependency. In section 4 we focus on the problems relating to credit-card companies and point out how the various public agencies created or restructured by the reform have failed to properly supervise them. In the final section we offer some concluding remarks.

II. Institutional Interdependency and Reform of Institutions

Korea has made, as noted by the World Bank (2003), less than fully successful progress in financial reform and will need to undertake further reforms to strengthen the

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[1] While evaluating the degree to which BOK independence was enhanced with the 1997 revision of the BOK Act, Cargill (2001) argues that central bank independence is neither necessary nor sufficient for price stability.

"regulator's ability to supervise certain risks in an integrated, coherent manner and to respond to new challenges."[2] Why has Korea, in spite of its apparent success in reforming its financial system, failed to create regulatory agencies that are, according to the World Bank assessment, less than fully capable of handling risks and challenges? The answer may lie, as suggested by the World Bank, in Korea's success in bringing about a rapid economic recovery from the economic crisis; it made further reforms appear less urgent or even not necessary. That may indeed be true but it is only a part of the answer. Another reason for the partial progress in financial reform, which we argue is much more important, is that in reforming the system of financial supervision Korea has limited the *scope* of reform to institutions and organizations directly involved in financial supervision and has left more or less intact other institutions that, although not specific to financial supervision, affect the functionality of the supervisory agencies. With those institutions remaining intact the supervisory agencies have not been able to operate as effectively as their statutory mandates call for. In other words, by limiting the scope of reform only to institutions and organizations directly involved in financial supervision Korea has failed to create the right institutional structure[3]—a set of interdependent institutions—in which the supervisory agencies are embedded and operate.

Institutions in a society do not function in isolation due to interdependency among them that makes the functionality of a particular institution depend on other institutions (Amable 1999, Aoki 2001, Boyer 2005, Fukuyama 2004, Lin and Nugent 1995). This institutional interdependency[4] thus makes it difficult to alter or design individual institutions in isolation. It also implies that an institutional reform, whether it is for establishing *de novo* a new institution or for changing some of the extant institutions, may fail to create an effectively functioning institution if either (1) the institutions that are complementary to it are absent[5] or (2) the new or reformed institution is not compatible with some of the extant institutions.[6] In the first case the absence of complementary institutions would deter the new or reformed institutions from functioning effectively while in the second case the presence of incompatible institutions would limit their effectiveness.

Institutional interdependency thus implies that for an institutional reform to succeed in achieving its intended objectives it will have to be accompanied by reforms that either create complementary institutions or abolish incompatible institutions or both. Obviously, reforming all the interdependent institutions along with the particular institution being

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[2] For discussion of the post-crisis financial reform and remaining agenda in Korea, see Cha (1999) and Kwon (2004).

[3] Lin and Nugent (1995: 2307) define "institutional structure" as the totality of institutions such as organizations, laws, customs and ideology in an economy and differentiate it from an "institutional arrangement," which is a "set of rules that govern behavior in a specific domain." In this paper we use the term in a less inclusive way to refer to a set of institutions that impact directly and indirectly the functioning of a specific institution (or institutional arrangement). That is, an institutional structure encompasses all the institutions that are interdependent with each other.

[4] In this paper we choose to use the term institutional interdependency instead of institutional complementarity. Institutional complementarity is a subset of institutional interdependency, which includes both a situation where a particular institution does not function effectively because of the presence of incompatible institutions and a situation where it does not function effectively because of the absence of complementary institutions. We should also be note that Aoki (2001: 10) defines institution as a "self-sustaining system of shared beliefs about a salient way in which the game is repeatedly played." This definition is much narrower than and differs from the commonly used and more general definition of institutions as humanly devised constraints on behavior such as constitution, statutes, laws, custom, conventions, social norms, etc.

[5] There is complementarity between two institutions when the performance of one institution is greater when it is in conjunction with the other than when it is not (Boyer 2005).

[6] As defined by Boyer (2005), institutional compatibility is present when two institutions can be jointly observed in existing economies and societies. This may be so in a long-run equilibrium, but in an economy undergoing reforms we may jointly observe institutions that are not compatible with each other.

created or reformed in a "big-bang" manner will not be an easy task, given that the number of such institutions may be large and reforming all of them at once would be too costly, if not impossible. Further compounding the difficulty of such reforms is that at the time of reform little may be known about the institutions that are either complementary to or incompatible with the institution being newly created or reformed. Such information may become known only after the reform and even then only after the passage of some significant time.

The problem becomes more serious when institutional interdependency is between formal institutions that are newly created or transplanted from abroad and the country's indigenous informal institutions such as social norms and conventions, which are slow to change. This interdependency seriously limits the autonomy and thus the effectiveness of the new institutions as they are to function in conjunction with extant institutions that are embedded in a "culture in which their logics are symbolically grounded, or organizationally structured, technically and materially constrained, and politically defended" (Hollingsworth and Boyer 1997: 2). Thus the country introducing new formal institutions from abroad may find them not functioning as well as they did in the country of their origin (Boyer and Hollingsworth 1997, Leipold 1991, Lin and Nugent 1995, Ruis and van de Walle 2003). Such interdependency may not be obvious, being revealed only after new institutions have been installed, and makes institutional reform a path-dependent process with slow-to-change informal institutions constraining the choice of new institutions that can function effectively.

1. Absence of Complementary Institutions as an Obstacle to Institutional Reform

A good example of the importance of complementary institutions for effective institutional reform is provided by North (1990). According to him, the Constitution of the United States has facilitated economic development in that country whereas similar constitutions adopted in many Latin American countries after their independence in the 19th century have not done as well there. He attributes this difference to the absence of appropriate complementary institutions in the Latin American countries: Their norms and world views are less conducive to innovation and growth, and the effective enforcement mechanisms that are crucial for the development of a complex system of contracting and a world of specialization and division of labour have been lacking.[7]

Chamlee-Wright's study (1998) of indigenous African credit institutions in Ghana also provides another such example. According to her, Western credit institutions such as Barclay's Bank, Standard Chartered Bank and Ghana Commercial Bank have not been successful in providing financial services to the bulk of the population in West Africa, as small entrepreneurs there are mostly illiterate women and are not familiar with the method of accountability that is based on the rules of record keeping and documentation, i.e., Western ways of doing business. Having evolved in a Western cultural context, the banks have "a corporate culture and a system of rules into which Ghanaian market women simply do not fit" (p.183) and thus have failed to provide financial services to those female entrepreneurs. For them it is the various indigenous financial arrangements—the institutions that are compatible with their own way of doing business—that have been the major source of investment funds.

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[7] Related to North's observation is Hodgson's remark (2001: 303-7) that since all legal systems must cope with complex relationships and with infinite variety the law, including the contract, is typically incomplete. The employment contract, for example, is always flexible and incompletely specified and often relies on trust and "give-and-take" rather than complete legal specification. It obviously follows that employment contracts would not function effectively in a society where cultural and other non-contractual norms conducive to the contracts were absent.

Still another example of the absence of complementary institutions as an obstacle to effective institutional reform is found in some of the Asian countries afflicted by the 1997-98 financial crises. In countries such as Indonesia, Malaysia, South Korea, and Thailand it was the opening of their financial markets when complementary institutions such as well-functioning supervisory agencies and an effective legal system were either absent or weak that contributed to their succumbing to financial crisis (Lee 2003).

A similar situation was found in Japan, which suffered a systemic banking crisis in 1997-98. One of the causes of the crisis was, according to Kawai (2005), the overextension of bank loans in risky areas during the bubble period of the second half of the 1980s. Deregulatory measures such as the lifting of interest rate controls and of restrictions on non-bank lending in the 1980s allowed small financial institutions to venture into new areas such as funding housing finance companies (*Jusen*) and other real estate investments when an adequate regulatory and supervisory framework was yet to be put in place.

In his critique of the post-crisis OECD/World Bank initiative to reform corporate governance in emerging markets, Singh (2002) argues that the attempt to introduce "best practice" in corporate governance in those countries, which he points out is essentially the Anglo-Saxon model of corporate governance, is misguided. As he puts it, emerging markets do not yet have the economic, social and legal institutional framework (e.g., information gathering and disseminating private organizations and regulatory agencies) in which the markets in the developed countries are embedded, and in its absence large conglomerate firms such as Korean *chaebols* help fill the institutional void. As Singh sees it, institutional reform that replaces conglomerate firms with the Anglo-Saxon model will not improve corporate governance in countries where the appropriate institutional framework, which takes a long time to develop, is absent.

2. Persistence of Incompatible Institutions as an Obstacle to Institutional Reform

The Icelandic government's attempt to improve farmers' livestock management in the late 19th century provides an example of the persistence of incompatible institutions as an obstacle to effective institutional reform[8] The government passed laws requiring the provision of fodder and prudent management of livestock in order to stop soil erosion and sheep overgrazing and help farmers cope better with vicissitudes in hay production resulting from severe changes in weather. The laws had, however, little impact on the farmers' behavior. Eggertsson (2001) offers two possible alternate explanations: One is the bounded rationality of the farmers and their inability or unwillingness to experiment with new strategies, and the other is the informal social security system based on sharing, a "strong Good Samaritan-norm," that has existed in Iceland for centuries. If the latter is the true cause for the ineffectiveness of the laws to change the farmers' behavior, this Icelandic example demonstrates the powerful influence that incompatible informal institutions exert persistently on the functionality of newly introduced formal institutions.

Another example may be found in the lack of progress in reforming the Japanese economic system in recent years. It is an economy in which reforms are needed, according to many astute observers of that economy, in institutional arrangements such as life-long employment, pay by seniority, cross-shareholdings, and relations between the government and private sector through the use of administrative guidance—the features of the Japanese economy commonly cited to differentiate it from the Anglo-American economic system (e.g., Sato 2002). According to Okuno-Fujiwara (1999), there is mutual

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[8] Iceland had had a long history of soil erosion and sheep overgrazing, which was a major factor in its long impoverishment (Diamond 2005).

complementarity among these structural elements and while it gives the Japanese economic system its robustness and stability the complementarity makes it difficult to reform the Japanese economic system: For it to change all the elements of the system will have to change together throughout the whole society: A piecemeal reform that changes some while others remain intact will not succeed.

The reform experience of the transition economies of Eastern and Central Europe is yet another case in point: The persistence of incompatible institutions—those rooted in centrally planned socialist economies—has presented an obstacle to the establishment of market economies. According to Brzeski (1994:6),

It will be years, in some cases decades, before the *Rechtsstaat* can create an environment favorable to private activities, especially those involving capital formation. Statutes can be altered easily enough; Western law teams stand by, keen to provide legal expertise. But it will take time for the complementary psychological, social, and cultural changes to take root. Perhaps only demography—a generational succession—can bring about those changes.

In the following sections we apply the insight we have gained by examining various empirical cases on institutional interdependency and institutional reform to finding out why the post-crisis reform in financial supervision in Korea has achieved less than a full success. We find the answer in that the scope of reform was limited to changing the specific agencies and institutions that were directly involved in financial supervision, leaving very much intact other institutions that affect their functionality. The price Korea has paid for such a limited reform is the recent large-scale financial instability, which has its root cause in the inadequate supervision of credit-card companies by the supervisory agencies.

III. Has the Institutional Reform Brought about Any Change in *Modus Operandi* in Financial Supervision in Korea?

As part of the post-crisis reform of the financial system the Korean government undertook a major structural reform in its main economic ministry, MOFE. With the promulgation of the newly amended Government Organization Act early in 1998 MOFE was reorganized with some of its functions transferred to other public agencies. For instance, its non-bank supervisory function was transferred to FSC/FSS while the monetary and credit policy functions were transferred to BOK. In addition, the budgetary functions were taken away from MOFE. This reorganization of MOFE was prompted by the realization that "policy decision-making had become overly concentrated, thereby undermining the checks and balances required for effective government" (MOFE 2002) and the criticism that those weaknesses had contributed much to the outbreak of the 1997-98 financial crisis in Korea.[9]

The reform of MOFE and in financial supervision led to the division of responsibilities and powers that had been concentrated in MOFE among a number of public agencies. MOFE was given the task of preparing and coordinating economic policies, drafting tax and customs legislation, and formulating policies for the financial system; FSC/FSS that of supervising financial institutions; BOK that of maintaining monetary stability and keeping an oversight of the financial system; and KDIC that of protecting depositors. In other words, the defining characteristic of the new regulatory regime is the division of

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[9] For a discussion of the causes of the 1997-98 financial crisis of Korea, see Lee, Lee and Lee (2002).

responsibilities among a number of public agencies with each of them given its own policy mandate and responsibilities while they all share the common objective of securing financial stability (Kim *et al.* 2002). The new regime, however, has not been successful in achieving this objective as it failed to bring about interagency cooperation necessary for policy coordination and to maintain checks and balances among them.

In spite of the apparent division of responsibilities among specialized and separate agencies it was not long before the new regulatory regime in effect turned into a hierarchical system headed by MOFE (Kim *et al.* 2002). With the power to initiate legislation MOFE has become the most powerful agency dominating other agencies[10] although the system is supposed to work on the basis of the division of responsibilities and powers. In fact, FSC/FSS and BOK have come under the direct influence of MOFE, and there has been very little of either functional cooperation or horizontal checks and balances among the public agencies. Appearances to the contrary, the *modus operandi* of the new regulatory regime has remained the same as that of the old one in which all the powers and policy functions were concentrated in the hands of MOFE. In short, the post-crisis reforms in financial supervision have had very little effect on the way that financial supervision is carried out in Korea (Kim 2004a and 2005). In this regard it is worth quoting fully a passage from the World Bank report on Korea's financial sector reform (2003: 6-7, bold face in the original):[11]

Given the scope and power of the FSC, FSS, and SFC, their independence is a matter of great importance. Although embodied in the law, in practice their operational independence has been called into question. Concerns arise because of the role taken by MOFE in interpreting laws and supervisory regulations, giving the FSC, FSS, and SFC only limited freedom in implementing supervision. In addition, the rapid turnover of the FSC chairmanship (the chairman also is the governor of the FSS) and the policy whereby

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[10] Some critics may take issue with this view on the grounds that FSC organizationally belongs to the Office of the Prime Minister (OPM) but not to MOFE and that in many advanced countries the competent ministry within the government has, like MOFE, the power to develop financial laws, being accompanied nevertheless by no such hierarchical problems as observed in Korea.

Regarding the first point, it is true that FSC formally belongs to OPM in terms of government organization. FSC, as a public sector agency, was originally so designed at the time of its creation that it could hopefully keep MOFE at arm's length. What has happened in the past seven years, however, has clearly demonstrated that such an intentional institutional design was ineffectual, as MOFE in fact has dominated FSC in policy matters. This is perhaps attributed in part to the fact that the Prime Minister has traditionally been regarded as quite a symbolic, rather than functional, position in Korea.

Regarding the second point, Kim (2004d: 50) offers the following explanations ([ ] added): "The deep-rooted Confucian cultural tradition seems to have provided rich soil that grew the vertical relationships between the public agencies in Korea. In addition, there has been something peculiar about Korean government bureaucrats in general and MOFE bureaucrats in particular that enables the latter, given the power to develop laws, to exercise policy dominance over FSC/FSS and BOK. Related, several features stand out. First, government bureaucrats are accustomed internally to an army-like atmosphere in which any orders from superiors are deemed authoritative and thus have to be absolutely obeyed by their subordinates in any circumstances. Second, government bureaucrats are accustomed externally to exclusive cohesion in which they [act as a clique] and protect themselves in unison. These two factors are certainly the core part of the general features that shape the bureaucratic culture in Korea. Third, MOFE bureaucrats have had deep-rooted elitism of their own that was naturally formed in the process of government-driven condensed economic growth for several decades in the latter part of the 20th century. To wit, with Confucianism as a backdrop, MOFE has easily extended its powers, both developing and interpreting laws. These strong powers of MOFE, intertwined with strict order-obedience and exclusive cohesion as a couple of general features of the bureaucratic culture and with deep-rooted elitism of its [MOFE's] own, have worked together to establish and preserve the institutional vertical hierarchy, on top of which MOFE is situated."

[11] The Securities and Futures Commission (SFC), which appears in the quotation from the World Bank report (2003), is a subcommittee under FSC and has five members. FSC vice chairman presides over SFC, which is responsible for oversight of securities and futures markets. In this paper we make no distinction between FSC and SFC since the former includes the latter organizationally.

FSC staff sometimes move to and from MOFE have the potential to detract from the credibility of supervisory independence.

In the following section we discuss the supervisory failure relating to credit-card companies as a case demonstrating the failure of reform in formal institutions to alter in a significant way the manner in which financial supervision is carried out in Korea. This failure is a consequence of limiting the scope of reform to those institutions directly involved in financial supervision and not extending it to other institutions that, although not directly involved in financial supervision, affect nevertheless the functionality of the supervisory agencies.

IV. Supervisory Failures Relating to Credit-Card Companies[12]

In 2003, the financial markets in Korea suffered instability with serious prudential problems relating to credit-card companies and huge household indebtedness. In March that year the solvency of those companies began to be widely questioned, and soon the financial markets were shaken with instability. To prevent an impending crisis MOFE, FSC/FSS, and BOK intervened, taking the lead in arranging rescue plans and forcing credit-card companies to abide by hastily drawn-up restructuring packages (Kim 2004b). Soon afterwards the markets returned to a seemingly stable situation.

The basic underlying problem, however, persisted, threatening market stability. For instance, the LG Card, the biggest credit-card company in Korea, became illiquid in November 2003, subsequently became insolvent and had to be bailed out in January 2004. The seriousness of the problem can be seen in that at the yearend of 2003 there were over 3.7 million[13] credit defaulters[14] (one-sixth of Korea's economically active population) with total credit to household amounting to US $389.2 billion[15] (over three-fifths of Korea's GDP for 2003) (BOK 2004, MOFE 2004).

What brought about such huge credit default and household indebtedness? The following quote from FSS (2002) points to a proximate cause for the problem—misconduct by credit-card companies:

[G]ranting cards to minors without parental consent, renewal or re-issuance of cards after expiration without the consent of the member even though no transaction took place in the member account, … attempts to attract new members with offer of high-priced giveaways, … setting credit limits well beyond the card members' income or ability to

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[12] This section draws heavily from Kim and Lee (2004).

[13] According to MOFE (2004), individual consumers who were on the list of credit defaulters totaled over 3.7 million at the yearend of 2003. The default by 2.4 million (64.4% of these credit defaulters) was related to credit card uses. Compared with the situation at the yearend of 2002, the year 2003 saw a dramatic increase both in the number of credit defaulters (1.1 million) and in the number of credit-cared related credit defaulters (0.9 million). The ratio of the latter to the former also increased from 56.7% to 64.4% in 2003. Since Korea had about 22.9 million economically active people at the yearend of 2003 (BOK 2004b), we can surmise that roughly one person out of six was a credit defaulter and one out of nine or ten a credit-card related credit defaulter. The register system of credit defaulters has been abolished in Korea since April 28, 2005 when the Act for the Use and Protection of Credit Information was revised. Now efforts are being made to build up the infrastructure for managing credit information such as credit bureaus.

[14] As regards individual consumers, a credit defaulter is by definition a person who has loans in arrears in excess of KRW 300,000 (or equivalently US $261 at the exchange rate of US $1 = KRW 1,150) for over three consecutive months (MOFE 2004).

[15] An exchange rate of US $1 = KRW 1,150 is used for conversion throughout the paper.

pay only after perfunctory or negligent verification process, and using the offer of high credit limit as a marketing tool to attract new members ....[16]

It seems obvious that misconduct on the part of credit-card companies such as these contributed to the huge credit default and household indebtedness, but it is also obvious that they could not have been committed if those companies had been properly supervised by the appropriate supervisory agencies. We must thus hold those agencies ultimately accountable for the misconduct of credit-card companies and the consequent credit default and household indebtedness.[17] The following discussion, based on a detailed examination by one of the authors of the relevant documents and data published by MOFE, FSC/FSS, and BOK during the 1999-2003 period, reports how these public agencies failed in their role as supervisory agencies (Kim 2004b and 2004c).

1. MOFE

MOFE began undertaking a series of deregulatory measures for credit-card companies in 1997-99. It included expanding the scope of financial activities permitted (*e.g.*, cash advances and card loans), removing the corporate borrowing limit (20 times the stockholders' equity), and also removing the ceiling ratio (60 percent) of account balances of non-core credit-card businesses (*i.e.*, cash advances and card loans) to those of both core (*i.e.*, settlement of credit-card payment) and non-core credit-card businesses (FSS 2003).[18] These were soon followed in 1999-2001 with another series of deregulatory measures, which aimed at popularizing a wide use of credit cards by the general public. It included removing the monthly credit limit (approximately US $609) on cash advances, offering tax breaks for credit-card purchases,[19] awarding lottery money for the receipts of credit-card payments, requiring corporate entertainment expenses to be paid with corporate credit cards, and offering further tax breaks for credit-card purchases (FSS 2003).[20]

These deregulatory measures were undertaken as part of government policies aimed at boosting domestic demand in the post-crisis economy.[21] These, plus MOFE's actions to

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[16] According to FSS (2001a), most of these practices became widely used by early 2001, rapidly popularized by street solicitors who were under contract with credit-card companies. As of the yearend of 2000 there were 31 thousand credit-card solicitors nationwide and they contributed to 58 percent of the total of 18.3 million credit cards newly issued during 2000.

[17] Hong (2004) points out that the absence of a credit rating system and appropriate bankruptcy laws is accountable for the problems relating to credit card companies in Korea. The United States experienced a similar expansion in credit card uses after deregulation but did not suffer as severe a consequence as Korea since it had a well developed credit rating system and bankruptcy laws.

[18] Of the three deregulatory measures, the first two were based on the Credit-Specialized Financial Business Act initiated by MOFE and introduced in July 1997, four months before the financial crisis broke out in November 1997. The last measure was introduced by MOFE revising the enforcement ordinances in April 1999. This revision provided MOFE with the regulatory basis for the ensuing revision in the enforcement rules in May 1999; i.e., the removal of the monthly credit limit on cash advances. See FSS (2003).

[19] The tax break measures may have had a salutary effect of enhancing transparency in business transactions, thwarting tax evasion and promoting tax revenues. See BAI (2004b).

[20] Of these five deregulatory measures, the first one was introduced by MOFE revising the enforcement rules in May 1999. This single measure, among others, proved to have had explosive impacts on credit-card holders' use of cash advances for years. Cash advances in 2002 amounted to about US $311 billion, approximately eleven times as much as that in 1998, which was about $28 billion. The second measure, a tax break offer, was introduced in August 1999, the third in January 2000, and the fourth in October 2000, and the fifth in August 2001.

[21] Although no documentary evidence such as public document from MOFE in support of this proposition is available, indirect evidence is readily available. An example is an article written by Mr. Byong Won Bahk in his capacity as the Director of the Economic Policy Bureau of MOFE for the *JoongAng Ilbo* (November 11, 2002) and posted on the official website of MOFE. As its title "The Policy of Boosting Domestic Demand Was the Unavoidable Option That Was Chosen to Stimulate the Economy" clearly reveals, his writing attempts to justify MOFE's policy stance of boosting domestic demand that was strongly maintained in 2001

stimulate real estate investment in the middle of 1998, were probably warranted at that time when the Korean economy was experiencing a credit crunch and a high rate of unemployment as a result of post-crisis restructuring in both real and financial sectors. MOFE, however, continued with the policy of promoting the use of credit cards well beyond the time when it was appropriate.

Early in 2001 there began to appear signs of excessive competition among credit-card companies, as evidenced in widespread practices such as "indiscriminate granting of credit cards – often to unqualified or ineligible applicants" and "street solicitation" for membership (FSS 2002). Household debts (including credit-card debts) were snowballing and the number of credit defaulters was increasing at a rapid rate. MOFE nevertheless stuck to its credit-card promotion policy through the first half of 2002 apparently because it was intent on boosting domestic demand and making a rapid recovery from the crisis of 1997-98.

In February 2002, the Financial Policy Coordination Committee,[22] which consisted of the MOFE Vice Minister, the FSC Vice Chairman, and the BOK Vice Governor, agreed to pursue a broad set of policy measures to limit the surge of household debts. As it turned out, however, the public agencies did not regard it as a top priority issue as what concerned them the most then was economic recovery from the crisis. In fact, at a meeting held in March 2002 the Committee expressed its reservation at taking *excessive* measures against household indebtedness, as it feared they would suppress consumption and thus delay economic recovery. It thus appears that the task of supervising credit-card companies was subordinated to the goal of bringing about rapid economic recovery. A consequence of this policy stance was an increase in overdue credits, credit default, and household indebtedness.

In May 2002, the MOFE Minister, the FSC Chairman, and the Policy Committee Chair of the Millennium Democratic Party (then the incumbent party) got together in the Ruling Party-Administration Consultation Meeting[23] and agreed to make an all-out effort to combat the prudential problems relating to credit-card companies and household debts. Finally, faced with the aggravating signs of the problem, MOFE decided to give up its policy of boosting domestic demand that it had maintained for four years since the middle of 1998. In July 2002 MOFE undertook policy measures to deal with the problem but its belated action only had the effect of putting a heavier regulatory burden on credit-card companies instead of mitigating the severity of the problem. Then,

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and up until the end of the first half of 2002. In light of Mr. Bahk's own admission, together with the fact that all those deregulatory measures that had been introduced in the aftermath of the 1997 economic crisis were kept unblemished all along during that period, it is reasonable to conclude that those deregulatory measures including credit-card promotion policy measures were actively promoted as a means for boosting domestic demand during that period. In addition, a recent audit report from the Board of Audit and Inspection (BAI) makes the point very clearly by beginning its general comments as follows (BAI 2004a, p.2): "In response to the occurrence of the 1997 economic crisis, the government removed, in its pursuit of the credit-card promotion policy, part of the existing limits and regulations that related to credit-card companies and credit-card uses. The policy was intended to revive the economy through boosting domestic demand and to secure the tax base through enhancing transparency in commercial transactions." Further, in his interview with the *Chosun Ilbo* (2004b), Mr. Jeung-Hyun Yoon, current FSC Chairman since August 2004, commented that "prudential problems of credit-card companies originated in the process of boosting private consumption that had been undertaken during the previous administration [i.e., the Kim Dae Jung Administration]." ([ ] added.)

[22] The Financial Policy Coordination Committee, an *ad hoc* organization without any legal basis, usually meets eight times a year to discuss financial and/or macroeconomic policies. For years the Committee has been allegedly known as the only channel of communication among the public agencies concerned. According Kim (2004b), the Financial Policy Coordination Committee served not as a channel for interagency cooperation and coordination but as a means for justifying MOFE's policy dominance over FSC/FSS and BOK.

[23] The Ruling Party-Administration Consultation Meeting is held two or three times a year on an irregular basis. It is likely that at such meetings political influence, if not political pressure, is transmitted to supervisory agencies, thus compromising their operational independence.

in the middle of March 2003 the discovery of accounting frauds by SK Global triggered a very serious, albeit temporary, instability in the financial markets already overburdened with overdue credits, credit default, and household indebtedness.

2. FSC/FSS

In February 2001, FSC/FSS first recognized signs of excessive competition among credit-card companies and decided subsequently to carry out a comprehensive set of measures to deal with the prudential problems relating to credit cards. They wanted to reintroduce, for instance, the ceiling ratio of account-balances of non-core credit-card business to those of both core and non-core credit-card business. FSC/FSS were, however, unable to put such measures into practice because of MOFE's opposition to revising the relevant laws and regulations.

As noted earlier, the ceiling ratio, which had been set at 60 percent, was removed in 1999 in the hope that such a measure would accelerate economic recovery from the financial crisis. In April 2001, FSC, being concerned with the rapid increase in non-core credit-card business such as cash advances and card loans, requested that MOFE provide a legal basis for FSC to reintroduce the ceiling ratio (BAI 2004b). Faced with MOFE's opposition, FSC attempted on its own in May 2001 to re-impose the ceiling ratio at 50 percent (FSS 2001b), taking the position that the re-imposition was a matter of regulatory discretion and was within their jurisdiction.[24] MOFE, however, took issue with FSC, insisting that the re-imposition of the ceiling ratio required a revision in law and was not, therefore, a matter of regulatory discretion. MOFE was probably opposed to the reintroduction because of the fear that such a measure would have a negative impact on domestic demand and slow the pace of economic recovery. Then, in May 2002, when the problems became more serious and urgently demanded a solution MOFE finally agreed to revise the law. In June 2002 it finally reintroduced the ceiling ratio but then one whole year later than thought appropriate and necessary by FSC/FSS.

The inability of FSC/FSS to reintroduce the ceiling ratio clearly demonstrates the lack of their autonomy in carrying out the supervisory task, alluded to in the World Bank report (2003). The cause for this lack of autonomy lies, we argue, in the hierarchical relationship that MOFE has maintained with other public agencies. By being at the apex of this hierarchy and by turning discretionary regulatory issues into legislative matters MOFE has been able to dominate other agencies in policy matters, turning them practically impotent in carrying out their statutory responsibilities especially when in conflict with MOFE's own policy objectives (FSS 1999). In fact, IMF (2003: 24) also noted in its report on Korea that "prudential regulators lack the unfettered right to issue new regulations when they perceive a need to do so." In this regard it is notable that the Board of Audit and Inspection (2004a, 2004b) provides delineations of several specific incidents in which MOFE has dominated FSC/FSS in supervisory issues on prudential problems of credit-card companies.[25]

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[24] The ceiling ratio was correctly regarded then as one of the most powerful direct measures with a great impact on profitability and business patterns of credit-card companies.

[25] The incidents reported in BAI (2004a, 2004b) include those in which MOFE has turned down or delayed a request made by FSC for revision of relevant legislation, and those in which the line of demarcation between laws and regulations has been drawn arbitrarily by MOFE with the result that the competent authorities that are responsible for applying the same rules (e.g., capital adequacy ratios) or the same procedures (e.g., licensing) may often differ – either MOFE or FSC in this matter – across sectors and types of financial institutions such as banking, securities, merchant banks, insurance companies, credit-card companies, and savings banks.

Until May 2002, FSC/FSS were sending out mixed signals regarding the problem of household debts. In April 2002 they announced plans to strengthen prudential supervision of credit-card companies, but soon after that in the same month FSC Chairman stated in a public speech that prudential policy measures would be pursued carefully so that economic recovery would not be deterred. Such inconsistent messages from the supervisory authorities are likely to have stirred up confusion in the financial markets while damaging credibility in supervisory policy. When MOFE took the occasion of the Ruling Party–Administration Consultation Meeting in May 2002 to announce a change in its policy stance of boosting private consumption, FSC/FSS quickly became decisive in their view on the prudential problems and started taking strict supervisory actions. These actions by FSC/FSS demonstrate that they lacked autonomy and were simply following the policies set by MOFE.

3. BOK

BOK itself took note of marked increases in cash advances of credit-card companies and in household debts as early as in September 1999 but did not regard them as a major threat to financial stability. In the first half of 2002, however, BOK began to express in various public statements its concern about the ever-increasing household debts although, like MOFE, it appeared to be torn between two conflicting objectives—boosting domestic demand for economic recovery and maintaining financial stability. But, by announcing in February 2002 that private consumption needed to be boosted, BOK in effect sent out a message saying that it was not overly concerned with the size of household debts.

In May 2002, the BOK Monetary Policy Committee made a decision to move the target level of the call rate slightly upward by a quarter percentage point. The decision was made with the problems of household indebtedness and financial instability in mind. A couple of weeks or so later, MOFE made a complete and abrupt turnaround in its policy stance, giving up its long-maintained policy of boosting domestic consumption. BOK itself then suddenly became expressly concerned with the prudential problems of credit-card companies and household debts.

BOK is *not* a part of the government unlike FSC, which is a government agency at a lower level of hierarchy headed by MOFE. But, its passive inconsistent patterns of behavior towards prudential problems relating to credit-card companies and household debts strongly suggests that in spite of the statutory independence it has gained with the post-crisis financial reform BOK has been subject to influence from MOFE. A weakened legal basis of BOK involvement in the matters of financial stability, which is a consequence of the 1997 revision of the Bank of Korea Act, may have contributed in part to such a situation. More likely, MOFE has been able to exert its influence on BOK by having a strong voice in appointing a majority of members of the BOK Monetary Policy Committee.[26]

4. Synopsis

The Ruling Party-Administration Consultation Meeting held in May 2002 marked the watershed at which MOFE basically abandoned its policy of boosting domestic demand

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[26] The BOK Monetary Policy Committee consists of seven members—BOK Governor and Vice Governor and five members recommended by five institutions and appointed by the President of the Republic of Korea. The five institutions are BOK, MOFE, FSC, the Korea Chamber of Commerce and Industry, and the Korea Federation of Banks, each recommending one prospective member. With its ability to influence most of those institutions, MOFE does have a strong voice in the selection of most members of MPC.

in an attempt to rapidly bring about a post-crisis economic recovery. It now began to tackle the prudential problems relating to credit-card companies that had been festering unattended for years. With this change in policy stance by MOFE all other public agencies, including FSC/FSS and BOK, followed suit and became outspoken and decisive in their views and actions regarding the prudential problems. Their new public policy stance was in a stark contrast with the inconsistent and ambiguous attitudes they had adopted before in public and a clear manifestation of their closely following the decisions of MOFE in matters relating to the economy.

What FSC/FSS and BOK had done before was to follow the policy line chosen by MOFE that was primarily concerned with achieving short-term macroeconomic policy objectives. But, as soon as MOFE made a complete and abrupt turnaround in its policy stance in May 2002 and became concerned with financial stability, FSC/FSS and BOK likewise made its policy turnaround. Such behavior by FSC/FSS and BOK clearly demonstrates that in spite of their statutory independence they have lacked autonomy.

In short, the prudential problems relating to credit-card companies and household debts were a failure of an institutional structure in which MOFE dominated other public agencies, making it difficult for them to carry out their statutory responsibilities when their doing so went against MOFE's achieving its own policy objectives. In such a system the task of financial supervision and the inter-agency supervisory coordination necessary for solving the credit-card and household-debt problems were simply relegated to a back burner until the problems reached crisis proportions and became serious enough to dominate other policy issues.

V. Concluding Remarks

The recent financial instability involving credit-card companies has cast doubts on whether the post-crisis reform in financial supervision has fundamentally changed the manner in which financial supervision is carried out in Korea. We have argued that in spite of the reform the supervisory agencies such as FSC/FSS and BOK were unable to function as fully independent entities due to constraints imposed on their operation by other institutional arrangements. Either through institutional complementarity or incompatibility `they affect the functionality of the reformed supervisory agencies and will need to be reformed if the supervisory agencies are to operate with autonomy as mandated and develop their own technical competence. The following list some of such reforms.[27]

First, Korea should stop the practice of rotating appointments of government officials,[28] which we argue has hampered FSC from acting as an independent agency and

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[27] All the three reform proposals listed in the text are to ensure both the operational independence and accountability of the supervisory authorities, FSC/FSS. The Korean government is typically characterized by a couple of deep-rooted traits—rotating appointments of government officials and the opaqueness in government decision-making. Under the current institutional structure of supervision in which MOFE has influence over FSC, the former trait tends to contribute to generating such negative side-effects as supervisory myopia, regulatory forbearance, industrial/political capture, mandate confusion, and inexperience and inexpertness on the part of supervisory government officials with the result that operational independence of the supervisor is damaged. The latter trait tends in turn to contribute to the cover-up of these side effects once they are generated, with the result that accountability of the supervisor is damaged. See Kim (2005) for a fuller discussion on the schematic relationship between the two typical traits of the Korean government and potential damages that they may inflict upon operational independence and accountability of the supervisor.

[28] Consider, for example, the turnover rate of the FSC Chairman. The Act for the Establishment of Financial Supervisory Organizations, enacted on December 31, 1997, explicitly states that the term of office of

developing its own cadre of technical experts. This practice is not conducive to supervisory officials becoming experienced and skillful experts in financial supervision. It has also given birth to supervisory myopia and regulatory forbearance as supervisory officials, having no fixed tenure in the office, tend to have a short time horizon and are apt to allow regulatory forbearance through inaction. When there are signs of an emerging problem they are inclined not to take action, hoping that the problem would go away. Such inaction, typical of the principal-agent problem, results in *de facto* regulatory forbearance. The fact that all the public agencies had suffered from this "disaster myopia"[29] until the first half of 2002 when the problems relating to credit card companies reached crisis proportions is an example of such regulatory forbearance.

Second, Korea must introduce greater transparency and openness in government decision-making. We noted earlier that MOFE itself admitted that its policy decision-making before the 1997 financial crisis had been too concentrated for effective checks and balances. It kept vital economic information to itself, thus limiting the scope of informed debate on policy matters. We now know, for example, that on the eve of the financial crisis of 1997 only a handful of highest-ranking MOFE officials had access to the information on the country's foreign exchange holdings (BOK 1999). The lack of transparency and openness in decision-making in government may lead to a purposeful cover-up of supervisory problems, thus re-enforcing the tendency towards regulatory forbearance and political/industrial capture of supervisory officials. Also, as noted by the IMF (2003) and the World Bank (2003), the lack of transparency with which some of the regulatory rules and regulations were introduced has undermined their effectiveness.

Third, Korea should change the highly hierarchical structure of the government that places MOFE above other public agencies such as FSC/FSS and BOK. This organizational structure has allowed MOFE to dominate them in policy matters and, specifically, to subordinate their supervisory task to achieving its short-term macroeconomic objectives. Its dominance in policy matters is further strengthened in the case of FSC as its staff consists predominantly of former MOFE officials[30] and as it routinely rotates its personnel with MOFE. These practices are likely to have encouraged FSC officials to be more loyal to MOFE than to FSC, acquire a mistaken notion about their mandate, identify themselves as economic policymakers rather than supervisors, and regard economic policymaking to be more important than carrying out supervisory tasks. Such attitudes would have led their supervisory role to be downgraded and become subordinate to MOFE's other missions. As long as the current hierarchical relationship between MOFE and the other public agencies persists there is the possibility that financial supervision will be subordinated to MOFE's other policy objectives.[31] Severing that relationship is

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FSC Chairman is three years. But in practice no chairman has ever completed his legal term of office, and the 5th turnover in chairmanship took place in 2004 when FSC had been in operation only for six years since April 1998. This translates into an average term of office for the four ex-chairmen of only about 19 months, a slightly over half of the legal term of office. It should also be noted that those four ex-chairmen as well as the present chairman were former officials of MOFE.

[29] According to BIS (2001), "disaster myopia" is "[t]he tendency for investors, entrepreneurs and financial institutions to become overly optimistic in booms … placing too little weight on low-probability adverse events." The recent Korean experience with financial supervision or lack of it that led to the 2003 credit-card fiasco reveals that the public agencies responsible for maintaining financial stability may have suffered the disaster myopia for some years.

[30] At the time of its creation (April 1998) FSC consisted of the administrative committee of 9 members, a subcommittee of 5 members (Securities and Futures Committee), and an adjunct unit of 19 government officials. The administrative committee was to set the overall policy while the adjunct unit was to "help the committee with its exercise of such functions as budgeting, accounting, and proceedings management" as stipulated in law. In less than three years since the birth of FSC the adjunct unit transformed itself into part of the supervisory authority with its staff more than tripled to 70 officials mostly of MOFE origin (Kim 2002).

[31] Considering the nature of those factors that are regarded responsible for the formation of the current hierarchical structure, the institutional hierarchy has good reason to persist for long. See Footnote x.

thus a *sine qua non* for creating supervisory agencies that are fully dedicated to and capable of carrying out their statutory responsibilities.

Our analysis of the Korean experience in reforming financial supervision points to the complexity relating to institutional reform in general; that is, reforming a particular institution, if it is to be successful in effect, cannot simply end with it. The fact that there is interdependency among various institutions in the economy implies that the reform of a particular institution will have to be accompanied by reforms in other institutions that affect directly or indirectly the functionality of the reformed institution. That is, reforming an institution requires reforming the entire institutional structure in which it is embedded. Some of the institutions in that institutional structure may be known prior to the reform while others may be revealed only afterwards (Streeck 2003). And some of them may be the society's overarching institutions such as culture and social norms and changes in such institutions, if possible, would have society-wide implications. Obviously, reforming all interdependent institutions at once—a sort of a "big-bang" approach—will be difficult, if not impossible, since we may know little about what they are prior to the reform and how they may interact with the particular institution in issue. This is also the conclusion that Lin and Nugent (1995: 2362) reach at the end of their extensive review of the literature on institutions and economic development:

…mere transplantations of successful institutions from DCs to LDCs [is] at best, unlikely to have the expected positive effects on performance, and, at worst, may have rather disastrous effects. Where to start and how to bring out the reforms in a country are questions that can be answered only with serious consideration of the country's existing institutional structure and human and physical endowments.[32]

The necessity of such consideration suggests that there is no one-size-fits-all formula for institutional reform and that there is a limit to what science can teach us on how to carry out institutional reform. A successful institutional reform may thus require, as observed by Nee (1998), a poet's insight into the human condition as much as science.

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[32] A specific example of the difficulty in transplanting foreign institutions is found in the case of Korean labor market institutions, which were borrowed from Japan. But unlike Japan, which has had relatively harmonious industrial relations, Korea has had a turbulent record. Yoon (2005) argues that the labor institutions imported from Japan could not fill the void left by the departure in the mid-1980s of the authoritarian government that oversaw labor relations in Korea and that, as Japan has done, Korea will have to take time and effort to adapt the imported labor institutions to its own cultural, sociopolitical and economic environment.

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Comments on "Financial Reform, Institutional Interdependency, and Supervisory Failure in the Post-Crisis Korea"

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Summary: The paper argues that a successful institutional reform requires changing not only the particular institution being reformed but also other interdependent institutions.   The paper indicates that Korea's post-crisis reform in financial supervision was limited to changing the formal institutions for financial supervision and further reforms are needed in interdependent institutions.   To illustrate this, the paper considers the 2003 financial market instability in Korea due to the fact that several credit card companies including the LG card, the largest one in the credit card industry, encountered serious solvency problems.   The paper concludes the 2003 financial market instability in Korea results mostly from the Korean government's hierarchical organizational structure that puts the Ministry of Finance and Economy (MOFE) above others such as the Financial Supervisory Commission (FSC) and the Bank of Korea (BOK).

Comments: This paper attempts to evaluate a particular Korean government policy concerning financial supervision in a case study format.   More such attempts are needed to critically evaluate various Korean government policies.   I have three general comments.

First, there should be more detailed descriptions of the incentives of the players, such as MOFE, FSE, and BOK.   Their incentives are described in the paper, but the political aspects seem entirely missing.   For example, why was MOFE obligated to overly concern about the rapid economic recovery?   Was there any explicit or implicit pressure from the Office of the President for political reasons at that time?

Second, the paper's suggestions for the further government reforms are: (1) to stop rotating appointment of government officials; (2) to introduce more transparency and openness in government decision making; (3) to change the highly hierarchical structure of the government that puts MOFE above FSC and BOK.   The first two suggestions do not seem quite relevant in light of the paper's emphasis on institutional interdependency.

Finally, the paper would improve much if it considers the lessons learned from the U.S. examples. For example, the U.S. government needed to decide whether to intervene in the financial market when its stability was threatened by the financially troubled Long Term Capital Management (LTCM) in the mid 90's. In the mid 80's, the U.S. government also needed to decide to intervene in the financial market due to the S&L crisis. Any findings on institutional/procedural differences between the Korean case and the U.S. cases (or the case of other advanced countries) would result in more concrete suggestions for the further reform in Korea.

CHAPTER 2-2

Reforming the Fiscal Management System in Korea

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I. Introduction

The Korean government has maintained a strong fiscal discipline since the early 1980s, keeping its budget more or less in balance and its debt at low levels. The fiscal balance showed large deficits after the economic crisis of 1997, but returned to surplus in 2000 thanks in part to the buoyant economy and the resumed consolidation efforts. The surplus has continued since then.

At the same time, however, we are faced with various risk factors that can adversely affect the government finance. The aging population and the technological catch-up with the advanced economies imply a much slower growth for Korea in the decades ahead. While the revenue growth slows down, the demand for public expenditure is increasing rapidly. The financial sector restructuring in the wake of economic crisis left irretrievable debts of 69 trillion won (9 percent of 2004 GDP) in the public sector, and the burden will fall mostly on taxpayers. All public pension schemes have structural problems due to the imbalance between contributions and benefits. Some of them (those for civil servants and military personnel) are already in serious trouble. The economic cooperation with North Korea will demand more and more government support in the future. The spending on social welfare programs has increased substantially after the crisis, and is set to increase further.

The government expenditure as a percentage of GDP has stabilized since 2001 at around 25 percent after rising rapidly since the mid-1990s. But it may resume its growth and result in worsening fiscal balances when these risk factors materialize.

At the same time, "global standards" began to be introduced in every area of the economy after the crisis. Public sector was no exception. The Korean government embarked on an ambitious reform agenda to cope with the worsening fiscal situation and to modernize its system of financial management.

This paper aims to (1) overview the development of public finance in Korea since the 1970s; (2) analyze its current status; (3) explain the institutional setup and assess the recent reform efforts; and (4) propose directions for change to maintain financial health and maximize the productivity of public spending.

II. Public Finance in the Last Three Decades

Large Deficits in the 1970s

In the 1970s and into the early 1980s, the Korean government ran a persistent budget deficit (see Figure 1). The deficit of the consolidated central government averaged about 3 percent of GDP in this period. Income transfer to the agricultural sector, heavy investment in social infrastructure, and various subsidies to promote heavy and chemical industries required large amounts of public money. But rapid economic growth helped contain the expenditure and net lending at around 20 percent of GDP (see Figure 2).

[Figure 1] Budget Surplus/Deficit of the Central Government
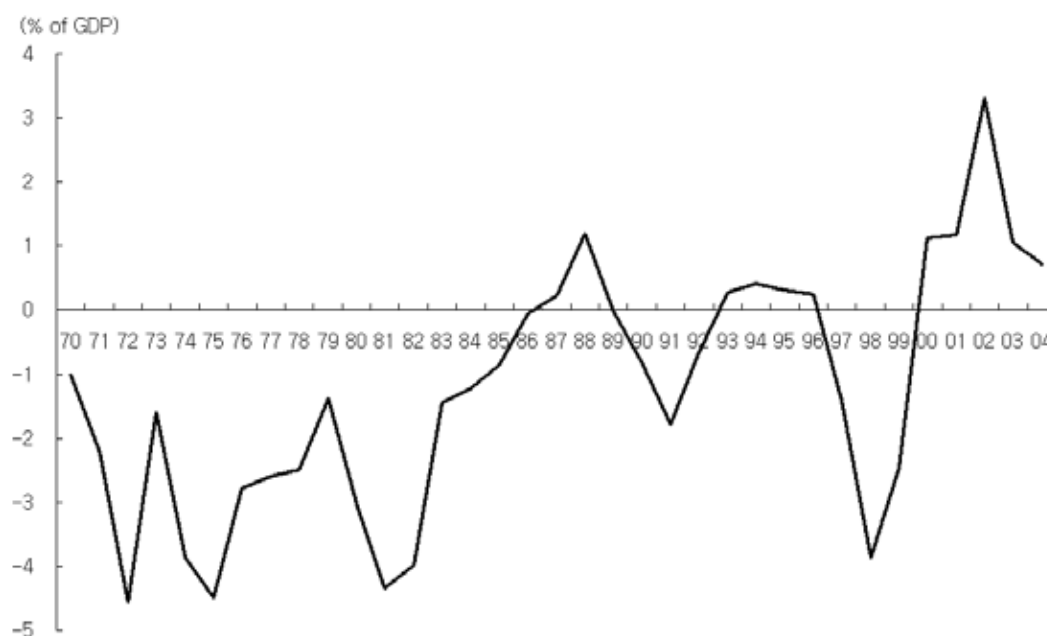
Source: Ministry of Finance and Economy.

[Figure 2] Expenditure and Revenue of the Central Government

Source: Ministry of Finance and Economy.

Fiscal Tightening in the 1980s

A major change in policy stance took place in the early 1980s. The second oil shock together with political instability left Korea with spiraling inflation and negative income growth in 1980. The new government that came into office in 1981 tightened monetary and fiscal policies rather drastically.[1]

On the monetary front, the annual growth rate of M2 was halved by the middle of the 1980s. On the fiscal front, consolidation took the form of reduced expenditure. The growth of real government expenditure and net lending was -3 percent in 1983, and remained at low levels until 1987 (see Figure 3). These changes coincided with a substantial reduction in inflation. Overall, the economy grew at a healthy pace up until the recent economic crisis (see Figure 4).

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[1] The new government recognized the intrinsic problems of the government-led growth strategy, especially those coming from the promotion of capital-intensive industries. This strategy distorted the efficient allocation of resources, helped the formation of large business conglomerates (the so-called *chaebol*), aggravated income inequalities, and produced macroeconomic instability. Consequently, the new government adopted "Liberalization and Stabilization" as its slogan for economic policy. While the stabilization policy was carried out successfully as explained in the text, the liberalization policy did not induce sufficient structural reforms in the economy. Many people think that this sowed the seed for the economic crisis of 1997.

[Figure 3] Growth of Real Expenditure and Revenue of the Central Government
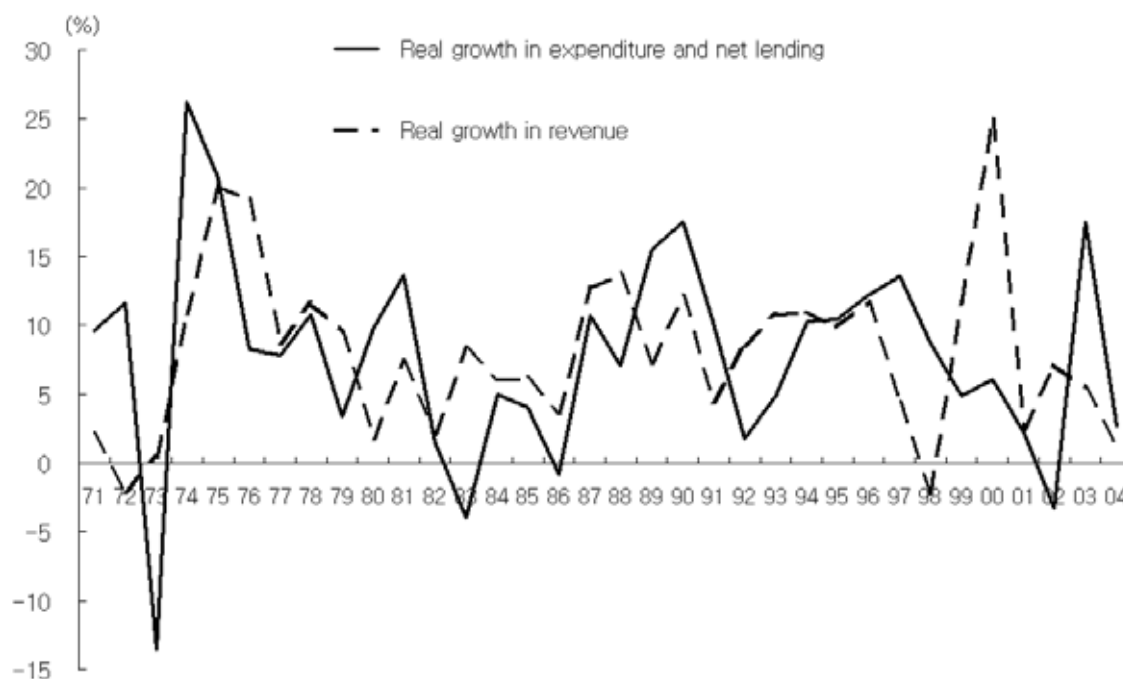
Note: Real values were obtained by deflating nominal values with GDP deflator.
Source: Ministry of Finance and Economy.

One important principle in fiscal management was established in this period. It was the principle of "Expenditure within Revenue," or the balanced budget principle. While not formalized in a law or a regulation, it acted as self-discipline imposed on the budget authorities against imprudent management of the budget.[2]

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[2] One innovation during this period is worthy of note. The Budget Review Committee (BRC) was set up within the budget office in 1982 (Bahn, 2003). It was composed of senior management of the budget office. The recommendations of budget examiners regarding the ministerial budget requests were submitted to and reviewed by the BRC and then final decisions were made by the BRC as a group in sessions closed to outsiders. When faced with the lobby from line ministries and other interested parties, budget examiners found it convenient to pass the onus of budget cuts to the BRC. The BRC has been very effective in containing the spending increase and establishing fiscal discipline. It still exists.

[Figure 4] Output Growth and Inflation
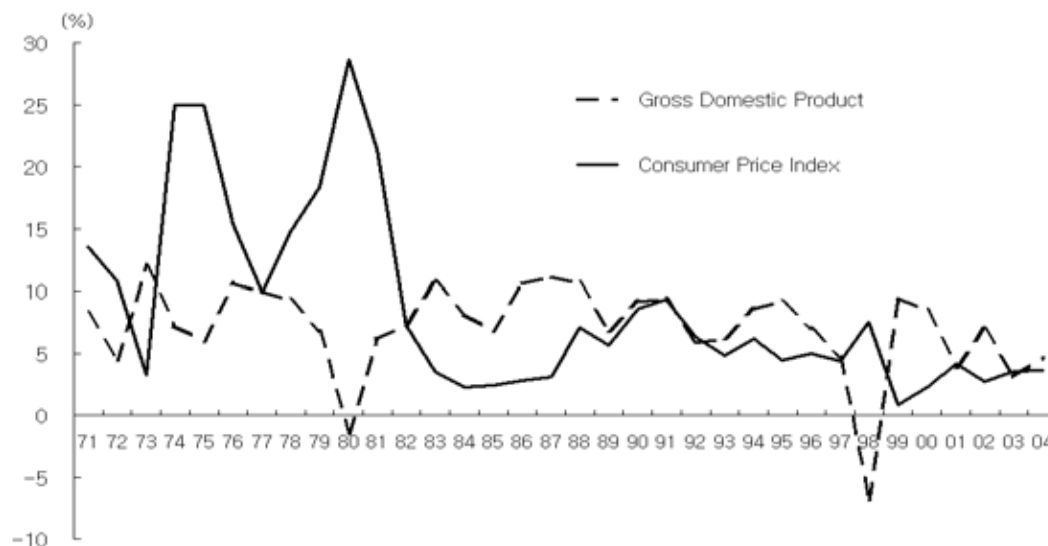
Source: Bank of Korea.

In fact, the strong economic growth and the moderate-to-high inflation produced higher-than-expected tax revenues in most years. This in turn made it relatively easy to keep the budget in balance. The National Pension Scheme (NPS) that was introduced in 1988 also contributed to the total revenue by one to three percent of GDP each year.[3]

The balanced budget principle kept the public debt to a minimal level. In 1996, the year before the crisis, the gross debt of the central government was less than 10 percent of GDP, and the net debt was negative; that is, the central government was a net creditor to the other sectors in the economy.[4] The local governments were generally in good shape as well.

Of course, there were costs as well as benefits associated with the balanced budget principle. Some argue that the counter-cyclical role of fiscal policy was constrained, and essential investment in social infrastructure was often postponed to contain the overall expenditure. But the Korean economy was able to achieve strong growth without much cyclical fluctuation for nearly one and a half decades after the balanced budget principle was adopted.[5]

Most importantly, strict application of the principle enabled the Korean government to keep the size of the government debt at a manageable level, and provided it with room for maneuver when the crisis hit the economy. Without too much worry about the rapid explosion of the budget deficit and public debt, the Korean government could plan massive fiscal supports to troubled financial institutions. It also expanded the welfare programs for the poor and the unemployed substantially.

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[3] But the long-term prospect of NPS is quite bleak. To finance the system, the contribution rate that stands currently at 9 percent will have to increase substantially in the future.

[4] There are doubts, however, about the quality of government assets, which are mostly loans to private entities and local governments.

[5] Specifically, the average growth rate was 7.2 percent (with standard deviation of 3.5 percent) during 1971-1982 and 7.0 percent (with standard deviation of 3.9 percent) during 1983-2004. The growth performance does not appear fundamentally different in these two periods. In addition, following the estimation method suggested by Bayoumi and Eichengreen (1995), a formal test can be carried out to see whether the cyclical response of the fiscal policy was weakened in the latter period. I could find no evidence for such claims.

Economic Crisis and Ballooning Budget Deficit

The fiscal support to financial sector restructuring primarily took the form of loans to two public corporations – Korea Deposit Insurance Corporation (KDIC) and Korea Asset Management Corporation (KAMCO).[6] The loans were spent on repaying the interest on the restructuring bonds issued by these corporations. The total outstanding stock of restructuring bonds stood at 102 trillion won (21 percent of 1998 GDP). The loans were eventually

Public assistance to the poor almost doubled after the crisis.[7] The unemployment insurance scheme, which had been introduced in 1995, rapidly enlarged its coverage and increased its benefit level.[8]

These developments left an unmistakable mark on the government finance. The consolidated budget, which remained more or less in balance before the crisis, dipped into deficit in 1998 of 4 percent of GDP. The ratio of government debt to GDP rose from 8 percent in 1996 to 15 percent in 1998 (see Figure 5). When government debt-guarantees[9] were included, the total public burden climbed to 30 percent of GDP.

[Figure 5] Debt / GDP Ratio
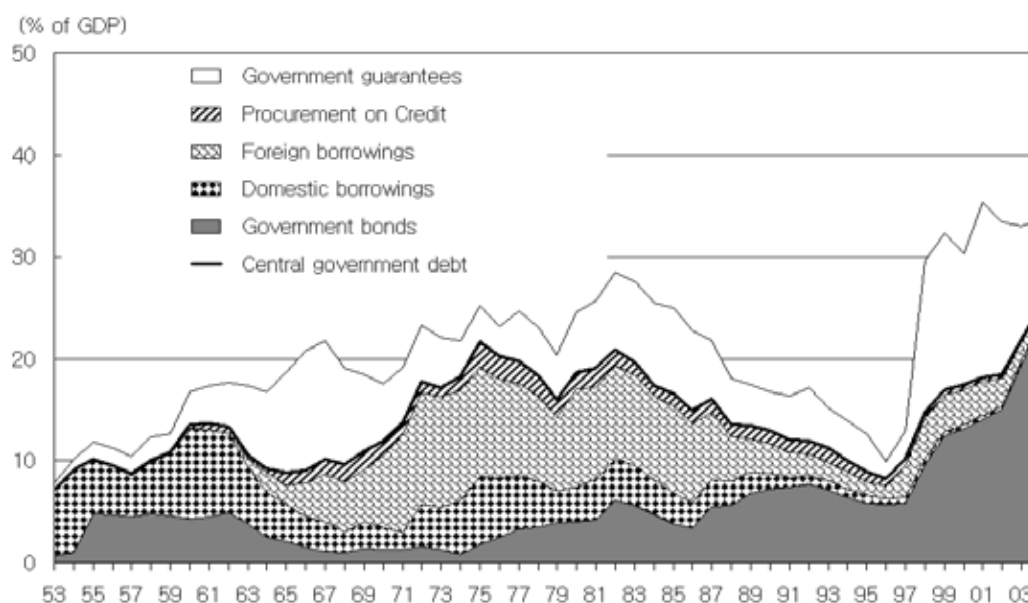
Source: 1953-90, Korea Development Institute (1991); 1991-2004, Ministry of Finance and Economy.

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[6] KDIC was responsible for recapitalizing underfunded institutions and paying out the deposits in closed institutions. KAMCO sold the assets purchased from troubled financial institutions in return for KAMCO bonds.

[7] But these expenditures still take up only a small portion of the total budget compared to western countries, as the social welfare system in Korea is in its early stage of development. In the future, however, public pension benefits and other welfare spending are certain to drive up the social welfare expenses to a level that is comparable to those in western countries.

[8] The unemployment rate, which had been below 3 percent up until 1997, rose to 7 percent in 1998.

[9] The bonds issued by KAMCO and KDIC constitute most of these government guarantees.

Beginning in 1999, the Korean government made consistent efforts to contain the expenditure growth (see Figures 1, 2, and 3). Aided by the dramatic rebound of the economy (see Figure 4) and the rapid growth in revenues, the budget recorded a surplus of 1.1 percent of GDP in 2000. It remained in surplus in following years.

On the other hand, the debt-to-GDP ratio kept rising despite surpluses since 2000. This anomaly is due to the fact that these surpluses came mostly from the National Pension Fund (NPF). The surplus in NPF was 2.6 percent of GDP in 2004. Most of the surpluses are used to buy assets in the financial market. These assets will be liquidated later to pay pension benefits to eligible retirees. When we exclude NPF from the consolidated budget, the government has consistently run budget deficits since 1989 except in 2002 (see Figure 6).

[Figure 6] Budget Balance Excluding the National Pension Fund
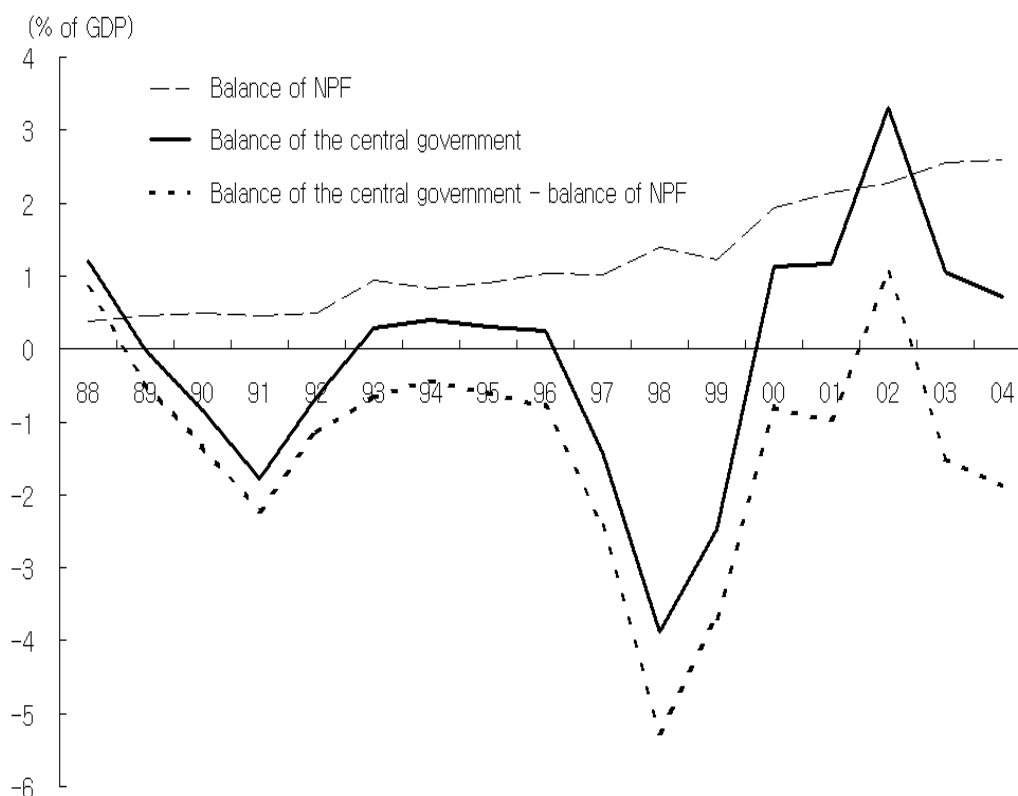
Source: Ministry of Finance and Economy.

III. Current State of the Public Finance

Financial Balance

As shown in Figure 6, the consolidated central government budget balance is over-stated due to the surpluses in NPF. To better assess the financial soundness of the government, we need to exclude NPF from the consolidated balance. There are two more factors to consider in addition to NPF in this regard. One is the net lending and the other is the repayment of restructuring bonds by the government.

The large amount of net lending has been a major factor behind large deficits in 1998 and 1999. In fact, the government lending activity has been quite extensive since the early days of government-led economic growth (see Figure 7). The official statistics shows that the default rate on government loans is close to 0 percent.[10] If this is true, loans do not reflect any deterioration of the government asset position, and we should disregard the net lending when assessing the financial health of the government.[11]

One exception is the government loans made to KDIC and KAMCO. In 2002, the government announced a plan to exempt KDIC and KAMCO from repaying the loans to the government. This decision essentially converted the loans into direct spending in the years they were made. The total amount exempted was 22 trillion won. We include these loans in the consolidated budget balances in the following discussion.

[Figure 7] Central Government Loans
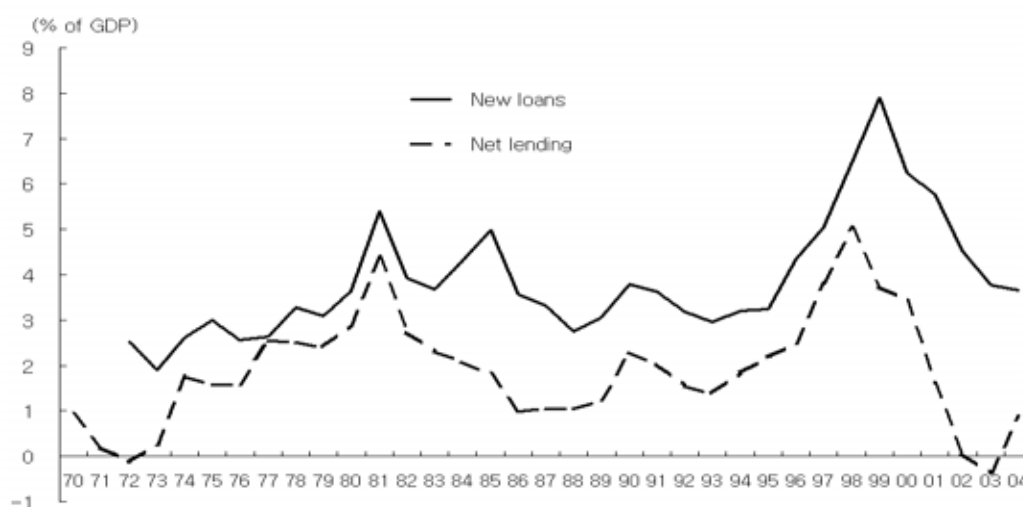
Source: Ministry of Finance and Economy.

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[10] Many people believe that the actual default rate is higher. After all, the government has frequently introduced rescheduling programs for agricultural loans.

[11] To be precise, the subsidy cost of loans emerging from the disparity between market interest rates and concessional lending rates should be included in government expenditures. With no reliable estimates on the subsidy cost, however, I decided to simply ignore it.

In addition to the loan cancellation, the government is sharing with KDIC and KAMCO the obligation on restructuring bonds. The government estimated that the irretrievable loss incurred during financial sector restructuring would amount to 69 trillion won. The government announced that it would take up a total of 49 trillion won of restructuring bonds, repaying their interest and principal. In 2003, 13 trillion won was spent on transforming part of these bonds into government bonds. The figure for 2004-2006 is 12 trillion won each year. But these expenditures mirror the results of past restructuring activities and do not signal a sudden decline in the financial health of the government in 2003-2006. We therefore exclude these expenditures from the consolidated balance.[12]

Table 1 shows the results of these adjustments. The adjusted balance is larger than the consolidated balance in 1998-2000 and smaller in 2001-2005. For example, in 2004, the balance declines from 5.6 trillion (0.7 percent of GDP) to –1.1 trillion won (-0.2 percent of GDP) after the adjustment. But they have been ±0.5 percent of GDP since 2001, and we can still say that the financial soundness of the government is not a very serious problem at this stage.

<Table 1> Consolidated Budget Balance and Its Adjustment

(Trillion won, %)

	1998	1999	2000	2001	2002	2003	2004	2005
Consolidated balance	-18.8	-13.1	6.5	7.3	22.7	7.6	5.6	5.6
(% of GDP)	(-3.9)	(-2.5)	(1.1)	(1.2)	(3.3)	(1.1)	(0.7)	(0.7)
NPF balance	6.7	6.5	11.2	13.3	15.6	18.5	20.2	24.4
(% of GDP)	(1.4)	(1.2)	(1.9)	(2.1)	(2.3)	(2.6)	(2.6)	(2.9)
Net lending	24.4	19.8	19.8	10.1	0.4	-2.5	1.4	6.4
Loans to KDIC and KAMCO	1.3	4.0	5.6	6.0	5.3			
Assumption of restructuring bonds						13.0	12.0	12.0
Adjusted balance	-2.4	-3.8	9.6	-2.0	2.2	-0.4	- 1.1	0.3
(% of GDP)	(-0.5)	(-0.7)	(1.7)	(-0.3)	(0.3)	(-0.1)	(-0.2)	(0.0)

Note: 1) The figures for 2005 are based on budget.

　　　 2) Adjusted balance = consolidated balance – NPF balance + net lending – loans to KDIC and
　　　　 KAMCO + assumption of restructuring bonds.

Government Liabilities

Another indicator for the soundness of public finance is government liabilities. The debt to GDP ratio amounted to 25 percent at the end of 2004 (see Figure 5). When

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[12] Ideally, we would include these expenditures in the consolidated balance in those years when restructuring bonds were issued.

government guarantees are included, it rises to 34 percent. The transformation of restructuring bonds is reducing the amount of guarantees at the expense of direct liabilities. But with the "adjusted balance" remaining close to zero, the total public burden including direct liabilities and guarantees is stabilizing at 33-34 percent of GDP. If an appropriate amount of control is exercised on the expenditure growth, the total burden will remain at the current level in the coming years.

The Size of Government Expenditure

Of course, it is not certain at all whether we would be able to contain successfully the growth of expenditure. Figure 8 shows the consolidated central government expenditure and the adjusted expenditure. Here the adjustment was made in the same way as in Table 1 (subtracting the NPF expenditure and the repayment of restructuring bonds and adding back the loans to KDIC and KAMCO). The consolidated expenditure has been increasing rapidly since the mid-1990s. Unless conscious efforts are made to contain it, the increased expenditure is more than likely to produce persistent deficits and rising government liabilities in the future.

[Figure 8] Adjusted Revenue and Expenditure

Source: Ministry of Finance and Economy.

Of particular importance are the public pension schemes such as the National Pension Scheme (NPS), the Government Employees' Pension Scheme (GPES), the Private School Teachers' Pension Scheme (PSTPS), and the Military Personnel Pension Scheme (MPPS). These pension schemes share one common feature; i.e., too generous benefits in relation

to contributions. With rapidly aging population, this imbalance has produced and will continue to produce devastating effect on their finance.

MPPS has been in deficits over 10 years and requires government supports of about 1 trillion won each year. GPES entered into deficit in 2001, and the deficit is expected to grow exponentially in coming years. PSTPS has basically the same problem but will experience difficulties in later years. NPS, with its huge coverage, can become a major drain on government budget.

In addition to pensions, health spending will increase rapidly with the aging population. According to a projection by the Korea Institute of Public Finance, the age-related spending will rise form 5 percent of GDP in 2004 to 25-30 percent in 2070 (see Figure 9).

[Figure 9] Projected Age-Related Spending

Source: Korea Institute of Public Finance (2005).

Increased spending on pensions will drive up the total size of government expenditure. Table 2 compares the general government spending across six countries including Korea. In 2000, the spending to GDP ratio was 23.0 percent in Korea and ranged between 30 and 50 percent in other countries. But when income transfers are excluded, the ratio declines to 19.4 percent in Korea and 20-30 percent in other countries. In particular, the U.S has a lower ratio than Korea. With the increase in age-related expenditures in Korea, the gap between Korea and other countries will diminish in the future.[13]

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[13] It is interesting to note in Table 2 the relatively small size of government consumption in Korea. It stands at 10.1 percent of GDP. This seems mainly due to the small size of public employment in Korea. On the

<Table 2> General Government Expenditures

(% of GDP)

	U.S	Japan	Germany	France	U.K	Korea
Consumption	15.1	16.8	19.0	23.3	19.4	10.1
Net capital outlays	0.9	6.0	3.0	3.3	2.2	8.3
Income transfers	13.7	10.0	18.9	17.8	13.7	3.6
Subsidies	0.5	0.9	1.6	1.2	0.5	0.3
Interest payments	3.4	3.3	3.3	3.2	2.4	0.7
Total	31.2	37.0	45.7	48.8	38.2	23.0
(Excluding income transfers)	(17.5)	(27.0)	(26.8)	(31.0)	(24.5)	(19.4)

Note: The data for Japan and Korea refer to year 2000. Others refer to year 2001.

Source: OECD, *OECD Economic Surveys: Korea*, Volume 2003/5-March.

Containing the expenditure growth is critical in attaining fiscal sustainability. Rising government expenditures not only damage the long-term stability of pubic finance but also pose a direct threat to the efficient functioning of the economy. Containing the total size of government expenditure will gain greater importance in the future with the decline in growth potential of the Korean economy. Han and others (2002) forecasts the potential income to grow at a much slower rate in coming years (see Table 3). Its growth rate has declined from 7.7 percent in the 1970s to 5.6 percent in the 1990s, and will decline further to 5.1 percent in 2000-05 and to 4.2 percent in 2005-10, primarily due to the slower growth of labor force. In fact, the total population is expected to shrink in absolute number in around 2030.

<Table 3> Forecasts of National Income

(%)

	1963-70	1970-79	1979-90	1990-00	2000-05	2005-10
Growth in national income	8.94	7.67	7.29	5.61	5.14	4.17
Contributions from						
Inputs	4.35	4.23	4.80	3.00	2.85	2.06
Labor	3.67	3.06	2.90	1.60	1.28	0.89
Workers	3.44	2.90	2.39	1.28	1.21	0.82
Capital	0.68	1.17	1.90	1.40	1.57	1.17
Total factor productivity	4.59	3.44	2.49	2.61	2.29	2.11

Source: Han and others (2002).

other hand, government investment as a percentage of GDP is larger in Korea than in other countries except Japan.

The slower economic growth will imply a slower growth in tax revenue. Expanding government expenditures at the same rate as in previous years is likely to produce persistent deficits, accelerate the decline in national saving, hamper the fixed capital formation, and further reduce the growth potential.

Functional Classification of Expenditures

Government expenditures can be classified in various ways. Table 4 shows the functional classification of the central government expenditure and net lending in Korea. Defense spending declined rapidly in the 1980s and 1990s and now corresponds to 11.4 percent of total spending and 2.5 percent of GDP. Education has traditionally taken up a large share (15-17 percent) in total spending, but an even larger share has been given to economic affairs (20-28 percent). Among the economic affairs, agriculture and transportation have been the major items of spending. On the other hand, health and social protection have received relatively less attention in budgetary spending though the latter is increasing rapidly in recent years.

<Table 4> Central Government Expenditure and Net Lending

	% of GDP					% of total spending				
	1970	1980	1990	2000	2003	1970	1980	1990	2000	2003
General public services	3.9	0.8	0.7	1.1	1.4	23.1	4.0	4.2	5.2	6.7
Defense	3.8	6.1	3.6	2.5	2.5	22.7	30.6	20.0	11.4	11.4
Public order and safety	0.0	0.9	0.8	1.0	1.1	0.0	4.6	4.3	4.6	5.3
Education	2.8	2.9	3.0	3.3	3.3	16.7	14.6	17.0	15.3	15.0
Health	0.2	0.2	0.3	0.2	0.1	1.3	1.0	1.7	0.7	0.4
Social protection	0.8	1.1	1.4	3.3	2.9	4.9	5.7	8.1	15.3	13.5
Housing and Community Amenities	0.0	0.5	1.8	1.2	1.1	0.3	2.5	10.1	5.3	5.0
Recreation, culture, and religion	0.2	0.1	0.1	0.2	0.3	1.4	0.7	0.5	0.8	1.2
Economic affairs	4.6	5.1	3.6	5.5	6.2	27.4	26.0	20.4	25.2	28.7
Fuel and energy	0.6	0.4	0.1	0.1	0.4	3.8	2.1	0.6	0.7	1.8
Agriculture, forestry, fishing, and hunting	1.9	1.2	1.8	1.4	1.4	11.2	5.9	10.2	6.2	6.7
Mining, manufacturing, and construction	-0.5	1.5	0.4	0.6	1.0	-3.0	7.4	2.0	2.6	4.5
Transportation and Communication	1.3	1.3	1.1	2.2	2.0	7.9	6.7	6.1	9.9	9.3
Other economic affairs	1.3	0.8	0.2	1.3	1.4	7.5	3.9	1.4	5.8	6.5
Other expenditures	0.4	2.1	2.4	3.5	2.8	2.2	10.4	13.7	16.2	12.8
Total	17.0	19.8	17.8	21.9	21.7	100.0	100.0	100.0	100.0	100.0

Source: Ministry of Finance and Economy.

The concentration of expenditures on economic affairs may reflect the less-developed-country status of Korea. Perhaps we still need large investment in roads, ports, and railways. Perhaps we still need to provide large government loans to the agricultural, manufacturing, and construction sectors because the financial market is not yet fully developed. But there are strong doubts about these assumptions.

First, the rapid increase in expenditure on social infrastructure during the 1990s need not be sustained in the future. Many (but certainly not all) experts in this area agree that, with the ever-stringent budget constraint and the completion of major road-building programs, it is time to reorganize the overall investment strategy. In particular, we should pay more attention to the demand-management (through increased user-charging) and the proper maintenance of existing stocks of infrastructure.

Second, the Korean financial market has undergone a rapid change since the 1980s and especially after the economic crisis. Banks are rapidly expanding their credits to households and small and medium-sized enterprises, and large corporations are turning ever more to capital (stock and bond) markets. The government appears to be playing a substitutive, rather than complementary, role to commercial banks in many cases. It is now generally believed that the government should reduce its role as a provider of financial resources for private enterprises. The reduced government role in this area will not only help restrain the growth of public expenditure but also promote the private financial market and reduce the distortion in resource allocation.

On the other hand, the government should increase its effort in the provision of basic public service such as public security, fire-fighting, judicial services, promotion of competitive business practices, prudential regulation of financial institutions, statistical services, environmental protection, etc. These services do not produce immediate benefits that the government can show off to the public, but they are vital in long-term economic growth and social development. Unfortunately, their importance has been generally understated to this day in Korea. For example, competition policy is still at its early stage of development. Statistical services also need to be improved; the government has deployed a lot of policy measures to mitigate regional disparities, but there do not even exist reliable data on gross regional product.

At the same time, more efforts are needed to reduce the outstanding stock of government loans. Figure 10 shows that in the post-crisis period, government loans grew by about the same amount as government liabilities. That is, the government issued bonds and other debt instruments and used the proceeds to make loans. The trend was reversed in recent years, but the outstanding stock of loans still stood at 13 percent of GDP at the end of 2004.

Government loans typically have maturity of 5 to 10 years while most of government bonds have maturity of less than 5 years. The interest rates on loans are lower than those on government bonds. Such difference in interest rates on loans extended over long periods will impose financial burden on the government in later years.

[Figure 10] Government Assets and Liabilities

Sources: Ministry of Finance and Economy.

IV. Institutional Setup and Reform Efforts

The Structure of the Budget

1) General Accounts, Special Accounts, and Funds

The budget of the central government as voted on in the National Assembly is comprised of one general account and various special accounts. There were a total of 23 special accounts in the fiscal year 2005 budget (see Table 5). Sources of funding for the general account are general-purpose (not ear-marked) taxes and non-tax revenues. Many special accounts have their own special ear-marked taxes or quasi-taxes (i.e., fees, charges, and other mandatory contributions). Transfers from the general account also take up a large portion of resources for special accounts.

<Table 5> Special Accounts

Name	Name
Fiscal Financing	Environmental Reconstruction
National Property Management	National Medical Center Management
Agriculture and Fisheries Structural Adjustment	Land Management and Balanced Regional Development
Rural Development Tax Management	Postal Insurance Service
Transportation Facilities	Automobile Traffic Management
Registration	Patent Management
Management of Funds Transferred to Local Governments	Balanced National Development
	Grain Management
Prison Operation	Agency
Military Personnel Pension	National Railroad
Management of Funds Transferred to Local Educational Agencies	Communication Service
	Government Procurement
Energy and Resources	

On a consolidated basis, the central government budget includes, in addition to the general and special accounts, numerous funds. There were 57 funds in 2005 including the National Pension Fund, the Employment Insurance Fund, and the Foreign Exchange Stabilization Fund. These funds were established much like special accounts to achieve specific policy objectives, and many of them have their own revenue sources including quasi-taxes.[14]

The difference between the funds and the general and special accounts lies in the managerial flexibility allowed in the former. Ministries can freely change fund expenditures within 30 percent of the planned amount without notice to the budget authorities and the National Assembly (see Table 6). The line items in the operational plans of funds are much less detailed than those in the general and special accounts. Their cash flows are managed independently by line ministries and do not pass through the treasury single account held in the Bank of Korea.

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[14] There were 101 quasi-taxes for special accounts and funds at the end of 2001 and their total revenue was estimated to be around 1 percent of GDP (OECD, 2003).

<Table 6> Characteristics of the General Account, Special Accounts, and Funds

	General Account	Special Accounts	Funds
Objective	Supporting general fiscal activities.	Supporting specific programs.	Same as S/A.
Revenues	General-purpose taxes and non-tax revenues	Ear-marked taxes, mandatory contributions, transfers from other accounts and funds, etc.	Mandatory contributions, transfers from other accounts and funds, etc.
Expenditures	Unrequited expenditures.	Unrequited expenditures and loans	Unrequited expenditures and loans
Linkages Between revenues and expenditures	None.	Clear linkages.	Same as S/A.
Authorization and execution of expenditure plans	Voted on in the National Assembly. Controlled and monitored during execution as mandated by the Constitution.	Same as G/A.	Same as G/A but larger flexibility guaranteed in Implementation.[1]

Note: 1) Ministries can change fund expenditures within 30 percent of the planned amount without notice to the budget authorities and the National Assembly. Cash flows are managed independently by the ministries in charge and do not go through the treasury single account held in the Bank of Korea. Unlimited carry-overs of unused cash are allowed.

The general account, special accounts, and funds form the consolidated central government budget (see Figure 11). The share of general account in the total consolidated expenditure and net lending stood at 55 percent in 2004, and those for special accounts and funds at 16 percent and 29 percent, respectively.[15]

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[15] The U.S. federal government also has a large number of trust funds, special funds, and public enterprise funds in addition to the general fund (U.S. GAO, 2001). In 1999, the spending of the funds other than the general fund corresponded to around 55 percent of total federal spending. But most of them (33 out of 55 percent) represented "long-term commitments" such as social security. In case of Korea, "long-term commitments" occupy only about 10 percent of total spending.

[Figure 11] Expenditure and Net Lending by Accounts and Funds

Source: Ministry of Finance and Economy.

2) Drawbacks

The highly complex structure of the budget has been criticized in many aspects.[16] First, it limits the ability of the budget authorities to centralize all national resources and then allocate them based on national priority. As mentioned above, special accounts and various funds have their own sources of revenue, which are not easily transferable to the general account or any other special accounts and funds in response to changing circumstances. This compartmentalization and fragmentation of resources reduces the allocative efficiency of the budget.

Second, fiscal transparency and program efficiency are also undermined by the complicated budget structure. Various accounts and funds are intricately interrelated with each other through complicated flow of grants and loans. It is difficult to see how much funding is being allocated to various spending areas. The functional classification of spending is not reported for the consolidated budget, and it is reported only for the previous year's outturns with a considerable time-lag of more than a year. We can find many programs with similar policy objectives and tools but under different accounts and funds. Consolidating similar programs would contribute to greater allocative and technical efficiency with increased value-for-money.

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[16] There is much similarity between the Korean and the Japanese budget system. See Bayoumi (1998) for the Japanese system.

3) Government Efforts

The government is making efforts to strengthen transparency and accountability and simplify the budget structure. The most important change occurred with the revision of the Fund Management Act and the National Assembly Act in 2001. Previously, there had been two types of funds – "public funds" and "other funds." The operational plans of "public funds" had been prepared by responsible ministries and reported to the National Assembly but had not required the latter's approval. Those of "other funds" had not been even reported to the National Assembly. In this sense, public and other funds had been off-budget accounts.

In 2001, they were regrouped into "funds" and "financial funds." "Funds" include all of previous "public funds" and some of "other funds." The operational plans of "funds" require the approval by the National Assembly and their financial reports are submitted to the latter, just like the general account and special accounts. That is, "funds" are on-budget items. [17] In 2004, further changes were made to move "financial funds" from off-budget to on-budget and subject them to the same degree of control by the National Assembly.

The government also introduced a review process in the Fund Management Act to abolish obsolete funds and consolidate those with similar objectives. The first such review was conducted in 2004 and subsequent reviews are scheduled every three years in the future.[18] In addition, a separate, *ad hoc* review was conducted on special accounts in 2004. The results of these two reviews were presented to the president in May 2005 in a combined report and received his approval. To implement the recommendations of the report, the government needs to have various laws revised in the National Assembly that provide legal bases for individual special accounts and funds. It remains to be seen how many of the recommendations will survive the opposition from diverse interest groups and succeed in the revision of relevant laws.

The past experience offers not a very good prospect. The number of funds had been declining from 114 in 1994 to 53 in 2002 but since then has stayed at around 55 (see Table 7) despite the government's effort to reduce the number further. A few special accounts were originally to be closed down in specific years (in 2003 in case of the Transportation and the Registration Special Accounts and in 2004 in case of the Rural Development Tax Management Special Account). But the subsequent revisions of the relevant laws, mostly to accommodate the desire of interest groups, have guaranteed their life up to this day.[19]

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[17] This change in typology produced discontinuity in the time series of fiscal data. Before 2001, the consolidated spending and revenue included "public funds" and excluded "other funds." After 2001, they include "funds" and exclude "financial funds." As a result, several important funds such as the Teachers' Pension Fund are now included in the consolidated financial statistics. But no attempt has been made to revise previous data to eliminate discontinuity.

[18] These reviews are called "Retention Reviews." Apart from the Retention Review, the government has also been conducting annual "Management Reviews" since 1999. Management Reviews look at the operational efficiency of funds, including the adequacy of their asset management practices.

[19] One favorable development is a series of new initiatives that are recently being introduced; the medium-term expenditure framework, top-down budgeting, performance management, and program budgeting. These initiatives are expected to reduce the line ministries' incentives to secure funding through special accounts and funds and to help the MPB in improving the allocative and operational efficiency of spending. More will be discussed below on individual initiatives.

<Table 7> Number of Funds[1)]

	'94	'95	'96	'97	'98	'99	'00	'01	'02	'03	'04	'05
At the start of the year	114	106	99	76	75	76	75	61	53	57		
Established during the year	6	4	4	3	3	2	2	0	7	1		
Closed during the year	-14	-11	-27	-4	-2	-3	-16	-8	-3			
At the end of the year	106	99	76	75	76	75	61	53	57			57

Note: Includes public and other funds before 2002 and funds and financial funds since then.
Source: Ministry of Planning and Budget.

Major Players and the Fiscal Discipline

1) Major Players

Major players in the budget process include the Ministry of Planning and Budget (MPB), the Ministry of Finance and Economy (MOFE), and the Board of Audit and Inspection (BAI) (See Table 8). The MPB is responsible for preparing the draft budget with the help of the Tax and Customs Office in the MOFE that provides revenue forecasts. When the budget is authorized by the National Assembly, the MPB prepares the quarterly budget implementation plan usually within a month and allocates funds to line ministries. The Treasury Bureau of the MOFE then prepares the monthly cash plan and releases cash to line ministries. The Treasury Bureau keeps track of cash flows into and from the treasury single account held in the Bank of Korea. It is also responsible for issuing government bonds and managing government assets and liabilities.

An important issue concerning the interplay among various players is that of fiscal discipline. The budget process in Korea has generally taken a highly centralized, strategic dominance-based approach in the terminology of von Hagen and Harden (1996). They distinguish between two approaches in budgeting. Under a target-based approach, the government collectively negotiates a set of binding, numerical targets for the budget. The budget process starts with negotiations among concerned parties over binding limits on the spending total or budget deficits. Once these limits have been agreed upon, they must be observed during the remainder of the budget process. On the other hand, under a strategic dominance-based approach, the budget process vests the budget authorities with special strategic powers. Often the main budgeting decisions are made in bilateral negotiations between the budget authorities and spending ministries.

2) The 1970s and 1980s

In the 1970s and 1980s, the Economic Planning Board (EPB) played a central role in budgeting as well as in preparing and implementing economic development plans. The EPB was the leading ministry within government, as reflected in the title of the head of the EPB as deputy prime minister. Negotiations over spending bids were conducted bilaterally between the deputy prime minister and spending ministers. Little

reconciliation occurred in the cabinet regarding the draft budget prepared by the deputy prime minister.

<Table 8> Major Players in Korea's Budget Process

Players	Roles
Ministry of Planning and Budget (MPB)	• Compiles budget bids and prepares the draft budget. • Allocates funds to spending ministries (apportionment). • Approves the transfers of funds between line items (virements).
Treasury Bureau of the Ministry of Finance and Economy (MOFE)	• Releases cash to spending ministries. • Manages the treasury single account held in the Bank of Korea. • Issues treasury bonds and manages assets and liabilities. • Collects ministerial financial reports, prepares the whole-of-government financial reports, and sends them to the BAI • Produces the government financial statistics.
Tax and Customs Office of the MOFE	• In charge of tax policy • Prepares revenue forecasts. • Oversees the National Tax Service and the Customs Service.
Ministry of Government Administration and Home Affairs (MOGAHA)	• In charge of local government tax and spending polices. • Allocates the Local Shared Taxes (a formula-based block grant to local governments) across local governments. • Coordinates the central government subsidies to local governments. • Approves the borrowing of individual local governments.
Board of Audit and Inspection (BAI)	• The supreme audit institution in Korea, whose head is nominated by and reports to the president. The National Assembly can also request audits on specific issues to the BAI. • Prepares and tables the financial report to the National Assembly. • Checks the regularity of ministerial activities.
National Assembly	• Deliberates and votes on the budget. • Approves the transfers of funds between programs. • Reviews and approves audit reports.
Spending ministries	• Execute the budget and prepare financial reports.

   The authoritarian nature of previous governments also limited the role of the National Assembly in the deliberation of draft budget. The National Assembly has been traditionally dominated by the party of the president. Insofar as the government had already consulted the ruling party before presenting the draft budget to the National Assembly, amendments typically entailed minor changes in the budget (see Figure 12). In addition, the Constitution prohibits the National Assembly from increasing the total spending or introducing new spending items unless agreed on by the government.

[Figure 12] Budget Amendments

Source: Ministry of Planning and Budget.

   The EPB also exercised tight control on expenditures in the implementation stage. Ministries were required to get spending authorization each quarter during the fiscal year. The EPB could postpone or block part of the expenditures (those classified as "discretionary allocation items") when deemed necessary. All limits on expenditures were imposed in cash terms. Transfers across appropriation accounts ("virements") were prohibited unless authorized by the National Assembly or by the EPB. In addition, supplementary budgets were normally introduced only once a year.
   The Treasury Bureau of the MOFE also had a tight grip on cash outflow. All cash disbursements were made strictly within the limits set in the monthly cash plans. Before the crisis of 1997, it was not uncommon for them to delay disbursements to line ministries when there was not enough money left in the treasury single account due to the seasonality in tax collection. This was in spite of the fact that they could issue short-term debt instruments within the limit set by the National Assembly to fill the gap between tax collection and cash needs. In addition, the revenue forecasts made by the Tax and

Customs Office were often very conservative with the actual tax collection overshooting the forecast by substantial margins.

3) The 1990s and after

Most of these characteristics carried over until recently. In the early 1990s, the EPB and the Ministry of Finance were merged into the Ministry of Finance and Economy (MOFE), and the deputy prime minister-ship was handed over to the head of MOFE. The latter exercised the same degree of centralizing power in budgeting as the head of the EPB (see Figure 13).

[Figure 13] Organizational Change in the Budgeting Function

Economic Planning Board (EPB)		Ministry of Planning and Budget (MPB)
	Ministry of Finance and Economy (MOFE)	
Ministry of Finance (MOF)		Ministry of Finance and Economy (MOFE)
(1970s and 1980s)	(Early 1990s)	(Late 1990s to this day)

But the recent reorganization in government resulted in a subtle change in the budget process. The budgeting function was separated from the MOFE and moved to the MPB. Previously, the EPB and then the MOFE had the formal role in setting the overall agenda for government policy and coordinating conflicting priorities among ministries. After the reorganization, the coordination role together with the prime minister-ship is kept in the MOFE, and the MPB is now devoid of such functions. All these factors can act to reduce the centralizing power of the MPB. In addition, the balance of power between the executive branch and the legislature is tipping toward the latter with the democratization of Korean politics.

4) Assessment

There is not yet a visible sign that these changes have weakened the centralizing power of the MPB and the fiscal discipline substantially. But the risk is increasing, as illustrated for example in the increasing number of supplementary budgets introduced during a year after the crisis (see Figure 14). In most cases, the supplementary budgets were intended to stimulate the economy. We would be better off with a new system of expenditure management that can cope with such a risk.

[Figure 14] Number of Supplementary Budgets Introduced

Source: Ministry of Planning and Budget.

We also observe some changes in the cash management practices and revenue forecasts in the post-crisis period. Pressured to stimulate the economy, and in particular to back up the front-loading[20] of annual spending that has been popular since 1999, the MOFE is resorting more and more to short-term debt instruments to fill the gap between tax collection and cash needs. The downward bias in revenue forecasts is also being reduced. In 2004, we actually had a large shortfall in tax collection, which was partly blamed on an overly optimistic assumption on the economic growth, which was in turn claimed by some to have been politically motivated.

The Budget Process

1) Before the Introduction of the MTEF

The budget process in the Korean central government is undergoing a significant change in recent years. The government introduced a medium-term expenditure framework (MTEF) together with a top-down budgeting in 2004 for fiscal year 2005.[21] The budget process before the change is summarized in Table 8.

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[20] In front-loading exercises, the MPB would allocate more funds than usual to the first half of the year, and urge line ministries to spend the allocated funds as early as possible. When necessary, that is when the growth is slower than expected despite front-loading, the MPB would consider introducing supplementary in the latter half of the year.

[21] Potter and Diamond (1999), Schiavo-Campo and Tommasi (1999), and World Bank (1998) provide a

The recent reform was intended to address several defects found in the previous budgeting practice. First, prior to the introduction of the MTEF, budgeting was centered on the next single budget year, lacking a medium-term perspective. The MPB and the National Assembly gave little consideration to the out-years beyond the budget year. Line ministries had little information on how much resource would be available to them in the future, and their medium- to long-term planning function was severely limited.

As a result, it was difficult for line ministries to plan ahead and rationalize their spending. Limited planning function in turn reduced the effectiveness and efficiency of overall public spending. It was also difficult for the MPB to identify and cope with the trend increase in spending. Without a long-term view on the appropriate level of tax burden, it induced an ever-increasing expenditure to accommodate rising demands from various sectors. It also fostered gradualism in budgeting and hindered a strategic reprioritization of spending precisely when the strengthened control on the aggregate expenditure generated greater necessity for flexible reprioritization.

<Table 8> Key Steps of the Budget Process before the Introduction of the MTEF

Month	Action
January	• The fiscal year starts on January 1st.
March	• The Ministry of Planning and Budget (MPB) sends the Guide to Budget Compilation to spending ministries.
May	• Ministries send budget bids to the MPB by the end of May.
June-July	• The MPB compiles the budget bids and prepares a preliminary budget proposal.
August-September	• The MPB goes through bilateral negotiations with spending ministries between mid-August and mid-September. • The MPB discusses the budget proposal with the ruling party.
October	• Authorized by the cabinet and the president, the draft budget is sent to the National Assembly by October 2nd. • In mid-October, the Committee on Budget and Accounts begins deliberation on the draft budget. Ministers are typically requested to testify at committee meetings. Meetings are normally open to the public.
December	• The draft budget is modified and approved by the Committee on Budget and Accounts and then by the National Assembly by December 2nd.

In addition, the counter-cyclical role of fiscal policy could be constrained when the attention was focused on a single year. The principle of "balanced budget in each year" had the potential to produce a pro-cyclical fluctuation in spending as illustrated in panel (a) of Figure 15. The so-called "automatic stabilizer" can be strengthened when spending

useful guide on the reform in this direction.

increases at a close-to-constant rate and the balanced budget is pursued over the medium term as in panel (b).

[Figure 15] Counter-cyclical Management of Spending

Second, before the introduction of the top-down process, budgeting relied excessively on a bottom-up approach. At the initial stage of budget preparation, the MPB made rough estimates of the total size and the sectoral allocation of the next year's budget. But the estimates were not transmitted to line ministries and therefore could not guide line ministries in preparing their budget requests. When reviewing their budget requests, the MPB focused on the microscopic spending control of individual programs. The sectoral allocation and the total size of the budget were determined at the last stage of budget preparation by aggregating the expenditures on individual programs.

As a result, the control of inputs assumed the major importance in budget discussions and little attention was paid to outputs or outcomes. Absorbed in details, the MPB had little scope to review and analyze policies, and the linkage between budgeting and policy-making was very weak. The budget negotiation between the MPB and line ministries was very time- and energy-consuming process for both parties. The accountability and autonomy of line ministries in preparing and managing their budget was also severely limited. Line ministries usually requested unrealistically large amount of budget, and massive cuts were inevitable.

A third characteristic of the previous budgeting practice was the central stage accorded to the general account. The MPB spent most of its time on reviewing and preparing the budget of the general account and paid less attention to special Accounts and funds.

The previous approach had certain merits. The budget authorities had large discretion over the annual spending and used the power to contain the expenditure growth and adjust the spending to changing revenue conditions. To some degree, such short-termism was inevitable in Korea where the socio-economic environment changes quite rapidly and unexpectedly. In addition, by emphasizing the input control and the regularity of budget execution, the abuse or misuse of tax money could be minimized. But the growing

size and complexity of budget is making it more important for the MPB to deregulate the budgeting process, enhance autonomy and accountability of line ministries, and to focus on the strategic management of public finance.

2) After the Introduction of the MTEF

With the introduction of the MTEF and the top-down budgeting, all these are changing. Now the annual budgeting exercise is preceded by a discussion on fiscal management over five years including the current year, the budget year, and three out-years. Following this discussion, the MPB transmits spending ceilings for sectors and programs to line ministries.[22] These ceilings encompass the general and special accounts and funds. Line ministries are asked to prepare their budget requests within these ceilings. When reviewing the ministerial budget requests, the MPB places less emphasis on the microscopic control of line items and more on the strategic alignment of budget requests with overall policy directions.

Key steps of the new budget process are explained in Table 9. The budget cycle starts in January, earlier than in previous years. The workload of budget examiners are accordingly spread out over a year rather than concentrated in July and August. This is deemed another merit of the new system.

The new system is already producing tangible results. In fiscal year 2005, the budget requests by line ministries represented an increase of 11.7 percent over the previous year's budget, much smaller than 30.8 percent for fiscal year 2004. Line ministries also voluntarily shuffled a larger portion of their spending across programs, cutting back 2.7 trillion won on existing ones and introducing new ones worth 3.0 trillion won. The corresponding figures for fiscal year 2004 were 1.6 and 1.5 trillion won, respectively.

<Table 9> Key Steps of the Budget Process after the Introduction of the MTEF

Month	Action
December	• The MPB sends to line ministries standard assumptions on macro-variables such as inflation, interest rates, exchange rates, etc. • Sectoral task forces are organized. They are composed of external experts and government officials from the MPB and relevant ministries.
January-April	• Line ministries submit to the MPB their spending needs for the next 5 years by the end of January. • Sectoral task forces discuss major policy issues and present their recommendations in a series of public hearings held in March and April. • By the end of April, the MPB prepares a draft National Fiscal Management Plan (NFMP) through discussions with line ministries. The draft NFMP contains major policy directions and fiscal aggregates (total spending, deficits, debts, etc.) for the next 5 years and tentative spending ceilings on sectors and programs for the budget year.

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[22] Ceilings are set for 14 spending areas such as social infrastructure, agriculture, education, and environment and then disaggregated into 56 programs. For example, social infrastructure has 7 programs, including roads, railways, subways, ports, airports, housing, and water resources. Separate ceilings are also set within each program for the general account and various special accounts and funds.

Cabinet meeting	• At the end of April, a cabinet meeting, chaired by the president, is held in a secluded place to discuss and finalize the ceilings. • Following the meeting, the ceilings are transmitted to line ministries in the Guide to Budget Preparation.
May-June	• Line ministries prepare their budget requests and send them to the MPB.
July-August	• The MPB prepares the draft budget. Less emphasis is placed on the microscopic control of line items and more on the strategic alignment of budget requests with overall policy directions.
August-December	• Goes through the same process as before the introduction of MTEF.

3) Rooms to Improve

There are of course rooms to improve. The first three points explained below concern the behavioral changes that are needed in the MPB and line ministries over the medium term. The next six points concern the changes in the budgetary system and MTEF that are called for immediately.

First, performance management in line ministries should be strengthened. In the discussion on policy directions and resource allocation across programs, performance information provides a valuable guide. There have been efforts in direction, but none of them have yet succeeded in instilling performance orientation in line ministries. Details on the current reform efforts will be given in the next subsection.

Second, the capacity for planning and prioritizing in line ministries should be enhanced. For example, line ministries should be required to publish long-term strategic plans, annual business plans, and annual performance reports as in other countries. And the planning and budget bureau of individual line ministries should now play a greater role in the coordination of ministerial policies and budget requests unlike in previous years when they would simply compile budget requests from program bureaus and send them to the MPB with little moderation.

Third, the role of the MPB should also be changed. As a central coordinator of government policies, the MPB strengthen its capacity for policy analysis and long-term forecasts. It should stress less on input control and pay more attention to outputs and outcomes. It should act as a consultant for line ministries to enhance their program performance and strive to build mutual trust in a collective action game.

Fourth, the medium-term targets in the MTEF should be clarified. Presently, it is not clear which variable the government is targeting at in the medium term; the budget balance, the total spending, or the debt-to-GDP ratio. An ideal strategy would be targeting at a balanced budget over the business cycle, given the low level of debt-to-GDP ratio in Korea. In this strategy, deficits are allowed in a period of lower-than-expected growths, and they are subsequently offset by surpluses in a period of higher-than-expected growths, holding down the accumulation of debt over the cycle. The debt-to-GDP ratio declines slowly as the GDP expands. Examples of this strategy can be found in the Growth and Stability Pact (GSP) of the European Economic and Monetary Union

(EMU), the "golden rule" of the British government, and the two-percent structural surplus rule of the Swedish government.[23]

Fifth, it is necessary to set out the annual operational targets that can guarantee the achievement of the medium-term targets. There are two types of operational targets commonly employed, namely *budget balance* and *total spending*. A prime example of the former is the three-percent deficit rule in the Maastricht treaty of the EMU. In contrast, the Swedish government imposes an expenditure ceiling on each of the three years ahead. The ceilings for the first two years coincide with those for the last two years determined in the previous year. The United Kingdom has adopted similar practices for expenditure control. The U.S. federal government experimented with both types of targets in the 1980s and 1990s (see Box).

Between these types of targets, total spending is a superior choice because (1) it is less influenced by the cyclical position of the economy and therefore easier to target; and (2) it assists in a counter-cyclical management of fiscal policy by leaving the balance to fluctuate over the cycle. Presently, the Korean government intends to keep the annual spending totals unchanged in successive NFMPs, and thus appears to have the total spending as annual targets. But this point needs to be clearly communicated to the public.[24]

Sixth, it is desirable to introduce various risk analyses in the National Fiscal Management Plan. Such analyses would address such issues as (1) the deviation of medium-term growth rates and other macroeconomic variables from the projected levels; (2) explicit and implicit contingent liabilities of the government coming from loan guarantees, public corporations, local governments, and others; and (3) population aging.

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[23] The GSP commits the member countries to achieve and maintain a budget position of close to balance or in surplus over the cycle. The golden rule allows the British government to borrow only to invest and not to fund current spending over the cycle. The current Swedish government is targeting at an average surplus of 2 percent of GDP over the cycle (Gustafsson, 2004).

[24] With a fixed total spending, it may be difficult to cope with an unexpected surge of spending needs, for example in times of economic hardship. An escape clause may be needed that is not too lax to undermine fiscal discipline nor too stringent to accommodate reasonable demands for increased spending.

<Box> Experience of the U.S. Federal Government on Deficit Control

The United States experimented with both types of annual operational targets explained in the text. In the 1980s, targets were set up for budget deficits. The Gramm-Rudman-Hollings Act of 1985 (GRH   ) stipulated deficit ceilings in nominal dollars for the next five years. The strategy, however, did not work. The actual deficits exceeded the stipulated ceilings in all years covered by GRH   . In 1987, GRH   was enacted and the deficit ceilings were adjusted upward to accommodate this reality. But it did not take long before GRH   also proved to be a failure.

In 1990, a new strategy was adopted with the enactment of the Budget Enforcement Act (BEA). Instead of setting limits on deficits, the congress introduced separate rules for discretionary spending and mandatory spending. On discretionary spending, cash limits were imposed for the next five years. Except in special circumstances, these limits were not to be breached. For mandatory spending (interest payments, social security benefits, etc.), which depend on exogenous variables such as interest rates and the number of the elderly, the so-called "pay-as-you-go (PAYGO)" system was introduced. In this system, any increase in deficits resulting from policy changes should be offset by corresponding changes in revenues or mandatory spending.

The new strategy worked well. It was renewed in 1993 and 1997. Actual spending on discretionary programs turned out to be larger than stipulated in the law every year except in 1996 (see Table 7). But the excess was always less than 1 percent of the stipulated amounts, and was mostly due to exceptional events such as the Gulf war and natural disasters.

Helped by the strong economy, the United States could attain budget surplus in 1999 for the first time since the mankind set foot on the moon. The unusually long period of boom in the 1990s increased revenues above and reduced the mandatory spending below the levels expected at the beginning. But it would be unfair to say that all surpluses were due to the strong economy. The rules introduced by BEA appear to have been quite effective in controlling expenditures and thereby reducing budget deficits.

First of all, these rules were aimed at controlling what could actually be controlled. Discretionary spending is by definition amenable to annual controls by the congress. Mandatory spending can also be controlled through the PAYGO rule by changing relevant laws. On the other hand, budget deficits are difficult to control because they are affected by the economic fluctuation as well as by the government policy. When a target cannot be directly controlled by the authorities in charge, it is difficult to hold them responsible for the results, and we cannot be sure that they will make their best effort to achieve the target.

<Table 7> Expenditures and revenues of the U. S. federal government

(billion dollars)

		1994	1995	1996	1997	1998
Total	BEA estimates	1,523	1,578	1,645	1,745	1,843
Spendings	Actuals	1,462	1,516	1,561	1,601	1,653
Discretionary	BEA limits	537	539	547	547	548
Spendings	Actuals	544	545	534	549	555
Mandatory	BEA estimates	765	795	843	920	996
Spendings	Actuals	715	738	785	809	855
Revenues	BEA estimates	1,230	1,306	1,379	1,440	1,523
	Actuals	1,259	1,352	1,453	1,579	1,723
Deficits	BEA estimates	-270	-230	-266	-305	-320
/Surpluses	Actuals	-203	-164	-107	-22	70

Source: OECD (1999).

Seventh, a mechanism for "baseline" projections should be strengthened. The MPB currently provides line ministries with standard assumptions on key macro-variables such as wage and price inflation. Based on these assumptions, line ministries project their spending needs for the next five years. But they should go further and distinguish between spending on existing programs ("baselines"), costs of new policy initiatives, and "savings options." The MPB would check the validity of ministerial projections and aggregate them to arrive at the government-wide baselines, costs of new policy initiatives, and savings options. Only then can the annual budgeting be closely linked with the National Fiscal Management Plan.

Eighth, a reconciliation process should be put in place to analyze the difference between projected revenue, spending, balance, and debt levels and the outturns. This is a critical step to secure accountability and transparency of macro-fiscal management. In case of the U.S. federal government, the deviation is decomposed into economic, policy, and technical factors.

Ninth, "program budgeting" needs to be introduced. The Korean government is currently redesigning the structure of its budget accounts around functions, administrations, and programs. The effort is spearheaded by the Budget and Accounting Reinvention Office (BARO).[25] The resulting program structure will make it easier to allocate resources according to the national priorities and set ceilings on sectoral spending. "Programs" will also act as the basic units of performance management in the future.

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[25] The BARO is a special task force organized in 2004 to lead reforms in the area of program budgeting, financial reports and government financial statistics, and the IT system. It is composed of secondees from various organizations including the MPB, MOFE, MOGAHA, and BAI.

Performance Management

1) Overview

As explained above, budgeting in Korea has traditionally been focused on the *ex ante* control of inputs. The authorities have little experience in performance management through such methods as performance monitoring and program evaluation. There is no established feedback mechanism that supplies performance information to those in charge of budget preparation and execution, which partly explains the continuation of some ineffective and inefficient programs.

Performance management becomes more important with the introduction of the MTEF and top-down approach in budgeting. These changes will allow greater autonomy to line ministries and can lead to greater inefficiency unless complemented with a new accountability system.

In recent years, diverse efforts have been made to strengthen performance management by the government. Some of them are listed in Table 10. Below, detailed explanation will be given on Performance Management System (PMS), Government Operations Assessment System (GOAS), and Self-Assessment of Spending Programs (SASP).

<Table 10> Diverse Initiatives for Performance Management

Performance Management Initiatives	Organizations in Charge
Performance Management System (PMS)	MPB
Government Operations Assessment System (GOAS)	Office of Government Policy Coordination (OGPC)
Management by Objectives (MBO)	MOGAHA
Performance Audit	BAI
Self-Assessment of Spending Programs (SASP)	MPB

2) Performance Management System (PMS)

The PMS is led by the MPB. Its design follows the framework in the Government Performance and Results Act (GPRA) of the U.S. federal government. It is based on the pilot project on performance budgeting carried out in 1999-2002.[26] It requires line ministries to (1) set up performance goals and indicators, (2) prepare annual performance plans and reports, and (3) submit them to the MPB at the start of the annual budget cycle.

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[26] In 2001, 39 organizations participated in the pilot. A survey of the pilot (Jun and others, 2002) found that over half of the indicators proposed in the performance reports were based on outputs and only one-fifth were based on outcomes. The rest were input indicators. And about two-thirds of the indicators were non-quantitative ones. The survey also found that many indicators change from one year to another, making it difficult to trace program performance consistently. It subsequently proposed the government to apply performance indicators only to major large-sized expenditure programs for which quantified indicators are easy to construct.

A major drawback of the PMS lies in the fact that it covers only part of ministerial activities. Those activities not involving large sums of expenditure (such as pure policy-making) are excluded from performance monitoring. Also, activities for which the benefits of performance monitoring are expected to be small (such as wages and salaries, "basic program" expenditures, and general administrative expenses) are excluded as well. This has the potential to lead line ministries to disregard those activities that are critical in achieving their overall mission but involve small expenditures or only wages and salaries, and to lose sight of the linkage between the mission, strategies, and performance goals.

The PMS, just like its pilot project, has not been very successful. There exists only a lukewarm support from the top management in the MPB. Line ministries are also showing little enthusiasm for the PMS. In most cases, performance indicators prepared by line ministries are not derived from ministerial missions in a systematic fashion. Most importantly, performance reports are not open to the public, giving little incentive for line ministries to think seriously about the exercise.

3) Government Operations Assessment System (GOAS)

The GOAS is led by the Office for Government Policy Coordination (OGPC). It aims to assess the performance and organizational capacity of ministries and citizen satisfaction with them. It is composed of the assessments of (1) the central government ministries, (2) local governments, (3) specific programs, etc. The assessment results are reported to the President in biannual cabinet meetings.

The GOAS has not been very successful either. Up to 2004, it did not require line ministries to set out a clear framework of mission and strategy. There was no systematic assessment of performance utilizing indicators, relying instead on subjective assessment by outside experts and in-house staff. In addition, there was no serious cooperation and coordination with the MPB.

An important change took place at the end of 2004. The OGPC now requires line ministries to establish performance indicators and announce target levels in annual business plans. Each ministry should report its annual business plan to the President in an open meeting held at the beginning of each year. From 2005 on, performance assessment by the OGPC will be based on these indicators.

After the introduction of new requirements, we observe a drastic change in the attitude of line ministries. They are making serious efforts to think through their missions and set out strategies and performance indicators. But the coordination with the MPB is still weak. And ministerial business plans are generally poor in content, lacking, for example, a systematic linkage between planning and budgeting.

4) Self-Assessment of Spending Programs (SASP)

The SASP is currently under preparation by the MPB. It is being designed after the Program Assessment Rating Tool (PART) of the U.S. federal government. It requires line ministries to assess their own programs with spending levels above a certain threshold. The assessment is supposed to cover all ministerial programs in a cycle of 3 years. According to a preliminary design, the assessment is based on 16 questions common for all types of programs and a few additional questions specific to different types of programs.[27] Table 11 shows the common questions asked.

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[27] Types of programs are infrastructure investment, procurement of large-scale facilities and equipment, provision of direct services, capital injection, subsidies to private entities, grants to local governments, and R&D.

Answers to the questions take the form of "yes (1)" or "no (0)." In case of the questions regarding the achievement of program objectives and the customer satisfaction, 4-scale answers (1.00, 0.67, 0.33, 0.00) should be given. A weight is assigned to each question and the overall assessment will be based on the weighted sum of the answers. Programs are then classified as "effective (85-100)," "moderately effective (70-84)," "adequate (50-69)," "not effective (0-50)," and "results not demonstrated." The MPB will review the results of ministerial self-assessments and take them into account when preparing annual draft budgets and the National Fiscal Management Plan.

<Table 11> Common Questions for the SASP

Areas	Common Questions
Program design	• Does the program have clear purposes and legal or other bases? • Can the government intervention be justified? • Is government spending necessary to achieve the objectives? • Is the program duplicative of other program? • Has the program been subjected to an objective feasibility study? • Is the proposed program design most cost-effective? • Are performance goals and indicators in place? • Do performance goals and indicators fully reflect program objectives? • Are the targets set at reasonable levels?
Program management	• Is the implementation regularly being monitored? • Is the program being implemented as planned? • Are efforts being made to reduce costs or increase efficiency?
Performance assessment and feedback	• Has an objective and comprehensive program evaluation been conducted? • Did the program achieve the intended objectives? • Are customers and stakeholders satisfied with the program performance? • Is the agency utilizing the assessment results for program improvement and budget planning?

5) Improvements Needed

There are several ways to improve the current efforts to strengthen performance management. First, the diverse initiatives should be consolidated into an integrated system of performance management as they produce inefficiency and overlapping responsibilities across various organizations (the MPB, OGPC, MOGAHA, and others). In this regard, a close cooperation between the OGPC and MPB looks essential, with the OGPC taking the lead and the MPB providing logistics.

Second, as in the case of MTEF, a sound system of planning and reporting should be established. It is a precondition for any type of good performance management. As a first step, we should consider requiring line ministries to prepare annual business plans and performance reports. The business plan would describe in detail the mission, the strategic and performance goals, the activities to attain the goals, and the associated resources. The performance report would review the performance results and discuss the future course of actions.

In the United States, federal agencies should prepare strategic plans, performance plans, and performance reports under the GPRA (Table 12). In Korea, line ministries are expected to prepare performance plans and reports under the PMS. More detailed requirements like those in GPRA would help enriching the plans and reports. The MPB can also compare them across different ministries and propose best practices. It can also rate their quality and publish the results on a web-site. Of course, line ministries should be given the freedom to determine the document formats and encouraged to experiment with different modes of presentation as long as they satisfy basic requirements.

<Table 12> Documents Required in GPRA

Documents	Requirements

Strategic plans	• Should cover not less than 5 years, and should be updated at least 3 years.
	• Must contain:
	  - A comprehensive mission statement for major functions and operations of the agency;
	  - General and outcome-related goals;
	  - A description of how the agency will achieve the goals and the operational process and resources required;
	  - A description of how the goals relate to annual performance plan goals;
	  - An identification of key factors external to, and beyond the control of, the agency that could significantly affect the achievement of goals; and
	  - A description of program evaluations, with a schedule for future program evaluations.

Performance plans	• Should cover each program activity in the agency's budget.
	• Must:
	  - Establish goals that define the level of performance to be achieved by a program activity;
	  - Express goals in an objective, quantifiable, and measurable form unless an alternative form is approved by OMB;
	  - Describe the operational processes and resources required to achieve goals;
	  - Establish performance indicators to be used in measuring or assessing the relevant outputs, service levels, and outcomes of each program activity;
	  - Provide a basis for comparing actual results with the established goals; and
	  - Describe the means to be used to verify and validate measured values.

Performance reports	• Should include actual program performance results for the 3 preceding fiscal years.
	• Must;
	  - Review how successfully performance goals were achieved;
	  - Evaluate the performance for the current year relative to the performance goals achieved during the fiscal year(s) covered by the reports;
	  - Where goals are not met, explain and describe (a) why the goals were not met, (b) plans and schedules for achieving the goals, and (c) if the goals are impractical or infeasible, why that is the case and what action is recommended;
	  - Describe the use and assess the effectiveness in achieving performance goals of any waiver under 31 U.S.C section 9703; and
	  - Include the summary findings of program evaluation completed during the fiscal year.

Source : GAO (1998).

Third, a greater emphasis on program evaluation is being called for. There is increasing awareness among many countries that performance monitoring and evaluation can provide complementary information on performance (Perrin (2002)). An effective performance management system requires both monitoring and evaluation. Evaluation has the potential to identify what actually has happened as a result of a program or initiative, whether planned or not, including unintended outcomes and effects that often may be more significant than the stated objectives. In particular, evaluation has the potential to identify why and how outcomes have come about. This is essential information in order to be able to attribute effects to program activities. It is also critical information in order to make decisions about future policies and programs, to assist in program improvement, and to be able to generalize what has happened from a single setting to elsewhere.

In a country like Korea which has little experience in evaluation, a formal strategy to introduce the evaluation practice seems desirable. The Australian Ministry of Finance, for example, imposed the following four requirements on line ministries (Mackay, 2003):

Every program should be evaluated every 3-5 years.

Each portfolio (i.e., comprising a line ministry plus other agencies) should prepare an annual portfolio evaluation plan, with a 3-5 year forward coverage, and submit it to the Department of Finance – these plans comprise major program evaluations with substantial resource or policy implications.

Ministers' new policy proposals should include a statement of proposed arrangements for future evaluations; and

Completed evaluation reports should normally published, unless there exist important policy sensitivity, national security, or commercial-in-confidence considerations, and the budget documents which ministries table in parliament each year should also report major devaluation findings.

This strategy had significant influence in spreading the evaluation practice among line ministries in subsequent years. MPB should consider adopting a similar strategy. In addition, attention should be paid to the accumulation of data, which is essential for good evaluation. As illustrated at the beginning of this paper, almost all sectors are in dire need of basic data. In particular, an income panel data set, none of which exists at the present, would provide a valuable basis to assess the various welfare programs that have been expanding rapidly in recent years.

Fourth, when a performance-orientation has been reasonably established in the government, a greater use of performance agreements can be encouraged. A minister and staff members would agree on a set of performance targets, review the progress, and discuss problems. Similar practices can be introduced between managers at all levels and their staff and between ministries and their agencies.

Under the current system in Korea, performance cannot significantly influence the annual salaries of individual employees. Salaries are determined in most part by the years of service and rank of the individual. But performance agreements do not require performance-based monetary rewards to be effective. They provide for "relational contracts" (Schick, 2003) and help enhance performance by spurring the parties to the contract to focus on results.

But it should be remembered that the introduction of performance agreements should be preceded by establishing a reasonably working performance management framework. Otherwise, they can generate rancor and lower the morale among the employees. It is important to build trust in the public sector in general and in the performance management system in particular before utilizing performance information for accountability purposes.

The Scope of the Government and the Financial Statistics

Complexity is not the only problem with the current budget system. Another problem is the limited scope of the government financial statistics. As explained above, the consolidated central government covers the general and special accounts and funds. But it excludes some important fiscal activities of the government. For example, the National Health Insurance is excluded from the consolidated government even though it is a social insurance program that covers over 90 percent of the population. Also excluded are various quasi-government organizations and research institutions (such as KDI) which are mainly financed and whose mandates are directly determined by the government.

Even within the central government, the revenue and expenditure statistics on one hand and the government asset and liability statistics on the other hand have different coverage. The latter excludes some funds that are included in the former, with possible under-reporting of the true size of government assets and liabilities. In addition, government assets are reported separately for credits (e.g., government loans), properties (e.g., securities and premises), cash holdings (e.g., deposits at the central bank), and supplies, making it impossible to get the total sizes of financial and non-financial assets.

Logical consistency is compromised also in the treatment of treasury bonds held by the National Pension Fund and other funds. These bond holdings are recorded simultaneously as government assets (as they are held by funds) and liabilities (as they are issued by the government). Ideally, such bond holdings should be netted out, and the asset and liability statistics should only reflect the net transactions between the government and the private sector.

The consolidated central government also shows large discrepancies with the National Accounts in its coverage. The latter includes the National Health Insurance in the government sector but excludes some activities such as the credit programs of the National Housing Fund (NHF). As a result, the amount of government liabilities differs significantly between two statistical systems.

The inadequate coverage of the fiscal data can induce an underestimation of the expenditure size and an overestimation of financial balance. It also hampers correct understanding of the fiscal stance.

Similar problems exist in the data for public financial and non-financial corporations. Together with the general government (the central and local governments and social security funds), public corporations constitute the public sector. However, in Korea, there is no clear definition of public corporations. For example, various financial funds such as the credit guarantee funds are not included in the public sector even though they have every aspect of public financial corporations. The government does not publish a comprehensive review on the financial status of individual public corporations, let alone consolidated financial statements.

This practice makes it difficult to assess the financial health of the public sector in general, and the implicit fiscal burden incurred through quasi-fiscal activities of financial funds in particular. Of particular concern are credit guarantee funds[28] that significantly expanded their activities after the recent economic crisis. At the end of 2003, the outstanding stock of guarantees corresponded to 11 percent of GDP, far higher than in other countries where the public guarantees usually amount to less than 1 percent of

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[28] These are Infrastructure Credit Guarantee Fund, Korea Technology Credit Guarantee Fund, Credit Guarantee Fund for Agriculture, Forestry, and Fishery, Korea Credit Guarantee Fund, and Housing Finance Credit Guarantee Fund.

GDP. Yet no reports exist that explain the future risks these funds may impose on the government finance.

As a first step to address this problem, we need to redefine the scope of the public sector and find ways to produce information on its financial status. The starting point will be the revised 2001 Government Finance Statistics Manual of IMF. But the revised Manual provides only a general guide on the scope of the general government and the public sector, and there are a lot of questions to be answered before applying it to the Korean case.

For example, should the National Housing Fund (NHF) be included in the central government or in the wider public sector? So long as the NHF is funded mainly through the issuance of NHF bonds and treasury bonds which requires an annual parliamentary approval as part of the budget, it should be included in the government. But the lending activities by the NHF are mostly carried out on a commercial basis though at concessional rates, and for this reason, National Accounts includes the NHF in the public corporations sector and excludes its bond issuance from government liabilities. Similar questions arise in the case of "enterprise special accounts" such as the National Railroad, the Communication Service, and the Government Procurement Special Accounts.

A reform is underway to redefine the public sector and to introduce accrual accounting in financial reports. The effort is led by the Budget and Accounting Reinvention Office (BARO). When their work is finished by 2007, big improvements will have been made in this regard.

V. Conclusion: Roads Ahead

The period after the crisis of 1997 witnessed many efforts to modernize the fiscal management system in Korea. Unlike in other developing countries where such efforts are often imposed by international organizations as a string attached to the aids provided, the Korean government began the reform process on their own initiatives. This feature entails both assets and liabilities in the design and implementation of reform.

On one hand, the "ownership" of reform can be secured and genuine efforts guaranteed. The reform can have a better footing when designed by "insiders" who have better knowledge on the Korean context. On the other hand, due to the lack of external help, it may be difficult to draw a comprehensive and well-designed blueprint that can guide various reform efforts. And without an external pressure, the reform drive may soon lose its momentum.

There are many improvements to be made in the current fiscal management system. The complicated budget structure needs to be streamlined. It is necessary to strengthen fiscal discipline in a target-based approach with the help of the MTEF. The MTEF itself should be improved in many aspects as explained in the text. It is also being called for to integrate various initiatives to introduce performance management and embody it in departmental planning and reporting. The scope of the government needs to be redefined and the financial reporting upgraded.

All these remain challenges to be tackled in coming years. Reflecting on the past experience, none of them look easy. But major moves have been already made, and there seems no way back.

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Comments on "Reforming the Fiscal Management System in Korea"

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Summary of the paper

The paper overviews the development of public finance in Korea since 1970 and analyzes its current status. It provides not only key statistics but also carefully explains the institutional setup. After the careful review, the paper assesses the recent reform efforts and proposes directions for change to maintain financial health and maximize the productivity of public spending.

General comments

The paper is an excellent overview paper on Fiscal management in Korea. It also provides well-balanced, appropriate policy recommendations. It will be indispensible article to understand the features of the fiscal system of the Korean government.

Specific comments

1. The paper focus on the management of fiscal system, but there are some other important issues, such as political economy aspect of fiscal system.

2. The paper focus on the expenditure side. To provide complete picture of fiscal system of the Korean government, one needs to provide analysis of the tax system and the direction of future changes for the tax system.

3. As one important reform effort, the author mentioned performance-based budget. To my knowledge, it is hard to implement performance-based budget system and it is hard to find a successful example of performance-based budget system. I personally think that performance-based budget system can at best introduce output-oriented analysis of public expenditures.

4. The Korean government has quasi-fiscal activities which were often excluded in the calculation of the official consolidated budget. The examples include public enterprises and public funds. The figure below, from Lee Changyong (2005), exemplifies the importance of inclusion of these quasi-fiscal activities to correctly capture the fiscal position.

Figure. Official and Reconstructed Consolidated Budget Balance

5. Minor comments

   (1) Size of funds might be more important than the number of funds.
   (2) The author emphasizes the importance of good panel data. Is Annual Urban Household Survey a panel data with reasonable quality?

Economic and Financial Integration in East Asia and Necessary Regulatory Reform for a Financial Hub in Korea

by
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Abstract

The purpose of this paper is to examine the extent of economic and financial integration occurring in East Asia and discuss necessary regulatory reform for Korea to become a Northeast Asian financial hub.   Increasing economic integration in East Asia over the last two decades has been evidenced by consistent growth in intra-regional trade and intra-regional investment.   Greater economic integration in the region, accompanied by financial deregulation and liberalization, has contributed to greater financial integration.   This study confirms increasing degree of financial market integration in East Asia by comparing movements of monthly money market rates before and after the Asian financial crisis.   Convergence of interest rates across the countries in East Asia is examined by analyzing deviations, correlation coefficients and multivariate co-integration tests of interest rates.

Given increased financial integration in East Asia, the Korean government's plan to create a Northeast Asian financial hub in Korea is not a fantasy, but an achievable dream. However, the Korean government needs to improve its financial structure and financial institutions and carry out various regulatory reforms.   First, transforming existing sector-based laws and regulations into function-based legal and regulatory systems is a pre-requisite.   Second, necessary measures to ensure transparency of corporate governance and market transactions are needed to encourage capital inflows.   Third, further deregulation of foreign exchange transactions by both domestic residents and foreigners is desired.

I. INTRODUCTION

East Asia has emerged as the most dynamic and successful region in the world, and its economic growth rates have seldom been surpassed by any other region in the world.

The so-called "Asian economic miracle" has been largely attributed to export-led economic expansion in the region.   The Asian economic miracle, which was started by Japan and then followed by the Newly Industrialized Economies (NIEs), namely, South Korea, Taiwan, Hong Kong, and Singapore, which have led the decades of spectacular economic growth, is now pursued by the ASEAN (Association of Southeast Asian Nations) countries, particularly Indonesia, Malaysia, Thailand, and the Philippines. This pattern of East Asian development has been thus commonly referred to as a "flying geese pattern."   East Asia includes both Northeast Asia and Southeast Asia. Geographically, Northeast Asia covers Japan, South Korea, North Korea, Mongolia, China, Taiwan, and Hong Kong.   In this study of economic and financial integration in East Asia, four countries are included: China, Japan, South Korea, and Taiwan, with Hong Kong as a separate entity.   Southeast Asia is generally represented by ten member nations of the ASEAN, but only five major countries of importance are included in this study.   They are Indonesia, Malaysia, the Philippines, Singapore and Thailand.

In this paper, we will analyze the scope and patterns of financial integration occurring in East Asia and evaluate the possibility of Korea's becoming a financial hub and necessary financial reforms to achieve this goal.   In the next section, we will discuss open and non-preferential regionalism which is actively growing in the region.   We will review the scope and patterns of unique economic integration occurring in East Asia, by looking various economic activities such as intra-region trade, investment and economic cooperation and their trend over the last two decades.   In section three, literature relevant to financial integration will be reviewed.   In section four, tests of financial integration in East Asia by descriptive statistics and a multivariate co-integration model will be analyzed.   The last section will address required regulatory changes in order to create a financial hub in Korea.

II. ECONOMIC INTEGRATION IN EAST ASIA

The 1990s witnessed a resurgence of regionalism as evidenced by the formation or reinforcement of two major trade blocs, the European Union (EU) and the North American market.   Regionalism can be traced back to the 1950s when the European Economic Community (EEC) was initially formed in 1957 by the treaties of Rome. Although the creation of the EEC prompted subsequent formation of regional economic integration in other regions of the world, only the EEC has grown as the most successful model of economic integration.   In 1992, the EEC was transformed into the EU, a single market in Europe, according to the Single European Act of 1987, and it has further deepened its integration with the formation of the Economic Monetary Union (EMU) in 1999 and circulation of a common currency, the euro, in 2002 according to the Maastricht Agreement of 1991.

The year 1993 also witnessed the creation of another powerful regional trade bloc by the ratification of NAFTA which is an expanded version of the Canada-US.   Free Trade Agreement to include Mexico.   If these two major trade blocs move toward closed regionalism, the rest of world, particularly East Asian countries, with no arrangement of economic integration whatsoever and with heavy dependency of their trade on the U.S. and the EU, would be affected the most.   The provision of NAFTA that is most susceptible to abuse is the domestic content rules known as rules of origin (usually over 50% in manufacturing and eventually 62.5% in the case of automobiles).

Both blocs insist that their arrangements complement the objectives of a multilateral trading system based on the General Agreement on Tariffs and Trade (GATT) and the

World Trade Organization (WTO) by promoting trade liberalization and strengthening the scope of international trade rules. In this regard, Schott (1993) described NAFTA as a "GATT-plus" accord that presages new and expanding multilateral trade negotiation. However, when such regional integration creates trade diversion and investment diversion, welfare of both member countries and non-member countries would be adversely affected. The U.S. Super 301 Clause, the most powerful antidumping mechanism in the world, has been intact in the Uruguay Round negotiations and in more recent negotiations of the WTO.

Facing challenges from the creation of two major trading blocs and the presence of protectionist provisions in the WTO system, many scholars and government officials in East Asian economies have expressed their interest in closed regionalism and have realized the need to study the possibility of pursuing regional integration. However, until now, no concrete steps have been taken to create a regional trade bloc in East Asia. Instead, East Asia exhibits a unique and dynamic pattern of economic integration that is quite different from the closed regionalism of North America and Western Europe. This takes a form of open and non-preferential regionalism, an economic integration process driven by market forces and spearheaded by businesses in the region.

One of dynamics in East Asia is the increasing importance of the region in the world production and trade. World output has grown 2.5 times from $12.5 trillion in 1981 to $31.5 trillion in 2000. On the other hand, east Asia's output growth has been 4.2 times from $1.76 trillion in 1981 to 7.38 trillion in 2000 (see Table 1). The United States and the EU, with their shares in the world output as 31.2 percent and 24.9 percent in 2000 respectively, are still larger economies than East Asia. However, East Asia's share in the world output has increased from 14.1 percent in 1981 to 23.4 percent in 2000. The EU's share has actually decreased from 30.7 percent in its peak year of 1991 to 24.9 percent in 2000. If the PPP (purchasing power parity) GDP figures are used, then East Asia's share in world total output is 26.3 percent in 2000 which is larger than either the share of the USA or the share of the EU. During the same period, the volume of world exports has increased 3.2 times from $1.9 trillion in 1981 to $6.4 trillion in 2000, while the volume of East Asia's exports has increased 6.1 times from $.27 trillion in 1981 to $1.66 trillion in 2000, twice faster growth rate than that of the world total exports (see Table 2).

Economic integration in a narrow sense is perceived as closed and preferential regionalism exemplified by the creation of trade blocs like NAFTA or the EU. However, economic integration in a broad sense can be viewed as increasing economic activities such as trade and foreign direct investment in a geographic region and reducing the importance of national boundary in the economic arena. The increasing degree of economic integration in the region can be seen from trade and investment patterns of the region. Table 3 shows exports of East Asia to different regions and imports of East Asia from different regions. Increase in trade of East Asian economies is also accompanied by a change in trade direction. The importance of the U.S. and the EU as East Asia's export markets and import sources has declined, and intra-region trade in East Asia has increased rapidly.

In 1980, East Asia's intraregional exports and imports were 31.2 percent and 30.7 percent of its total exports and imports, respectively. These intraregional trade figures have gradually increased over the past two decades and reached 48.4 percent of total exports and 52.6 percent of total imports in 2001. During the same time period, exports to the EU and the USA have levelled off at 15 percent and 23 percent respectively, and imports from the USA have declined from 18.1 percent at their peak in 1990 to 13.7 percent in 2001. The trend toward increasing intraregional trade can also be seen from data on individual countries, which is not shown in this paper. All the countries in East Asia except for China show a steady decrease in their share of total exports going to and

imports coming from the USA and a steady increase in their share of total exports going to and imports coming from within the region.

The growth of intraregional trade in East Asia has been largely attributable to the increased intra-industry trade among East Asian economies arising from foreign direct investment (FDI) flows that have taken place in the region. Table 4 shows FDI flows into different regions in the world. The share of the USA has decreased from 30.79 percent of the world total in 1980 to 16.93 percent in 2001. The share of the EU has increased from 38.80 percent of the world total in 1980 to 43.93 percent in 2001 thanks to the creation of a common market. Without any free trade area or common market arrangements covering all the countries in the region, the amount of FDI flows in East Asia has grown more than twelve times from $5.6 billion 1980 to $69.9 billion in 1995, and East Asia has more than doubled its share of the world total FDI flows from 10.25 percent in 1980 to 21.15 percent in 1995. However, the Asian financial crisis of 1997-98 has slowed downed the FDI flows into the region, and its share in 2001 was at 12.87 percent.

Noteworthy in FDI flows into the region is a change in the sources of FDI. The FDI flows into the region that had been dominated by US firms until 1980 were initially replaced by Japanese firms during the 1980s, and then followed by the NIEs, that is, Singapore, Hong Kong, South Korea, and Taiwan during the 1990s. More recently China has emerged not only as the largest recipient of the FDI flows, but also as one of the major investors in the region too. The FDI flows from Japan and the NIEs into the ASEAN countries prior to the Asian financial crisis ranged from a minimum of 41 percent of total FDI flows into the Philippines up to 66 percent of total FDI flows into Thailand.

We have observed increasing economic integration in the area of trade and investment in East Asia. Financial deregulation and liberalization in the region have also allowed free movement of financial capital. Greater economic integration, accompanied by financial deregulation and liberalization, may lead to greater financial integration in the region.

III. REVIEW OF LITERATURE

There are three most commonly used measures of financial integration besides a simple observation of changes in capital flows across countries. They are interest rate parity conditions, inter-country saving-investment correlations, and inter-country consumption correlations. First, in the analysis of saving-investment correlations, Feldstein and Horioka (1980) were the first to propose a test for capital mobility based on saving-investment correlations. If the capital is perfectly mobile among countries, then domestic investment is not necessarily related to domestic savings. Feldstein and Horioka (1980) regressed investment on savings with data from OECD countries for the period of 1960-1974 and concluded low capital mobility because of high correlation coefficients (about .9). This analysis has been applied by others for different countries and time periods. However, this analysis has been under criticism because of its strict assumptions of both exogeneity of real interest rates and real interest parity, which do not usually hold. Furthermore, Montiel (1993) demonstrated that savings and investment may be correlated even though capital is perfectly mobile. Obstfeld (1994) also showed that investment and savings are both sensitive to business cycle movements and shocks in productivity and world real interest rate. According to Obstfeld (1994), saving-investment correlation coefficients for OECD have declined from the 1970s to the 1980s. A similar result was obtained by Montiel (1993) for 17 Pacific Basin countries. More recently Rensselaer and Copeland (2000) applied a similar analysis to the 15 Latin American countries.

Second, in the analysis of consumption correlations, Obstfeld (1986, 1994) proposed a test for capital mobility based on consumption correlations. The hypothesis is that if capital markets are integrated, then countries can trade internationally in financial assets to eliminate domestic consumption shocks and make their consumption over time smooth. Using the data of Summers and Heston (1991) for the period of 1951-1988, Obstfeld (1994) found that consumption correlations were higher for developed than developing countries and that they were higher in the later period than earlier period. Montiel (1993) applied a similar test to developing countries and found relatively high capital mobility in the majority of East Asian countries, including Korea, Singapore, Thailand, Malaysia and the Philippines. More recently, Allitt and Moosa (1998) found imperfect capital mobility from some APEC countries and concluded that consumption patterns do not make a good criterion for measuring capital mobility.

Third, financial integration can be measured by the equalization of the rates of return on similar financial assets because, the more open and integrated markets among individual economies become, the less different should the rates of return be. Elimination of barriers to capital flows and technological advances in financial transactions over the last few decades have dramatically increased integration of financial markets. This diversification of financial assets across economies tends to reduce the differences among interest rates of individual countries.   There have been many studies examining capital market integration or convergence of interest rates using real interest rates (Camarero, et al., 2002; Moosa and Bhatti, 1995; Phylaktis, 1999; and Yamada, 2002). There is extensive empirical literature on interest rate parity conditions for the OECD countries (Camarero, et. al., 2002; Goodwin and Grennes, 1994; Kleimeier and Sander, 2000; and Yamada, 2002).   There are also some studies that focused on East Asia (Chinn and Frankel, 1994; Glick and Moreno, 1994; and Phylaktis, 1999).   Studies both on the OECD countries and on East Asia found that the impact of foreign interest rates on domestic rates in the region has increased over time, thus confirming an increasing tendency toward convergence.   However, most of the studies have tested the influence of foreign interest rates such as the U.S. rates or the Japanese rates on the domestic rates in the region, rather than testing convergence of interest rates among the countries within the region.

While many previous studies on interest rate parity conditions were based on differentials in real interest rates, Marston (1995) and Lemmen (1998) questioned the validity of real interest rate differentials as a measurement of financial integration. Lemmen (1998) specifically stated that differentials in real interest rates across countries can not be comparable because they are denominated in their own national currency. Consequently they do not offer profit opportunities for individual investors or borrowers because no single agent compares real interest rates across countries.   Furthermore, he showed that the real interest rate parity requires very restrictive conditions such as zero exchange rate risk premium, zero country premium as measured by the validity of the covered interest parity, and zero deviation from the ex ante relative purchasing power parity.   There has been ample empirical evidence that reveals persistent deviations from the purchasing power parity.   Therefore, using real interest rates in East Asia as an indicator of financial integration may lead to a rejection of financial market integration because of incomplete economic integration in the region.

This study is differentiated from previous studies on financial integration in East Asia in two respects.   First, the previous studies on East Asia focused on the real interest parity conditions, which are too restrictive and potentially misleading.   Instead, this study tests convergence of nominal interest rates in East Asia as an indicator of financial integration in the region.   Second, this study focuses on co-movement of nominal interest rates within the region by using a multivariate co-integration test, while most of

the previous studies dealt with the influence of a dominant foreign interest rate (e.g. the U.S. rates) on the domestic interest rate using a bivariate co-integration test. The bivariate co-integration test treats the foreign interest rate as exogenous. On the other hand, all interest rates are endogenous in the multivariate co-integration test.

IV. EMPIRICAL ANALYSIS

The variable chosen to analyze the degree of financial market integration in East Asia is the nominal monthly money market rate for ten East Asian countries for the period from January 1990 to December 2002. No earlier period was used because many East Asian countries still had considerable financial regulation during the 1980s. For example, Taiwan and South Korea liberalized their interest rates in 1989. However, it is not a good idea to analyze the entire period as a whole because the sample period is not homogeneous. The Asian financial crisis occurred in 1997, starting from Thailand in July 1997, spreading to neighbouring countries, and eventually affecting South Korea in December 1997. Most of the East Asian economies suffered from the Asian financial crisis, and at the same time, it was a wakeup call to the region. Exodus of foreign capital, chaos in financial markets, and unusually high interest rates continued to affect the countries in the region at least until June 1998. In response to the crisis and also under pressure from the International Monetary Fund (IMF), many countries in the region underwent major financial reforms that resulted in a drastic change in their financial systems from the pre-crisis period to the post-crisis period. Therefore, we perform analyses for two separate periods, the pre-crisis period and the post-crisis period.

Table 5 presents descriptive statistics on the monthly money market rates for both the pre-crisis period (from January 1990 to July 1997) and the post-crisis period (from January 1999 to December 2002). Monthly money market rates are from the International Financial Statistics published by the IMF except for Taiwan where the data is taken from the Monthly Statistics of the Republic of China. Whenever the money market rate is not available, alternative rates are used: bank rate for China, call money rate for Indonesia, and inter-bank rate for Singapore.

During the pre-crisis period, the average money market rates ranged from a minimum in Singapore of 3.665 percent to a maximum in the Philippines of 14.07 percent. During the post-crisis period, the average money market rates ranged from a low of .086 percent in Japan to a high of 20.95 percent in Indonesia. The high average rate in Indonesia is because Indonesia had not yet recovered from the crisis until the end of 1998, with a money market rate as high as 81 percent in August 1998. Comparing the pre- and post-crisis period money market rates exposes a difference in the trend and stability of interest rates. All the nations except for Indonesia experienced decreasing interest rates, and all the nations except for Indonesia and Hong Kong experienced less volatile movements of interest rates evidenced by much smaller standard deviations. The average money market rate was 8.46 percent in the pre-crisis period and 3.94 percent in the post-crisis period, while the average standard deviation of the money market rates was 2.26 in the pre-crisis period and 1.48 in the post-crisis period. This trend seems to be in line with the overall reduction in interest rates in the world which has occurred in the last few years. The average money market rate of 3.94 percent in the post-crisis period is obtained by excluding Indonesia, which had not recovered from the effects of the Asian financial crisis until sometime in the post-crisis period. If Indonesia is included in the calculation, the average money market rate increases to 5.64 percent, which is still lower than the average rate in the pre-crisis period.

In order to see the trend of co-movement of money market rates among the ten East Asian countries, correlation analysis is performed. Table 6 shows the estimated Pearson correlation coefficients among the ten countries along with the level of significance of the coefficient, and the number of observations for the pre- and post-crisis periods. The results for the pre-crisis period indicate only 13 significant correlation coefficients out of 45 pair-wise comparisons at the significance level of 1 percent. However, three significant and negative correlation coefficients for China are actually against co-movement, leaving only 10 significant cases as meaningful. Three countries, Japan, Singapore and Thailand, exhibit co-movement of their money market rates with those of at least three other countries in the region. On the other hand, the estimated results for the post-crisis period indicate that the money market rates among the ten countries move together with 45 significant correlation coefficients out of 45 pair-wise comparisons. The correlation coefficients are all positive and they range from a low of .502 to a high of .919. So far, we have observed three indicators of increased financial market integration in the region from the pre-crisis period to the post-crisis period: a reduction in nominal interest rates, less volatility of these rates, and an increase in significant correlation coefficients. In the post-crisis period, money market rates among the ten East Asian countries tend to be closer together and move together. This trend is partly due to globalization and the overall lower level of interest rates in the world. For whatever reasons there might be, the increasing financial market integration in East Asia is a fact that cannot be denied. Since the Asian financial crisis, we have also observed stabilized exchange rates with less volatility and strong positive correlations in nominal exchange rates among the East Asian currencies that adopted floating exchange rate regimes (data not reported in this paper). This is another indicator of increasing financial integration in East Asia.

We now extend our analysis by performing a co-integration test for money market rates to examine convergence of interest rates across countries. In other words, this study will test the financial market integration hypothesis by performing co-integration tests with the data on monthly money market rates from 10 East Asian countries for the period from January 1990 to December 2002, which is divided into two separate periods, the pre-crisis period and the post-crisis period. Money market rates in individual countries may fluctuate in response to domestic financial conditions and move far apart from one another. However, if financial markets are integrated, efficient arbitrage in international financial markets will prevent money market rates in individual countries from moving far apart. In other words, if money market rates are co-integrated, they cannot wander too far away. Therefore, a co-integration test is a suitable test for convergence of interest rates and financial markets integration. As a prerequisite for co-integration analysis, the unit root test is applied to check whether the money market rate series are stationary or non-stationary. The following regression is used for the unit root test.

$$\Delta r = a + b\, r_{t-1} + \Sigma\, c_i\, \Delta\, r_{t-1} + T + e_t, \qquad\qquad (1)$$

where r is money market rate, T is a trend variable, and u is white noise. The augmented Dickey-Fuller (ADF) test statistic is the ratio of b to its standard error obtained from the regression. If the value of b is negative and significantly different from zero, then the null hypothesis of a unit root ($b = d = 0$) or random walks is rejected. The test results on the level series and on the first difference series for both the pre-crisis and post-crisis periods are presented in Table 7. For the pre-crisis period, the null hypothesis of a unit root is rejected in 2 cases out of the 10 level series: Taiwan and the Philippines. The null hypothesis of a unit root is rejected in all of the first difference series at the one percent significance level. For the post-crisis period, the null

hypothesis of a unit root is rejected in 5 cases out of the 10 level series at the 5 percent significance level: China, Hong Kong, South Korea, Singapore, and Thailand.   The null hypothesis of a unit root is rejected in 8 cases out of the 10 first difference series at the 1 percent significance level, with the exception of South Korea and Thailand.   However, the null hypothesis of a unit root can be rejected for even South Korea and Thailand at the 5 percent significance level.   Therefore, we conclude that the first difference series of individual countries for both the pre-crisis and post-crisis periods are indeed stationary and that the original interest rate series are integrated of order 1, that is, I(1).

Traditionally, bivariate co-integration tests such as the ADF test recommended by Engle and Granger (1987) are used to examine the convergence of interest rates.   For example, if the interest rate series in two different markets are non-stationary, but exhibit a linear combination of them, which is a stationary process, then the two interest rate series are said to be co-integrated with each other and there is a long-run relationship between the two series.   However, the bivariate tests have been under attack recently because of several limitations.   Commonly listed limitations include sensitivity of the critical values to sample size and the restrictive requirement that one of the two series is designated as exogenous.   To overcome these limitations of the bivariate tests, Stock and Watson (1988) and Johansen (1991) developed a multivariate co-integration testing system for the existence of common trends in a set of non-stationary variables. Since we are interested in examining the presence of a common trend in the interest rates among the East Asian economies, this multivariate test would be more appropriate than the bivariate test to define dimensionality of the common stochastic trend process.

Let X_t be a vector of money market rates of selected countries, r_1 r_2 …. r_n.   The following vector autoregressive model can be estimated.

$$\Delta X_t = c + G X_{t-1} + \Sigma H_i \Delta X_{t-i} \quad + \varepsilon_{t,} \tag{2}$$

where c is a constant vector, G and H_i are n x n matrices of parameters, and ε_t is a white noise vector of n x 1.   Johansen (1991) developed the trace test statistic of evaluating the null hypothesis that there are at most r co-integration vectors, implying that there are n-r common stochastic trends among the variables.   This trace test statistic is given by

$$\tau_{trace} = - T \Sigma \ln (1-\lambda_i), \tag{3}$$

where T is the sample size, and λ_i is the n-r smallest squared canonical correlations of X_{t-1} with respect to ΔX_{t-i}.   Each univariate interest rate series may contain a stochastic trend.   However, this stochastic trend may be common to other interest rate series.   If there are r co-integrating vectors for a set of n interest rates where r = n-1, the nth interest rate can be expressed in terms of n-1 interest rates.   Then the interest rate series contain the same stochastic trend, and the series are said to be co-integrated.   Therefore, the number of co-integrating vectors existing in the multivariate co-integration test is a good indicator of the extent of financial integration.

Table 8 presents the results of the Johansen multivariate co-integration test for a group of countries that exhibit non-stationary money market rates.   For the pre-crisis period, they are China, Hong Kong, Japan, South Korea, Indonesia, Malaysia, Singapore, and Thailand.   For the post-crisis period, they are Japan, Taiwan, Indonesia, Malaysia, and the Philippines.   We used the assumption of a linear deterministic trend in the data. For the pre-crisis period, we cannot reject the null hypothesis of r ≤ 6.   The multivariate co-integration test for the pre-crisis period indicates the existence of six co-integrating

equations with eight interest rate series. So there are at least two stochastic trends among eight interest rate series instead of one common stochastic trend, implying a lower degree of financial integration.   For the post-crisis period, we cannot reject the null hypothesis of $r \leq 4$.   The multivariate co-integration test for the post-crisis period indicates the existence of four co-integrating equations with five interest rate series and thus implies that any single money market rate can be a representative of the group of five money market rates.   This result indicates convergence of interest rates among countries with non-stationary interest rate series in the post-crisis period and implies a higher degree of financial market integration in the post-crisis period than in the pre-crisis period.

Because the test for co-integration is supposed to be applied only to non-stationary series to see whether a linear combination of them can be a random walk, we could not apply this test to the countries with stationary interest rate series.   While no test for co-integration is applicable for the countries with stationary interest rate series, a comparison of the two groups may be noteworthy.   Compared to the countries with non-stationary interest rate series, the countries with stationary interest rate series, particularly in the post-crisis period, exhibit much smaller variations in their average interest rates and standard deviation, which implicitly indicates convergence of their interest rates.   Comparing the two periods, there are more countries with stationary interest rate series in the post-crisis period than in the pre-crisis period.   Exceptions are Taiwan and the Philippines, which changed from being stationary in the pre-crisis period to non-stationary in the post-crisis period.

V. REGULATORY REFORM FOR A FINANCIAL HUB

In the previous sections, we have shown that economic integration in East Asia with regards to activities in trade and investment has increased considerably in the last two decades and that financial integration in East Asia has also increased in the last few years. The Asian financial crisis of 1997-1998 also strengthened regional cooperation in East Asia.   With these trends, there are many potential benefits of becoming a Northeast Asian financial hub.   While London and New York evolved into international financial centers naturally and gradually, Singapore developed into a financial hub in the last five years artificially by the government's effort to create a conducive environment for capital flows.   So, Korea can establish a financial center by improving its financial structure and institutional systems.

There are many benefits coming from establishment of a financial hub.   Financial capital will be supplied at lower costs, enabling Korea to finance large-scale investment projects in rapidly growing China and possibly in North Korea once tension in the Korean peninsula subdues.   Furthermore, a financial hub will promote expansion of high valued industries.   With China taking over labor-intensive industries and low technology industries from Korea, it is necessary for Korea to move into high value-added industries.   The development of a financial hub will not only attract foreign financial companies, but also contribute to advancement of the domestic financial services sector. A financial hub will advance legal and accounting service sectors as well as other supporting services.   Korea has many highly educated workers who are currently unemployed, and the creation of a financial hub will absorb many of them.

Attempts to create a financial hub in the region have been accelerating.   In addition to the efforts to expand the two existing hubs, Hong Kong and Singapore, China plans to establish Shanghai as its new trade and financial center and Japan plans to make Tokyo as Asia's financial center.   Korea has some advantages over its potential competitors.

Korea has a more open business environment and it is easier in Korea to start a business than in Japan or China. Korea's financial market is larger than Hong Kong and Singapore, the two existing regional financial hubs. Furthermore, Korea has an advantage over Japan and China in that Korea's implementation of financial reforms and various deregulatory measures since the Asian crisis have contributed to Korea's conformity with international standards. However, such reforms are only the first step towards development of a successful financial hub.

The government plan is to develop asset management as a leading industry and attract the world's top 50 asset management firms to set up their operations bases in Korea by 2007 in the first stage. During the second stage from 2008-2012, the Korean government plans to establish a niche financial hub by proactively attracting prominent foreign financial firms to set up their regional operation headquarters in Korea while emerging as the major asset management center in Asia. During the final stage ending in 2020, it plans to develop into a major financial center as a mixed form of a niche and global hub. Some point out that Korea has many stumbling blocks such as militant labor unions, rigid labor market, higher taxes and poor English language skills. This might be the reason why Seoul was ranked fifth out of six Asian cities in a 2003 survey by McKinsey and Co. for identifying a potential financial hub. However, we believe that the main reason is still restrictive legal and regulatory environments and less transparency of corporate governance and market transactions in Korea.

First, existing laws and regulations related to finance should have a major overhaul. Korea's current legal and regulation systems are based on a division of financial sectors such as banking, insurance and securities, etc. However, international financial institutions have enhanced their competitiveness through mergers with businesses engaged in complementary activities, and foreign governments have responded to this changing financial environment by allowing expansion of integrated business activities as can be seen in the creation of a universal banking system. Under the current system, creation of a new financial services sector will make confusion in regard to which law is applicable and allow loopholes, and the government should enact a new set of laws and regulations each time when a new financial services sector is created. So, it is necessary to change the current system into a function-based legal and regulatory system. This new system based on function – business activities, market access, asset management and regulatory oversight - will enhance consistency, fairness and efficiency of regulatory administration because same regulatory interpretations will be applied to similar situation regardless of the type of financial services.

Second, the Korean government should push further for transparency of corporate governance and market transactions, even though there has been an improvement in this area since the Asian financial crisis. There is empirical evidence from many different countries that corporate governance is an important factor in explaining the market value of firms (Black, 2003) and that transparency of market transactions including accounting transparency is a major determinant influencing capital flows (La Porta, 1997). Korea was rated poorly among the surveyed countries by two recent surveys. In 2000 PricewaterhouseCoopers (PwC) conducted the opacity appraisal in terms of economy, management, law and ethics over 35 countries. Singapore was in the first place with the opacity index of 29 and Korea's opacity index stood at 73. Among the 35 countries, only five countries had higher opacity index than Korea. A transparency and disclosure survey by S&P rated 1600 firms in the world according to the degree of disclosure of necessary information for accurate evaluation of management performance. Singapore, Japan and Thailand are ahead of Korea in the rating. Without reliable financial information and transparent corporate governance, building a financial hub will not lead to realization of a dream.

Third, the Korean government should increase convertibility of Korean Won.   It is true that Korea liberalized foreign exchange transactions and removed some existing restrictions imposed on foreigners for domestic financial activities.   This deregulation more than tripled the volume of domestic financial transactions carried out by foreigners in the last few years.   But there are still many regulations in effect including limitations on the issuance of Won-based stock by non-residents and limits on Won-based loans by non–residents.   Removal of the remaining regulations will make it more convenient to do business in Korea by foreigners and eliminate country risks for both domestic and foreign investors by assuring full convertibility of capital accounts.

To have a financial hub in Korea, massive deregulation measures are needed to induce capital flows.   Fierce competition prompted by deregulations may have a negative effect on the performance of domestic financial institutions, causing some into bankruptcy. However, those survived will come out stronger and more competitive. Since large scale financial transactions may cause instability in the domestic financial market, proper regulatory oversight should be maintained.

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Table 1. Current GDP and PPP GDP, Selected Years ($ US billion)

	Current GDP						PPP GDP	
	1981	Share	1991	Share	2000	Share	2000	Share
China	228.3		402.6		1077.5		5019.4	
Hong Kong	30.5		86.0		162.6		171.0	
Japan	1183.6		3483.3		4841.6		3394.4	
S. Korea	69.6		295.2		461.5		821.7	
Taiwan	48.2		179.4		309.4		541.4	
<u>Northeast Asia</u>	<u>1560.2</u>	<u>12.5</u>	<u>4446.5</u>	<u>19.1</u>	<u>6852.6</u>	<u>21.8</u>	<u>9947.9</u>	<u>22.6</u>
Indonesia	92.5		116.5		152.2		640.3	
Malaysia	25.5		49.1		89.7		211.0	
Philippines	35.6		45.4		74.7		300.1	
Singapore	13.9		42.8		92.3		93.8	
Thailand	34.8		98.2		120.7		388.8	
<u>Southeast Asia</u>	<u>202.3</u>	<u>1.6</u>	<u>352.0</u>	<u>1.5</u>	<u>529.6</u>	<u>1.7</u>	<u>1634.0</u>	<u>3.7</u>
<u>East Asia</u>	<u>1762.5</u>	<u>14.1</u>	<u>4798.5</u>	<u>20.6</u>	<u>7382.2</u>	<u>23.4</u>	<u>11581.9</u>	<u>26.3</u>
EU	3133.0	25.0	7143.3	30.7	7836.4	24.9	8631.3	19.6
USA	3104.5	24.8	5930.7	25.5	9837.4	31.2	9612.7	21.8
World	12510.5	100.0	23259.5	100.0	31498.1	100.0	44002.4	100.0

Source: UNCTAD, World Investment Report, various years.

Table 2. Exports and Imports, Selected Years ($ US million)

Country	Exports-fob					Imports-cif				
	1980	1985	1990	1995	2000	1980	1985	1990	1995	2000
CHINA	18099.3	27350	62091	148797	249297	19941	42252	53345	129113	206132
HONG KONG	19751.7	30186.8	82159.9	173750	201860	22447	29703	82490	192751	212805
JAPAN	130441	177164	287581	443116	479249	141296	130488	235368	335882	379511
KOREA	17512	30282	65016	125052	172268	22292	31136	69844	135119	160481
TAIWAN	19786.3	30696	67079.4	111563	147777	19764	20124	54831	103698	139927
Northeast Asia	205590.3	295678.8	563927.3	853487	1250451	225741	253703	495878	896563	1098856
%	10.5	15.6	16.4	16.6	19.7	11.2	12.9	14.0	17.2	16.8
INDONESIA	21909	18586.7	25675.2	45417	62124	10834	10259	21837	40630	33515
MALAYSIA	12944.7	15316.1	29451.5	73914	98135	10779	12253	29258	77691	82199
PHILIPPINES	5741.2	4611.4	8116.8	17502	39783	8291	5455	13004	28341	33808
SINGAPORE	19375.3	22812.3	52729.7	118268	137804	24007	26285	60774	124507	134545
THAILAND	6505.4	7120.6	23068.3	56439	69057	9214	9242	33045	70786	61924
Southeast Asia	66475.6	68447.1	139041.5	311540	406903	63126	63494	157917	341954	345990
%	3.4	3.6	4.0	6.1	6.4	3.1	3.2	4.5	6.6	5.3
East Asia	*272065.9*	*364125.9*	*702968.8*	*1165027*	*1657354*	*288867*	*317197*	*653795*	*1238517*	*1444846*
%	*14.0*	*19.3*	*20.4*	*22.7*	*26.1*	*14.3*	*16.1*	*18.5*	*23.8*	*22.1*
EU	703289	667614	1384700	2060780	2245390	789154	679065	1436910	1973740	2253410
%	36.1	35.3	40.2	40.2	35.3	39.1	34.5	40.6	37.9	34.4
USA	225566	218815	393592	584743	781125	256984	352463	516987	770852	1259300
%	11.6	11.6	11.4	11.4	12.3	12.7	17.9	14.6	14.8	19.2
WORLD	1948750	1890290	3442700	*5130110*	*6353330*	2018420	1968180	3536460	*5201820*	*6543060*

Source: IMF, International Financial Statistics, various years

Table 3. Exports and Imports of East Asia to and from East Asia, EU and USA

Exports of East Asia (in %)

	1980	1985	1990	1995	1996	1997	1998	1999	2000	2001
East Asia	31.2	33.6	39.4	50.1	50.8	49.7	44.2	45.7	48.4	48.4
EU	14.7	11.7	17.5	15.0	14.7	14.9	17.1	16.7	15.6	15.5
USA	22.6	32.3	26.2	22.0	21.5	21.8	24.2	24.5	23.7	23.0

Imports of East Asia (in %)

	1980	1985	1990	1995	1996	1997	1998	1999	2000	2001
East Asia	30.7	39.1	42.9	51.5	50.7	50.7	52.2	53.4	54.4	52.6
EU	9.6	10.9	14.4	14.4	14.4	13.9	14.0	13.0	11.8	12.9
USA	16.4	17.5	18.1	16.1	16.3	16.1	16.5	15.5	14.0	13.7

East Asia includes Japan, China, Hong Kong, Taiwan, South Korea, Indonesia, Malaysia, the Philippines, Singapore, and Thailand.
Source: IMF, Directions of Trade Statistics Yearbook, 2002.

Table 4. FDI Inflows, Selected Years ($US million)

	1980	Share	1985	Share	1990	Share	1995	Share	2000	Share	2001	Share
China	57		1659		3487		35849		40772		46846	
Hong Kong	710		-267		3275		6213		61938		22834	
Japan	278		642		1753		41		8322		6202	
S. Korea	6		234		789		1776		9283		3198	
Taiwan	166		342		1330		1559		4928		4109	
Northeast Asia	3197	5.82	4595	7.98	12624	6.23	47433	14.35	127243	8.53	83189	11.32
Indonesia	180		310		1092		4346		-4550		-3277	
Malaysia	934		695		2611		5816		3788		554	
Philippines	-106		12		550		1459		1241		1792	
Singapore	1236		1047		5575		8788		5407		8609	
Thailand	189		164		2562		2068		2813		3759	
Southeast Asia	2433	4.43	2228	3.87	12390	6.11	22477	6.80	8699	0.58	11437	1.56
East Asia	5630	10.25	6823	11.85	25014	12.34	69910	21.15	135942	9.11	94626	12.87
EU	21317	38.80	15879	27.57	90213	44.49	114439	34.62	808519	54.19	322954	43.93
USA	16918	30.79	20490	35.58	48422	23.88	58772	17.78	300912	20.17	124435	16.93
World	54945	100.00	57596	100.00	202782	100.00	330516	100.00	1491934	100.00	735146	100.00

Source: UNCTAD, Handbook of Statistics, 2002

Table 5. Descriptive Statistics

Descriptive Statistics (Jan. 1990 - June 1997)

	N	Minimum	Maximum	Mean	Std. Deviation
CHI	88	7.20	10.44	8.8486	1.26924
HKC	46	3.38	11.50	5.3484	1.24583
JAP	90	.444	8.191	3.52906	2.683370
KOR	90	9.5	19.7	13.464	2.2037
TAI	90	5.09	13.23	7.1219	1.57784
IND	90	5.68	26.90	12.4378	3.23469
MAL	90	4.116	10.100	6.63009	1.180271
PHI	90	7.426	36.210	14.07151	4.494053
SIN	90	1.0	7.7	3.665	1.4969
THA	90	2.367	16.259	9.43558	3.225900
Valid N (listwise)	46				

Descriptive Statistics (July 1998 – Dec. 2002)

	N	Minimum	Maximum	Mean	Std. Deviation
CHI	54	2.70	5.22	3.4633	.76542
HKC	54	1.38	17.75	4.7278	2.53049
JAP	54	.002	.427	.08674	.115780
KOR	54	3.99	12.67	5.2019	1.48925
TAI	54	1.52	6.95	4.1344	1.42230
IND	54	8.49	81.01	20.9539	17.70454
MAL	54	2.51	9.21	3.3604	1.55883
PHI	54	6.9	15.9	10.031	2.5262
SIN	54	.75	5.38	2.0980	.99787
THA	54	1.23	11.72	2.4069	1.91939
Valid N (listwise)	54				

CHI = Mainland China, HKC = Hong Kong, China, JAP = Japan,
KOR = South Korea, TAI = Taiwan, IND = Indonesia, MAL = Malaysia,
PHI = the Philippines, SIN = Singapore, and THA= Thailand.

Table 6A. Correlation Coefficients (Jan. 1990 – June 1997**)**

		CHI	HKC	JAP	KOR	TAI	IND	MAL	PHI	SIN	THA
CHI	Pearson Correlation	1	-.216	-.670**	-.554**	-.252*	-.225*	-.677**	-.232*	-.220*	-.123
	Sig. (2-tailed)	.	.150	.000	.000	.018	.035	.000	.029	.039	.253
	N	88	46	88	88	88	88	88	88	88	88
HKC	Pearson Correlation	-.216	1	.211	.238	-.040	.780**	.306*	.219	.112	.556**
	Sig. (2-tailed)	.150	.	.159	.111	.793	.000	.038	.144	.459	.000
	N	46	46	46	46	46	46	46	46	46	46
JAP	Pearson Correlation	-.670**	.211	1	.612**	.570**	.252*	.143	.270*	.690**	.284**
	Sig. (2-tailed)	.000	.159	.	.000	.000	.017	.178	.010	.000	.007
	N	88	46	90	90	90	90	90	90	90	90
KOR	Pearson Correlation	-.554**	.238	.612**	1	.150	.185	.248*	.227*	.403**	.212*
	Sig. (2-tailed)	.000	.111	.000	.	.159	.081	.019	.031	.000	.045
	N	88	46	90	90	90	90	90	90	90	90
TAI	Pearson Correlation	-.252*	-.040	.570**	.150	1	.034	-.193	-.018	.603**	.215*
	Sig. (2-tailed)	.018	.793	.000	.159	.	.753	.069	.868	.000	.042
	N	88	46	90	90	90	90	90	90	90	90
IND	Pearson Correlation	-.225*	.780**	.252*	.185	.034	1	.130	-.038	.213*	.525**
	Sig. (2-tailed)	.035	.000	.017	.081	.753	.	.222	.725	.044	.000
	N	88	46	90	90	90	90	90	90	90	90
MAL	Pearson Correlation	-.677**	.306*	.143	.248*	-.193	.130	1	.168	-.214*	-.042
	Sig. (2-tailed)	.000	.038	.178	.019	.069	.222	.	.112	.043	.696
PHI	Pearson Correlation	-.232*	.219	.270*	.227*	-.018	-.038	.168	1	.009	-.092
SIN	Pearson Correlation	-.220*	.112	.690**	.403**	.603**	.213*	-.214*	.009	1	.492**
	Sig. (2-tailed)	.039	.459	.000	.000	.000	.044	.043	.936	.	.000
	N	88	46	90	90	90	90	90	90	90	90
THA	Pearson Correlation	-.123	.556**	.284**	.212*	.215*	.525**	-.042	-.092	.492**	1
	Sig. (2-tailed)	.253	.000	.007	.045	.042	.000	.696	.388	.000	.
	N	88	46	90	90	90	90	90	90	90	90

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

Table 6B. Correlation Coefficients (July 1999 – Dec. 2002)

		CHI	HKC	JAP	KOR	TAI	IND	MAL	PHI	SIN	THA
CHI	Pearson Correlation	1	.594**	.655**	.776**	.728**	.907**	.867**	.785**	.611**	.689**
	Sig. (2-tailed)	.	.000	.000	.000	.000	.000	.000	.000	.000	.000
	N	54	54	54	54	54	54	54	54	54	54
HKC	Pearson Correlation	.594**	1	.652**	.630**	.824**	.527**	.577**	.694**	.779**	.541**
	Sig. (2-tailed)	.000	.	.000	.000	.000	.000	.000	.000	.000	.000
	N	54	54	54	54	54	54	54	54	54	54
JAP	Pearson Correlation	.655**	.652**	1	.815**	.681**	.678**	.748**	.863**	.707**	.694**
	Sig. (2-tailed)	.000	.000	.	.000	.000	.000	.000	.000	.000	.000
	N	54	54	54	54	54	54	54	54	54	54
KOR	Pearson Correlation	.776**	.630**	.815**	1	.712**	.834**	.905**	.710**	.821**	.919**
	Sig. (2-tailed)	.000	.000	.000	.	.000	.000	.000	.000	.000	.000
	N	54	54	54	54	54	54	54	54	54	54
TAI	Pearson Correlation	.728**	.824**	.681**	.712**	1	.549**	.562**	.808**	.852**	.502**
	Sig. (2-tailed)	.000	.000	.000	.000	.	.000	.000	.000	.000	.000
	N	54	54	54	54	54	54	54	54	54	54
IND	Pearson Correlation	.907**	.527**	.678**	.834**	.549**	1	.962**	.668**	.572**	.845**
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.	.000	.000	.000	.000
	N	54	54	54	54	54	54	54	54	54	54
MAL	Pearson Correlation	.867**	.577**	.748**	.905**	.562**	.962**	1	.687**	.634**	.905**
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.	.000	.000	.000
	N	54	54	54	54	54	54	54	54	54	54
PHI	Pearson Correlation	.785**	.694**	.863**	.710**	.808**	.668**	.687**	1	.709**	.550**
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.	.000	.000
	N	54	54	54	54	54	54	54	54	54	54
SIN	Pearson Correlation	.611**	.779**	.707**	.821**	.852**	.572**	.634**	.709**	1	.737**
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.000	.	.000
	N	54	54	54	54	54	54	54	54	54	54
THA	Pearson Correlation	.689**	.541**	.694**	.919**	.502**	.845**	.905**	.550**	.737**	1
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.000	.000	.
	N	54	54	54	54	54	54	54	54	54	54

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

Table 7. Unit Root Tests for Money Market Rates
Pre-crisis Period (Jan. 1990 – June 1997)

Country	Levels		First Differences	
	lag	ADF statistic	lag	ADF statistic
China	2	-2.032152	2	-4.358656**
Hong Kong	2	-1.756557	2	-4.469104**
Japan	2	-1.545663	1	-4.858091**
S. Korea	2	-3.390949	2	-6.034975**
Taiwan	1	-5.162297**	1	-9.529255**
Indonesia	2	-2.379215	2	-6.097177**
Malaysia	2	-1.436168	1	-8.746820**
Philippines	2	-4.680725**	2	-8.519602**
Singapore	2	-1.676088	2	-5.386017**
Thailand	2	-2.506739	2	-6.716186**

Post-crisis Period (July 1998 – Dec. 2002)

Country	Levels		First Differences	
	lag	ADF statistic	lag	ADF statistic
China	1	-3.787775*	1	-6.319919**
Hong Kong	2	-3.863159*	2	-6.404870**
Japan	1	-3.030101	1	-4.935971**
S. Korea	1	-10.762610**	1	-3.747458*
Taiwan	1	-2.165212	1	-4.782432**
Indonesia	1	-2.165212	1	-6.398614**
Malaysia	1	-1.716078	1	-4.610259**
Philippines	1	-2.506624	1	-5.240516**
Singapore	1	-3.800198*	1	-5.083557**
Thailand	1	-20.889741**	1	-3.532143*

** significant at the 1 percent level.
* significant at the 5 percent level.

Table 8. Multivariate Co-integration Test Results

Pre-crisis Period (Jan. 1990 – June 1997)
Series: China, Hong Kong, Japan, South Korea, Indonesia, Malaysia, Singapore, and Thailand
Lag interval: 1 to 2
Test assumption: linear deterministic trend in the data

Hypothesis	Likelihood Ratio	Eigenvalue	5% Critical Value	1% Critical Value
H: r=0	280.26	.877	156.00	168.36
H: r≤1	196.39	.730	124.24	133.57
H: r≤2	143.96	.711	94.15	103.18
H: r≤3	94.25	.602	68.52	76.07
H: r≤4	57.36	.491	47.21	54.46
H: r≤5	30.28	.394	29.68	35.65
H: r≤6	10.27	.216	15.41	20.04
H: r≤7	.53	.013	3.76	6.65

Likelihood ratio test indicates 6 co-integration equations at 5% significance level.

Post-crisis Period (July 1998 – Dec. 2002)

Series: Japan, Taiwan, Indonesia, Malaysia, and the Philippines
Lag interval: 1 to 2
Test assumption: linear deterministic trend in the data

Hypothesis	Likelihood Ratio	Eigenvalue	5% Critical Value	1% Critical Value
H: r=0	136.35	.616	68.53	76.07
H: r≤1	84.64	.601	47.21	54.46
H: r≤2	39.99	.367	29.68	35.65
H: r≤3	16.23	.247	15.41	20.04
H: r≤4	2.12	.092	3.76	6.65

Likelihood ratio test indicates 4 co-integration equations at 5% significance level.

Comments on "Economic and Financial Integration in East Asia and Necessary Regulatory Reform for a Financial Hub in Korea"

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I have enjoyed Professor Park's coauthored paper very much. I found it to be timely and educational. It is timely because the Korean government has made many efforts for it to be a financial hub, and this paper could be a good supplement to its efforts. It is also educational. Using monthly money market rates, Prof. Park has demonstrated the convergence of interest rates across countries in Far East Asia after the Asian Financial Crisis and confirmed the increasing financial market integration. Based on the findings, Prof. Park has emphasized necessary regulatory reform for financial hub in Korea.

I agree with Prof. Park, especially on the quantitative part. The Far East Asian crisis has been an important structural break in this region. Globalization the issue of which Prof. Park has just raised is one scope. Massive current account surplus is another. Search for economic rationale behind large amount of the current account surplus in East Asian countries is more than an academic puzzle. (1) It could simply be reflection of serious economic imbalance in U.S.[1] (2) It could be the outcome of the mercantile government's policy.[2] Or (3) it could be the result of inefficient financial market.[3] Nonetheless a more sophisticated and vital financial market is needed for recycling surpluses in a more efficient way and it will be. Naturally, the benefit for building a financial hub could be much greater than what we imagine.

For regulatory reform for a financial hub in Korea Prof. Park has proposed 1) functional based legal and regulatory system 2) enhancing transparency of corporate governance and market transactions and 3) convertible of the KRW.

In fact Prof. Park's suggestions are more than the necessary condition for financial hub. They are prerequisites for Korea to be an advanced, developed country. In theory, these should be satisfied by all means. In reality, however, things are very complicated. For example, new functional based legal and regulatory system so-called consolidated financial law submerged even before it emerged in public. Without government leadership conflict of interests would make the new law very hard to legislate. Government is reluctant to let the KRW convertible. Considering pro-cyclical nature of international capital flows deregulating capital flows is not going to be easy since it has potential risk of depriving monetary policy instruments.

In my opinion, we shouldn't be too ambitious to create a financial hub in Korea. Instead, we should narrow down to what we really can do. What Prof. Park presents in his paper may be summarized as developing financial market in terms of depth and quality, the benefit of which is a liquid market. Perhaps we should create future market for commodities the Korean economy is well aware of. They are computer chips, steel, LCD, petroleum, among others. Korean firms will benefit from liquid commodity markets and have a better understanding of pricing them. Eventually, it will attract foreign investors. To be honest, market driven approach to create a financial hub in Korea seems to be more viable than government led approach.

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[1] Obstfeld, M. and K. Rogoff, "The Unsustainable US Current Account Position Revisited", NBER working paper 10869, October 2004.

[2] The Economist, Oriental Mercantilists, Sept.18th, 2003.

[3] Wolf, M., "Capital Flow must change Course," Financial Times, June 26, 2005.

Safeguarding Economic Cooperation, Reform, and Development on the Korean Peninsula

by

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I. Introduction

In the aftermath of the collapse of the Soviet Union and other socialist regimes in Central and Eastern Europe (CEE), many analysts expected that the Democratic Peoples' Republic of Korea (DPRK, or North Korea) would soon suffer the same destiny. However, despite a decade of economic decline, international isolation, and widespread famine the North Korean regime managed to muddle through in the 1990s. By the end of the last decade, when Kim Jong-il had consolidated his power and gained acceptance by the political elite as well as the citizenry, the assessment of North Korean politics and the prospects for change on the Korean peninsula became more differentiated. Particularly since the historical summit in June 2000 optimists among students of Korean affairs, international observers, and South Korean policy makers tend to believe that the DPRK leadership has started a process of serious economic and possibly political transition. Optimists argue that the North Korean regime may be prepared to disarm its military threat potential and to overcome military tensions in Northeast Asia if the United States abrogates economic sanctions (Kim 2000). Moreover, mainly driven by Kim Dae-jung's 'sunshine policy', a consultative and cooperative process between the Koreas appeared to have begun that aims at national reconciliation. The South Korean government not only held out the prospect of aid and bilateral economic cooperation and called for a peaceful coexistence of the two nations, but also offered a long-term unification proposal. At the same time, North Korea seemed to be willing to consider a model of 'one country, two systems' (similar to the model of China and Hong Kong) as a feasible long-term development option (Noland 2000a). These (presumed) changes in political articulation

and action, raised substantial hopes for achieving a stable peace, economic prosperity, and a unified Korea in the medium and long run. This optimistic viewpoint has been reinforced in July 2002 when North Korean authorities introduced an unexpected price reform, wages increases, and other half-hearted policy changes that might be regarded as a first small step towards market-oriented reforms.[1]

Pessimists, on the contrary, interpret the recent change in North Korean rhetoric and the regime's conciliatory gestures as just another tactical move in the overall game of brinkmanship that the North Korean leadership has been playing for a long time. They point out that genuine reform and opening up is not on the North Korean agenda and that the new rhetoric and gestures are just applied in order to secure international aid flows, which are needed to preserve the regime. Moreover, skeptics interpret the recent price and salary increases merely as a means to pass the burden of economic decay more fully onto North Korea's suffering citizens (Kim 2000; Eckert 2002).

All analysts agree, however, that the future political and economic developments on the Korean peninsula will be characterized by substantial change that bears considerable uncertainties, risks, and costs. The expected fundamental shift in North Korean economic and political development as well as in inter-Korean relations has been discussed in numerous studies that are based on different scenarios.[2] Due to the lack of (reliable) data on the North Korean economy, some studies on the DPRK and North-South economic relations have been rather descriptive than analytic. Other studies seek to draw lessons from transition economies in CEE and East Asia or from the experiences of German unification. Therein, scholars frequently assume that economic transition and integration strategies that worked well elsewhere can be similarly applied on the Korean peninsula without accounting for different context- and time-specificity. Finally, some studies discussing the prospects for economic reform in North Korea and North-South economic cooperation tend to disregard the fact that policy reform has not only an economic, but also a social, political, and even a geopolitical dimension.[3] But neglecting the political, economic, and social interdependencies of policy reform and institutional change may lead to theoretically efficient solutions, but politically not feasible propositions.

At present, there is a lack of studies that analyze inter-Korean economic cooperation and possible economic reforms in North Korea from a theoretically-conceptual perspective.[4] In order to avoid ad-hoc policy action and to develop a comprehensive development strategy for North Korea and inter-Korean economic relations, more studies are needed that explicitly consider the dialectic relationships between economics and politics and focus on incentives which make reform and integration a viable policy choice. This paper seeks to contribute to this discussion. In particular, it addresses the question of how an inter-Korean economic integration process and economic reforms in North Korea (that will necessarily accompany integration) can be institutionally safeguarded.

The analysis builds upon recent research on the emerging economic cooperation between North and South Korea.[5] By applying an institutional and politico-economic perspective, it extends this research through a normative, though theoretically underpinned, analysis of how inter-Korean economic integration could be enhanced and institutionally governed. In this context, a recently developed concept of governance can

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[1] See "Open sesame", Economist, July 25, 2002 as well as the critical analysis of these policy changes in Eberstadt (2004).

[2] See, e.g., Lee (2001b), Kim (2000), Noland (2000a and b), and Pollack and Lee (1999).

[3] See, e.g., Flassbeck and Horn (1996) and Lee (2002).

[4] Notable exceptions include, e.g., Noland et al. (1998 and 2000), and Kim (2000).

[5] See, e.g., Noland (2000a–d), Pollack and Lee (1999), Pfennig (2001), Lee (2001b), and Ahrens (2002a).

be fruitfully applied in order to identify appropriate institutions, which can safeguard the reconciliation process on the Korean peninsula.

The paper is structured as follows. In the next section, different scenarios of future economic and political developments on the Korean peninsula are briefly discussed. Section 3 provides the conceptual basis for the subsequent analysis by highlighting the importance of institutions for successful economic reform and integration. Section 4 elaborates institutional safeguards for a gradual reform-cum-integration scenario. Section 5 concludes.

II. The Final Countdown or Towards a New North Korea?

The precise course, the scope as well as the pace of the expected fundamental shift in inter-Korean dynamics is far from clear. Actual future developments will ultimately depend on how the fundamental dilemma faced by the North Korean regime will be overcome. As Pollack and Lee (1999: xv) observe, "(i)f the North Korean regime launched major market-oriented economic reforms, the country would very likely face massive socioeconomic disruption and a growing challenge to its political legitimacy. But if the leadership resists major change, the country's economic base will decline further, ultimately threatening the regime's viability." Due to the lack of information about North Korea, the complex dynamics of the involved reform and policy issues, and the enormously politicized nature of inter-Korean relations, it is highly speculative to make any well-founded predictions about the actual direction of future economic integration. Contingent on how the North Korean leadership will seek to solve its dilemma, there are at least five different scenarios for peninsula development, which have been discussed in the literature (see Figure 1).[6] While, in the end, all scenarios will (most likely) lead to a reunification of the two Koreas, they substantially differ with respect to the political and economic costs incurred on the political elite in North Korea and the societies of both countries.

Figure 1: Scenarios of North Korean Development and Implications for Peninsula Integration

Sources: Lee (2001b); Pollack and Lee (1999), Noland (2000b), Foster-Carter (1998).

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[6] For detailed descriptions of these scenarios, possible variations and deviations as well as policy implications, see Pollack and Lee (1999) and Noland (2000b and 2002).

The first scenario, big-bang economic reform, is more of a theoretical interest. Given the North Korean leadership's primary concern with regime survival, it cannot be realistically expected that bold market-oriented economic reforms will be conducted in a shock-therapy like manner. This would literally turn the economy upside down, deprive the government of any effective control of economic processes, and directly undermine the regime's legitimacy. The second scenario, economic/political collapse cannot be entirely ruled out. In fact, if the North Korean leadership does not conduct any meaningful economic reforms or if it initiates reforms, but fails, the collapse scenario may be conceivable; especially if foreign aid flows tend to decrease and mass mobilization, e.g., responding to worsening economic conditions, will emerge (Noland 2002). In that case, the absorption of the North Korean economy into South Korea's through a German-style transformation-cum-integration program may appear inevitable. Similarly, the third scenario, conflict–collapse–absorption, appears to be unlikely at present. Although North Korea has repeatedly used its nuclear and military threat potential as a trump card, its leadership does not appear to be prepared for a military conflict. Although the country's military power belongs to the strongest in the world, there are hardly any chances to survive a conflict with South Korea victoriously, given the current geopolitical situation in Northeast Asia.[7]

Given a number of positive signals that occurred over the past few years, optimists may claim that the North Korean leadership has in fact already begun to undertake a genuine policy shift, to initiate gradual market-oriented economic reforms and hence to put the fourth scenario into action: Subsequent to the historical summit in 2000[8], North Korea undertook a striking shift in foreign policy. It improved its bilateral relationship with China as well as Russia and established diplomatic relations with a number of Western governments including most member countries of the European Union. Furthermore, North Korea made four treaties with South Korea relating to investment guarantees, payment mechanisms, trade dispute arbitration, a legal framework for foreign direct investment, and preventing double taxation. Several *chaebols* have started to further economic cooperation with the North, which may imply a new dimension of hard-currency infusions into economic projects in North Korea. More specifically, economic cooperation between the North and the South has been fostered through the Mt. Kumgang tourism project, a contract for an industrial park that allows Hyundai to invest multi-billion US dollar in the area of Kaesong close to the so-called Demilitarized Zone, and the reported possibility of another special economic zone (SEZ) (also to be developed by Hyundai).[9]

In addition, farmers markets and private enterprises in the retail sector have been increasingly tolerated, more business delegations have been going abroad, and several hundreds of economists and civil servants have been sent abroad for training and to study market economics and management, a training institute for market-economic practices and a research institute focusing on capitalism were opened in 1998 and 2000, respectively, and DPRK officials raised the hope in public that the country may join the International Monetary Fund (IMF) and the World Bank. Moreover, North Korea became a member of the ASEAN Regional Forum in 2000, which is the very first such dialogue on multilateral security that the DPRK has ever participated in.[10] This course of 'positive

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[7] Regarding the conflict scenario see the detailed analysis in Pollack and Lee (1999)

[8] A comprehensive evaluation of the inter-Korean summit can be found in Chon (2002). Regarding a thoughtful reassessment, see Moon and Kim (2001).

[9] See Lee (2001b), Noland (2001a), and Eberstadt (2002).

[10] See Eberstadt (2002), Hassig and Oh (2002), and Economist Intelligence Unit (2002).

developments' preliminarily climaxed in July 2002 when the Kim Jong-il regime introduced a price reform that was labeled by one foreign observer as the "most dramatic liberalization measures since the start of Communist rule"[11] All these measures, that appeared unthinkable a few years ago, may be seen by optimists as a willingness to break with old habits and to create a "new North Korea" that is ready to travel to the modern world of the 21st century. Most observers, however, view the fifth scenario, i.e. the muddling-through strategy, as the most likely variant. [12] They argue that the international diplomacy campaign and the partial economic reform measures, which have been implemented (if not only announced) so far, just served the purpose to secure foreign aid and to enhance the regime's legitimacy externally and internally (Eberstadt 2004; Hassig and Oh 2002; Kim 2000).

However, even if Pyongyang opts for the muddling-through strategy for the present and is able to receive external assistance without being forced to undertake major reforms, this strategy will not be viable indefinitely. Regime-preserving reforms will inevitably imply further economic decline. This will force the North Korean leadership at some point in time to choose whether to allow the economy to collapse and consequently to risk its political survival or to seek to maintain its power through genuine, though gradual economic reforms. The realization of this latter option, however, presupposes the willingness and ability of the leadership to adequately change, adjust or re-interpret the predominant *Juche* ideology. Although most recent developments document weak signals that an ideological shift may become possible (Babson 2001a), the realization of the necessary policy steps of such a change does not appear to be feasible at present.

Nevertheless, recent events on the Korean peninsula raise some hopes for productive and fruitful progress in inter-Korean consultation and cooperation. Even if it seems to be illusionary to seriously talk about an eventually peaceful unification today, policy research should take different scenarios seriously into consideration and seek to elaborate strategies which help North and South Korean policy makers as well as external actors to adequately deal with different development trajectories. In this context, the gradual-reform option does not seem to be a too unrealistic scenario at least as external *economic* cooperation is concerned. Although this scenario may not be the one which is to be preferred from the perspective of pure economic theory (Wolf 1998), it seems to be more feasible for political reasons: (1) Strengthening economic cooperation between the two Koreas may be one of the least politically sensitive areas of reform (at least at the lower stages of cooperation); (2) a gradual opening could help the North Korean leadership to maintain its control over economic development; (3) gradual reforms may allow the North Korean leadership to slowly adjust its ideological label that may be attached to the

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[11] "Signs of change emerge in North Korea", New York Times, August 10, 2002.

[12] See, e.g., Noland (2000b) and Pollack and Lee (1999). Pollack and Lee (1999) account for yet another scenario, that is theoretically conceivable but, at present, hardly realistic: If the North Korean polity should enter an enduring stage of disequilibrium but not ultimately collapse and if external powers, in particular China, decide to support the weakened regime, its chances to survive would be substantially enhanced. Although the Chinese authorities are currently not inclined to do so and rather support Kim Dae-jung's sunshine policy, Pollack and Lee (1999: xvi) identify three sets of circumstances which may lead the Chinese government to change its viewpoint: "(1) if the North (…) signals its readiness to 'tilt' toward Beijing in exchange for enhanced economic and political support; (2) if the indicators of instability in the North and its repercussions for stability and security in contiguous border areas convince the Chinese that they need to act to manage the risks to their security and ensure their long-term interests; or (3) if the ROK and the United States embark on unilateral actions to counter instability in the North that China believes would undermine its long-term political and security interests."

reform process. In this context, it would be conceivable to expect a gradual shift in political articulation and action toward a 'socialist market-based economy, North-Korean style'; (4) a gradual engagement approach would reduce the chance of a North Korean collapse and help preserve peace on the Korean peninsula[13]; and (5) gradualism may also be favored by the South Korean government and citizenry. Even if the cumulated economic costs ought to be higher than under a big bang-cum-rapid unification scenario, these costs could be distributed over a much longer period of time making integration more affordable for a South Korean economy that currently struggles to recover from its recent crisis.

Given the recent 'reform measures and diplomatic opening', it could be assumed that North Korea is in the middle of Scenario 5 facing the alternative to have the economy further decline and eventually collapse or to start market-oriented reforms. Pessimists may argue that the recent price reform is a half-baked policy measure that will merely fuel inflation, further destabilize the economy and just represent the first step for a final countdown for the North Korean economy. However, if this reform will be complemented by further policy and institutional reform measures that are suitable to strengthen the supply side of the economy, then the optimistic view will be strengthened, namely that the Kim Jong-il regime is on its way to create a 'new North Korea'. At present, it is too early to tell. Therefore, neither the gradual reform-cum-integration scenario nor the collapse-cum-absorption scenario should be ruled out, the more so as collapse could also occur as the result of failed gradual reforms (Noland 2002).

The following analysis is based on the following assumptions[14]:

- Kim Jong-il and his advisors do not (any longer) regard the North Korean state as a model for Korean unification. They are primarily concerned with regime survival;
- the economy of North Korea is caught in dire straights and cannot rely anymore on open-ended subsidies from other (former) socialist countries. Given the centrally planned character of policy making, an economic recovery cannot be expected;
- economic reform (especially big-bang style) is regarded as a potentially destabilizing factor. However, recent shifts in political rhetoric, progress in diplomatic opening, and some signs of increased flexibility in economic policy making may reflect a greater amenability of the North Korean regime to change. But a firm commitment to genuine reform does not exist;
- growing economic vulnerabilities imply an increasing likelihood of significant change in North Korea: without reform, an economic and subsequent political collapse is inevitable;[15]
- aintaining peace and political stability on the Korean peninsula is the overall objective, that is shared by all states.

This paper focuses on a gradual reform-cum-integration scenario, in which North Korea would be willing to improve relations and to gradually promote economic integration with the South. This scenario also assumes the maintenance of two sovereign

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[13] A disadvantage of such an engagement approach may be seen in its effect to strengthen and reward a totalitarian regime and to prolong the suffering of millions of North Koreans if primarily the ruling elite will benefit from foreign aid and investment; see Hassig and Oh (2000).

[14] These assumptions essentially follow the line of reasoning in Noland (2001b).

[15] This assumption may not hold, if the scenario referred to in footnote 12 occurs. Should, e.g. China offer to North Korea substantial cooperation and support in order to maintain the rigid North Korean regime and hence its prevailing disequilibria, collapse is less likely. However, this scenario is supposed to be least likely given the present (geo)political situation in North East Asia; see Pollack and Lee (1999).

states and a sufficient degree of convergence of economic and political practices to make sustained reforms plausible and feasible. In particular, this means generating sufficient reform in the North Korea's economic system to make some degree of integration with the South sustainable and also revitalizing and reforming South Korea's economy after the recent crisis. Last but not least, such a soft-landing-cum-integration scenario requires substantial, but diplomatic external framing, i.e. especially that third countries, which are key players in North East Asian politics, provide adequate assurances as well as suitable incentives to the North Korean regime.

III. The Institutional Foundation of Integration and Transition

The gradual reform-cum-integration scenario is based on the notion of a peaceful coexistence of the two Koreas as two sovereign countries as well as mutually beneficial economic cooperation and integration. Both economic integration between North and South as well as reforms of the North Korean economy will be gradual in this scenario, and it would be possible for North Korea to basically separate political and economic reforms. This would imply that the political regime might survive for a considerable period of time and be able to conduct domestic economic reforms at its will.

Since the outcomes of different policy measures strongly depend on the existing economic and political institutions, it is of utmost importance to make institution building a top priority in the integration-cum-reform agenda. In the gradual reform-cum-integration scenario, institutions need to be created that enhance the incentive compatibility for the North Korean policy makers so that economic reform and integration becomes a viable policy choice for them. Moreover, geopolitical and security aspects need to be taken into account in order to reduce political tensions on the Korean peninsula and to create mutual trust between the involved countries. This chapter elaborates a theoretical concept that may be appropriate to guide and safeguard policy reform through adaptively efficient institution building.

The recent literature on the political economy of policy reform and economic transition explicitly focuses on the interaction of political institutions, economic rules and regulations, and economic performance.[16] One of the key propositions of this strand of the literature is that a country's politico-institutional matrix determines the incentives of government officials and hence whether or not policy making will be characterized by good or by bad governance. In the course of the 1990s, the establishment of suitably crafted economic *and* political institutions constituting good governance has been increasingly recognized as an unalterable precondition to formulate and implement market-oriented reforms, to enforce private contracts and property rights, to foster regional integration, and to achieve sustained economic growth. Following North (1994: 360), institutions are

> "the humanly devised constraints that structure human interaction. They are made up of formal constraints (e.g., rules, laws, constitutions), informal constraints (e.g., norms of behavior, conventions, self-imposed codes of conduct), and their enforcement characteristics. Together they define the incentive structure of societies and specifically economies."

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[16] See, e.g., Roland (2002 and 1994), Ahrens and Meurers (2002), Ahrens (2002b), Sturzenegger and Tommasi (1998), Campos and Root (1996), Weingast (1995), Knack and Keefer (1995), and North (1990).

While institutions constrain economic behaviour, organizations, such as government agencies, the legislature, political parties, courts, the military, business firms, trade unions as well as civic organizations, are the players. Organizations themselves are built upon institutional arrangements. Hence, they act according to their preferences on the one hand and the institutional constraints in which they are embedded, on the other hand.

Institutions serve collective purposes and structure interaction in markets, firms, networks as well as political exchange and the implementation of public policies. They may facilitate economic exchange (domestically and internationally), induce human capital development, encourage technological change, and reduce transaction costs. But they may also support political and economic monopolies, thwart capital formation, and increase the costs of transacting. Generally, institutions provide the incentive structure of individual behaviour, that determines individual choices and dictates the skills and knowledge, which are expected to have the highest payoff. Finally, institutions influence a country's economic performance, because they have a significant impact on the efficacy of micro- and macroeconomic policies. In the absence of an institutional foundation of policy reform, even the 'right' policy choices will not materialize as expected.[17]

A great variety of institutions and organizations perform critical roles in market economies and during the processes of economic transition and regional economic integration: contract and company law, bankruptcy and liability regulations, foreign trade laws, the security of (intellectual) property rights, informal institutions such as entrepreneurial spirit, reciprocity and mutual trust in sharing information and resources and transferring knowledge as well as organizations such as independent central banks, anti-trust offices, anti-corruption agencies, universities, research organizations, intermediary agencies acting as information brokers, business associations or financial organizations supplying long-term investment and venture capital as well as civic organizations such as watchdog committees and ombudsmen and a great variety of non-governmental organizations. However, the emergence of these and other institutions and organizations and their proper functioning cannot be taken for granted. Collective-action and institutional failures often result from the inability of private actors to organize themselves, to coordinate investment, innovation activities, and production decisions, and to enforce private contracts. Even if collective action succeeds, the outcome may be socially inefficient due to an unequal distribution of power in the private sector. In these cases, private ordering alone will not yield socially desired results. Under such circumstances, it is the role of the state to help overcome these types of institutional failure and to *facilitate* the supply, that is the implementation and enforcement, and at times also the creation of socially beneficial institutions.[18]

But the supply of institutions by the government is not only contingent on the reform-mindedness of the political leadership but also depends on the administrative capacity and bureaucratic capabilities of the state apparatus. Moreover, the capacities of a public administration to implement economic reforms depend on the existence of a skilled, meritocratic, and professional civil service, that is shielded from vested interests, and a transparent, non-discriminating government-business interface as well as on the institutions that guide political processes in a given country or between countries.[19]

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[17] See Ahrens and Meurers (2002), Ahrens (2002b) and Kaufman et al. (1999).

[18] Impediments to institutional change are discussed at length in Bardhan (2000) and Lin and Nugent (1995).

[19] See Feeny (1988), World Bank (1997), Evans (1995) as well as Lee (1999) for an application of this argument to South Korea.

These considerations underline the argument that policy reform, economic transition and integration will be only successful if they are based on a secure and stable politico-institutional foundation.[20] Such a foundation that enhances the incentive compatibility of policy reform and economic performance for political decision makers is of particular importance if a firm and irreversible commitment to reform is absent or cannot be easily made credible, as is the case in today's North Korea. In this case, it is also a necessary mechanism to institutionally safeguard inter-Korean integration and a more general economic opening of the North Korean economy vis-à-vis the rest of the world. The institutional arrangements that underlie the DPRK's external economic relations must be designed to benefit not only the North Korean economy in general but also the current political elite, so that it is in the interest of North Korea's authorities to achieve progress also in domestic economic reforms as a precondition to fully reap the benefits from foreign trade, foreign direct investment, and the access to international capital markets.[21]

Thus, elaborating a set of economically effective and politically feasible reform measures is one side of a coin, the reverse side being the need to craft institutional arrangements that enhance policy makers' credible commitment to policy reform and enable them to implement reform measures successfully. This insight has led scholars of economic development and transition as well as policy makers and international organizations to give governance-related reforms a prominent role on the agenda of policy and institutional reform.[22] Given the notion that institutions primarily shape economic and political exchange and determine the formation of policies, we define governance as

> the capacity of a country's formal and informal institutional matrix (in which individual actors, social groups, civic organizations and policy makers interact with each other) to implement and enforce public policies and to improve market coordination.

Each country's governance structure is based on innumerable formal as well as informal institutional arrangements, which affect policy formulation and enforcement. Since the number of relevant institutions is very large and various institutions are of different significance in different countries, conceptual and empirical analyses must rely on proxy variables to assess the efficacy and the deficits of a country's governance structure. To identify suitable proxies in a systematical way, Ahrens and Meurers (2002) condense the complexity inherent to country-specific governance structures: They identify separate governance dimensions, which mirror the quality of a country's institutions. It is argued that institutions, that help enhance the quality of policy making, need to show distinct characteristics: (1) they must be clearly defined and political as well as economic actors must be confident that they are properly enforced; (2) all actors must know and understand the rules and be able to recognize whether or not they are observed; (3) the set of rules must be sufficiently flexible to allow for institutional change if preferences, specific societal needs, or international conditions change over time. This also presupposes the existence of various channels through which individual actors or

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[20] For further in-depth elaboration on this argument see, e.g., North (1995), North and Weingast (1989), and Ahrens (2002b).

[21] Of course, this argument holds only for the gradual reform-cum-integration scenario. In the collapse-cum-absorption scenario, a North Korean political elite that needs to benefit from external economic relations does not exist.

[22] For an overview of the discussion of governance and its impact on policy reform see Ahrens (2002b).

organizations can initiate and contribute to institutional reform processes; and (4) institutional safeguards must be in place, which hinder powerful political and economic actors to arbitrarily circumvent or change existing rules at the expense of other actors or society as a whole.

These characteristics constitute four fundamental governance dimensions: predictability, transparency, participation, and accountability. All of these elementary principles are required for the sound management of public resources, an enabling environment for (international) market transactions, and a productive partnership between the public and private sector, that does not degrade into closed circles of influence and privilege. Beyond the realm of national policy reform, they are also required to conduct the activities of international organizations and to frame and to guide regional integration processes such as the envisaged inter-Korean economic rapprochement.

Governance provides the overall perspective from which these interrelated and mutually reinforcing principles are derived.[23] Institutional arrangements that further these principles are expected to provide those incentives, which are conducive to effective policy making and developmental outcomes. A governance structure is *effective* if it ensures that public policies and projects are properly implemented and that market processes can thrive within a given legal and regulatory framework, which is not subject to arbitrary political interference.

From this perspective, effective governance is independent of the basic character of a political system, i.e. the regime type. Even if the full realization of these principles cannot be expected to occur in totalitarian or other non-democratic settings, key elements of effective governance may not be absent. Recall in this context that East Asia's high-performing developmental states, most of which had rather authoritarian regimes when they successfully managed to catch up with more advanced economies, showed numerous elements of effective governance (Campos and Root 1996; Evans 1995). Under such circumstances, key elements of good governance may first come into existence at sectoral or sub-national levels or in specific parts or functions of the state apparatus such as particular government agencies and ministries and their relations with an existing or emerging private sector or with their counterparts abroad. In these subordinated realms, actual conditions may reflect the overall principles to varying degrees. Hence, we follow Wohlmuth (1998: 9) in presuming that "(w)hatever the quality and extent of macro-governance, the degree of meso- and micro-governance can vary by quality and extent". Even in countries with unfavorable structures of macro-level governance, functioning institutional structures at the meso and micro level can exist.

With respect to a potential economic reform process in North Korea and a possible inter-Korean economic integration process, one can argue that the more that policy reform and integration are reflected by the qualities that are associated with effective governance the more they induce political legitimacy, and the more private agents and the negotiating governments will comply with the given rules and regulations and accept policy changes.

A governance structure that scores relatively high on the fulfillment of these principles and yields comparatively high and sustained economic growth rates has been called a market-enhancing governance structure (MEGS).[24] In Ahrens (2002b), I argued

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[23] For a discussion of these principles and the corresponding imperatives for institution building see Ahrens (2002b).

[24] See Ahrens (2002b) for an in-depth discussion of this analytical concept of governance. In addition, see Root (1996), Olson (1997), and Kaufman et al. (1999). Recent research by development and institutional

that it takes a number of interdependent and mutually reinforcing reform measures at four levels of institution building to institute a MEGS. These comprise (1) the need to craft institutional mechanisms that allow governments to credibly commit to economic reforms and the need to enhance state capability and hence to create a state that is able to protect property rights, enforce contracts, and implement policy reforms; (2) the need to limit state authority in order to avoid predatory government behavior; (3) the need for capacity building as a precondition for technically, administratively, and politically implementing and enforcing reform policies; and (4) the need to create key economic institutions for enhancing and sustaining markets.

Creating the different components of a MEGS based on the four fundamental principles of governance is of utmost importance. With respect to the highly complex gradual reform-cum-integration scenario, we pointed out earlier that economic integration between the two Koreas presupposes a sufficient degree of convergence between the two countries regarding economic and political practices. Although this does not necessarily presuppose a radical transformation of the North Korean economy, it requires the introduction of at least some basic elements of a market system. This, however, will be only possible if the North Korean governance structure is considerably reformed with respect to economic policy making. Moreover, the envisaged economic integration process itself needs to be institutionally guided and safeguarded. This requires the creation of another MEGS that must be compatible with the national governance structures of the two integration parties. This 'integration MEGS' involves the creation of institutional arrangements that (1) make commitments to promises and policies of the two governments credible; (2) limit the authority of the two governments and reduce the propensity of any party to behave opportunistically[25]; (3) create in both countries the capacities needed to implement integration-related policies and enforce the agreed upon rules of integration; and (4) guide economic integration proper. Finally and of pivotal importance, the 'integration MEGS' requires the creation of institutions that are appropriate to create confidence and trust between the two Korean governments on the one hand and between the Kim Jong-il regime and the political leaderships of other countries which have a stake in Northeast Asian development, particularly China, Japan, Russia, and the United States, on the other hand. Therefore, the measures to craft an 'integration MEGS' should not only be guided by the four fundamental principles of governance (accountability, participation, predictability, and transparency), but also by a fifth principle – reciprocity. Keohane (1986: 8; emphasis in original) defined reciprocity as a concept that

> "refers to *exchanges of roughly equivalent values in which the actions of each party are contingent on the prior actions of the others in such a way that good is returned for good, and bad for bad.* These exchanges are often, but not necessarily, mutually beneficial;

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economists has persuasively suggested that market-enhancing government activism is critical to economic development (Aoki et al. 1997, World Bank 1997). But since government interventions can also severely impede economic development, if it is badly designed and implemented, governance-related reform measures need to accompany or even to precede policy reform.

[25] This aspect touches a politically highly sensitive issue: If, e.g., North and South Korea agree to cooperate more closely in economic terms and South Korea makes some specific investment in the North's economy (say in the transportation sector), it must be ensured that no holdup occurs, i.e. a situation in which North Korean policy makers behave opportunistically, do not comply with the mutually agreed upon rules of the game and instead seek to capture the rents that would actually accrue to the investor from the South.

they may be based on self-interest as well as on shared concepts of rights and obligations; and the value of what is exchanged may or may not be comparable."

Institutional arrangements that foster reciprocity have proved to facilitate international cooperation and to deter defection. In the context of the envisaged economic integration on the Korean peninsula, institution building guided by that principle could greatly help to make negotiations between the two Koreas and possibly third countries more transparent and predictable and to build confidence and trust between the negotiating parties.[26]

In general, MEGS are not only subject to political design, but also to evolutionary change, because they are embedded into the wider institutional matrix of society. This implies, on the one hand, that the formal institutional and organizational pillars of a MEGS are basically malleable through political intervention. On the other hand, this entails that policy makers would be badly advised if they try to craft new MEGS 'overnight' or in a top-down manner. Due to their bounded rationality, policy makers can neither know nor compare the consequences of all politically feasible actions nor can they anticipate all future changes in international relations, market conditions, and societal preferences. Like every economic decision, the design of formal institutions is subject to uncertainty. This also implies that it is not advisable simply to copy distinct components of governance structures which function effectively elsewhere in a different institutional environment. Thus, it needs to be emphasized that no blueprint for creating good governance exists, but that the emergence of MEGS is highly country- and context-specific.

After all, crafting a MEGS is a dynamic process. Policy makers need to ensure that policies match institutional arrangements and vice versa. Good governance requires a continual adjustment and fine-tuning of institutions and policies to changing political, economic, social, and international constraints. Thus, although the structural foundations of a MEGS must be relatively durable to allow for stabilizing expectations of both public officials and private economic actors, they need also to be sufficiently flexible in order to allow for institutional innovations, for adjusting institutions if new forms of conflict resolution are needed, and for feedback mechanisms that help to correct organizational errors and facilitate policy revisions in cases of failures. A MEGS is (sufficiently) flexible and hence adaptively efficient in a Northian sense if it is based on institutions that encourage learning processes, foster innovative activities, and ensure a relatively high degree of policy adaptability to a changing political, economic, and international environment.[27]

IV. Towards Gradual Reform and Integration on the Korean Peninsula

Based on the preceding conceptual considerations this chapter explicitly discusses how economic cooperation and integration between the two Koreas and economic transition towards a more market-oriented system in North Korea might be institutionally safeguarded in a gradual reform-cum-integration scenario.[28] It is assumed that the overall objectives of the gradual approach are to create peace and security on the Korean peninsula and to foster economic growth and development in North Korea.

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[26] See Keohane (1986) for a critical discussion of the concept of reciprocity and its application in international relations.

[27] See North (1990) for a discussion of the concept of adaptive efficiency.

[28] Parts of this section draw upon, but considerably extend the discussion in Ahrens (2002a).

Taking the nascent cooperation between North and South Korea as a starting point, the following considerations address three key questions: What may be the adequate sequencing of opening and integrating the North Korean economy with South Korea's? Which domestic economic reforms would be needed to make the integration process successful, and has the North Korean regime the capability and capacity to undertake these necessary reforms?

4.1 Sequencing and safeguarding economic integration

Due to its *Juche* ideology and the centrally planned character of economic policy making, North Korea's economy has been almost entirely closed vis-à-vis the outside world. In the aftermath of the collapse of the former Eastern bloc and hence the loss of its traditional trading partners, foreign trade turnover has even further declined making the domestic economy increasingly aid-dependent. North Korean foreign trade has shown a persistent deficit, foreign trade turnover has substantially fallen in the 1990s, and a substantial portion of the country's imports are in fact aid in form of food and oil. The low openness of the North Korean economy is reflected by a very low foreign trade turnover that accounted for 12.6% in GDP in 2000. Since the end of the *Ardous March* period in 1998, though, imports have increased substantially from below US $ 1.2 billion (in current US $ according to mirror statistics) to some US $ 2,2 billion in 2003 – in the same period, export continued to fall thus widening the trade deficit. The improved access to imported goods – largely financed by explicit or implicit foreign aid from Western countries, may have helped the DPRK to overcome the threat of economic collapse (Eberstadt 2004).

China is the main trading partner for North Korean imports (which are dominated by industrial intermediates and petroleum), whereas Japan and South Korea are the main destinations of the country's exports, which are dominated by natural resources and related products as well as light manufactures. Moreover, although the country's foreign debt is relatively low in absolute terms, North Korea is cut off from international capital markets, because it essentially defaulted on debt repayment. Inter-Korean trade has considerably grown over the last decade from roughly US $1 million in 1988 to US $724 million in 2003. However, bilateral trade has been usually conducted in an indirect way and it is still politically controlled.[29]

More recent developments indicate that the Kim Jong-il regime may be increasingly willing to cautiously and gradually open up the economy and accept external aid, advice, and technical support. After a decade of substantial negative growth rates, that reduced domestic output by some 50%, and due to the ongoing energy crisis, widespread famine, and seriously underdeveloped physical and institutional infrastructures, the North Korean authority seems to realize the binding constraints of its autarkic development strategy and hence may seek to improve its external economic relations (Lee 2001b).

4.1.1 Stages of economic integration

Basically, opening up the North Korean economy will imply a significantly increasing exposure to international competition, considerable changes in domestic output

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[29] SeePark (2005) and Economic Intelligence Unit (2001 and 2002). For a detailed stocktaking of North Korea's foreign trade regime and performance as well as a discussion of data reliability, see Noland (2000b) as well as Eberstadt (2001). In addition, see Noland (2001a) for an analysis of North Korea's unconventional and illicit activities to finance the chronic trade gap.

composition causing major structural adjustment processes, and a large-scale redeployment of millions of workers. Ultimately, these risks may seriously threaten the survival of the Kim Jong-il regime. Therefore, in order to make integration a viable policy choice, only a gradual and staggered integration strategy, that accounts for binding political side conditions and seeks to minimize the economic costs of opening up, appears to be feasible on the Korean peninsula in order not to make excessive (and unrealistic) demands on the political capabilities, the economic capacity, and the ideological receptivity of the North Korean system as well as the financial capacities of South Korea that is needed to support and manage the integration process.

In principle, integration steps beyond project-style cooperation range from a free trade area to ever deeper forms of integration to eventually a (full) economic union, in which economic policies of the integrating countries would be harmonized (standardized). While market integration (i.e. deregulation) dominates the first stages of the process, policy integration becomes increasingly important at later stages, when new institutions and organizations have to be created for governing the integration area. This shift in emphasis also implies a shift in potential political costs, because increasing policy and institutional integration entails a growing loss of sovereignty in economic policy making. This, in turn, will not only make it more difficult to cope with asymmetric shocks affecting the Korean economies, but also to conduct tailor-made reform measures which fit different development needs in the Northern and Southern economy.

Figure 2 portrays an idealized gradual integration model that is based on three broad components: (1) confidence and trust building measures (CTBM); (2) the staggered economic integration process; and (3) the external framing of economic integration. The unalterable foundation of any progress in integration would be the continuation and intensification of government-led CTBM, which could greatly enhance transparency and predictability in inter-Korean relations. These measures would have to be complemented by creating an institutional and legal framework for inter-Korean economic exchange and gradually increasing CTBM through cultural and educational exchanges (e.g., family reunions, study trips, external training programs for North Korean bureaucrats, economists, engineers, etc., and partnerships between towns, clubs, and associations).

Figure 2: An Idealized Model of Economic Integration

Source: Ahrens (2002a)

A staggered integration strategy would be the core of the process. Even if one-off projects (such as the Mt. Kumgang tourism project) do not yield spillover effects on the North Korean economy, they can well serve the purpose of strengthening mutual trust. In that sense, such projects show a pilot character which induce learning processes for the North Korean government and bureaucracy as well as foreign investors enabling all parties to find more effective ways for collaboration. Gradually, such pilot projects could be complemented by projects that offer prospects for (limited) spillovers into the broader economy, e.g., SEZs, industrial parks and preferential investment zones in urban areas.

In the Korean case, an economic integration process would be highly politicized from the very beginning and the degree of politicization would further increase the more policy integration will become necessary in order to accomplish deeper steps of integration. Since, at present, the North Korean leadership is neither willing nor able to credibly commit to domestic economic reforms and has no access to international capital markets, the creation of a free trade area appears to be impossible. However, the establishment of SEZs may prove to be an economically useful and politically feasible strategy that could be promoted before the two Koreas may enter deeper stages of integration.

From North Korea's perspective, SEZs have the advantages that they can absorb foreign investment without affecting the domestic economy, support learning processes and would allow to build up strategic economic relations with South Korea, China, or Russia without the need to immediately engage in a major economic reform program. A critical point is that the North Korean government would in principle be able to increase its political credibility if it undertakes major public infrastructure and logistical investment in SEZs. This would credibly signal its commitment due to the irreversible nature (i.e. the sunk costs) of such investment.[30] If SEZs perform well over time, they may gradually yield increasing tax revenues, which the government could use for financing social needs in the domestic economy. In sum, even if the overall commitment to economic reform is extremely low in North Korea, the establishment of SEZs may represent a feasible opportunity for the political regime to accept lower degrees of freedom in policy making in exchange for attracting foreign investment and technology.

If domestic economic reforms become a viable policy choice for the North Korean leadership, the creation of a free trade area and subsequently a customs union with the South would be conceivable. Such integration steps would yield considerable efficiency gains in economic exchange, but require some policy coordination mainly relating to (foreign) trade and competition policies. While the integration of product markets would hardly affect the South Korean economy, Noland et al. (2000) estimate that it would have substantial positive effects on the economy in the North. Led by huge increases in the exports of light manufactures, the foreign trade share in North Korean national income is estimated to increase by more than 300%. At the same time, the Northern economy would be subject to massive changes in output patterns with output figures increasing especially in the manufacturing and construction sectors and decreases in the production of capital goods. While food availability would considerably improve, employment in agriculture would decrease releasing labor into the growing industrial sectors. If military demobilization would be feasible and could complement the establishment of a customs union, an enormous peace dividend would be achieved possibly amounting to a two-digit percentage points increase in GDP.

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[30] See Litwack and Qian (1998) who persuasively argue that SEZs could be used as effective catalysts of economic integration and reform even in transition economies, which do not adopt a bold economic transformation program.

Factor market integration would have a significant impact on both North and South Korea. It is to be expected that labor tend to massively migrate from North to South and capital vice versa. This would not only imply enormous shifts in production patterns but also entail a higher wealth and income inequality in both economies. With respect to real convergence, Noland et al. (2000) find that

> "the amount of capital investment necessary to raise Northern per capita incomes to 60 percent those of the South would actually drive the rate of return on capital in the North below that in the South. However, it would be possible to attain the 60 percent target without such equalization of the rate of return in the two parts of Korea under high-end estimates of the speed of technological convergence. This suggests that either the rate of technological convergence would have to be very rapid (say, 12 percent annually), or restriction on migration from the North to the South would have to be imposed on a semi-permanent basis."

This conclusion underlines the necessity to provide the Northern economy with capital investment and transfer payments (from the South or from abroad) as quickly as possible and to (temporarily) restrict the migration of labor. Consequently, the creation of a common market (subsequent to a customs union) would be only feasible if it is initially 'restricted', so that it temporarily protects the North Korean economy. Particularly, restrictions would be necessary with respect to the harmonization of technical, environmental, and social standards for specific products as well as the free mobility of labor. Due to the substantial development gap between North and South Korea, the former can hardly be expected to successfully compete in a common market if it has to adjust its production processes to South Korean standards. Similarly, as long as a huge inter-Korean income gap and a (partially) politically controlled North Korean economy exist, a free movement of labor may imply mass migration on the peninsula, which would overburden the absorption capacity of the South and make the North suffer from a substantial brain drain. Thus, the creation of a common market, that ensures the free mobility of goods, services, capital, and labor, would be conceivable in the very long run, if the North Korean economy will have achieved sufficient progress in economic reforms so that it is prepared to compete with South Korean companies. Finally, a (full) economic union would require a harmonization (and standardization) of the economic policies of the two Koreas. This particularly relates to the introduction of a single currency and the adoption of common labor market, fiscal, and welfare policies. Such a union would eventually crown the integration process in the very long term, if a potential unification will be seriously discussed.

4.1.2 External flanking

The idealized model, portrayed in Figure 2, shows, however, yet another factor determining the integration process: an external framing of peninsula integration is not only necessary for North Korea in order to get access to financial and technical assistance from abroad, but also – and even more important – in order to externally safeguard the integration process from a geopolitical and security perspective. Without resolving the problems relating to a military confrontation between the Koreas and the security threat that North Korea imposes on the international community, there will be a limit of economic cooperation at a low level. As Kim (2002: 280) argues: "It is common sense to believe that North Korea will build up military capabilities if it recovers economic strength. This is the main argument why the South Korean people do not want to go further with the Sunshine policy". This is in fact also a concern of third countries such as

Japan and the United States. In order to align the preferences of all parties involved, the process of North Korea's economic opening needs to be institutionally safeguarded through the integration of economic, political as well as security initiatives (Lee 2001a; Wit 2000). Moreover, difficulties of integration as well as specific concerns of third states could be more easily overcome by employing a 'two-plus-x formula' in an external flanking of the integration process (Pfennig 2001). In particular, those countries should be involved which have a stake in North-East Asian development such as China, Japan, Russia, the United States as well as the European Union that could possibly assume a mediating role. In this context, it is of utmost importance that the external frame could not be interpreted by the North Korean regime as an attempt to undermine its political sovereignty. Therefore, external safeguards and support have to go hand in hand with confidence building measures, (possibly) the international recognition of the North Korean regime as well as accepting the notion of coexistence. Particularly, the latter two aspects may allow North Korea to regard its nuclear and military programs "as valuable but not vital, [so that; J.A.] it would presumably be possible to negotiate an end to those programs in exchange for some particular package of benefits" (Eberstadt 2002: 28). Similarly, international recognition of the North Korean regime in combination with the principle of coexistence may convince political leaders in the DPRK that their regime is not threatened from the outside and could survive next to South Korea. In such a case, a North-South peace agreement and a genuine 'one nation, two states' policy might be possible (Eberstadt 2002: 28). Last but not least, North Korea could and should be involved in regional economic cooperation in Northeast Asia as quickly as possible. In this context, the Northeast Asia Economic Forum (NEAEF), in which North Korean representatives already participate, is a good example. The NEAEF is a non-governmental organization aiming at the facilitation of dialogue, the dissemination of information, and the promotion of research on Northeast Asian economic cooperation. Through informal institutions and networks, it has become possible for this organization to actively involve all Northeast Asian countries including the DPRK in an ongoing and fruitful dialogue and thus to enhance trust. In addition, Valencia (1994) suggests the possibility of establishing an Association of Northeast Asian Provinces and common forums to discuss issues relating to a regional labor market, regional communication and transportation, or environmental problems. All these opportunities for an active engagement of North Korea through channels that provide benefits and hence incentives for all parties involved will help to build trust and confidence and might strengthen the position of those individuals in the North Korean state apparatus, which are basically open-minded regarding reform. Such a strategy would be, as Valencia (1994: 65) argues, "consistent with a common Asian perspective that to change a society one must engage it and influence it through a wide spectrum of multilateral initiatives."

4.1.3 Creating an 'integration MEGS'

The realization of a staggered approach to integration is a highly complex and politically sensitive process, even if it focuses on the economic realm. Effective economic integration and underlying policy reform require credible commitments that political promises are actually delivered, an adequate administrative capacity of state institutions, and the technical and political capability of policy makers to implement new policies and enforce new rules of the game. In this regard, the governance structure underlying the integration process is of utmost importance.

An 'integration MEGS', which could serve as an appropriate foundation for the sketched staggered integration strategy, should not rely on the objective to achieve unification. A gradual and staggered integration approach should be rather based on the

notion of peaceful coexistence and mutual recognition and be driven by pragmatic flexibility and politically feasible policy steps, which benefit both sides. In this respect, a valuable lesson from Germany's 'Ostpolitik' in the 1970s could be learnt. As Hans Maretzki (1999: 25 and 27), a former Ambassador of the German Democratic Republic to the DPRK, argues

> "It would be highly useful if ROK strategy toward North Korea discriminated more strictly between normalization inter-Korean relations and envisaging actual unification (…). The experience of the inter-German rapprochement in the 1970s indicates that positive momentum arises from strict efforts to focus all agreements on contemporary utility; only a pragmatic approach fosters reduction of mistrust. In the specific situation between the two Koreas it would be important to avoid slogans about reconciling the two halves; coexistence needs reciprocal feasibility. To manifest emphatically national intentions to embrace the other side produces only a retreat of the weaker and more suspicious party."

Cooperative coexistence rather than unification should be the primary principle guiding integration. Note that it is not only the past, but also the expected future that matters for present choices and political decisions. Expectation dependence, i.e. "the influence of expectations of the future on the present" (Richter 1999) can impede or reinforce public policies in the present. If, e.g., the South Korean engagement policy explicitly aims at unification, two sets of expectations would be raised: first, the North Korean political elite would expect the South Korean government to unilaterally dictate North-South integration according to its own rules; secondly, South Korean people may associate the realization of long-cherished hopes, but also the incurrence of substantial costs for themselves with such an objective. As a result, South Koreans may lose their initial optimism and withdraw their support of government policies vis-à-vis the North. The North Korean leadership may in fact be willing to agree with the South's engagement policy but only in order to bargain for further aid by conducting 'cosmetic' economic reforms. Both reactions would be detrimental to an integration process. Institutionalizing 'coexistence' as the primary principle that underlies official policy statements and bilateral agreements would affect the expectations of the parties involved, increase the likelihood of mutually beneficial economic cooperation, and each party could be expected to support the overall integration process.

In order to avoid opportunistic behavior by one of the two governments, the 'integration MEGS' needs to provide institutional arrangements that ensure specific reciprocity, i.e. "conditional exchanges on a quid pro quo basis" (Keohane 1986: 25). For example, funds provided by South Korea and other countries to modernize the North's infrastructure should be offered only if Pyongyang conducts tangible reductions of its military threat potential (Wit 2000). Without specific reciprocity, South Korea and third countries may fear the danger of continued brinkmanship on part of the Kim Jong-il regime, while the North Korean leadership may fear a loss of political power, control, and bargaining leverage in international negotiations.

Keohane (1986: 24) argues that specific reciprocity is a suitable principle guiding international relations especially if "norms of obligation are weak (…) but when the occurrence of mutually beneficial cooperation seems possible." The likelihood of cooperation between governments, which exercise specific reciprocity, will be the higher the more interests they have in common, the greater the expected benefits from future cooperation, and the smaller the number of actors participating in cooperative undertakings. Thus, an inter-Korean integration process may be suitably based on institutional arrangements that link the North and the South together and foster specific reciprocity.

An example, proposed by Wit (2000), would be to establish a Korea Reconciliation Fund (KRF) that may be used for promoting inter-Korean economic cooperation, supporting agricultural development in the DPRK, and providing humanitarian programs. In addition, the KRF would include a cooperative threat reduction program. Such a program could encourage cooperation between North and South Korea and third countries with respect to demilitarization, the conversion of defense industries, and monitoring military technological development. In order to avoid any suspicion of North Korea that a single country (e.g., the U.S.) seeks to dominate integration and restructuring policies on the Korean peninsula, a KRF needs to be set up under multilateral leadership (including North and South Korea).

Figure 3 portrays the long-term integration process as being divided into four phases (from normalization to market integration to policy coordination to eventual unification) and assigns fundamental components of an 'integration MEGS' to these phases. These components comprise intergovernmental or supranational political institutions and organizations, which serve to monitor and safeguard the integration process internally and externally. Since the design of a concrete strategy of institution building will be contingent on specific future developments, Figure 3 only sketches possible key components of such a strategy.

Figure 3: Instituting an 'Integration MEGS'

Guiding principles: cooperative coexistence, mutual recognition, and specific reciprocity

internally steering economic integration →

- summits of equals;
- North-South council;
- intergovernmental commission;

- institutional/organizational framework for monitoring integration and policy coordination:
  * competition agency; fiscal council;
  * common central bank;
  * Korean Court of Justice

Phase I	**Phase II**	**Phase III**	**Phase IV**
normalization; consultation; projects	market integration	policy coordination and integration	policy harmonization and unification

- "2+"-party talks, bilateral economic assistance, support of international organizations,
- regional economic cooperation, international NGOs (e.g., NEAEF)
- Korean peninsula development fund

- ASEAN Regional Forum
- complementary organizations:
  * KEDO, KADO, KEA
  * KATPA
  * JCHCR

→

externally framing economic integration

Gradually increasing inter-Korean consultation and cooperation in the economic realm as well as in areas that do not relate to core political controversies represents a suitable starting point for the normalization of North-South relations, because such activities may serve the interests of both parties. In the normalization phase, when a formal institutionalization of inter-Korean cooperation will not have yet taken place, joint projects, policies, and strategic planning should be conducted through informal 'summits

of equals' bringing together the heads of state or high-rank officials. Formal institution building becomes necessary at the stages of market and policy integration, in order to coherently steer economic cooperation and coordination. In this context, institution building needs to ensure participation and equal representation of both Koreas, i.e. the existence of various channels through which both Korean governments can equally initiate and contribute to institutional reform proposals. Activities in Phases II and III should be governed by an intergovernmental commission with equal representation of the North and South Korean governments. This commission would be responsible for policy implementation and has to take decisions unanimously. Its work would be guided and supervised by a North-South council, i.e. meetings of the heads of state as well as of ministerial councils at regular intervals. If policy integration will become increasingly important, further institutions and organizations need to be created ranging from an anti-trust agency policing the common market to a fiscal council coordinating public finances and eventually a common central bank. In addition, a Korean Court of Justice would help resolving economic disputes that may more frequently occur with deepening integration.

Furthermore, the integration process could be reinforced from the very beginning by strengthening the Korean Peninsula Energy Development Organization (KEDO) and establishing complementary organizations and institutional arrangements such as a Korean Agency for Training and Public Administration (KATPA) to modernize the economic bureaucracies in both Koreas, a Korean Environment Agency (KEA), a Korea Agricultural Development Organization (KADO), or a Joint Commission for Historical and Cultural Research (JCHCR). Especially the latter may be a suitable instrument for building confidence and trust. North-South projects in cultural and historical research may facilitate the identification of common ground and roots in rather non-political areas and should benefit both parties (Pfennig 2001).

Finally, the external framing of the integration process will not only be guided by official bilateral and multilateral forums, in which security and economic matters of common concern need to be resolved. In addition, international non-governmental organizations (NGOs) such as the NEAEF or the East-West Center in Honolulu, HI, could play a key role in confidence and trust building and prepare the ground for official rapprochement through establishing informal discussion networks. Moreover, NGOs could possibly serve as mediators, which – as non-political, non-profit organizations – might be better suited than (Western) governments to impartially administer funds and international agreements that should support reform and integration on the Korean peninsula. Once, crucial security problems will have been overcome, North Korea will be able to gain access to the funds and technical assistance of international financial organizations such as the IMF, the World Bank, and the ADB.[31] In the meantime, the integration process may be financially safeguarded through the creation of a multilateral Korean Peninsula Development Fund that pools resources for public and private investment and would provide them to North and South Korea according to the degree of progress that would have been achieved in the integration and reform process.

4.2 Economic Transition à la Pyongyang?

Although it has one of the strongest military forces in the world, controls virtually every aspect of its country's political and most aspects of its economic life, and has a

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[31] In this context, a Northeast Asian Development Bank, the establishment of which has been discussed and promoted for more than ten years particularly by the NEAEF, could play a key role in fostering an inter-Korean integration process; see Katz (2001) and Rowley (2001).

government-party apparatus that is able to exercise tremendous discretionary powers, today's North Korea is a weak state. It is weak in the sense that it can neither feed its people nor is it able to create and enforce the basic conditions for implementing economic development enhancing and growth promoting policies. Its public administration is inefficient and hardly prepared to manage economic reforms, policy making is neither transparent nor predictable, and the political elite is not held accountable for its actions. Leaders in government, the Korea Workers' Party, and the military act in collusion at the expense of society as a whole. Under such circumstances, even a reform-minded political leader would face severe problems to implement reform policies that contradict the interests of the military, the bureaucracy, or communist party. Even if economic reforms would be announced and partially implemented, they would be hardly durable due to a lack of credible commitment and enforcement devices and the resistance of potential losers from economic reforms, who try to block their implementation.

As pointed out earlier, however, more recent developments seem to indicate that a window of opportunity may have opened in the DPRK, the more so as the political leadership publicly admitted recently that the economy has fallen into decay (Hassig and Oh 2002). Aside from its diplomatic campaign vis-à-vis Japan, Russia, and Western governments and cautious steps improving economic cooperation with South Korea, the government undertook several rudimentary reform steps. Political authorities started to streamline the government apparatus and to restructure the bureaucracy making it a younger and more technically oriented administration. Moreover, limits relating to private property were relaxed, rudimentary cost accounting standards were established, and the notion of price, cost, and profit were introduced in economic management. In addition, constitutional amendments emphasize the economic goal 'growth and prosperity of the Fatherland', that strikingly differs from the earlier prescription aiming at the 'country's independent development'.[32]

Furthermore, Babson (2001b: 87) observes that

> "(w)ith the growth of the informal market economy, forces have also emerged that are working to break down the strict control of the state over the freedom and lives of the population. (…) Diversion of goods from the state distribution system and foreign aid, asset stripping, and other forms of stealing from the government are weakening state control over people's behavior. Embezzlement and corruption are now replacing duty and conformity. Thus, the emergence of the informal economy in North Korea is accelerating the likelihood of fundamental political and economic reform."

Last but not least, with the end of the Cold War, North Korea lost political and economic support from its former Eastern European allies and was robbed of "its economic lifeline and its socialist legitimacy" (Babson 2001b: 84). In this context, the economic transition process in China and its enhanced relations with the United States and South Korea even accelerated North Korea's international isolation. In the end, the DPRK has been loosing even its former military edge due to its deteriorating economy and the decrease in arms supplies from Russia (Kim 2000).

All these changes may entail a new policy direction, which could turn out to be more market-friendly as well as more outward-oriented. Hence, North Korea may be regarded as a country that is at the beginning of cautiously moving toward a hybrid economic system, Pyongyang style.

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[32] See Babson (2001a), Hassig and Oh (2002), and Xintian (2001).

Basically, North Korean authorities could achieve an immediate relaxation of their dire straits by seeking access to international markets and the funds and technical assistance of international organizations, and – above all – cooperating closer with South Korea. Opening up the economy would not only help to avoid the recurrence of famine but also greatly facilitate the implementation of market-oriented reforms. International integration and domestic economic reforms presuppose, however, a reform-minded political leadership and an adequate politico-institutional foundation, i.e. a MEGS, through which political commitments to change can be made credible and reform measures actually implemented.

A binding side condition for constituting a MEGS in North Korea is that economic reform will be only feasible only if it does not undermine the power of the North Korean elite. Particularly, this implies that reform and integration must not question the sovereignty of the North Korean state, they need to be designed in a way that they can be justified by decent ideological shifts, they have to be in the interest of the North Korean leadership, and they should create no losers. As discussed in Chapter 3, a MEGS rests on four pillars:

- a strong state that is able to credibly commit to economic reforms, protect property rights, and enforce contracts;
- institutions that limit state authority in order to avoid predatory government behavior;
- capacity building in the public sector in order to ensure policy implementation;
- key economic institutions that constitute a market-oriented economy.

4.2.1 Enhancing state strength for economic policy making

With respect to the first component of a MEGS, most scholars agree that state strength is a conditio sine qua non for enhancing the capability and sustainability of policy making. It helps to avoid the capture of the state apparatus by narrowly defined interest groups, enhances political stability as well as the long-term predictability of the political system and hence can contribute to stabilizing the expectations of (private) economic actors and prolonging the time horizon of policy makers. In today's North Korea, authority is vested in persons, not to say in one (!) person – not in rules, and a shift to a rule-of-law state cannot be expected under current political conditions. How can North Korea become a strong state in the sense that it is capable of implementing growth-enhancing economic reforms, protecting property rights, and enforcing legal rights and contracts? States are considered strong if they show at least two characteristics which help to overcome problems of collective action: (1) they must be autonomous and hence shielded from the influence of vested interest groups in order to formulate policies independently; and (2) they need to exhibit sufficient degrees of centralization and internal cohesion in order to overcome collective action and principal-agent problems and to implement policies effectively (Doner 1992).

Assuming that the Kim Jong-il regime actually intends to gradually open up and reform its economy, the notion of the developmental state, that underlay the economic development processes in several high-performing Asian economies in the 1960s and 1970s, may offer some pointers of how to enhance state strength for economic policy making. According to Johnson (1987: 140, 142–3),

> (d)evelopmental states are generated and come to the fore because of the desire to break out of the stagnation of dependency and underdevelopment; the truly successful ones understand that they need the market to maintain efficiency,

motivate the people over the long term, and serve as a check on institutionalized corruption while they are battling against underdevelopment. (...) A developmental elite creates political stability over the long term, maintains sufficient equality in distribution to prevent class or sectoral exploitation (land reform is critical), sets national goals and standards that are internationally oriented and based on nonideological external referents, creates (or at least recognizes) a bureaucratic elite capable of administering the system, and insulates its bureaucrats from direct political influence so that they can function technocratically. It does *not* monopolize economic management or decision making, guarantee full employment, allow ideology to confuse its thinking, permit the development of political pluralism that might challenge its goals, or waste valuable resources by suppressing noncritical sectors (it discriminates against them with disincentives and then ignores them).

The main characteristics of developmental states include: (1) stable political rule ensured by a political-administrative elite that does not accede to political pressures which could impede economic growth; (2) cooperation between the public sector and the economy that is guided by an economic planning agency; (3) investment in universal education and policies aiming at a more equitable distribution of opportunities and wealth; and (4) a government whose members understand the need for market-conforming policies and interventions (Johnson 1987, 1999).

A most critical feature of a strong (developmental) state is the necessity to ensure the autonomy of both the economic bureaucracy and the political elite who are in charge of strategy formulation and economic policy making. Hence, public sector reform, particularly public administration reform, is a key governance issue in order to strengthen the state apparatus, which has to be addressed at an early stage of the reform process. It concerns the core institutions of government and includes (i) strengthening of central mechanisms for economic policy formulation, coordination, and implementation; (ii) public financial management reform including strengthening audit capacity; and (iii) civil service reform. Economic reform and transition call for new kinds of professional and managerial expertise. Strong and effective institutions are needed to perform market-friendly government functions including the provision of public goods and a legal and regulatory framework for market transactions, protection of property rights, and contract enforcement.

However, administrative professionalism is only a necessary, not a sufficient condition for effective policy reform. Other institutional key features of public administration reform include the replacement of political appointments and dismissals by the introduction of meritocratic standards in promotion and in recruitment, providing civil servants with opportunities for long-term career rewards, and setting transparent rules for hiring and firing.[33]

Finally, state strength also depends on the legitimacy of the political regime. An interesting facet of the recently emerged 'new thinking' is that even the *Juche* doctrine has been subject to reinterpretation. As Kim Jong-il stated in May 2001: "We should have a

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[33] For making meritocratic personnel policies work, governments need to place strong emphasis on education policies in order to create a pool of highly qualified potential civil servants. Note in this context that, although establishing effective economic bureaucracies is a complex task, it is not as time-consuming and difficult as one might expect. Countries as diverse as South Korea and Taiwan or France and Austria, whose bureaucracies were considered to be incompetent, ineffective, and non-meritocratic in the first half of the 20th century and even into the 1950s, managed within some 20 years to establish high-quality public administrations through comprehensive civil service reforms; see, e.g. Chang and Cheema (2002).

correct understanding of self-reliance. The nature of self-reliance we referred to in the past is qualitatively different from the one we refer to know"[34], namely enhancing efficiency and promoting technology. A gradual shift in political articulation and action toward a 'socialist market-based economy, North-Korean style' and the overall goal to pursue 'growth and prosperity of the Fatherland' may in fact help the political elite to undertake gradual economic reforms under the umbrella of socialism without losing its face.

4.2.2 Strength without limits?

While a strong government is essential to formulate and implement economic reform, it raises the risk that policy makers are tempted to violate economic rights of entrepreneurs and to confiscate citizens' wealth, thereby creating disincentives for economic actors to carry out long-term investment and to provide information, which in turn blocks thriving (or in the North Korean case: the emergence of) markets, and eventually impedes economic development. If there are no institutional safeguards that hinder policy makers from altering rights, laws, and regulations at will, it is almost impossible to make credible commitments to economic actors and especially to foreign investors. Hence, for a MEGS to evolve and to survive, public officials (and also economic actors) must have incentives to abide by the system's rules. Policy makers must find it in their own interest to observe a set of (private) economic rights as well as the limits on government behavior. Therefore, a MEGS need to include institutional arrangements, which monitor the behavior of public officials and penalize misbehavior, reduce information asymmetries, stabilize expectations, and provide economic actors with exit and/or voice options. In general, a relatively effective means to raise the political transaction costs of establishing power cartels is to institute several independent channels of control over government agencies and individual public officials. Another complementary means is to craft institutions that provide citizens with information about political activities and help to coordinate their actions so that they can react in concert if political officials transgress private rights.[35]

Therefore, in advanced countries with developed market economies, state strength is usually limited through a subtle system of checks and balances, a horizontal and vertical separation of power, free and general political elections, appropriate state-business-society interfaces, the work of independent domestic NGOs and watchdog organizations, or systems of market-preserving federalism. But none of these options appears to be available in today's North Korea. If, however, a strong North Korean state is an unalterable precondition for effective market-oriented reforms, what would be a suitable mechanism to limit such a possibly emerging strong government? One approach would be that the government binds its own hands at least with respect to specific policy realms and imposes limits upon its activities (e.g., through establishing an independent central bank in the course of a major reform program). At present, this option cannot be realistically expected, although its realization may become feasible in the long run. The only currently feasible alternative is to establish limits on the government through an external flanking of North Korea's reform and integration process as discussed above. Even if the engagement and international involvement of the DPRK is an imperfect

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[34] Yi Yong-Hwa, "Important Conditions for Promoting Self-Reliance," Minju Choson, May 16, 2001; quoted in Hassig and Oh (2002: 98).

[35] For an extensive discussion of this argument, see Ahrens (2002b) and the literature referred to therein.

disciplining device, it may be appropriate to provide the Kim Jong-il regime with incentives to conduct domestic economic reforms. Gradually opening up the economy and increasing its exposure to foreign competition as well as membership in international organizations such as the World Bank and the ADB and hence the obligation to abide by these organizations' rules and policies might slowly help to make a potential commitment to reform credible.

4.2.3 Capacity building

Successful economic reforms not only require a secure political foundation, but also the capacity of the state apparatus to implement and enforce political decisions, public policies, and regulations. Strategies, programs, and decisions aiming at economic reform neither change policy nor yield desired results automatically. Even if policies are well-designed, substantial implementation problems may occur.

Capacity building refers to measures at three levels: (i) institution building (i.e. replacing a less efficient by a more efficient set of rules and functions); (ii) organizational restructuring (i.e. the design of organizational forms better suited to the new set of institutions); and (iii) human resource development (in particular education and training). Capacity is the ability of public sector organizations to perform appropriate tasks effectively, efficiently, and sustainably. Beyond the set of irreducible public sector functions such as establishing law and order and setting the rules of the game for economic and political interaction, appropriate tasks are those defined by necessity, history or specific situation within a given country (Grindle and Hilderbrand 1995). In this context, it should be emphasized that human resource development without institution building and organizational restructuring will have no sustainable effect. This argument particularly holds for North Korea, where those administrative institutions and organizations, that are essential for the functioning of a (rudimentary) market-oriented system, are virtually absent.

A systematic and coherent approach to constitute a MEGS in North Korea must go beyond measures to foster human resource development and seek to reform existing and to craft new institutions, which perform core governance functions. Sector-specific steps to overcome weaknesses in governance must be supplemented by cross-sector and macro-level attempts. For example, in the absence of a sound macroeconomic policy framework, initiatives at the sector level will not yield the desired results. Similarly, since the structure of the public administration imposes a uniform stamp on all public agencies, a broad macro-level attempt to resolve the administrative impediments is needed to increase the chances of efficient project implementation and the benefits to a wider segment of society.

Given these interdependencies, the reform of the economic bureaucracy will be more effective if it is approached wholesale. Since measures such as higher salaries, performance-based employment, downsizing of surplus staff, and organizational restructuring are central to improving the implementation capacities of weak executing agencies, it is necessary to complement sector-level capacity building with measures that must be applied to the public administration in its entirety. This appears to be even more important if one considers that implementation depends not just on line agencies but also on the ministries and departments that oversee their work. It is these civil servants, directly under the political leadership, that allocate resources, and take or influence the decisions that critically determine the outcome of economic projects and policies. Much more so than in the case of line agencies, reforming these core government functions requires integrated approaches focusing on the public administration as a whole.

A systematic approach to overcome major institutional and structural impediments to sound and market-oriented economic management would, e.g., include:

- the introduction of hard budget constraints in the public sector;
- strengthening personnel management through merit-based recruitment and promotion schemes;
- competitive wages for bureaucrats that can increase integrity and professionalism;
- independent personnel agencies which reduce external pressure on appointments and patronage;
- effective accounting and auditing practices to enhance the financial accountability of policy makers;
- statutory boards partitioning the policy space by assigning single policies to special agencies that help monitor bureaucratic performance;
- publication of government documents and data (e.g., rules and statutes, budgets, and revenues);
- anti-corruption agencies which reduce bureaucrats' propensity to use their specific information for extra-legal activities;
- improving and enforcing legal and regulatory frameworks;
- clarification and institutionalization of the relations between the central government and local authorities; and
- establishing institutionalized linkages to the nascent private sector and promoting its development.

Such steps aiming at public administration reform would not threaten the political regime per se, so that their realization appears to be feasible even in the North Korean context. To be effective, however, institutional and organizational reforms must be accompanied by improvements in human resource development, the more so as knowledge of market economics and modern management techniques is virtually absent in North Korea. Moreover, civil servants have been used to follow directives from their superiors and discouraged to take own initiatives, to cooperate horizontally across government departments, to report deficiencies of the administrative system, or to make suggestions for its improvement. Therefore, bureaucrats need to develop new behavioral routines and work ethics, which may be facilitated through investment in human resource development. In this context, it is of utmost importance to strengthen the overall education system and to accept technical assistance, which can be provided by international organizations such as the ADB or the United Nations Development Programme. More specifically, one may, e.g., think of cost-effective and sustainable measures such as hiring long-term foreign consultants for on-the-job training, study tours and long-term training abroad, seminars and workshops on market economics and modern management techniques, which enhance skills and improve the communication among public officials, and train-the-trainers programs due to huge number of training and capacity building needs. In order to ensure that the North Korean government can assume full ownership of any reform program, capacity building measures, which are conducted in collaboration with foreign consultants or international organizations, need to be based on commonly understood goals possibly embodied in a memorandum of understanding, and donor organizations and their North Korean counterparts should jointly develop a road map for projects and reform programs.

4.2.4 Building economic institutions

Today, it is widely recognized that macroeconomic stabilization, privatization, and price reforms are necessary but insufficient steps of economic transition and that appropriate economic rules and regulations must be crafted as early as possible in order to make incentives work and markets perform well, to reduce transaction uncertainties between economic actors, and hence to support market development and coordination. But which are the key economic institutions that matter for market performance? A useful starting point is the set of *constitutive principles* of a market economy elaborated by the German *ordo* liberal school and, in particular, by Eucken (1990/1952). *Ordo* liberals derive their prescriptions for public policy making from the notion of *order*, which is a fundamental precondition for making governance structures effective.

> "Order means that repetitive events or actions fit into a discernible pattern which allows people to have confidence that the pattern of future actions, on which they may depend, can be predicted reasonably well. If the world is ordered, complexity, and hence the knowledge problem, is reduced and economic agents are better able to specialise. Institutions serve to facilitate the emergence of order." (Kasper and Streit 1998: 151; emphasis omitted).

Ordo liberal scholars favor order policy (i.e., supporting and enhancing the economic and social order of society) over process intervention. This maxim is essentially based on three axioms including that (1) cognitive abilities of individuals are limited so that an order that allows recognizable patterns to be uncovered, will improve living standards through an enhanced division of labor and give citizens distinctive realms of freedom; (2) individual economic freedom is an unalterable prerequisite of competition; and (3) order is required to make binding commitments possible and to enforce formal rules in order to overcome problems of asymmetric information and the temptations of opportunistic behavior (Kasper and Streit 1998).

The constitutive principles of order policy which promise to enhance and maintain competitive markets include a flexible system of market prices, monetary stability, private property rights, open markets (i.e., freedom of entry and exit), liability of economic actors for their actions and commitments, freedom of contract, and the steadiness of economic policy making. Since the proper functioning of a competitive order is based on the decentralized *ex post* coordination of individual plans and actions through market transactions, establishing a system of flexible market prices will be the focal point of creating and maintaining a market economy. Only a price system that reflects the scarcities of goods, services, and the factors of production can efficiently fulfill the functions of a competitive system.

These principles need to be complemented by so-called *regulating principles*, because actual market-oriented economies may show weaknesses and deficits that require correction. Eucken thus emphasizes the need for anti-trust policies in order to prevent the emergence of monopolistic power, the need to correct income distribution in order to enhance social justice, the need for social safety nets and the protection of employees, and the need for institutions that help internalize external effects. Furthermore, as emphasized by more recent research findings, substantial market and coordination failure frequently impede economic growth particularly in developing and transition countries. Thus, it is critical to understand that regulation may go beyond issues such as securities regulation, financial supervision, and anti-trust. Rodrik (1995 and 1999) and Lau (1997) persuasively argue that, e.g., imperfect capital markets and coordination failures require strategic government interventions in order to trigger socially desirable

private investment. By referring to the experiences in East Asia (particularly in South Korea and Taiwan in the 1960s and 1970s), they show that governments effectively coordinated private investment decisions, provided targeted subsidization and thus helped to initiate a process of sustained growth. However, while institutions such as staggered entry procedures regulating market access, financial restraint, and the provision of contingent rents worked effectively in these countries, similar mechanisms failed elsewhere. This fact does not call into question the usefulness of specific policy interventions per se, but indicates the need to sustainably improve the quality of the domestic governance structure, which determines the efficacy of government action in a given country setting.

Which economic institutions should be established in North Korea if it pursues a gradual reform process and aims at a staggered economic integration with South Korea? Although the constitutive principles are interdependent and hence ought to be crafted simultaneously, such a radical institutional change is politically not feasible. With respect to economic integration, such an approach would not be necessary either, until the two Koreas decide to found a free trade area or a (restricted) common market. Therefore, the North Korean leadership may enjoy some degrees of freedom in institution building during the early stages of the integration process. Thus, it appears to be reasonable to aim at an economically second-best solution, which is pragmatic and politically feasible.

Establishing macroeconomic stability is an unalterable precondition for any reform program. This presupposes a market-oriented price system and a (possibly) independent central bank as well as prudent fiscal management of public expenditures and at least a rudimentary market-oriented tax system. However, in the North Korean context, a complete price liberalization will be hardly realized, because such a move would contradict the interests of the political leadership. Similarly, although privatization of state-owned enterprises (SOEs) is a critical step in transforming a centrally-planned into a market economy, large-scale privatization will not be feasible in the short run. This could hardly be justified within the present Juche framework and would take the government into an ideological cul-de-sac. Moreover, due to the fact that much of the industrial capital stock will be rendered obsolete in the course of economic transition, a quick large-scale privatization would, in the absence of (foreign) investment capital, lead to numerous bankruptcies (or continuing massive government subsidies). This, in turn, would threaten to undermine emerging confidence in the functioning of market forces and could impede overall economic reform. In this context, it may be more promising to legalize and extend already existing small-scale private transactions as conducted on farmers markets and in the retail sector.[36] Promoting newly emerging small and medium sized enterprises and hence creating a labor-intensive private sector gradually in a bottom-up manner could reinforce a (partial) price liberalization, support a badly needed supply-side reaction of the economy, and foster job creation. This, in turn, would help to absorb labor that will be laid off in the course of agricultural and industrial restructuring.

Given the current political side conditions, it appears to be reasonable for North Korea to formulate an overall economic reform strategy that is based on a dual-track approach – similar to that of China. In fact, after an 'unofficial' trip to China in January 2001, during which Kim Jong-il had inspected Shanghai's vibrant market economy, *Nodong Sinmun*, the communist party's newspaper, pronounced that "(t)hings are not what they used to be in the 1960s (…). With the start of the new age of the 2000s, an all-around re-examination should be given to outworn patterns and practices (…). We should bring

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[36] According to estimates of South Korea's Ministry of Unification, more than 300 'unofficial' markets exist, which meet more than 70% of the urban population's consumption needs (Babson 2001b).

about technical modernization by boldly doing away with what needs to be abolished, instead of being shackled by ready-made ideas or hanging on to old and outdated conceptions."[37] This postulate of 'a new economic thinking' may have been in fact greatly inspired by economic reforms in China. At least, North Koreans seem to regard the Chinese model as a suitable reference (Eberstadt 2002).

Several scholars, however, argue that following the Chinese path of reform would be mistaken, because initial conditions as well as policy priorities considerably differ between post-1978 China and today's North Korea.[38] They argue that China had an agricultural and rural society, whereas the DPRK is industrialized and urbanized; that the Chinese economy had achieved macroeconomic stability which is absent in North Korea; that money had played a much more significant role in economic transactions; that China had (at least temporarily) conducted cutbacks in its military manpower and defense industries, whereas the Kim Jong-il regime sticks to its 'military-first politics'; that China could rely on ethnic Chinese abroad for support – an option that may not be available to North Korea at present; and that an effective implementation of a gradual, dual-price strategy, Chinese-style would presuppose substantial state capacity as well as macroeconomic stability, which are absent in North Korea. Eberstadt (2002: 33) concludes that "(i)f North Korea *were* to experiment deliberately with a new economic direction, one might expect the chosen path to comport less with the recent 'China model' than with 'military as modernizer' template familiar from the political economies of prewar Japan and Park Chung-hee's South Korea."

Although these arguments are to be taken seriously and a successful reform strategy cannot be easily transferred from one country to another, the suggestion to adopt of a dual-track approach to reform should not be rejected. In fact, any kind of effective economic reform (big-bang style or gradual) needs to be based on a macroeconomically stable environment and can be only implemented if the state apparatus has sufficient capacities and capabilities. Thus, strengthening the North Korean governance structure as well as the government's ability to stabilize the economy need to be given a high priority on the reform agenda. Aside from that, it may be reasonably expected that, once North Korea pursues economic reforms seriously, substantial funds will be available from South Korea as well as the international community.

Additionally, under the current political side conditions, a proper sequencing of economic reforms may mean that agricultural reform should precede industrial restructuring. Even if the starting position for North Korea (with an estimated share of roughly 33% of the labor force employed in agriculture) is not as favorable as it was in China at the end of the 1970s (more than 70%), it is much better than in the transition economies in CEE.[39] Moreover, given the chronic food shortages, agricultural reform needs to be given a priority. In addition, agricultural reform promises to yield a visible and instant success, which might increase confidence in market forces and strengthen the support of further reforms at later stages (Lee (1997). The price reform in July 2000, that brought prices and wages closer to market levels, can be basically interpreted as a step in the right direction, if the North Korean leadership allows the supply side of the economy to react accordingly. Thus, in order to benefit from these changes, economic actors must

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[37] Quoted in Eberstadt (2002: 24–5).

[38] See, e.g., Eberstadt (2002) and Noland (2002).

[39] See Noland (2000b). Thus, North Korea may not enjoy the advantage to liberalize its agricultural sector and release surplus labor into a potentially emerging light manufacturing sector to the extent, which China was able to realize. Nevertheless, its employment share in agriculture is relatively high so that agricultural liberalization could help to release needed labor into other branches of the economy.

be allowed to act according to price incentives and be provided with the respective means. Essentially, this requires quickly legalizing and expanding the nascent market conditions, which already exist in North Korea, and abolishing agricultural collectives (McMillan 1997).

A greater impediment to economic reform is the current heavy-industry bias. A large-scale restructuring of industry would not only be costly and time-consuming, but also overcharge the present administrative capacity of the state and contradict the interests of the political elite. This is another argument that supports the adoption of a dual-track approach. Such an approach would allow to maintain parts of the planned economy for a transition period, until a possibly emerging private sector will have gained sufficiently economic strength so that it can absorb surplus labor from heavy industry. Qian (1999: 17) succinctly summarizes how the system worked in China:

> "Under the plan track, economic agents were assigned rights to and obligations for fixed quantities of goods at fixed plan prices as specified in the pre-existing plan. In addition, a market track was introduced under which economic agents participated in the market at free market prices, provided that they fulfilled their obligations under the pre-existing plan. With this approach, real market prices and markets as a resource allocation institution were created in China in the very early stages of reform".

Although this approach had been frequently criticized by neoclassical economists for distorting resource allocation, more recent theoretical work as well as the Chinese experiences showed that dual-track liberalization can be and in fact was efficient. Equally important, this approach provided the means to compensate potential losers from market reforms (Lau et al. 1997 and 2000). While the market track provided economic actors with the opportunity to increase their welfare, the plan track implicitly provided transfers that compensated potential losers from marketization by delivering the previous rents, which continued to exist under the maintained plan arrangements. Eventually, the dual-track liberalization served to reduce opposition to economic reforms *ex ante* (because it temporarily protected status-quo rents) and increased the opposition to reform reversal *ex post* (because an increasing number of agents benefited from the reforms in the course of time).

A dual-track approach in North Korea would not only help to gradually overcome obstacles to industrial reform, it would also be a reform, that could be ideologically digested. Furthermore, it would be consistent with the gradual opening strategy suggested in the preceding section. Moreover, such an approach neither requires a complete price liberalization nor the introduction of full currency convertibility nor a large-scale privatization of SOEs. Nevertheless, it would be possible (and necessary) to create competition under a dual-track approach: by fostering the emergence of private businesses in sectors such as agriculture, retail trade, and light manufacturing, strengthening the corporate-control structures of, and introducing hard budget constraints for, SOEs (in addition, they may be put under the authority of regional or local administrations similar to China's so-called township and village enterprises). Finally and most important, this approach does not presuppose major political change.

Another major – maybe the most critical – challenge to politics will be the migration flows to South Korea but also to China, that will have to be expected during an economic opening and integration process. Due to the large income gap between North and South Korea as well as limited economic and suppressed political freedoms, numerous North Koreans may be inclined to emigrate. This would entail a heavy brain drain for the DPRK, social and fiscal problems for South Korea, and potentially even political problems for China. Since massive migration will not be in the interest of any of the policy making

parties, policy measures will be necessary to reduce the threat of an exit option. Even if the so-called demilitarized zone will be maintained in order to control the movement of people, this may prove to be an insufficient device to discourage migration; especially if the border to China will not be closed. Thus, even if border controls will be maintained – and they should, until the Koreas agree on establishing a common market – additional policy measures are needed that provide North Koreans with incentives to stay.

Remedies for potential exit, which could be used in a "creative response" (Hirschman 1978: 104), must provide people with some 'attractions,' which would reinforce their normal reluctance to leave and enhance their loyalty vis-à-vis the North Korean regime. In this context, one may think of improvements in the provision of public and private goods. More specifically, a shared-growth strategy, which provides people with *real* assets may prove to be a suitable incentive system (McMillan 1997). Real assets may include granting private property rights to the North Korean population regarding the houses and apartments, in which they live, pieces of land, which they could cultivate, as well as free education and health care. In addition, fostering labor-intensive manufacturing, public investment in infrastructure, and land reform may help people to exploit their assets more effectively.

Moreover, such a shared-growth strategy may serve as a credible signal indicating the political leadership's commitment to reform and economic development. In addition, it can help, in combination with the dual-track approach, to create win-win situations, i.e. a reform without losers. This would enhance the legitimacy of the political leadership, reduce potential resistance to reform, and reduce incentives to migrate.

After all, a dual-track approach would not contradict the establishment of the pillars of a developmental state as it had been created in South Korea in the 1960s. If these pillars, which were discussed above in Section 4.2.1, are adjusted to North Korean conditions, the incentive compatibility of policy making could be in fact enhanced and – in combination with a dual-track liberalization – reform and integration could be gradually promoted.

V. Conclusion

The envisaged integration process on the Korean peninsula is, without doubt, one of the most complex and intellectually challenging issues now facing the Northeast Asian region. Whether or not economic rapprochement and cooperation between the two Koreas will prove to become a viable policy option, critically depends on the reform-mindedness of the North Korean leadership, the design of South Korea's 'Nordpolitik', and the way in which third countries such as the United States, China, Japan, and Russia approach the Kim Jong-il regime.

Gradual economic reform and integration policies on the Korean peninsula need to be based on a secure politico-institutional foundation. Sketching a conceptual road map regarding future economic integration provides reference points, which may help governments to avoid ad-hoc policy making and to navigate more systematically through the complicated terrain of institutional and policy reform. Thus, given the assumption that the North Korean leadership is willing to gradually open up its economy vis-à-vis South Korea and third countries, the central hypothesis of this paper is that it is of utmost importance to institutionally safeguard such a process by crafting effective market-enhancing governance structures (MEGS) that improve the incentive compatibility of all parties, which are involved in this process.

First of all, increasingly closer economic cooperation requires an 'integration MEGS' that is suitable to (1) create trust and confidence between the two Koreas and between the DPRK leadership and governments of third countries which play a significant role in

Northeast Asian politics; (2) govern a staggered integration strategy through the creation of institutions and organizations; and (3) externally frame and safeguard the overall integration process. This 'integration MEGS' should not explicitly aim at unification but rely on the notion of peaceful coexistence and mutual recognition and follow the principle of specific reciprocity. Institution building should be driven by pragmatic flexibility and politically feasible policy steps, which benefit both sides. Second, inter-Korean economic integration presupposes the creation of a domestic MEGS for North Korea, which enhances the capability and capacity of the government to implement economic reforms. The envisaged staggered integration strategy will provide the North Korean leadership with some degrees of freedom with respect to the scope, pace, and timing of reforms. Thus, at the early stages of integration, it will not be necessary to realize all constitutive principles of a market economy. Instead, North Korea could opt in favor of a politically feasible dual-track approach to reform similar to that of China.

Before concluding, several limits of the preceding analysis are briefly to be discussed. First, within a gradual reform-cum-integration scenario, it is not only necessary to craft an 'integration MEGS' and a MEGS for implementing reforms in North Korea, it is also essential to adequately adjust the current South Korean governance structure to new political, economic, and international side conditions. Therefore, it would be desirable to extend the analysis and examine the institutional adjustment needs that would be faced by South Korea. Secondly, with respect to economic reforms in North Korea, the preceding considerations focused on basic reforms, which would be required at the early stages of economic cooperation. In the course of deeper integration, i.e. at the stage of a free-trade area and beyond, many more reform measures are to be considered and conducted. This concerns, e.g., the questions relating to the introduction of currency convertibility, the choice of the exchange rate regime, the design of foreign trade policies, the privatization of SOEs, the creation and financing of social safety nets as well as the development of financial markets. Thirdly, as emphasized at the beginning of this paper, the gradual reform-cum-integration scenario is only one scenario among others. Since especially the collapse-cum-absorption scenario cannot be ruled out ex ante, it would be useful to elaborate institutional safeguards for this and other scenarios as well in order to prepare policy makers for different contingencies. It is beyond the scope of this paper to address these questions, but the mentioned limits may define a future research agenda, which might contribute to a better understanding of the options and constraints, the risks and benefits of inter-Korean policy making.

Economic and political development on the Korean peninsula is at a critical moment. The North Korean economy is in the midst of decay, famine appears to be a latent threat,, and the number of refugees to South Korea and China has been significantly increasing. At the same time, since Kim Dae-jung's term in office is coming to an end in 2002, the design South Korea's future 'Nordpolitik' is far from clear. China and Russia appear to support actively a constructive engagement policy vis-à-vis the DPRK, whereas Japan and the United States take a rather ambivalent position. All this may imply that the Kim Jong-il regime is seriously willing to normalize relations with South Korea and other countries and to conduct gradual economic reforms. But at present, the North Korean leadership is not able to credibly commit to the transition towards a more market-based system. Hassig and Oh (2002: 106) conclude

"In projecting trends, should one assume a linear trend in which North Korea slowly but steadily opens up (…)? Or should one expect accelerating change, or a stop-and-go series of openings and retrenchments? Of the many factors involved in influencing change and its trajectory, arguably the most important is the logic of regime survival. Because North Korea is governed by the will and whim of Kim Jong-Il (…), the costs and

benefits of change should be viewed from Kim's perspective. This is the one constant and knowable factor in North Korean affairs."

Hence, as long as effective political and economic institutions are not in place, the pursuit of reforms in North Korea is solely contingent on personal leadership. This may turn out to be the Achilles heel of potential market-oriented reforms in the hermit kingdom.

If, however, the Kim Jong-il regime opts in favor of economic reform and integration, a number of lessons can be learnt from other transition economies, especially from China. In this context, it is of utmost importance not to plan or anticipate the entire reform process but to craft a MEGS that is sufficiently flexible to adjust to changing economic or political circumstances. Moreover, policy makers should not aim at economically (theoretically) efficient outcomes, but consider the political feasibility of reform and integration measures ex ante. Thus, institution building should aim to achieve two objectives: to enhance economic efficiency and competition and to create a win-win situation and thus make reforms interest compatible for the North Korean elite, the North Korean population, and South Korean citizens.[40]

Finally, note that even gradual reforms – accompanied by (slowly) increasing international cooperation in terms of food aid, financial and technical support, improved diplomatic relations, normalization of relations with South Korea, Japan, China, Russia, and the United States – may gradually unfold economic and political dynamics in the reform and development process which could put increased pressure on the government to further open up the economy. If political power and stability is not undermined, economic progress may make it easier for the government to support further reform steps as long as the sovereignty of the country, the legitimacy of the ruling elite, and the political monopoly are not adversely affected.

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[40] See Qian (2001) for an analysis of how institution building aiming at these two objectives worked in China.

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Comments on "Safeguarding Economic Cooperation, Reform, and Development on the Korean Peninsula"

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I strongly believe that this paper is not acceptable to the Korea Development Review.

The Korea Development Review requires that papers should be of originality and of high quality in order for them to be accepted. The Korea Development Review also asks the papers should have implications for the related government policy.

However, it seems to me that this paper fails to meet those requirements.

First of all, most of the contents of this paper are not new. In fact, they have been already discussed among the researchers in Korea. In addition, discussions for importance of state strength(page no. 22), capacity building(page no. 24), and economic institutions(page no. 26) are also quite old ones like common sense. Thus, they are not creative ideas.

Secondly, this paper has a tendency of generalizing the situation too much. For example, the scenarios in page no. 2 only assumes unification of two Koreas. However, it is also likely that North Korea survive as an independent country for a quite long decades. Another example is on page no. 14. It is just an idealized model of integration as the author mentioned. Furthermore, it is already well-known model of integration. Therefore, I do not think the paper contains innovative suggestions for future policy.

Third, several points of this paper are based on misinformation, although they are minor.

Bank-based and Market-based Financial Systems: Time-series Evidence

by
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Abstract

In this paper, we reexamine the relative merits of bank-based and market-based financial systems in promoting long-run economic growth, which has been debated since the 19th century. Recent empirical studies based on cross-sectional analyses have failed to find strong evidence in favor of either a bank-based view or a market-based view. Instead, they find evidence in favor of either financial services or law and finance views.

Given the paucity of rigorous time-series analyses of the issue, we reexamine the issue by using time-series analyses. We find that in the U.S., the U.K., and Japan, the stock market played an important role in financing economic growth, whereas the banking sector played a more important role in Germany, France, and Korea. A more detailed subsample analysis shows that for all countries, the banking sector played an important role in the early years of economic growth. Regarding the causal relation between financial systems and economic growth, except for Korea, all countries show that the financial system leads economic growth. A further analysis shows that the banking sector and the stock market in each country were complementary to each other in each country in the process of economic growth except for the U.S., where the two sectors were mildly substitutable.

Our findings suggest, among other things, that recent cross-country studies may provide a limited picture of the debate on the relative merits of bank-based and market-based financial systems.

I. Introduction

In understanding the cause of the recent Asian financial crisis of 1997-98, one of the often-mentioned problems was a collusion among big corporations, politicians (bureaucrats included), and banks, which resulted in corruption, cronyism, and complacency in Asian countries. To correct these problems, some have proposed an independent banking system with a strong corporate governance structure. And others have pointed out a need to strengthen and improve the capital markets with sound stock markets so that companies can raise money not only through banks but also by way of stock markets, where numerous investors participate. As such, to better understand the cause of the Asian financial crisis and remedy the problems associated with it, we need to fully grasp the merits and limitations of bank-based and capital market-based financial systems.

Between bank-based and market-based financial systems, which is better for promoting long-run economic growth? Since the 19th century, many economists have argued that bank-based systems are better at mobilizing savings, identifying good investments, and exerting sound corporate control, particularly during the early stages of economic development and in weak institutional environments. Proponents of the market-based view stress that markets will reduce the inherent inefficiencies associated with banks and enhance economic growth.

Recent studies tend to argue that distinguishing countries by financial structure does not help in explaining cross-country differences in long-run economic performance. For example, Levine (2002) shows that financial structure is not a good predictor of growth in a *cross-country* growth framework: Neither a bank-based system nor a market-based system is closely associated with economic growth. Rather, recent studies find evidence in favor of either financial services or law and finance views. Distinguishing countries by their overall level of financial development helps to explain cross-country differences in economic growth. Moreover, the component of financial development explained by the legal rights of outside investors and the efficiency of the legal system in enforcing those rights is strongly linked to long-run growth [LaPorta, Lopez-de-Silanes, Shleifer and Vishny (1998, 2002)].

On the other hand, some economists take a view that these relationships need not be stable and can evolve over time. For example, Boyd and Smith (1996, 1998) develop models in which countries become more market-based, with positive implications for economic growth, as they develop. Rajan and Zingales (1998a) argue that bank-based systems are better at promoting growth in countries with poor legal systems, while market-based systems have advantages as legal systems improve. From a financial system architecture perspective, Boot and Thaker (1997) claim that a financial system in its infancy will be bank-dominated, but increased financial market sophistication diminishes the importance of bank lending. Recently, a political economy approach also points out the historical evolution of the two systems. Perotti and Thadden (2003) point out that as share-holdings by median voters increase, the dominant structure will move towards favoring equity markets over banks with riskier corporate strategies and higher profits.

Conventional studies primarily based on cross-sectional analyses have made a significant contribution to understanding the relative merits and importance of the two systems in economic development. Cross-sectional analyses are useful in particular when these relationships are stable over time. If we take a view that these relationships

need not be stable and may evolve over time as some economists argue, then cross-sectional analyses may provide a limited picture about the relations.   In particular, prior studies on the causal relations between financial structure and economic growth, a fundamental issue in finance, provide only a partial analysis of dynamic causal relations because they lack a rigorous time-series analysis of the dynamic causal relation.   Even the causal relation may change over time.

We find a paucity of time-series analyses of the debate on the relative merits of the two systems as well as analyses from a historical perspective.   In this paper, to complement recent studies of cross-sectional analyses, we focus on time-series analyses of the relative importance of the bank-based versus market-based debate.

A conventional, fundamental question has been the causal relation between financial development and economic growth.   Regarding the causal relation between financial systems and economic growth, some argue that financial development primarily follows economic growth and that the sources of economic growth should be sought elsewhere [e.g., Robinson (1952)].[1]   Others argue that financial development leads economic growth [e.g., Bagehot (1873) and Schumpeter (1912)].   Regarding the role of financial intermediaries in economic development, economic theories tend to diverge.[2]   Some argue that financial intermediaries ameliorate the economic consequences of informational asymmetries, with beneficial implications for resource allocation and economic activity.[3]   Others note that overall growth rates actually slow down with enhanced financial intermediaries [Bencivenga and Smith 1991; King and Levine 1993b]. While several studies show that the level of financial development is a good predictor of economic growth, they did not settle the issue of causality.[4]

In this paper, using time-series analysis, we address the following questions:
1. Whether financial systems lead economic growth or economic growth leads the growth in financial systems (or financial development).
2. If the development in financial systems leads economic growth, between the banking sector and the stock market, which one primarily leads economic growth?
3. Whether there is any evidence of the historical shift in the importance of each system over time (e.g., from banking to market systems) as some theories anticipate.
4. Whether the two sectors – the banking sector and the stock market – have been substitutable in the process of economic growth.

Extant empirical research on country studies primarily uses country-specific measures of financial structures. For example, studies of Germany commonly focus on the extent to

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[1] For more on how economic activity influences the financial sector, see Patrick (1966) and Greenwood and Jovanovic (1990).

[2] For instance, Alexander Hamilton (1781) argued that "banks were the happiest engines that ever were invented" for spurring economic growth. Others, however, question whether finance boosts growth. President John Adams (1819) asserted that banks harm the "morality, tranquility, and even wealth" of nations. These are taken from Hammond (1991).

[3] For additional literature, see Townsend (1979); Gale and Hellwig (1985); Diamond (1984); Boyd and Prescott (1986); Diamond and Dybvig (1983); and Greenwood and Jovanovic (1990). For reviews of this literature, see Gertler (1988) and Levine (1997).

[4] See, for example, King and Levine (1993a,b), Levine and Zervos (1998), Neusser and Kugler (1998), Rousseau and Wachtel (1998), and Levine, Loayza, and Beck (2000).

which banks own shares or vote proxy shares. Studies of Japan frequently focus on whether a company has a main bank. Studies of the United States sometimes concentrate on the role of market takeovers as corporate control devices. These country-specific measures are very useful; however, they are difficult to use in a broad cross-country analysis. We use a consistent measure of financial system structure across countries and compare six countries − the U.S., the U.K., Germany, France, Japan, and Korea − with different financial systems and growth rates.

We find that for each country, a certain financial system is a good predictor of economic growth. In addition, we find the trend that, in an earlier sample period, the banking sector played a more important role, but over time, the importance of the stock market has increased relative to that of the banking sector. A further analysis shows that the growth in the two sectors – the banking sector and the stock market – was primarily complementary except for the U.S., where the two sectors were substitutable.

The paper is organized as follows. In section 2, we briefly review various theoretical and empirical studies. Section 3 provides a time-series causal analysis of the relation between financial systems and economic growth for several countries including the U.S., the U.K., Germany, France, Japan, and Korea. Section 4 provides an analysis of whether the two sectors have been substitutable in the process of economic growth. Section 5 provides further analysis about the debate on the role of the Korean financial system. Section 6 concludes the paper.

II. Related Literature

Economists have made numerous theoretical insights into the comparative advantages of different financial systems. Allen and Gale (2000) provide a comprehensive review of the vast literature on comparative financial systems. In the past, four competing theories of financial structure have been proposed: a bank-based view, a market-based view, a financial services view, and a law and finance view.

The bank-based view tends to emphasize the positive role of banks in mobilizing capital, identifying good projects, monitoring managers, and managing risk. According to this view, banks finance industrial expansion more effectively than markets in under-developed economies (Gerschenkron, 1962). Powerful banks can induce firms to reveal information and pay debts better than atomistic markets (Rajan and Zingales, 1998b). And banks are more effective in providing external resources to new, innovative activities that require staged financing because banks can credibly commit to making additional funding available as the project develops (Stulz, 2000).

The market-based view highlights the positive role of markets in enhancing risk management, information dissemination, corporate control, capital allocation, and mitigating the problems associated with excessively powerful banks [Levine and Zervos, 1998]. They also emphasize that markets provide key financial services that stimulate innovation and long-run growth.

The financial services view minimizes the importance of the bank-based versus market-based debate. It stresses that financial arrangements – contracts, markets, and intermediaries – arise to ameliorate market imperfections and provide financial services. By providing these financial services more or less effectively, different financial systems promote economic growth to a greater or lesser degree [Merton and Bodie (1995) and Levine (1997)]. According to this view, the main issue is not banks *or* markets. The issue is creating an environment in which intermediaries *and* markets provide sound financial services. Furthermore, banks and markets might act as complements in providing financial services [Boyd and Smith, 1998; Huybens and Smith, 1999].

The law and finance view emphasizes the role of the legal system in creating a growth-promoting financial sector. [La Porta, Lopez-de-Silanes, Shleifer, and Vishny, henceforth LLSV, 1998]. According to this view, bank-based versus market-based is not an especially useful way to distinguish financial systems. Instead, it is the overall level and quality of financial services – as determined by the legal system – that improves the efficient allocation of resources and economic growth.

From a financial system architecture perspective, Boot and Thaker (1997) point out that there is valuable information feedback from the equilibrium market prices of securities to the real decisions of firms that affect those market prices, whereas banks are superior in resolving an asset substitution moral hazard. Thus, in choosing between banks and financial markets, one trades off the improvement in real decisions due to feedback from market prices against a more efficient attenuation of moral hazards.[5] Allen and Gale (1997) suggest that bank-oriented systems provide better intertemporal risk sharing, whereas market-oriented systems provide better cross-sectional risk sharing.

In terms of empirical evidence on the role of financial system and economic growth, the majority of prior studies tend to focus on broad cross-sectional analyses of countries. Levin (2002) examines empirical evidence on competing theories of financial structures − bank-based views, market-based views, financial services views, and law and finance views − using his newly constructed broad cross-country dataset. He finds no cross-country empirical support for either market-based or bank-based views. Instead, he finds cross-country evidence that is consistent with the financial services view in that distinguishing countries by their overall level of financial development helps to explain cross-country differences in economic growth. He also finds that the legal system plays a leading role in determining the level of growth-promoting financial services supporting the LLSV (1998) view.

To assess the four competing views of financial structures from somewhat different perspectives, Beck and Levine (2002) examine the impact of financial structures on industry growth, new establishment formation, and efficient capital allocation using cross-industry, cross-country panel data. They find no support for either the market-based or the bank-based views. Instead, they find that distinguishing countries by overall financial development and legal system efficiency is more useful than distinguishing countries by whether they are relatively bank-based or market-based.

Using traditional cross-section, instrumental variable procedures and recent dynamic panel techniques, Levine, Loayza, and Beck (2000) examine a causal link between finance and growth. They find that the exogenous component of financial intermediary development is positively associated with economic growth and that cross-country differences in legal and accounting systems help account for differences in financial development. Although this paper does not fully resolve all concerns about causality, it uses new data and new econometric procedures that directly confront the potential biases

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[5] In addition to these conventional views, there is a political economy approach. The literature on the political economy approach of financial structures is still new and relatively small. See Pagano and Volpin (2004), Bolton and Rosenthal (2002), and Biais and Perotti (2002).

Recently, Perotti and Thadden (2003) provide a model in which legislation affects corporate governance and the return to human and financial capital so that a certain congruence of interests can lead to a political majority to support either bank over equity dominance or equity over bank dominance. As share-holdings by median voters increase, the dominance structure will move towards favoring equity markets over banks with riskier corporate strategies and higher profits

induced by simultaneity, omitted variables, and unobserved country-specific effects that have plagued previous empirical work on the finance-growth link.[6]

III. Causal Relations between Financial Systems and Economic Growth

3.1 Causal relations

To examine the hypothesis that the banking sector (or the stock market) plays a more important role in the economic growth of a country, we employ the Granger-causality test.[7] Specifically, the null hypothesis we test is that the banking sector (or the stock market) does not Granger-cause economic growth.   If the banking sector Granger-causes economic growth, it implies that banking sector growth helps better predict economic growth.

As a measure of economic growth, we use per capita real GDP growth rate (GDPGR), as in previous studies. For stock market importance, we employ two measures: the growth in stock market capitalization (STOCKGR) and the ratio of stock market capitalization to the GDP (STOCKRA).   Similarly, for measures of banking sector importance, we use both the growth in the banking sector (BANKGR) and the ratio of the banking sector to the GDP (BANKRA).   For the size of the banking sector, we use 'the total assets of the deposit money banks'.

Consider the following trivariate autoregressions with m lags:[8]

$$Y_t = \alpha_1 + \sum_{j=1}^{m} \beta_{1j} Y_{t-j} + \sum_{j=1}^{m} \gamma_{1j} X1_{t-j} + \sum_{j=1}^{m} \gamma_{2j} X2_{t-j} + e_{1t},$$

$$X1_t = \alpha_2 + \sum_{j=1}^{m} \beta_{2j} X1_{t-j} + \sum_{j=1}^{m} \delta_{1j} Y_{t-j} + \sum_{j=1}^{m} \delta_{2j} X2_{t-j} + e_{2t},$$

$$X2_t = \alpha_3 + \sum_{j=1}^{m} \beta_{3j} X2_{t-j} + \sum_{j=1}^{m} \phi_{1j} Y_{t-j} + \sum_{j=1}^{m} \phi_{2j} X2_{t-j} + e_{3t},$$

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[6] For the study of whether financial development is a good predictor of economic growth, see Rajan and Zingales (1998a), and Demirgüç-Kunt and Maksimovic (1998, 2002). Rajan and Zingales (1998a) show that, in countries with well-developed financial systems, industries that are naturally heavy users of external finance grow relatively faster than other industries. Demirgüç-Kunt and Maksimovic (1998) show that firms in countries with better-developed financial systems grow faster than they could have grown without this access.

[7] The notion behind causality testing in Granger (1969) is based on the premise that the future cannot cause the present or the past.   Formally, if the prediction of y using past x is more accurate than the prediction without using past x in the mean square error sense [i.e., if $\sigma^2(y_t \mid I_{t-1}) < \sigma^2(y_t \mid I_{t-1} - x_t)$, where I_t is the information set], x Granger-causes y.

[8] When we implemented bivariate causality tests between GDP and the banking sector or the stock market, we find almost identical results.   As such, to save space, we do not report the results of the bivariate causality tests.

where Yt is GDPGR, X1t is STOCKGR (or STOCKRA), and X2t is BANKGR (or BANKRA).

If the γ_{1j} coefficients in (1) are statistically significant, inclusion of past values of X1 (STOCKGR), in addition to the past values of Y (GDPGR) and X2 (BANKGR), yields a better forecast of Y (GDPGR), and we say X1 (STOCKGR) Granger-causes Y (GDPGR). If a standard F-test does not reject the hypothesis that γ_{1j} = 0 for all j, then X1 does not Granger-cause Y.   Similarly, if the γ_{2j} coefficients in (1) are statistically significant, inclusion of past values of X2 (BANKGR), in addition to the past values of Y (GDPGR) and X1 (STOCKGR), yields a better forecast of Y (GDPGR), and we say X2 (BANKGR) Granger-causes Y(GDPGR).

In addition to testing whether either the banking sector or the stock market Granger-causes economic growth of each country based on (1), we test whether economic growth Granger-causes either banking sector or stock market growth, and whether the banking sector (or the stock market) Granger-causes the stock market (or the banking sector) based on regression equations (2) and (3).

3.2 Data

Empirical research on the comparative merits of bank-based and market-based financial systems has centered on Germany and Japan as bank-based systems and the United States and the United Kingdom as market-based systems.   In addition, we include France and Korea in our sample to be compared with Germany and Japan, respectively.

We use annual data from the 1960s.   However, due to data availability, we have somewhat different sample periods for each country: 1960-2002 for the U.S., 1966-2002 for the U.K., 1960-2002 for Japan, 1970-2002 for (South) Korea, and 1975-1998 for France and Germany.[9]

For measures of stock market value, we use 'U.S. market value' from DATASTREAM, 'U.K. market capitalization' from the London Stock Exchange, and 'Japan's stock market trading value' from the Tokyo Stock Exchange.   For Germany and France, the stock market capitalization data are from the 'World Stock Exchange Fact Book 2001', published by Meridian Securities Markets LLC, which contains the data only for 1975-2000.   'Stock value traded' for Korea is obtained from Datastream.

 For measures of banking sector value, as in other studies, we use 'Deposit money banks: Assets' from Datastream. Other variables such as Real GDP, nominal GDP, GDP deflator, and population are from Datastream.

3.3 Empirical results

Table 1 presents simple statistics on variables we use as measures of economic growth (GDPGR), growth in stock market capitalization (STOCKGR), the ratio of stock market capitalization to GDP (STOCKRA), growth in the banking sector (BANKGR), and the ratio of the banking sector to GDP (BANKRA).   For our sample period, per capita real

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[9] For Germany, we use West Germany data, which are available until 1998.   For comparison, we also use the same sample period for France.

GDP   has grown at an annual average rate of   2.2% for the U.S., 2.1% for the U.K., 1.9% for West Germany, 1.0% for France, 4.1% for Japan, and 6.0% for Korea.   Using our measures, the banking sector has grown faster than the stock market in the sample period in the U.S., the U.K., and France, whereas the stock market grows faster than the banking sector in Germany, Japan, and Korea.   Using our measures, the sample average size of the stock market is greater than that of the banking sector in the U.S., Germany, Japan, and Korea.

The results of various Granger-causality tests are presented in Table 2. Considering both Akaike and Schwarz information criteria, we use two lags (i.e., m = 2) in the trivariate autoregressions in (1) – (3).   Panel A shows that in the U.S., the stock market Granger-causes per capita real GDP growth, regardless of whether we use STOCKGR or STOCKRA.   However, the banking sector does not Granger-cause GDP growth.   It is evident that in the U.S., the stock market plays a more important role in economic growth than the banking sector according to the Granger-causality test.   Given that the U.S. is regarded as a typical example of a market-based financial system, this finding is not very surprising and is in favor of the hypothesis that in terms of economic growth in the U.S., the stock market played a more important role than the banking sector.

Panel B shows the test results of the U.K., which are very similar to those of the U.S.: The U.K. stock market Granger-causes GDP growth rate, regardless of whether we use STOCKGR or STOCKRA.   The U.K. banking sector does not Granger-cause GDP growth. This finding is again in favor of the hypothesis that in the economic growth of the U.K., the stock market played a more important role than the banking sector.   Compared with the U.S. case, the relative dominance of the U.K. stock market in Granger-causing economic growth is not as strong as that of the U.S.

Now we turn to Germany in panel C, which is regarded as a typical country with a bank-based financial system.   First, it is noted that neither BANKGR nor STOCKGR Granger-causes Germany's economic growth.   That is, in terms of growth, neither the banking sector nor the stock market Granger-causes Germany's economic growth. However, BANKRA Granger-causes GDP growth, whereas STOCKRA does not.   This is quite a significant finding and appears to confirm the conventional wisdom that the banking sector played a major role in German economic growth.   This finding is quite different from that of the U.S. and the U.K., where the stock market Granger-causes GDP growth.   However, it is noted that stock market variables Granger-cause banking variables in Germany, which implies that the German stock market contains predictable information about the banking sector.

In contrast, in panel D, we observe that both STOCKGR and BANKGR Granger-cause France's economic growth.   Furthermore, both STOCKRA and BANKRA also Granger-cause France's economic growth.   This suggests that both the banking sector and the stock market played an important role in France's economic growth, which is different from Germany's case, where the stock market does not Granger-cause GDP growth. However, it is noted that the banking sector Granger-causes GDP growth more strongly than the stock market does, which is somewhat close to the German case but quite different from the U.S. and the U.K.   Another interesting feature is that France's GDP growth Granger-causes BANKRA.   That is, the fraction of France's banking sector relative to GDP is predictable by the GDP growth rate, which indicates another close relation between economic growth and the banking sector in France.

In panel E, we find that Japan's stock market (both STOCKGR and STOCKRA) Granger-causes GDPGR, but BANKGR does not.   BANKRA Granger-causes GDPGR, but the causal relation is weak.   We anticipated finding that Japan's banking sector would Granger-cause GDP growth rather than the stock market because Japan, along

with Germany, is considered to be a bank-based system. Our finding suggests that banks may have played an important role in Japan's economic development, but as far as predictability of Japan's economic growth is concerned, the stock market played a more important role in the Japanese economy. This finding prompts us to examine whether this pattern of a causal relation is observed in the earlier sample period or whether this is simply a recent pattern in Japan, which will be taken up below.

Panel F presents the test result for Korea, widely regarded as following Japan's economic growth pattern. It is noted that neither STOCKGR nor BANKGR Granger-causes economic growth. However, BANKRA Granger-causes GDP growth, while STOCKRA does not. This indicates that the banking sector plays a more important role than the stock market in predicting economic growth, which is quite different from Japan. This seems consistent with Korea's long-standing practice of funneling financial resources to some target industries such as exporting corporations and heavy industries through bank financing to achieve fast economic growth.   Another interesting feature is that GDP growth strongly Granger-causes BANKGR, STOCKGR, and STOCKRA. I.e., economic growth helps predict both banking and stock market growth. This suggests that Korea's economic growth leads the development of the financial systems − whether the banking sector or the stock market − more than financial system has contributed to Korea's economic growth.

Since stock market capitalization is based on stock market prices, which are supposed to be a leading economic indicator, it is usually anticipated that stock market size (or growth) contains more useful information in predicting economic growth than banking sector size (or growth). Given this anticipation, the finding of the Granger-causal relation from the banking sector to economic growth found in Germany, France and Korea seems quite significant, and it indicates a strong influence of the banking sector in economic growth in these countries.

Regarding the causal relation between financial systems and economic growth, all countries except for Korea and France show that financial systems lead (or Granger-cause) economic growth.   In Korea, we find that GDP growth strongly Granger-causes BANKGR, STOCKGR, and STOCKRA.   In France, GDP growth Granger-causes BANKRA.

3.4 Further empirical results based on sub-sample analyses

As discussed above, some theories suggest that during early stages of economic development and in weak institutional environments, bank-based systems are better at promoting growth, while market-based systems have advantages as legal systems improve. To see whether we can find evidence for the theoretical prediction of the historical evolution of the relative importance of the two financial systems, we implement Granger-causality tests for earlier sample periods for the U.S., the U.K., Japan, and Korea, whose results are presented in Table 3.[10]

Panels A.1 and A.2 present the causal relations for the U.S. sample period of 1960-1980 and 1960-1985, respectively. We observe that at least for the sample of 1960-1980, BANKRA, together with STOCKGR and STOCKRA, Granger-causes U.S. economic growth. Furthermore, BANKGR Granger-causes STOCKGR, and BANKRA Granger-causes STOCKRA. For the sample of 1960-1985, BANKGR Granger-causes STOCKGR.

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[10] For Germany and France, we have the sample period starting from 1975, which is too short a time period to implement an effective sub-sample analysis.

None of these was observed for the U.S. sample of 1960-2002. Taken together, these findings imply that the U.S. banking sector played an important role in predicting economic growth and stock market growth in earlier sample period.

Panels B.1 and B.2 examine the causal relations for the U.K. sample period of 1966-1985 and 1966-1990, respectively. We observe that for the sample of 1966-1985, BANKGR Granger-causes U.K. economic growth, while STOCKGR fails to Granger-cause economic growth. For the sample of 1966-1990, BANKRA, together with STOCKRA and STOCKGR, Granger-causes U.K. economic growth. These were not observed for the U.K. sample of 1966-2002. As such, we uncover evidence that the U.K. banking sector played an important role in predicting economic growth in the earlier sample period.

Panels C1 and C2 report the causal relations for Japan's sample period of 1960-1985 and 1960-1990, respectively. We observe that for the sample of 1960-1985, BANKRA Granger-causes Japan's economic growth, while STOCKRA fails to Granger-cause economic growth. For the sample of 1960-1990, BANKRA, together with STOCKRA, Granger-causes Japan's economic growth as in the whole sample period of 1960-2002, but BANKRA Granger-causes Japan's economic growth more strongly than STOCKRA does. These findings indicate that Japan's banking sector played an important role in leading economic growth in the earlier sample period, which is consistent with the view that Japan was a banking-based system in this earlier period.

Panel D examines the causal relations for Korea's sample period of 1970-1990. We observe that BANKGR Granger-causes Korea's economic growth, while STOCKGR fails to Granger-cause economic growth. For Korea's whole sample period, neither BANKGR nor STOCKGR Granger-causes Korea's economic growth. Again, the banking sector played an important role in Korea's economic growth in the earlier period.

3.5 Summary of dynamic causal relations

Previous studies tend to find that financial structures are not a good predictor of growth in a *cross-country* growth framework: Neither bank-based system nor market-based financial system is closely associated with economic growth. However, using time-series analyses, we find that, for each country we examine, a certain financial system is a good predictor of economic growth. In addition, we find a trend in earlier sample periods wherein the banking sector played a more important role, but over time, the importance of the stock market has increased relative to the banking sector.

Given our finding of the evolution of the two financial systems over time, conventional studies based on cross-sectional analysis may not provide a full picture of the evolving relationships between financial structures and economic growth in each country. Still, our findings are mostly consistent with theoretical predictions: Both the banking sector and the stock market relative to the GDP have grown over time, and the stock market has become relatively more important in explaining economic growth over time.

IV.   The Substitutability between the Banking Sector and the Stock Market

4.1 An identification of substitutability based on a bivariate framework

One of the important issues in the relationship between the banking sector and the stock market is whether the two sectors are complementing or substituting each other over time in terms of their relative importance. Several theories suggest that the stock market becomes more important as the economy grows over time relative to the banking

sector, and we find evidence supporting this view in that stock market growth tends to Granger-cause economic growth in recent years. For our sample, we find that both stock market size (or capitalization) and banking sector size relative to the GDP have been growing over time [see Table 1].

An interesting question is whether or not the two sectors − the banking sector and the stock market − were substitutable in the process of economic growth in each country. As a preliminary step, Table 4 shows cross correlations between STOCKRA and BANKRA. In particular, the contemporaneous correlation between the two ratios varies substantially across countries. Germany and France show very high contemporaneous correlations of 0.95 and 0.76, respectively. The U.K., Japan and Korea show moderate contemporaneous correlations of 0.57, 0.12, and 0.17, respectively. The U.S. shows a small contemporaneous correlation of 0.04. At first glance, we may conjecture that countries with a high correlation may exhibit a high complementary effect and little substitution effect.

To address this issue in a more rigorous manner, we need to empirically identify the extent of the complementary and substitution relationship between the two sectors. For this purpose, we need to identify complement and substitution effects using data. Consider a 2-by-1 vector z_t consisting of STOCKRA ($X1_t$) and BANKRA ($X2_t$): $z_t = [X1_t, X2_t]'$. By the Wold theorem, z_t has the following bivariate moving average representation (BMAR):

$$z_t = [X1_t, X2_t]' = B(L)\, \varepsilon_t, \quad \text{or} \tag{4}$$

$$\begin{bmatrix} X1_t \\ X2_t \end{bmatrix} = \begin{bmatrix} B_{11}(L) & B_{12}(L) \\ B_{21}(L) & B_{22}(L) \end{bmatrix} \begin{bmatrix} \varepsilon_t^1 \\ \varepsilon_t^2 \end{bmatrix} , \tag{5}$$

where $X1_t$ = STOCKRA$_t$; $X2_t$ = BANKRA$_t$; ε_t is a 2 x 1 vector consisting of ε_t^1 and ε_t^2; L is the lag operator (i.e., $L^n x_t = x_{t-n}$), $B_{ij}(L)$ for i, j = 1, 2 is a polynomial in the lag operator L (i.e.,), and the innovations are orthonormalized such that

$$B_{ij}(L) = \sum_k b_{ij}^k L^k \text{ with } \sum_k = \sum_{k=0}^{\infty}), \text{ and}$$

var(ε_t) = I. The above representation implies that STOCKRA ($X1_t$) and BANKRA ($X2_t$) are driven by two types of shocks (or disturbances) yet to be identified.

Here we want to identify the two shocks as complement and substitution shocks, respectively. To achieve this identification, we exploit the relation between the above bivariate moving average representation (BMAR) and its corresponding bivariate vector autoregression (BVAR). This is because the BMAR model (i.e., estimates of B(L)) in (4) is derived in practice by inverting a bivariate vector autoregression (BVAR).

By estimating the BVAR of $z_t = [X1_t, X2_t]'$:

$$z_t = A(L) z_{t-1} + u_t, \tag{6}$$

where $A(L) = [\ A_{ij}(L)\ ] = [\quad]$ for $i, j = 1, 2$, $u \sum_{k=0}^{m} a_{ij}^{k+1} L^k \ ]\ 1_t = [u_{1t}, u_{2t}]' = z_t - E(z_t \mid z_{t-s}, s > 1)$ with $\text{var}(u_t) = \Omega$, we obtain estimates of $A(L)$ and Ω. Inverting this BVAR of z_t yields a BMAR of z_t:

$$z_t = [I - A(L)L]^{-1} u_t, \tag{7}$$

where I is the identity matrix of rank two.

By comparing z_t in (4) with that in (7), estimates of B(L) can be obtained by noticing that

$$B^0 \varepsilon_t = u_t \tag{8}$$

and that

$$z_t = B(L) \varepsilon_t = [I - A(L)L]^{-1} u_t. \tag{9}$$

Using (8), (9) implies that

$$B(L) = [I - A(L)L]^{-1} B^0. \tag{10}$$

To calculate B(L), we only need an estimate of B^0 since A(L) is available from the estimation of BVAR. This can be obtained by taking the variance of each side of (8):

$$B^0 B^{0'} = \Omega. \tag{11}$$

I.e.,

$$\begin{pmatrix} b_{11}^0 & b_{12}^0 \\ b_{21}^0 & b_{22}^0 \end{pmatrix} \begin{pmatrix} b_{11}^0 & b_{21}^0 \\ b_{12}^0 & b_{22}^0 \end{pmatrix} = \begin{pmatrix} \sigma_{11} & \cdot \\ \sigma_{21} & \sigma_{22} \end{pmatrix}.$$

Here, we obtain three restrictions for the four elements of B^0: b_{11}^0, b_{12}^0, b_{21}^0, and b_{22}^0. Therefore, to just-identify the two disturbances as complement and substitution disturbances, we need an additional restriction on the coefficients of the BMAR [see Blanchard and Quah (1989)].

4.2 An identifying restriction for the substitution effect

We have shown above that we need to introduce an additional restriction to identify the complement and substitution disturbances. Here, we identify the substitution effect and its disturbances, ε_t^s, by imposing the following restriction. The substitution effect disturbance affects, by definition, STOCKRA and BANKRA in an opposite manner. In practice, however, we cannot impose an inequality restriction because it is too broad to be

implemented, and the opposite movement of STOCKRA and BANKRA need not occur in the same period.   As such, we take an alternative, more flexible, approach by assuming that its long-term effect on STOCKRA is the negative of its long-term effect on BANKRA. That is, we identify the substitution disturbance, ε_t^s, as having effects on   STOCKRA and BANKRA in such a way that the sum of the long-term effects on the two ratios over time adds up to zero.   On the other hand, in the absence of such a restriction, the complement effect disturbance, ε_t^c,   is allowed to affect both ratios in the same direction.[11]

Since MAR coefficients b_{12}^k and b_{22}^k measure the effect of the second shock on STOCKRA ($X1_t$) and BANKRA ($X2_t$) after k periods, respectively, the above restriction on the substitution disturbance, ε_t^s, is represented by the restriction that the coefficients in $B_{12}(L)$ and $B_{22}(L)$ add up to zero:

$$\Sigma_k\, b_{12}^{\,k} + \Sigma_k\, b_{22}^{\,k} = B_{12}(L)\big|_{L=1} + B_{22}(L)\big|_{L=1} = B_{12}(1) + B_{22}(1) = 0, \qquad (12)$$

where $B_{ij}(L)\big|_{L=1} = B_{ij}(1) = \Sigma_k\, b_{ij}^{\,k}$ represents the cumulative effect of the j-th disturbance on the i-th variable over time.[12]

Given the relation between the MAR coefficients and VAR coefficients in (10), $B(L) = [I - A(L)L]^{-1} B^0$,   the restriction on the MAR coefficients in (12) is implemented by imposing the following restriction on the VAR coefficients:

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[11] The restriction on the substitution disturbance ε_t^s may help assure its opposite impact on the two types of ratios.   The question remains as to how to guarantee that the complement effect disturbance will affect the two types of ratios in the same direction.   Here, we simply take the position that, in the absence of such a restriction, the complement effect disturbance ε_t^c is allowed to affect both ratios in the same direction.   As such, it seems that there is no stringent restriction that guarantees the effects of the complement disturbance.   As discussed in the text, the bivariate VAR model is under-identified, requiring only one additional restriction.   If we impose an additional restriction on the complement effect disturbance, we have an over-identifying restriction, which needs to be tested for its empirical validity.   Given this problem, we take the position in this paper that we impose a just-identifying restriction (on the substitution effect disturbance) and see whether the outcome will show that the complement effect disturbances affect both ratios in the same direction.   This can be an informal test of the validity of our restriction.   In fact, we confirm that the complement effect indeed affects the two ratios in the same direction, confirming our conjecture [see Section 4.4].

[12] As an alternative identifying restriction, we may consider a more restrictive one.   For example, we may identify the substitution disturbance ε_t^s by assuming that its effect on STOCKRA is the negative of its effect on BANKRA in each period: $b_{12}^0 = - b_{22}^0$.

We find this restriction too restrictive because under this assumption there is a one-to-one substitution in the two ratios in each period without allowing for possible (temporary) adjustments over time.

$$[1 - A_{22}(1) + A_{21}(1)]\, b_{12}^{0} + [1 - A_{11}(1) + A_{12}(1)]\, b_{22}^{0} = 0. \tag{13}$$

This provides an additional restriction on the relationship between the BMAR coefficients b_{12}^{0} and b_{22}^{0} given estimates of the BVAR, $A_{11}(1)$, $A_{12}(1)$, $A_{21}(1)$, and $A_{22}(1)$.

With this additional restriction, we can achieve the just-identification of the bivariate model of $[X1_t, X2_t]'$. As a result of imposing this restriction on BMAR in (4) (or (5)), we now obtain the following just-identified BMAR representation:

$$z_t = [X1_t, X2_t]' = B(L)\, \varepsilon_t, \quad \text{or} \tag{14}$$

$$\begin{bmatrix} X1_t \\ X2_t \end{bmatrix} = \begin{bmatrix} B_{11}(L) & B_{12}(L) \\ B_{21}(L) & B_{22}(L) \end{bmatrix} \begin{bmatrix} \varepsilon_t^c \\ \varepsilon_t^s \end{bmatrix}, \tag{15}$$

where $X1_t$ = STOCKRA; $X2_t$ = BANKRA; ε_t is a 2 x 1 vector consisting of ε_t^c and ε_t^s; ε_t^c = complementary effect shock; ε_t^s = substitution effect shock; and the innovations are orthonormalized such that $Var(\varepsilon_t) = I$. Now, we can interpret that STOCKRA and BANKRA are driven by two types of shocks (or disturbances): complementary and substitution shocks. The time paths of the dynamic effects of complementary and substitution effects on STOCKRA and BANKRA are implied by the coefficients of the polynomials $B_{ij}(L)$, b_{ij}^{k}.

4.3 A measure of the relative importance of each effect

Since we are interested in identifying the relative importance of the two types of shocks in driving the two ratios, we need to establish a measure of the relative importance of each effect. The complement effect contributes to a positive correlation between STOCKRA and BANKRA, while the substitution effect generates a negative correlation, and the size of the correlation of the two ratios is related to the relative importance of each effect.

Such a measure would be to use the fraction of (forecast error) variance in each return explained by each type of disturbance. For example,

$$Q_{X1}^{c} = \frac{\sum_k (b_{11}^k)^2}{\sum_k \left[(b_{11}^k)^2 + (b_{12}^k)^2 \right]} \tag{16}$$

measures the fraction of the forecast error variance in X1 (i.e., STOCKRA) explained by the complement effect disturbance because the MAR coefficient b_{1j}^{k} measures the effect of ε_t^c (for j =1) or ε_t^s (for j = 2) on X1 (STOCKRA) in k periods. Therefore,

$$Q^c = \frac{\sum_k (b_{11}^k)^2}{\sum_k \left[(b_{11}^k)^2 + (b_{12}^k)^2 \right]} + \frac{\sum_k (b_{21}^k)^2}{\sum_k \left[(b_{21}^k)^2 + (b_{22}^k)^2 \right]}$$

(17)

will measure the relative importance of the complement effect disturbance that explains variances in X1 (STOCKRA) and X2 (BANKRA).   Similarly,

$$Q^s = \frac{\sum_k (b_{12}^k)^2}{\sum_k \left[(b_{11}^k)^2 + (b_{12}^k)^2 \right]} + \frac{\sum_k (b_{22}^k)^2}{\sum_k \left[(b_{21}^k)^2 + (b_{22}^k)^2 \right]}$$

(18)

will measure the relative importance of the substitution effect disturbance that

explains variances in X1 (STOCKRA) and X2 (BANKRA).[13]

4.4 Empirical results of substitutability

An informal way to see the validity of our analysis is that the substitution shock generates a negative (contemporaneous) relation between the two ratios, whereas the other shock, called the complement shock, generates a positive (contemporaneous) relation between the two ratios.

Figures 1 – 6 show the dynamic effect of each type of shock on the two ratios.   For each figure, it is observed that the substitution shock generates a negative (contemporaneous) relation between the two ratios, whereas the other shock, called the complement shock, generates a positive (contemporaneous) relation between the two ratios for each country without exception.   This confirms that there are indeed two types of shocks that drive the two ratios in the same direction (i.e., complement shocks) and in the opposite direction (i.e., substitution shock), respectively, and our framework helps identify the two types of shocks.

From Table 4, we observe that the contemporaneous correlation between the two ratios varies substantially across countries.   Germany (0.95) and France (0.76) show very high contemporaneous correlations.   The U.K. (0.57), Japan (0.12) and Korea (0.17) show moderate contemporaneous correlations.   The U.S. shows a small contemporaneous correlation of 0.04.

Table 5 shows the relative importance of the two types of shocks for each country. We observe that the complement shocks are dominantly more important than the

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[13] As an alternative measure, one may consider

$$Q^* = \frac{\left[\sum_k (b_{11}^k)^2 + (b_{21}^k)^2 \right]}{\sum_k \left[(b_{11}^k)^2 + (b_{12}^k)^2 + (b_{21}^k)^2 + (b_{22}^k)^2 \right]}$$

to measure the relative importance of the complement effect disturbance that explains variances in STOCKRA and BANKRA.   The problem with such a measure is that it ignores the different sizes of the variance of STOCKRA and BANKRA by mixing the two.   For example, although the complement effect disturbance explains 40% of the variance in STOCKRA and 80% of the variance in BANKRA, the above measure may provide less than 50% of the relative importance (say, the variance of stock return is four times that of bond return), which seems unreasonable.

substitution shocks (i.e., $Q^c > Q^s$) in explaining the two ratios' forecast error variance throughout the forecasting horizons for Germany and France. For example, for Germany (France) the complement and substitution shocks explain 174~198% (137~180%) and 25~2% (62~19%), respectively, for different forecasting horizons. That is, although we observe that both the banking sector and the stock market have expanded for these countries, the expansion was mainly due to comovements in the two ratios rather than to the substitution between the two sectors.

For countries of moderate correlations such as the U.K. and Japan, the complementary shocks are mildly more important than the substitution shocks in explaining overall forecast error variances. For the U.S., which shows little correlation between the two ratios, we observe the substitution shocks were relatively more important than the complement shocks for most of the horizons. This suggests, among other things, that the growth in the two ratios in the U.S. involves to some extent the substitution between the two sectors and that the two sectors of the U.S. are more easily substitutable than for other countries. For Korea, we find neither a strong complementary relation nor a strong substituting relation.

Overall, we find that the growth in the two sectors in each country was primarily due to the comovements in the two sectors except for one country, the U.S. In the U.S., we observe some evidence of mild substitutability between the two sectors. This finding suggests, among other things, that a theory based on a strong substitution between the two sectors over time is not supported by the data.

V. Further Analyses of the Korean Financial System

Among the six countries we have considered, Korea has achieved the highest economic growth for the sample period. Given our finding that that the banking sector plays a more important role than the stock market in leading Korean economic growth based on the whole sample and sub-sample analyses (panel F of Table 2 and panel D of Table 3), we may want to characterize Korea as a bank-based financial system. However, there seem to be differing views on this.

According to Demirguc-Kunt and Levine (2001), Korean financial markets were sufficiently well developed even prior to the Asian financial crisis so that the country's financial system already deserved to be classified as market-based. They point out that Korea already had a relatively active and efficient equity market, and that the market share of non-bank financial institutions (NBFIs) exceeded that of commercial banks.

It is noted that the growth of NBFIs and direct debt financing through such vehicles as corporate bonds and commercial papers during the 1990s was a result of hastily prepared financial liberalization and the implicit guarantee extended by the government. Direct debt instruments were often guaranteed by commercial banks, and NBFIs were heavily controlled by the *chaebols* that were regarded as too-big-to-fail. Hence, the importance of capital markets and NBFIs was not perceived as normal market development. As such, Hahm (2004) characterizes the Korean financial system at the onset of the Asian financial crisis as a combination of a pseudo-market and quasi-bank-based system.

Indeed, in the aftermath of the Asian financial crisis, the Korean government undertook a series of structural reforms, and the reform efforts were in part to establish a more market-based financial system. It is ironic to observe that, regardless of the government reform efforts geared toward a market-based system, the post-crisis financial

flows were more concentrated in the banking sector, that is, the resurgence of commercial banks rather than capital markets. Hahm (2004) investigates the post-crisis financial transition and notes that it was a process for correcting the distorted pre-crisis financial structure. Specifically, he shows the time-series of the composite index developed by Demirguc-Kunt and Levine (2001), which was applied to Korea as a way of characterizing the evolution of a financial structure in the post-crisis period [Figure 8.3 in Hahm (2004)]. He notes that the Korean system was evolving into a more market-based system immediately after the crisis. However, it is gradually returning to the bank based-system in recent years.

We present two figures: time series of BANKRA and STOCKRA for Korea. The time series of STOCKRA [Figure 7.A] looks very similar to that of Hahm (2004), suggesting that the Korean stock market ratio increased significantly immediately following the financial crisis, but has declined thereafter. Does this imply that the Korean banking sector's importance behaved in the opposite direction? The time-series of Korean BANKRA [Figure 7.B] shows that the Korean banking sector ratio also increased right after the financial crisis and then declined thereafter. This finding is consistent with our finding that the banking sector and the stock market have been neither complementary nor substitutive for Korea [see Panel F of Table 5]. As such, we cannot really characterize the Korean financial system as having returned gradually to either a banking or market system.

Given that that the banking sector plays a more important role than the stock market in leading Korean economic growth, another important question would be what the main source of causality from the banking sector to growth in Korea was.

We can consider three possible channels behind the causal linkage from financial intermediation to growth. First, an efficient banking system promotes financial saving and capital accumulation by assuring adequate returns to savers. Second, an efficient banking system allocates scarce resources from the most productive investment opportunities. As a result, the productivity of capital increases, which in turn contributes to economic growth. Third, given information asymmetry, an efficient banking system performs intermediation at smaller transaction costs and thereby contributes to growth. Then, among the three channels − capital accumulation, productivity and intermediation cost channels −, which one was most important to Korea in the sample period?

To address this issue, we collect three additional data sets − investment, labor productivity, and bank credit − and implement a set of causal relation tests to see whether the banking sector Granger-causes Korean economic growth through investment channels, productivity channels, or credit channels. The causality tests reported in Table 6 indicate that the Korean banking sector contributed to GDP growth through credit channels rather than through productivity or investment channels.

VI. Concluding Remarks

Between bank-based and market-based financial systems, which is better for promoting long-run economic growth? This issue has been debated since the 19th century. Among the four conventional views − a bank-based view, a market-based view, a financial services view, and a law and finance view − empirical studies based on cross-sectional analyses have failed to find strong evidence in favor of either a bank-based view or a market based-view.

Recent studies tend to find that distinguishing countries by their financial structures does not help in explaining cross-country differences in long-run economic performance.

Instead, they find evidence in favor of either financial services or law and finance views. That is, they find that while financial structures per se do not explain cross-sectional industrial performance, overall financial development and legal environments are important for industry growth and for the efficiency of capital allocation. Moreover, the component of financial development explained by the legal rights of outside investors and the efficiency of the legal system in enforcing those rights is strongly linked to long-run growth.

Given the paucity of rigorous time-series analyses of the relative importance of bank-based and market-based financial systems, we have conducted time-series analyses using Granger-causality tests. The results show that in the U.S., the U.K., and Japan, the stock market played an important role in financing economic growth, whereas in Germany, France, and Korea, the banking sector played a more important role. A more detailed sub-sample analysis shows that for all countries, the banking sector played an important role in early years of economic growth. Regarding the causal relation between financial systems and economic growth, except for Korea, all countries show that financial systems lead economic growth. A further analysis shows that growth in both the banking sector and the stock market relative to the GDP in each country was complementary to each other in each country except for the U.S. In the U.S., the two sectors have been mildly substitutable in the growth of the two sectors.

These findings raise an important question for recent studies, which find that distinguishing countries by financial structure does not help in explaining cross-country differences in long-run economic performance. Using time-series analyses, we find that for all countries, the banking sector played an important role in early years of economic growth, but recently the stock market plays an even more important role in economic growth. Given this evolution in the relative importance of the two financial systems, previous studies based on cross-sectional analyses that assume a stable relationship may provide only a partial description of these dynamic relationships.

Regarding the causal relation between financial systems and economic growth, at least for one country in our sample, Korea, we find strong evidence that economic growth leads financial system development. With accumulated data, it would be very interesting to examine China's case: whether this is also the case given its growing economic importance in the world economy and some claim that China is adopting the growth model of Korea.

Another interesting finding is about Japan. The conventional view is that Japan has a bank-based financial system. However, the stock market in Japan played a more important role in leading economic growth than did the banking sector, particularly in recent years. One way to understand this finding is that although the banking sector remains important, it may have had a mixed effect on Japanese economic growth in recent years (e.g., large bad loans). A more rigorous examination of the effect of the banking sector on economic growth remains a future research agenda.

Our analysis is flexible in that it does not have to classify countries as either market-based or bank-based. Rather we allow the data to decide it over time. Our study is primarily based on measures of the size and activity of banks and equity markets in order to construct an aggregate index of the degree to which each country is comparatively market- or bank-based. A further time-series analysis using alternative measures of financial structures, such as regulatory restrictions on bank activities (Barth, Caprio, and Levine (2001a,b, 2002)) or state-ownership (La Porta, Lopez-de-Silanes, and Shleifer's (2002)) may deepen our understanding of the relation between financial systems and economic growth.

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Table 1. Descriptive statistics

Country	period	variable	mean	standard error
The U.S.	1961 - 2002	GDPGR	0.02266	0.02100
		STOCKGR	0.05132	0.17507
		BANKGR	0.11995	0.15846
		STOCKRA	0.74747	0.30571
		BANKRA	0.06505	0.04478
		STOCKRAG	0.01760	0.17204
		BANKRAG	0.08428	0.15712
The U.K.	1967 - 2002	GDPGR	0.02114	0.01916
		STOCKGR	0.07051	0.26464
		BANKGR	0.12320	0.19762
		STOCKRA	0.76598	0.40149
		BANKRA	0.78188	0.35748
		STOCKRAG	0.04607	0.26232
		BANKRAG	0.09610	0.18445
Germany	1976 - 1998	GDPGR	0.01937	0.01813
		STOCKGR	0.11040	0.23025
		BANKGR	0.09299	0.08766
		STOCKRA	0.21650	0.11697
		BANKRA	0.19750	0.08858
		STOCKRAG	0.08660	0.23194
		BANKRAG	0.06839	0.08836
France	1976 - 1998	GDPGR	0.01031	0.12925
		STOCKGR	0.07893	0.27827
		BANKGR	0.08509	0.16845
		STOCKRA	0.22955	0.10680
		BANKRA	0.33714	0.10558
		STOCKRAG	0.07451	0.28855
		BANKRAG	0.07462	0.14731
Japan	1961 - 2002	GDPGR	0.04068	0.03572
		STOCKGR	0.11219	0.37508
		BANKGR	0.09803	0.22485
		STOCKRA	0.25012	0.17444
		BANKRA	0.15136	0.08940
		STOCKRAG	0.06269	0.36081
		BANKRAG	0.04784	0.20964
Korea	1971 - 2002	GDPGR	0.05996	0.03739
		STOCKGR	0.39501	0.80552
		BANKGR	0.16363	0.41064
		STOCKRA	0.33688	0.42914
		BANKRA	0.05992	0.01995
		STOCKRAG	0.29339	0.72053
		BANKRAG	0.08649	0.39141

Notes:
GDPGR = per capita GDP growth rate; STOCKGR = the growth rate in stock market capitalization, BANKGR = the growth rate in the banking sector; STOCKRA = stock market capitalization/GDP, BANKRA =banking sector size/GDP; STOCKRAG = the growth rate in STOCKRA, BANKRAG = the growth rate in BANKRA.

Table 2. Causality tests

$$Y_t = \alpha + \sum_{j=1}^{2} \beta_j Y_{t-j} + \sum_{j=1}^{2} \gamma_{1j} X1_{t-j} + \sum_{j=1}^{2} \gamma_{2j} X2_{t-j}$$

H_0 : $\gamma_{1j} = 0$ for all j , or $\gamma_{2j} = 0$ for all j

Panel A. the U.S.: 1960-2002

Y_t	X_t	Chi-squared (2)	significance	adj. R^2
GDPGR	STOCKGR***	25.5771	0.0000	0.4117
	BANKGR	0.1246	0.9395	
GDPGR	STOCKRA***	22.4619	0.0000	0.2916
	BANKRA	4.0576	0.1314	
BANKGR	STOCKGR	4.5198	0.1043	0.2059
	GDPGR	0.6338	0.7283	
STOCKGR	BANKGR	4.0414	0.1325	-0.0124
	GDPGR	0.2434	0.8854	
BANKRA	STOCKRA	4.5804	0.1012	0.9726
	GDPGR	0.1581	0.9239	
STOCKRA	BANKRA	4.1917	0.1229	0.7658
	GDPGR	1.5951	0.4504	

Panel B. the U.K.: 1966-2002

Y_t	X_t	Chi-squared (2)	significance	adj. R^2
GDPGR	STOCKGR**	7.2377	0.0268	0.3130
	BANKGR	3.4523	0.1779	
GDPGR	STOCKRA***	10.8204	0.0044	0.3465
	BANKRA	3.0598	0.2165	
BANKGR	STOCKGR	4.5298	0.1038	0.1162
	GDPGR	1.6604	0.4359	
STOCKGR	BANKGR	0.1144	0.9443	0.0729
	GDPGR	2.3385	0.3105	
BANKRA	STOCKRA	4.5530	0.1026	0.8572
	GDPGR	2.4910	0.2877	
STOCKRA	BANKRA	3.3115	0.1909	0.8351
	GDPGR	1.5946	0.4505	

Panel C. Germany: 1975-1998

Y_t	X_t	Chi-squared (2)	significance	adj. R^2
GDPGR	STOCKGR	2.4044	0.3005	0.0953
	BANKGR	2.8219	0.2439	
GDPGR	STOCKRA	0.1916	0.9086	0.1900
	BANKRA***	9.1977	0.0100	
BANKGR	STOCKGR***	13.1374	0.0014	-0.0587
	GDPGR	1.3877	0.4996	
STOCKGR	BANKGR	0.5668	0.7531	-0.2508
	GDPGR	1.9609	0.3751	
BANKRA	STOCKRA***	12.2044	0.0022	0.9356
	GDPGR	1.1361	0.5666	
STOCKRA	BANKRA	2.0822	0.3530	0.7826
	GDPGR	0.1627	0.9218	

Panel D. France: 1975-1998

Y_t	X_t	Chi-squared (2)	significance	adj. R^2
GDPGR	STOCKGR***	20.7177	0.0000	0.4171
	BANKGR***	33.1919	0.0000	
GDPGR	STOCKRA***	34.7729	0.0000	0.3442
	BANKRA***	36.9706	0.0000	
BANKGR	STOCKGR***	14.2865	0.0007	0.3604
	GDPGR	0.3541	0.8377	
STOCKGR	BANKGR**	8.4101	0.0149	-0.1925
	GDPGR	0.1900	0.9093	
BANKRA	STOCKRA**	6.3943	0.0408	0.8795
	GDPGR**	8.0359	0.0179	
STOCKRA	BANKRA	4.0645	0.1310	0.5426
	GDPGR	0.5007	0.7785	

Panel E. Japan: 1960-2002

Y_t	X_t	Chi-squared (2)	significance	adj. R^2
GDPGR	STOCKGR***	22.4984	0.0000	0.5862
	BANKGR	1.7171	0.4237	
GDPGR	STOCKRA**	8.8741	0.0118	0.5637
	BANKRA*	4.8198	0.0898	
BANKGR	STOCKGR	1.4101	0.4940	-0.0340
	GDPGR	0.7435	0.6895	
STOCKGR	BANKGR	2.7125	0.2576	-0.0541
	GDPGR	2.5939	0.2733	
BANKRA	STOCKRA	11.5262	0.0031	0.7338
	GDPGR	3.7619	0.1524	
STOCKRA	BANKRA	0.5234	0.7697	0.7116
	GDPGR	2.8487	0.2406	

Panel F. Korea: 1970-2002

Y_t	X_t	Chi-squared (2)	significance	adj. R^2
GDPGR	STOCKGR	2.8813	0.2367	-0.1159
	BANKGR	0.3654	0.8329	
GDPGR	STOCKRA	2.3928	0.3022	0.2060
	BANKRA**	8.4085	0.0149	
BANKGR	STOCKGR	4.0161	0.1342	-0.0081
	GDPGR***	13.0435	0.0014	
STOCKGR	BANKGR	1.8573	0.3950	0.2641
	GDPGR***	10.4815	0.0052	
BANKRA	STOCKRA	0.7012	0.7042	0.3010
	GDPGR	0.9024	0.6368	
STOCKRA	BANKRA**	7.4631	0.0239	0.7739
	GDPGR***	12.5726	0.0018	

Notes:
GDPGR = per capita GDP growth rate; STOCKGR = the growth rate in stock market capitalization,
BANKGR = the growth rate in the banking sector; STOCKRA = stock market capitalization/GDP,
BANKRA = banking sector size/GDP; STOCKRAG = the growth rate in STOCKRA,
BANKRAG = the growth rate in BANKRA.
***, **, and * indicate significance at 1%, 5%, and 10%, respectively.

Table 3. Causality tests using sub-samples

$$Y_t = \alpha + \sum_{j=1}^{2} \beta_j Y_{t-j} + \sum_{j=1}^{2} \gamma_{1j} X1_{t-j} + \sum_{j=1}^{2} \gamma_{2j} X2_{t-j}$$

H_0 : $\gamma_{1j} = 0$ for all j , or $\gamma_{2j} = 0$ for all j

Panel A.1 the U.S. : 1960- 1980

Y_t	X_t	Chi-squared (2)	significance	adj. R^2
GDPGR	STOCKGR***	13.0287	0.0014	0.2830
	BANKGR	0.6945	.70660	
GDPGR	STOCKRA***	47.5065	0.0000	0.6502
	BANKRA***	19.6419	0.0000	
BANKGR	STOCKGR	3.7778	0.1512	0.0002
	GDPGR	3.6879	0.1581	
STOCKGR	BANKGR**	7.3938	0.0247	0.3717
	GDPGR	2.4454	0.2944	
BANKRA	STOCKRA**	6.2543	0.0438	0.9719
	GDPGR	0.4015	0.8180	
STOCKRA	BANKRA**	6.4028	0.0407	0.6066
	GDPGR	4.8400	0.0889	

Panel A.2   the U.S.: 1960- 1985

Y_t	X_t	Chi-squared (2)	significance	adj. R^2
GDPGR	STOCKGR***	17.6804	0.0001	0.3773
	BANKGR	0.3112	0.8558	
GDPGR	STOCKRA***	24.8211	0.0000	0.3285
	BANKRA	0.7050	0.7028	
BANKGR	STOCKGR	3.6479	0.1613	-0.0184
	GDPGR	2.4126	0.2992	
STOCKGR	BANKGR*	4.6597	0.0973	0.3572
	GDPGR	3.6442	0.1616	
BANKRA	STOCKRA**	6.0683	0.0481	0.9600
	GDPGR	0.1122	0.9454	
STOCKRA	BANKRA	3.9972	0.1355	0.6193
	GDPGR	4.2481	0.1195	

Panel B.1   the U.K.: 1966-1985

Y_t	X_t	Chi-squared (2)	significance	adj. R^2
GDPGR	STOCKGR	3.5833	0.1666	0.0722
	BANKGR**	6.1317	0.0466	
GDPGR	STOCKRA***	9.9868	0.0067	0.2029
	BANKRA	0.5565	0.7570	
BANKGR	STOCKGR	4.2046	0.1221	0.1508
	GDPGR	0.0583	0.9712	
STOCKGR	BANKGR	1.5349	0.4642	0.1534
	GDPGR	2.9340	0.2300	
BANKRA	STOCKRA**	7.1518	0.0279	0.9266
	GDPGR*	5.0374	0.0805	
STOCKRA	BANKRA	1.2637	0.5315	0.2095
	GDPGR	3.5408	0.1702	

Panel B.2   the U.K.: 1966-1990

Y_t	X_t	Chi-squared (2)	significance	adj. R^2
GDPGR	STOCKGR*	5.3073	0.0703	0.1511
	BANKGR	4.0798	0.1300	
GDPGR	STOCKRA**	6.4086	0.0405	0.2746
	BANKRA*	5.1387	0.0765	
BANKGR	STOCKGR	4.0959	0.1289	0.0157
	GDPGR	1.5687	0.4563	
STOCKGR	BANKGR	0.0876	0.9571	0.0783
	GDPGR	1.7238	0.4223	
BANKRA	STOCKRA	2.8360	0.2421	0.8153
	GDPGR	0.5728	0.7509	
STOCKRA	BANKRA	2.2757	0.3204	0.5047
	GDPGR	0.7830	0.6760	

Panel C.1   **Japan**: 1960-1985

Y_t	X_t	Chi-squared (2)	significance	adj. R^2
GDPGR	STOCKGR***	15.2185	0.0004	0.4688
	BANKGR	1.0309	0.5972	
GDPGR	STOCKRA	3.4779	0.1755	0.5510
	BANKRA**	8.6255	0.0133	
BANKGR	STOCKGR	0.2225	0.8946	-0.2298
	GDPGR	0.3332	0.8465	
STOCKGR	BANKGR	0.5846	0.7465	-0.1997
	GDPGR	0.4556	0.7962	
BANKRA	STOCKRA	0.6108	0.7368	0.7564
	GDPGR	2.8300	0.2429	
STOCKRA	BANKRA	1.1214	0.5707	-0.0128
	GDPGR	1.6041	0.4484	

Panel C.2   **Japan**: 1960-1990

Y_t	X_t	Chi-squared (2)	significance	adj. R^2
GDPGR	STOCKGR***	13.6539	0.0010	0.4459
	BANKGR	1.2547	0.5339	
GDPGR	STOCKRA*	5.7901	0.0552	0.5336
	BANKRA**	8.0237	0.0180	
BANKGR	STOCKGR	0.4555	0.7962	-0.0931
	GDPGR	0.5432	0.7621	
STOCKGR	BANKGR	2.9036	0.2341	-0.1480
	GDPGR	1.1561	0.5609	
BANKRA	STOCKRA	6.3925	0.0409	0.7618
	GDPGR	2.6987	0.2593	
STOCKRA	BANKRA	0.3196	0.8523	0.6994
	GDPGR	0.2377	0.8878	

Panel D. Korea: 1970- 1990

Y_t	X_t	Chi-squared (2)	significance	adj. R^2
GDPGR	STOCKGR	2.4637	0.2917	-0.1458
	BANKGR**	6.2674	0.0435	
GDPGR	STOCKRA	0.1447	0.9301	-0.4561
	BANKRA	0.5857	0.7461	
BANKGR	STOCKGR***	11.1298	0.0038	0.0550
	GDPGR	3.4159	0.1812	
STOCKGR	BANKGR*	5.3594	0.0685	-0.2421
	GDPGR	0.0728	0.9642	
BANKRA	STOCKRA**	7.9211	0.0190	0.3813
	GDPGR	0.5901	0.7444	
STOCKRA	BANKRA**	6.9331	0.0312	0.8121
	GDPGR**	6.3500	0.0417	

Notes:
GDPGR = per capita GDP growth rate
STOCKGR = the growth rate in stock market capitalization,
BANKGR = the growth rate in the banking sector,
STOCKRA = stock market capitalization/GDP,
BANKRA =banking sector size/GDP   .
***, **, and * indicate significance at 1%, 5%, and 10%, respectively.

Table 4. Relations between the stock market and the banking sector

Cross Correlations of Series STOCKRA (X_t) and BANKRA (Y_t)

X_t Y_{t-j} j=	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6
The U.S.: 1961 - 2002	-0.326	-0.272	-0.195	-0.079	-0.012	0.021	0.038	0.068	0.104	0.144	0.201	0.266	0.333
The U.K.: 1967 - 2002	0.051	0.148	0.240	0.369	0.485	0.568	0.571	0.552	0.575	0.604	0.599	0.574	0.613
Germany: 1976 – 1998	0.120	0.243	0.332	0.377	0.488	0.706	0.951	0.737	0.563	0.475	0.404	0.323	0.177
France: 1976 - 1998	0.147	0.242	0.304	0.249	0.309	0.491	0.762	0.692	0.562	0.562	0.546	0.408	0.243
Japan: 1961 - 2002	0.114	0.078	0.111	0.177	0.185	0.171	0.119	0.008	-0.102	-0.220	-0.303	-0.391	-0.428
Korea: 1971 - 2002	0.109	0.118	0.123	0.034	0.005	0.093	0.171	0.305	0.520	0.331	0.208	0.137	-0.093

Notes:
STOCKRA = stock market capitalization/GDP,
BANKRA =banking sector size/GDP,
STOCKRAG = the growth rate in STOCKRA,
BANKRAG = the growth rate in BANKRA.

Figure 1.A Responses of stockra (series 1) and bankra (series 2) to complement shocks: USA

Figure 1.B Responses of stockra (series 1) and bankra (series 2) to substitution shocks:USA

Figure 2.A Responses to stockra (series 1) and bankra (series 2) to complement shocks: UK

Figure 2.B Responses of stockra (series 1) and bankra (series 2) to substitution shocks: UK

Figure 3.A Responses of stockra (series 1) and bankra (series 2)
to complement shocks: Germany

Figure 3.B Responses of stockra (series 1) and bankra (series 2)
to substitution shocks: Germany

Figure 4.A Responses of stockra (series 1) and bankra (series 2)
to complement shocks: France

Figure 4.B Responses of stockra (series 1) and bankra (series 2)
to substitution shocks: France

Figure 5.A Responses of stockra (series 1) and bankra (series 2) to complement shocks: Japan

Figure 5.B Responses of stockra (series 1) and bankra (series 2) to substitution shocks: Japan

Figure 6.A Responses of stockra (series 1) and bankra (series 2) to complement shocks: Korea

Figure 6.B Responses of stockra (series 1) and bankra (series 2) to substitution shocks: Korea

Table 5. The substitution effect

This tables shows the percentage of the forecast error variance of STOCKRA and BANKRA explained by complement shocks (e^c) and substitution shocks (e^s), and the measure of overall importance of the two types of shocks, Q^c and Q^s, defined in (17) and (18)

Panel A.	the U.S.					
		stockra		bankra		
Step	e^c	e^s	e^c	e^s	Q^c	Q^s
1	36.422	63.578	67.224	32.776	103.646	96.354
2	28.555	71.445	54.613	45.387	83.168	116.832
3	24.243	75.757	50.23	49.77	74.473	125.527
4	21.955	78.045	49.554	50.446	71.509	128.491
8	20.458	79.542	57.136	42.864	77.594	122.406
12	21.405	78.595	64.812	35.188	86.217	113.783
16	22.407	77.593	69.551	30.449	91.958	108.042
20	23.386	76.614	72.442	27.558	95.828	104.172
24	24.258	75.742	74.334	25.666	98.592	101.408

Panel B.	the U.K.					
		stockra		bankra		
Step	e^c	e^s	e^c	e^s	Q^c	Q^s
1	25.458	74.542	46.635	53.365	72.093	127.907
2	23.844	76.156	59.116	40.884	82.96	117.04
3	25.712	74.288	65.385	34.615	91.097	108.903
4	28.222	71.778	69.235	30.765	97.457	102.543
8	37.503	62.497	76.643	23.357	114.146	85.854
12	43.397	56.603	79.717	20.283	123.114	76.886
16	46.821	53.179	81.311	18.689	128.132	71.868
20	48.856	51.144	82.221	17.779	131.077	68.923
24	50.11	49.89	82.77	17.23	132.88	67.12

Panel C.	Germany					
		stockra		bankra		
Step	e^c	e^s	e^c	e^s	Q^c	Q^s
1	78.966	21.034	96.014	3.986	174.98	25.02
2	82.602	17.398	95.929	4.071	178.531	21.469
3	86.037	13.963	97.339	2.661	183.376	16.624
4	88.329	11.671	97.734	2.266	186.063	13.937
8	94.476	5.524	98.728	1.272	193.204	6.796
12	97.275	2.725	98.962	1.038	196.237	3.763
16	98.396	1.604	99.04	0.96	197.436	2.564
20	98.825	1.175	99.067	0.933	197.892	2.108
24	98.987	1.013	99.077	0.923	198.064	1.936

Panel D.	France					
		stockra		bankra		
Step	e^c	e^s	e^c	e^s	Q^c	Q^s
1	49.789	50.211	87.887	12.113	137.676	62.324
2	58.316	41.684	91.364	8.636	149.68	50.32
3	62.723	37.277	93.582	6.418	156.305	43.695
4	66.032	33.968	94.822	5.178	160.854	39.146
8	73.203	26.797	96.945	3.055	170.148	29.852
12	76.982	23.018	97.695	2.305	174.677	25.323
16	79.365	20.635	98.072	1.928	177.437	22.563
20	80.981	19.019	98.295	1.705	179.276	20.724
24	82.132	17.868	98.44	1.56	180.572	19.428

Panel E.	Japan					
		stockra		bankra		
Step	De^c	e^s	e^c	e^s	Q^c	Q^s
1	88.47	11.53	23.432	76.568	111.902	88.098
2	89.035	10.965	28.47	71.53	117.505	82.495
3	88.132	11.868	33.1	66.9	121.232	78.768
4	86.87	13.13	36.796	63.204	123.666	76.334
8	84.584	15.416	43.207	56.793	127.791	72.209
12	84.522	15.478	44.208	55.792	128.73	71.27
16	84.463	15.537	44.388	55.612	128.851	71.149
20	84.443	15.557	44.436	55.564	128.879	71.121
24	84.439	15.561	44.448	55.552	128.887	71.113

Panel F.	Korea					
	stockra		bankra			
Step	e^c	e^s	e^c	e^s	Q^c	Q^s
1	53.873	46.127	35.732	64.268	89.605	110.395
2	46.639	53.361	38.275	61.725	84.914	115.086
3	54.908	45.092	36.984	63.016	91.892	108.108
4	60.899	39.101	35.933	64.067	96.832	103.168
8	65.748	34.252	35.202	64.798	100.95	99.05
12	65.118	34.882	35.488	64.512	100.606	99.394
16	65.019	34.981	35.523	64.477	100.542	99.458
20	65.023	34.977	35.522	64.478	100.545	99.455
24	65.023	34.977	35.522	64.478	100.545	99.455

Notes:
STOCKRA = stock market capitalization/GDP.
BANKRA = banking sector size/GDP .

Figure 7. A Korea STOCKRA series (1970-2002)

Figure 7. B Korea BANKRA series (1970-2002)

Notes:
STOCKRA = stock market capitalization/GDP,
BANKRA = banking sector size/GDP   .

Table 6. Causality tests: Using Korean data, 1970-2002

$$Y_t = \alpha + \sum_{j=1}^{2} \beta_j Y_{t-j} + \sum_{j=1}^{2} \gamma_{1j} X1_{t-j} + \sum_{j=1}^{2} \gamma_{2j} X2_{t-j}$$

H_0 : $\gamma_{1j} = 0$ for all j , or $\gamma_{2j} = 0$ for all j

Y_t	X_t	Chi-squared (2)	significance	adj. R^2
INVGR	STOCKGR	0.5383	0.7640	0.0729
	BANKGR	3.8558	0.1454	
INVRA	STOCKRA	2.0020	0.3675	0.7932
	BANKRA	1.5604	0.4583	
PRODGR	STOCKGR***	10.5627	0.0050	0.5274
	BABKGR	1.8201	0.4024	
PRODRA	STOCKRA	2.2497	0.3246	0.9975
	BANKRA	3.1878	0.2031	
CREDITGR	STOCKGR	3.6578	0.1605	0.2652
	BANKGR***	11.2323	0.0036	
CREDITRA	STOCKRA	1.2592	0.5327	0.9406
	BANKRA***	30.5442	0.0000	

Notes:
INVGR = the growth rate in investment,
INVRA = investment/GDP,
PRODGR = the growth rate in labor productivity,
PRODRA = labor productivity/GDP,
CREDITGR = the growth rate in bank credit
CREDITRA = bank credit/GDP,
STOCKGR = the growth rate in stock market capitalization,
BANKGR = the growth rate in the banking sector,
STOCKRA = stock market capitalization/GDP,
BANKRA =banking sector size/GDP   .
***, **, and * indicate significance at 1%, 5%, and 10%, respectively.

Comments on "Bank-based and Market-based Financial Systems: Time-series Evidence"

Changkyu Choi,
Myongii University

Overall comment

This paper finds a time series evidence on bank-based and market-based financial system. The important contribution is that the classification between both systems is left to data itself unlike general traditional belief. Furthermore the literature part is very well surveyed for readers. On the whole this paper deserves to be publishable with minor revision.

Small revision

-Causality tests from financial system to growth have been dealt in previous studies using time series data. (for example, Luintel & Khan 1999; Demetriades & Hussein 1996; : Shan, Morris, and Sun 2001; Fase & Abma 2003 etc.)
* Therefore distinction between existing papers and this paper needs to be further explained.
-Asian crisis episode and heavy government intervention in the Korean financial system (or perhaps Japanese financial system) could be inserted somewhere in the text.
- A small policy implication or suggestion for Korean financial system can be added in the chapter 5 or 6 of the paper.

Looking for Evidence of Relationship Lending in Korea: Competitiveness in Local Banks' in SME Loan Market[*]

by
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Abstract

This paper examines recent SME lending data from Korean banks of different size and category to see if small local banks are likely to have comparative advantages in relationship lending to informationally opaque SMEs. We find some evidences for relationship lending by small banks in loan premium charged by banks and much stronger evidences for relationship lending by small banks in (original) loan maturity and the use of collateral to dictate comparative advantage of small banks in relationship banking. These results indicate that small banks enjoy quite strong competitive edges in SME loan market in Korea. Our study also suggest only a relatively minor competitive effect the Basel II on local banks primarily because the large nation-wide banks that are likely to adopt Internal Ratings-Based approach tend to make different types of SME loans to different types of borrowers than local banks.

I. Introduction

Close ties between banks and their client firms are common in many countries. The extant research literature on the international banking suggests that, in developing and under-developed countries, banks with relationship lending technologies have comparative advantages since their clients are often informationally opaque. In developed countries where borrowers are more transparent, banks with transactions lending technologies may have comparative advantages.

Transaction lending technologies, such as financial statement lending and asset-based lending, are primarily based on quantitative data. These transaction lending technologies are distinguished primarily by the source and type of information used. Financial statement lending uses financial ratios, asset-based lending uses the quantity and quality of the available collateral that is usually accounts receivable and inventory, and business credit scoring lending uses the financial condition and history of the principal owner of the firm (Berger and Udell [2002]). The information used in transactions lending is generally relatively transparent and is easily observable and verified. Therefore, with transaction lending technology, only relatively informationally transparent firms that have high-quality financial statements, high-quality collateral, and/or individuals with high-quality past performance generally receive credit from banks.

Relationship lending technologies, in contrast, are primarily based on qualitative data, such as the information of character and reliability of the firm's owner, the history of the firm's relationships with its suppliers, and the business prospects in the local neighborhood in which the firm operates. Under the banking system where these are dominant technologies of lending, the bank loan officers generally gather the information through the contact with the client firm, its customers, and its local community on a variety of dimensions, since those clients are generally informationally opaque, without sufficient high-quality quantitative and verifiable information.

Some of the literature describes "relationship lending" as being beneficial to both banks and their client; a bank continuously acquires information about the firm and can thus intervene quickly and informally and a firm, as a client, can be provided with loans and other diverse banking services on the basis of a continuing relationship. (Fama [1985], Diamond [1991]) Also, as the bank is able to have a competitive advantage in collecting information and monitoring the borrowing firm, the relationship banking reduces informational asymmetries and thus risks of financial distress for the client firm can be alleviated. The continuous contact between borrower and lender in the provision of various financial services can produce valuable input for the lender in making decisions on whether to extend credit, how to price loans, and whether to require collateral or attach other conditions to the loan.

Others in contrast describe "relationship lending" as being pernicious; the relationship banking arrangements allow insiders (bank directors) to expropriate outsiders (minority shareholders and depositors). Indeed, in many developing countries, these ties are so close that banks lend primarily to firms controlled by their own directors, or to firms controlled by the friends and families of directors.

Previous literatures regarding relationship lending behavior in Korea and other Asian developing countries highlights the negative aspects of the relationship lending since most of those literatures are analyses to find causes of the financial crisis of the end of 1997.

However, it would be important and may be more interesting to figure out the difference of degree of the relationship banking among banks that are different each other in size and/or geographic area of business. This is because those kind of analysis can provide very important information regarding the competitiveness or competition structure of the banking industry in the countries of interest. For example, the comparative advantage of a certain type of banking organizations in making relationship loans to informationally opaque SMEs appears to be a key factor regarding the competitive effects on the markets for lending to SMEs.

The literature provides evidences on the comparative advantages of the different sizes of banks and how these comparative advantages help sort SME customers among banks and provide separate market niches for both nation-wide banks and local banks. The literature also suggests a number of reasons why large and small banks may have comparative advantages in different types of SME loans to different customers using different lending technologies.

Large banks may have comparative advantages in transaction lending technologies to relatively transparent SMEs because of economies of scale in the processing of quantitative information. Small local banks are likely to have comparative advantages in relationship lending to informationally opaque SMEs because the information on which the credits are based is difficult to quantify and transmit through the communication channels of large banking organizations. As well, because the loan officer that deals directly with the SME is the primary repository of the information, agency problems may be created within the bank that may best be resolved by structuring the bank as a small, closely-held institution (Berger and Udell [2002]).

Looking for the differences in the SME lending behavior of different type of banks will also gives important implications for measuring the competitive effects of the proposed implementation of the Basel II capital requirements on banks in the market for lending to SMEs in Korea. Large banks tend to have comparative advantages in transaction loans to relatively transparent SMEs and small and local banks tend to have comparative advantages in relationship lending to relatively opaque SMEs. If this is true, then the competitive effects on most local banks may be relatively limited. However, it is possible that the competitive effects on these other large nation-wide banks in the SME lending market may be significant if there are no significant comparative advantages or disadvantages of each type of banks in SME lending. Also, the competitive effects on some small and large banks may differ to the extent that some large banks tend to behave like local banks and/or to the extent that some small banks tend to be behave more like large banks.

In this paper, we analyze recent SME lending data from Korean banks of different size and category to see if it remains consistent with the research literature about large banks versus small and local banks. We provide evidence on the Korean banks' SME loan market segmentation by looking for the features of relationship banking and comparing those features among different categories of banks using large sample of loan level records. To our knowledge, our paper is the first attempt to examine relationship banking in Korea using loan level data.

The paper is organized as follows. Section II gives a brief introduction to a significant change in portfolio structure of Korean banking industry since foreign exchange crisis in 1997. Section III reviews some theoretical and empirical literature on the relationship banking and presents the results of empirical study. Section IV discusses the implication of empirical result on competition structure of SME loan market in the context of adopting New Basel Accord by 2007. Section V concludes the paper.

II. Recent trend in bank lending to SMEs in Korea

Foreign exchange crisis brought a revolutionary change in Korean banking industry: explosive growth of loans to households and SMEs accompanied by rapid contraction of loans to large corporations.

Before the crisis of 1997, Korean banks concentrated on relationship lending to industrial conglomerates (*chaebol*), making it difficult for consumers and SMEs to secure credit. Though *chaebol* and other large companies published financial statements and made other quantitative information available, bank loans have been largely approved based on their tight relationship with their main banks.

After the crisis, 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 1> Changes in Outstanding Loans of Korean Banks

(Billion KRW)

	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 SMEs	-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 and Financial Supervisory Services.

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 relationship lending to *chaebol*-affiliated firms, at which time, the banks were focused on reducing their debt. Consequently, this led to intense competition among banks to increase lending in the high-profit and low-risk household sector.[1] 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.

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[1] 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.

Moreover, rising real estate prices raised the collateral value of households, allowing them to borrow more money.

In addition, loans to SMEs using transaction lending technologies expanded quite substantially in the post-crisis period. Although bank loans to large businesses decreased slightly due to the reduced demand for funding among large companies, there was heightened demand for short-term funding among SMEs in order to increase production activities, as the domestic economy recovered from the crisis. During the five years following the crisis, from the end of 1998 to 2004, SME loans in Korea 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 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.[2]

<Figure 1> Outstanding Loans of Korean Domestic Banks by Sectors

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

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

III. Empirical assessment on competition structure in SME loan market

1. Loan technologies and bank size

Lending technologies such as relationship or transactions lending technologies are not inherently related with size of lending institutions. However, many researches have tried to find the fundamental cause of comparative advantages in lending technologies from size differences among various lending institutions. Three explanations have been suggested for adapting different lending technologies; economies of scale, organizational diseconomies, and agency problem.

Large banks may have comparative advantages in transaction lending technologies to relatively transparent borrowers stemming from economies of scale in processing quantitative information. But, small banks are more likely to have comparative advantages in relationship lending to opaque entities because the information on which the loan decisions are based is difficult to quantify and transmit through the highly complex and institutionalized communication channels of large banking organizations. On the other hand, some researches argue that it is very cost inefficient for large banking institutions to provide loan services for both relatively large corporate customers and informationally opaque SMEs due to organizational diseconomies. Such arguments are advocated by a group of researchers whose roots can be traced back to institutional economics (Williamson 1988). They emphasize the importance of institutional arrangement and organizational structure in shaping decision making. They argue that a large banking organization with a multitude of decision making units is inevitably associated with large transactions cost. It is not difficult to infer that a loan decision based on transactions loan technologies would suffer less in terms of organizational diseconomies than one based on relationship loan technologies.

Finally, Berger and Udell (2002) argue that agency problem could be also an important factor in inducing banks of various sizes into different lending technologies. Loan officers that deals directly with the SMEs are the primary repository of so-called "soft" information that agency problem is more likely to happen in a large bank than in a small, closely knitted institution in which the conflicts of interests between loan officers and management can be more easily monitored and cured with lower cost.

2. Empirical literature

Many empirical evidences have been accumulated indicating various differences in the SME loans provided by different sizes of lending institutions, especially large banking organizations versus banks. Most studies confirm the hypothesis that large institutions have the tendency to concentrate on loans to relatively transparent SMEs and small lenders such as community banks and trust companies tend to make loans to SMEs with relatively obscure information structure. Hatnes, Ou, and Berney (1999) find that relative to community banks, large banking organizations in the U.S. lend to larger, older, more financially secure SMEs. It could be expected that those SMEs are more likely to be associated with groups receiving transactions loans.

Larger banks have been found to charge lower interest rates and earn lower yields on the SME loans they make (Hannan (1991), Berger, Rosen, and Udell (2003), Carter, McNully, and Verbrugge (2004) etc.). The low interest rates charged by large lenders are thought to reflect better risk profiles of SMEs large banks make loans to. Relatively transparent SMEs with much hard information to offer to lenders are likely to be less risky than relatively opaque SMEs the credit decision for whom is primarily based on soft information. The lower loan rates may also reflect cost efficiency because the processing of hard information may be generally less costly than the processing of soft information. However, it is also impossible to exclude the possibility that, to some extent, the lower interest rates offered by large banks simply indicate lower marginal funding costs of those institutions. Financial institutions with large assets may be able to enjoy better chance of diversification and cheaper funding sources. Therefore, it could be argued that transactions loans based on hard information to relatively transparent SMEs made by large banks may generally be less risky, less costly than relationship loans based on soft information to relatively opaque SMEs made by community banks.

Large banks are found to be less likely to require collateral for the loan they make than community banks (Berger and Udell (1996)). Though pledging collateral reduces risk, secured loans often are more risky than collateralized loans because they tend to be made to relatively risky, informationally opaque borrowers to control various problems stemming from asymmetric information. Therefore, the finding of less pledged collateral on SME loans made by large banks is not inconsistent with different lending technologies story we have discussed so far.

In sum, a large body of literature indicates that large banking organizations and community banks align themselves in SME loan market depending on size and the main driving force behind the self selection process is the comparative advantage in lending technologies.

Empirical findings suggest that there exists a certain degree of market segmentation in the market for loans to SMEs and the segmentation results from comparative advantages of lending institutions of different sizes. One more implication of the empirical findings is that a moderate change in marginal funding cost would not result in a significant shift of competitive edge between large banks and small banks due to market segmentation based on lending technologies. For example, it is expected that marginal funding cost of a large banking organization adopting A-IRB (advanced internal ratings based approach) under Basel II would be significantly lower than marginal funding cost of small banks opting to standardized approach in assessing required capital charges for SME loans. The deterioration of small banks' competitive would be realized in a much smaller scale than generally expected if there exists segmentation in SME loan market.

3. Empirical Results

In this section, we analyze differences in characteristics of SME loans to investigate the existence of comparative advantage in lending technologies using individual loan level information. Our analysis also offers some evidences on the market segmentation in SME loan market in Korea and sheds a light on the possible effects of Basel II on the competition structure in SME loan market.

There have been some researches to investigate the existence of relationship lending in corporate loan market in Korea (Bae, Kang, and Lim (2004) among others). However, to our knowledge, our study is the first attempt to examine relationship banking and competitive structure in SME loan market in Korea using loan level data.

Our data set consists of individual loan records sample from 7 Korean banks (five national and two regional banks)[3] whose combined market share in SME loans amounted to 54.3% at the end of the first quarter of 2004.

We sampled randomly 500 loans from each bank's SME loan portfolio that the data set includes detailed information on 3,500 individual loans such as original loan balance, interest rate, maturity, collateral or loan guarantee, credit rate, etc.

To facilitate the analysis, we divide seven banks in the sample into two groups according to size of SME loans. The first group dubbed as large banks in this study include 5 national banks and the second group dubbed as small banks 2 regional banks. Furthermore, we subdivide large banks into two groups to represent different degrees of importance of SME loan business to each bank. The first group includes two large banks which maintain relatively large SME loan portfolios and the remaining three large banks are assigned to the second group[4]. We call them general large banks and SME large banks, respectively.

The sample includes 379 loans initiated by government program to assist SMEs. Since individual banks exercise little discretion in loan decision for government loan program, we drop those observations from the sample, which leaves 2,621 samples to use for the analysis.

<Table 2> shows the definition of variables appearing in the paper. All entries are self-explanatory except for credit ratings (CR). All banks provided us credit ratings based on 10 categorical scales. But, banks use different system in assessing credit risk of loan applications and it is very difficult to compare level of credit ratings across banks. For analysis' sake, we simplify the categorization into 5 groups from 1 to 5 in order to minimize risk stemming from different credit scoring systems. Lower values of CR are assigned to loans with higher credit risks. <Table 3> reports the details of re-grouping and comparison with S&P's credit ratings for corporate bonds.

<Table 2> Definition of Variables

variable	definition
loan	size of loan at origination
premium	interest premium over KTB with similar remaining maturity
maturity	maturity at origination in year
collateral	dummy for collateral or loan guarantee
CS	dummy for credit scoring
CR	categorical variable for credit ratings (5 categories)

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[3] They are KB(16.0%), Kiup(15.2%), Woori(11.8), Shinhan(6.8%), Choheung(6.0%), Daegu(2.3%), and Pusan(22%) banks. The market shares are in parentheses. We exclude Nonhyup banks, the third largest SME lender in Korea with 14.1%, from random sampling considering its unique structure of SME loans that 43.5% of SME loans issued by the bank are made to "financial and insurance companies".

[4] We do not report the identity of individual banks in each group. The list is available from the authors upon request and proper arrangement to avoid revealing identity.

<Table 3> Re-grouping of Credit Ratings

CR	internal assessment of credit rating	comparable rating grade for corporate bonds[1]	default probability[2]
1	1	AAA	(0.00, 0.02]
1	2	AA	(0.02, 0.05]
2	3	A	(0.05, 0.14]
2	4	BBB	(0.14, 0.52]
3	5	BB	(0.52, 2.03]
3	6	B	(2.03, 6.94]
4	7	CCC	(6.94, 16.70]
4	8	CC	(16.70, 17.00]
5	9	C	(17.00, 18.25]
5	10	D	(18.25, 20.00]

Note : 1) Direct and consistent comparison with credit ratings for corporate bonds is not possible due to different internal standards of credit scoring in banks.

2) Default probability is the expected default probability for S&P's credit grading based on U.S. data in 2000 provided by KMV Credit monitor.

We examine averages of variables in <Table 2> with SME loans issued by three groups of lenders to get a sense of differences in lending technologies. <Table 5> reports the results.

Literature on the changes in competitive structure in SME loan market paid much attention to changes in the proportion of SME loans among total loan portfolio to find evidence on comparative advantages based on lending technologies (Strahan and Weston (1996, 1998) and Peek and Rogerson (1998)). In Korean case, it seems quite difficult to attribute the source of comparative advantage to the proportion of SME loans. The average proportion of SME loans in large banks was 37.3% at the end of first quarter of 2004 whereas it was 63.7% for small banks. On the other hand, the proportions of SME loans out of all corporate loans were 85.0% and 94.9%, respectively. Hence, small banks commands higher proportion of SME loans than large banks in <Table 4> that reports official statistics on the composition of loan portfolio by all banks provided by Financial Supervisory Services. Our sample seems to be in accordance with the official statistics since the average proportions of SME loans among corporate loans in the sample are

90.0% and 93.5% for large and small banks, respectively. However, there are two reasons we should be careful in interpreting the differences as evidence for relationship banking in small banks. First, SME lending in Korea is significantly influenced by government program that requires banks to maintain the proportion of SME loans at a pre-specified level. Therefore, it may not reflect voluntary choice of lending technologies aligned along comparative advantage. Second, there is no significant difference in the proportion of SME loans out of all corporate loans and it is also worth noting that total amount of SME loans by small banks is just less than 15% of SME loans by large banks.

<Table 4> Composition of Loan Portfolio of Banks

(unit: trillion KRW, %)

		total loan			
		corporate loan	SME loan	consumer loan	others
large banks	382.6	169.6 (44.3)	144.1 (37.7)	209.5 (54.7)	3.5 (0.9)
small banks	32.2	21.6 (67.1)	20.5 (63.7)	9.9 (30.8)	0.7 (2.1)

Note: Numbers in parentheses are proportions out of total loans
Source: Financial Supervisory Services

The average premium charged by small banks is 2.61%, which is higher by 21 basis points than the average premium charged by large banks. Excluding SME large bank, we observe that the difference in average premium increases to 37 basis points. Other things being equal, significantly higher loan premium could be interpreted as an evidence for comparative advantage of small banks in SME loan market. Another very interesting point to note is that though SME large banks commands very large market share in SME loan market, they, on average, charge much higher premium than general large banks. We suspect that the difference can be explained by different portions of SME loans secured by collateral and loan guarantee. While we can find some differences in loan premium charged by banks of different sizes, the magnitude is not significant enough to dictate comparative advantage of small banks in relationship banking and studies in other countries show much larger spread than we found in the paper.

<Table 5> Bank Size and Loan Characteristics

(unit: %, million KRW, year)

	Small banks	Large banks			All banks
		SME large banks	General large banks		7
Number of observations	844	949	828	1,777	2,621
Proportion of SME loans	93.5	94.4	84.9	90.0	90.2
Loan	120.5	168.5	159.1	164.1	150.1
Premium	2.61 (2.78)	2.54 (2.78)	2.24 (2.22)	2.40 (2.52)	2.46 (2.60)
Maturity	1.8741 (1.8950)	1.3233 (1.1989)	1.1056 (0.8100)	1.2249 (1.0177)	1.3928 (1.3002)
Collateral	91.65 (86.02)	70.42 (82.82)	51.50 (72.34)	61.87 (77.94)	69.57 (80.54)
Credit scoring	0.92 (0.89)	0.72 (0.79)	0.98 (0.92)	0.83 (0.84)	0.86 (0.86)
Credit rating	3.9542 (3.9760)	3.7340 (5.3364)	5.1126 (5.4111)	4.3568 (5.3710)	4.2528 (4.9325)

Note: 1) Loans based on government lending program and loans with remaining maturity less than one month are excluded.

2) Proportion of SME loans is calculated as the proportion of SME loans out of total corporate loans.

3) Numbers in parentheses are the simple average disregarding loan amount.

We can find a much stronger evidence for relationship lending by small banks in (original) maturity. The average duration of loan contract is approximately 1.9 years for SME loans by small banks whereas it is only 1.2 years for large banks and 1.3 years for SME large banks. It is argued that small banks are willing to assume loan contracts with longer maturity because they put much emphasis on qualitative information in loan decision obtained by long-term intricate relationship with borrowers.

Turning to the use of collateral in securing loans, large banks are less adamant in requiring collateral than small banks. The proportions of loans secured by collateral or guarantee are 61.87% and 91.65% for large and small banks, respectively. Again, other things being equal, the finding support the assertion than small banks have comparative advantage in relationship lending since the quality of information used in relationship information should be compensated by collaterals.

It is generally predicted that the average credit rating concentrating in relationship banking should be lower than the one in transactions banking. We can find no significant difference in the proportion of loans that went through a formal credit screening procedure. This may reflect a magnificent cultural change occurred in banking sector after foreign exchange crisis in 1997 and the subsequent structural reform. It is quite surprising that average credit rating of SME loans issue by small bank that are though to be more involved with informationally opaque borrowers is higher than average credit rating of SME loans issued by large banks. The average credit grades are approximately 4.0 and 5.1 for small and large banks, respectively. The finding is inconsistent with the general tendency found in premium, maturity, and collateral. One can view this seemingly perturbing finding in two perspectives. It may reflect the fact that small banks are choosier in loan decision so that the actual credit risk of small banks' SME loan portfolio is lower than large banks. For example, the proportion of bad SME loans in small banks is 1.9%, which is much lower than 2.9% for large banks. On the other hand, one can argue that the higher credit ratings for loans issued by small banks simply reflect lenient attitude built in internal credit rating system.

We conduct several regression analyses to overcome obvious limitations built in crude comparison of average tendencies in different groups and to apply more formal econometric tests to some of the differences in contract terms such as premium and credit ratings. The contract terms are expected to be closely inter-correlated and crucially depend on lender's assessment on borrower's creditworthiness. Therefore, it is reasonable to presume that important contract variables such as premium, duration, collateral, and credit rating are jointly determined. It is, however, very difficult to obtain proper instruments to overcome the subtle econometric problem of simultaneity. We take a much bolder approach to the problem rather than continue futile searches for "proper" instruments. We impose very strong but convenient simplifying assumptions on loan decision process so that we can avoid the annoying but important econometric problems. We assume that decision on loan contract terms are made sequentially in the order of credit rating, collateral, and premium. In other word, an econometric model to incorporate the sequential nature of the problem can be written as a recursive model following the sequence of decision making. The assumption is very strong and should be subject to rigorous robustness checks. We, however, decide that it brings us much more insight implications to impose very strong assumption to assign enough structure

<Table 6> Credit Rating of SME Loans: Ordered Logit

	Model I	Model II
constant 2	-2.9956*** (0.0952)	-3.7541*** (0.5845)
constant 3	-1.5951*** (0.0795)	-2.3518*** (0.5821)
constant 4	2.5542*** (0.1022)	1.8262*** (0.6051)
constant 5	4.3285*** (0.2180)	3.6058*** (0.6371)
SME large bank	-0.1082 (0.0882)	-0.1544* (0.0895)
small bank	-1.7457*** (0.1290)	-1.0909*** (0.1274)
maturity		0.0154*** (0.0049)
ln(loan)		0.0509 (0.0329)
Number of observations	2386	2386
LR-statistic	310.6389***	335.0765***
Log-likelihood	-2179.167	-1122.434
Wald	189.891***	237.6388***

Note: 1) Dependent variable is CR (a categorical variable with five categories).

    2) Maturities are in months.

    3) LR statistic is the test statistics for the null of joint significance of explanatory variables except for constants. The distribution of the test statistics under the null hypothesis is χ^2 distribution with the degrees of freedom 2 and 4, respectively.

    4) Wald statistics is the test statistics for the null hypothesis that the coefficients on dummies for SME large banks and small banks are not statistically different. The distribution of the test statistics under the null hypothesis is χ^2 distribution with the degree of freedom 1

    5) *: statistically significant at 10% level, **: statistically significant at 5% level, ***: statistically significant at 1% level

    6) Standard errors are in parentheses based on Bolleslev-White quasi- maximum likelihood robust estimator.

on the model rather than just to sit and worry about complicated econometric problems and their horrendous consequences. In sum, any statistical test conducted in the following analyses should be interpreted as a joint test for the significance of null hypothesis we explicitly forward in the text and the assumptions on recursive structure in decision making.

Following the recursive structure, we run a ordered logit regression to inspect the determination of credit ratings. The dependent variable is CR defined in <Table 2> as a categorical variable with 5 categories. We estimate two models. The first model use dummies for SME large banks and small banks taking general large banks as base. The second model augments the first model with two additional explanatory variables; maturity and log of loan amount (loan). The estimation result is reported in <Table 6>. For robustness of estimated standard errors, we calculate robust estimator based on quasi-maximum likelihood estimation suggested by Bolleslov and White (19??).

The most notable thing is that small banks assign much better credit ratings than general large banks as easily inferred from statistically significant negative coefficient estimate. Small banks also assign better credit ratings than SME large banks and the fact is formally confirmed by the rejection of the null hypothesis that the coefficients on dummies for SME large banks and small banks are same (see Wald statistics in the table). The result is intact in regression with additional explanatory variables. One can argue that small banks' SME portfolio consist of less risky loans than large banks based on the small banks' association with higher credit ratings and conclude that the evidence rejects the idea mapping small banks into relationship lending technology that is generally regarded as more risky due to opaque information structure. However, it is not entirely clear that what small banks' association with higher credit ratings exactly implies and the way we specified the regression model makes it possible for us to interpret the result as an evidence for lenient credit rating policy maintained by small banks. Therefore, it is not clear why small banks are associated with higher credit ratings and further researches are called for to provide a definite answer to the question.

Following our assumption on the recursive structure of loan decision, we next analyze collateral decision via logit regression. The dependent variable is the dummy taking the value 1 if the loan is secured by collateral or loan guarantee and 0 otherwise. We present three different specifications for collateral decision. Model I includes two dummies indicating bank size. Model II add maturity and log of original loan amount into the regression and finally Model III includes dummies for credit ratings as additional explanatory variables. We do not include interest premium as an explanatory variable to take into consideration the assumed recursive structure in loan decision.

Without controlling for effect of credit ratings, significant differences seem to exist across different sizes of banks in the probability of requiring collateral or loan guarantee to secure the loan. It is more likely that small banks and SME large banks require collateral but it is very difficult to determine whether or not there is statistically significant difference between small banks and SME large banks according to Wald test – see Wald statistics in the first and second columns in <Table 7>. However, if we take credit ratings into the regression, we can find the differences neither between general large banks and small banks nor between SME large banks and small banks (see Wald statistics in Model III). Still, SME large banks seem to be more persistent in requiring collaterals in loan decision than general large banks. In sum, based on collateral requirement, we can find quite strong evidence for relationship banking from SME large banks but the evidence is not so strong for small banks.

<Table 7> Collateral decision of SME Loans: Logit

	Model I	Model II	Model III
constant	1.1109*** (0.0841)	0.4945 (0.7061)	1.8984** (0.7612)
SME large bank	0.4198*** (0.1219)	0.2860** (0.1333)	0.3201** (0.1337)
small bank	0.7380*** (0.1357)	1.4794*** (0.1462)	0.2371 (0.1711)
maturity		0.0214*** (0.0052)	0.0192*** (0.0051)
ln(loan)		0.0250 (0.0406)	0.0362 (0.0407)
CR 2			1.6299*** (0.3576)
CR 3			1.6141*** (0.3625)
CR 4			0.9482** (0.4786)
CR 5			2.8290*** (0.5530)
Number of observations	2386	2386	2386
McFadden R2	0.0137	0.0235	0.0430
Log-likelihood	-1133.684	-1122.434	-1099.943
prediction evaluation	81.31%	81.31%	81.43%
Wald	5.2867**	1.8733	0.2688

Note: 1) Dependent variable is collateral(a dummy variable)
　　 2) Maturities are in months.
　　 3) Prediction evaluation is the ratio of coincidence between actual dummies and predicted dummies with the cutoff value 0.5.
　　 4) Wald statistics is the test statistics for the null hypothesis that the coefficients on dummies for SME large banks and small banks are not statistically different. The distribution of the test statistics under the null hypothesis is χ^2 distribution with the degree of freedom 1
　　 5) *: statistically significant at 10% level, **: statistically significant at 5% level, ***: statistically significant at 1% level
　　 6) Standard errors are in parentheses based on Bolleslev-White quasi-maximum likelihood robust estimator.

Loans with longer maturity and in larger amount are associated with higher probability of collateral requirement. Also, worse credit ratings are associated with higher probability of collateral requirement, though the relationship is not monotonic.

As the final analysis to examine comparative advantages in lending technologies and infer evidences for relationship baking by relatively small banks, we conduct a regression analysis for premium charged by banks as the compensation for risk embedded in SME loans. According to the assumption we imposed on the sequence of loan decision, receiving loan applications from borrowers, lenders, first of all, assess credit risk of the potential borrower and then determine whether or not to require collateral as means to secure the loan. Finally, the lender determine the level of risk premium considering all other loan contract terms such as maturity, loan amount etc. <Table 8> reports the result of OLS regressions with different sets of explanatory variables. Compared to general large banks or SME large banks, small banks charge much higher risk premium for loans with the same contract conditions. The differences are approximately 160 bps and 70 bps in Model III and quite significant in terms of both statistic and practical senses. The relationship is preserved across different specifications and hence pretty robust. As expected, shorter maturity and smaller loan size are associated with lower premium and a borrower can reduce interest burden by providing collaterals. It is also found that better credit ratings, in general, can bring lower risk premium.

We find that small banks can charge much higher risk premium than larger banks for loans with the same contract conditions without losing their competitive edges in SME loan market. One can offer the result as an evidence for comparative advantage of small banks in relationship banking in Korean SME loan market. It is quite an extraordinary phenomenon that small banks can compete with their larger counterparts in SME loan market even if they charge much higher risk premium for the loans with same quantifiable conditions. One of the most convincing explanation would be found in special relationship or bondage between SME borrowers and small banks, which are most likely established based on repetitive long-term face-to-face transactions.

<Table 8> Determinants of Premium

	Model I	Model II	Model III
constant	2.1950*** (0.0727)	6.3376*** (0.4573)	5.3942*** (0.4466)
SME large bank	0.5191*** (0.0885)	0.9141*** (0.0948)	0.9077*** (0.0933)
small bank	0.5537*** (0.1003)	1.2160*** (0.0975)	1.6155*** (0.1102)
collateral		-0.7513*** (0.1250)	-0.6693*** (0.1172)
maturity		-0.0369*** (0.0025)	-0.0373*** (0.0026)
ln(loan)		-0.1864*** (0.0259)	-0.1936*** (0.0258)
CR 2			0.4293*** (0.1222)
CR 3			1.1277*** (0.1237)
CR 4			0.6900*** (0.1880)
CR 5			2.1932*** (0.7229)
number of observations	2386	2386	2386
R2	0.0190	0.1593	0.2003
F-statistic	23.0731***	90.1698***	66.109***
Wald-statistic	0.1632	20.1304***	71.2884***

Note: 1) Dependent variable is the risk premium over KTB with similar maturity.
2) Maturities are in months.
3) Wald statistics is the test statistics for the null hypothesis that the coefficients on dummies for SME large banks and small banks are not statistically different. The distribution of the test statistics under the null hypothesis is χ^2 distribution with the degree of freedom 1
4) *: statistically significant at 10% level, **: statistically significant at 5% level, ***: statistically significant at 1% level
5) Standard errors are in parentheses based on White heteroskedasticity consistent estimator.

IV. The Basel II and competition structure of SME credit market

Under the proposed Basel II, individual banks are allowed to choose either standardized approach or internal ratings-based approach in calculating required capital for credit risks. For banks opting to use the standardized approach for SME exposures, a risk-weight for general corporate exposures of 20~150% would be applied depending on credit rating provided by external rating agencies. Therefore, it is easily expected that most loans to SMEs are classified as loans requiring much higher risk weight than the current level of 100%. 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.[5]

<Table 9> Risk weight applied to corporate exposures (standard approach)

(Unit : %)

Credit rate	AAA~AA	A	BBB~BB	Below B	No grade
Risk weight	20	50	100	150	100

Note : credit rate is based on S&P's categorization.
Source : BIS (2004).

Under the internal ratings based (IRB) approach, an adjustment in the risk-weight formula that is favorable 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.[6] 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 a more favorable retail risk-weight formula as long as the bank's exposure of any individual SME (with turnover between €1 and €5 million) is less than €1 million and the credit is managed as a retail exposure or be guaranteed by an individual.

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[5] The Bank for International Settlements (BIS, 2004) 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 retail credits.

[6] Under the IRB approach, the required capital for an SME loan would depend on a number of factors, including the probability of default (PD) and loss given default (LGD) assigned by the bank, whether the loan is classified as retail or corporate, and the size of the borrowing firm. 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, and EAD, subject to meeting minimum standards. In both cases, banks must use the risk weight functions provided for the purpose of deriving capital requirements.

Therefore, it is possible for a bank using A-IRB to apply much lower risk weights to SME loans with investment grades than a bank opting for standardized approach. That is, loans to borrowers with credit rating lower than BBB are likely to be assigned much lower risk weight when A-IRB is used and, with modification for SME loans the risk weight could be lower than 75% assigned to SME loans under standardized approach.

The fact that risk weight could vary depending on the way a bank assess credit risk of borrowers has a significant implications on the competition structure in SME loan market. That is, there can be an issue raised as to whether a reduction in the implicit risk weights for SME credits extended by the banks that adopt the IRB approach of Basel II might significantly adversely affect the competitive position of banks that are likely to adopt the standard approach since the implementation of Basel II may reduce the minimum regulatory capital, potentially lowering the marginal costs of SME lending for IRB adopting banks. For example, the substitution effect of a decline in marginal costs at IRB adopting nation-wide banks relative to non-IRB adopting local banks could possibly encourage IRB banks to reduce price and/or increase quantity of SME lending, potentially reducing the price received by local banks on SME loans or reducing the market shares of local banks.

The magnitudes of these potential changes in competitive positions depend on the comparative advantage of each type of banks in making relationship lending to informationally opaque SMEs. If large banks have comparative advantages in transactions loans to relatively transparent SMEs and small local banks have comparative advantages in relationship lending to relatively opaque SMEs, the competitive effects on most community banks may be relatively limited since the SME credit market is segmented by the difference in that comparative advantage or disadvantages.

In other words, if the difference in marginal funding cost is not big enough and he degree of segmentation in SME loan market is high, one can infer that the substitution effect based on lower marginal funding cost would cast minor implication on competition structure in the market. In contrast, expected advantage in marginal funding cost by large banks that adopt A-IRB would bring a fundamental change in SME market if pattern of loan decision by large banks are not distinguishable from that of small banks and hence the market is more like integrated rather than segmented one.

Therefore, it is necessary to examine the degree of market segmentation based on comparative advantages in loan technologies by comparing terms of loan contracts. Under the circumstance that most large banks are expected to choose A-IRB and most small banks standardized approach, the comparative advantages in different loan technologies could be proper measure through which we can examine the change in competition structure in SME loan market.

Analysis in previous section indicates that small banks enjoy quite strong competitive edges in SME loan market in Korea and charge significantly higher risk premium to loans with same quantifiable contract conditions than larger banks. Therefore, it is more likely that small banks would be able to maintain competitive edges in SME markets even after new risk assessment system is institutionalized in full scale rather than yield to larger banks equipped with cost effectiveness based on cheaper funding cost created by Basel II .

V. Conclusion

In this paper, we analyze recent SME lending data from Korean banks of different size and category to see if it remains consistent with the research literature about large banks versus small and local banks. In particular, we examine whether small local banks are likely to have comparative advantages in relationship lending to informationally opaque SMEs.

We use data set that consists of individual loan records sample from 7 Korean banks whose combined market share in SME loans amounted to 54.3% at the end of the first quarter of 2004. The data set includes detailed information on 3,500 individual loans such as original loan balance, interest rate, maturity, collateral or loan guarantee, credit rate, etc.

After the comparative analysis using the simple averages of variables of SME loans issued by three groups of Korean banks, we conduct several regression analyses to apply more formal econometric tests to some of the differences in contract terms such as premium and credit ratings. In addition, following our assumption on the recursive structure of loan decision, we also analyze collateral decision via logit regression.

Through the analysis, we find some evidences for relationship lending by small banks in loan premium charged by banks and much stronger evidences for relationship lending by small banks in (original) loan maturity and the use of collateral to dictate comparative advantage of small banks in relationship banking.

This also implies that the proposed implementation of the Basel II capital requirements on banks in the market for lending to SMEs in Korea has little competitive effects. It has been argued that reduced risk weights for SME credits extended by large banking organizations which adopt the Internal Ratings-Based (IRB) approach of Basel II might significantly adversely affect the competitive positions of small banking organizations such as local banks that do not adopt IRB. Our study suggest only a relatively minor competitive effect on local banks primarily because the large nation-wide banks that are likely to adopt IRB tend to make different types of SME loans to different types of borrowers than local banks.

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Comments on "Looking for Evidence of Relationship Lending in Korea: Competitiveness in Local Banks' in SME Loan Market"

Jabonn Kim,

Korea Institute of Finance

1. The paper tries to investigate if small local banks have comparative advantages in relationship lending. The paper found that local banks have strong comparative advantages.

2. The banks the paper covers are 5 nation-wide, 2 local banks, and 2,621 loans. However, it seems unclear whether the data is cross-sectional or time series or panel? which year? Should add explanation about data.

3. The paper suggests three evidences for the strong comparative advantages:

    1) Evidence 1. average credit rating of small banks' loans is higher than that of SME large banks.

    2) Evidence 2. the proportions of loans secured by collateral or guarantee are 61.87% and 91.65% for large and small banks

    3) Evidence 3. Average premium charged by the small banks is 2.61%, higher by 21bp than that by large banks

4. Following the recursive conjecture of the paper, contradictory intuitions are derived, surprisingly counter-intuitive.

    First, if the evidences 1 and 2 are combined, the higher credit rating requires more collaterals (guarantee), lower credit rating is less adamant in requiring collaterals counter intuitive.

    Second, if evidences 1,2, and 3 are combined, the higher credit rating and the more collaterals requires higher risk premium   counter-intuitive.

5. The fact suggested as fourth evidence that the average duration of loan contract with small banks is 1.9 years, while 1.2 and 1.3 for large and SME large respectively may be caused by the reality of the loan structures not by the emphasis on qualitative information obtained from the long-term relationship. The local banks serve relatively more facility investment fund loan than the commercial banks do.

6. In Table 3, would you please suggest default probability of Korean CR? Is the probability ceiled by the 20.00?

7. In Table 6, the drastic changes in estimates might be caused by the simultaneity, seems not easy to be trivially ignored. Appropriate approach should be adopted and reported.

8. In Table 7, the reported second Wald statistic seems uneasy. Please make sure if it is correct.

9. In Table 8, there should be monotonicity in the estimates of CR2~5. Also please make sure F statistic.

<Table 3> Re-grouping of Credit Ratings

CR	internal assessment of credit rating	comparable rating grade for corporate bonds[1]	default probability[2]
1	1	AAA	(0.00, 0.02]
1	2	AA	(0.02, 0.05]
2	3	A	(0.05, 0.14]
2	4	BBB	(0.14, 0.52]
3	5	BB	(0.52, 2.03]
3	6	B	(2.03, 6.94]
4	7	CCC	(6.94, 16.70]
4	8	CC	(16.70, 17.00]
5	9	C	(17.00, 18.25]
5	10	D	(18.25, 20.00]

Note : 1) Direct and consistent comparison with credit ratings for corporate bonds is not possible due to different internal standards of credit scoring in banks.
2) Default probability is the expected default probability for S&P's credit grading based on U.S. data in 2000 provided by KMV Credit monitor.

<Table 5> Bank Size and Loan Characteristics

(unit: %, million KRW, year)

	Small banks	Large banks			All banks
	Small banks	SME large banks	General large banks		All banks
Number of observations	844	949	828	1,777	2,621
Proportion of SME loans	93.5	94.4	84.9	90.0	90.2
Loan	120.5	168.5	159.1	164.1	150.1
Premium	2.61 (2.78)	2.54 (2.78)	2.24 (2.22)	2.40 (2.52)	2.46 (2.60)
Maturity	1.8741 (1.8950)	1.3233 (1.1989)	1.1056 (0.8100)	1.2249 (1.0177)	1.3928 (1.3002)
Collateral	91.65 (86.02)	70.42 (82.82)	51.50 (72.34)	61.87 (77.94)	69.57 (80.54)
Credit scoring	0.92 (0.89)	0.72 (0.79)	0.98 (0.92)	0.83 (0.84)	0.86 (0.86)
Credit rating	3.9542 (3.9760)	3.7340 (5.3364)	5.1126 (5.4111)	4.3568 (5.3710)	4.2528 (4.9325)

Note: 1) Loans based on government lending program and loans with remaining maturity less than one month
        are excluded.
      2) Proportion of SME loans is calculated as the proportion of SME loans out of total corporate loans.
      3) Numbers in parentheses are the simple average disregarding loan amount.

<Table 6> Credit Rating of SME Loans: Ordered Logit

	Model I	Model II
constant 2	-2.9956*** (0.0952)	-3.7541*** (0.5845)
constant 3	-1.5951*** (0.0795)	-2.3518*** (0.5821)
constant 4	2.5542*** (0.1022)	1.8262*** (0.6051)
constant 5	4.3285*** (0.2180)	3.6058*** (0.6371)
SME large bank	-0.1082 (0.0882)	-0.1544* (0.0895)
small bank	-1.7457*** (0.1290)	-1.0909*** (0.1274)
maturity		0.0154*** (0.0049)
ln(loan)		0.0509 (0.0329)
Number of observations	2386	2386
LR-statistic	310.6389***	335.0765***
Log-likelihood	-2179.167	-1122.434
Wald	189.891***	237.6388***

Note: 1) Dependent variable is CR (a categorical variable with five categories).
  2) Maturities are in months.
  3) LR statistic is the test statistics for the null of joint significance of explanatory variables except for constants. The distribution of the test statistics under the null hypothesis is χ^2 distribution with the degrees of freedom 2 and 4, respectively.
  4) Wald statistics is the test statistics for the null hypothesis that the coefficients on dummies for SME large banks and small banks are not statistically different. The distribution of the test statistics under the null hypothesis is χ^2 distribution with the degree of freedom 1
  5) *: statistically significant at 10% level, **: statistically significant at 5% level, ***: statistically significant at 1% level
  6) Standard errors are in parentheses based on Bolleslev-White quasi-maximum likelihood robust estimator.

<Table 7> Collateral decision of SME Loans: Logit

	Model I	Model II	Model III
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<Table 8> Determinants of Premium

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F-statistic	23.0731***	90.1698***	66.109***
Wald-statistic	0.1632	20.1304***	71.2884***

Note: 1) Dependent variable is the risk premium over KTB with similar maturity.
2) Maturities are in months.
3) Wald statistics is the test statistics for the null hypothesis that the coefficients on dummies for SME large banks and small banks are not statistically different. The distribution of the test statistics under the null hypothesis is χ^2 distribution with the degree of freedom 1
4) *: statistically significant at 10% level, **: statistically significant at 5% level, ***: statistically significant at 1% level
5) Standard errors are in parentheses based on White heteroskedasticity consistent estimator.

CHAPTER 4-1

Shareholder Protection Laws and Corporate Boards :
Evidence from Europe

By

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Abstract

Country-specific factors might have greater explanatory power than firm-specific factors in explaining corporate board structure.   In particular, when a country's minority shareholder laws are strong, then minority shareholders should have more power to affect board structure.   In empirical tests, we find that European firms in countries with stronger shareholder protection laws have (i) more independent directors.

. Introduction

The relationship between *country-level* governance (e.g., securities regulations and laws) and *firm-level* governance (e.g., boards of directors and incentive-based compensation) is a subject that is much discussed in the current academic literature.[1]   On the one hand, some firm-level governance mechanisms might be *substitutes* for weak country-level governance. After all, in a country where investor protection laws are weak, its stockholders may have to rely on other means of protection (LaPorta, Lopez-de-Silanes, Shleifer, and Vishny (LLSV hereafter) (1998)).   For example, LLSV (1998) find that firms in countries with *poor* investor protection have *higher* ownership concentrations, suggesting that ownership concentration, a purported firm-level corporate governance mechanism, is a substitute for poor legal protection.[2]   By analogy, does this mean that firms in countries with poor shareholder laws might have 'better' boards of directors?   We think the answer is "no."

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[1] See Doidge, Karolyi, and Stulz (2004), Durnev and Kim (2004), Krishnamurti, Sevic, and Sevic (2004), and Klapper and Love (2004).

[2] While corporate governance can take on many forms, they could all be characterized in one of two

Our contentions are as follows. Minority shareholders in countries whose laws promote and protect shareholder rights are probably *more* likely to be able to have the kinds of boards that they desire. In addition, corporate boards in countries where the law supports board oversight and actions are probably *more* likely to be effective. For example, if a country has laws that give minority shareholders reasonable power to put their representatives on boards, then these minority shareholders are more likely to get the kinds of boards that they want. In turn, these elected boards can really only be effective if they have the legal power (such as the right to challenge management) to act in the shareholders' best interests. We hypothesize, therefore, that 'good' shareholder laws and 'good' boards go hand-in-hand, i.e., that they must be *complements*.

Our contention that boards and shareholder laws must be complements is *not* contradictory to the LLSV (1998) hypothesis that ownership structure and shareholder laws are substitutes. Their story can co-exist with ours. To put it simply, LLSV contend that in countries with poor shareholder protection, shareholders may have to take it upon themselves to look out for their own best interests. In order for these shareholders to have the power and incentive to look out for themselves, they probably would have to become 'large' shareholders. That is, if the laws are weak in protecting minority shareholders, then these shareholders may have to become *majority* shareholders. The LLSV contention is straight-forward and they are able to empirically confirm a negative relationship between law quality and ownership concentration. We can take the LLSV argument one step further in order to incorporate corporate boards. A *majority* shareholder in the LLSV scenario can of course influence board structure, but the resulting board here likely aligns itself with the *large* shareholder, *not* with *minority* shareholders. Note that this implies that concentrated ownership and 'good' boards (one that is aligned with minority shareholders) might be negatively related. A negative relationship between concentrated ownership and board quality is entirely consistent with the LLSV "substitution hypothesis" between ownership concentration and country laws, and with our "complement hypothesis" between board quality and country laws.

We empirically examine and attempt to explain board independence and board size across 14 European countries with different qualities of shareholder laws. In our paper, we make two implicit assumptions. First, we assume that minority shareholders desire 'good' boards. Second, we assume that boards with few members and independent members are 'good' boards. There is little or no controversy in the first assumption, but there may be some controversy in the second assumption. The second assumption is based on prior research. Yermack (1996) finds that smaller boards are more effective monitors, probably because process losses increase with board size.[3] Weisbach (1988) finds that independent board members are more effective, probably because they are less susceptible to self-serving managerial influence.[4] Our paper's hypothesis is that minority shareholders can only get what they want (i.e., 'good' boards) when they have the empowerment and ability (i.e., strong minority shareholder laws) to do so. That is, board

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ways: those at the firm level, such as large shareholders, compensation contracts, effective boards, and so forth, and those at the market or system level, such as strong legal environments, active markets for corporate control, and so forth. It is quite likely that any corporate governance mechanism, regardless of whether it is at the firm-level or market-level, can be substitutes or complements for one another.

[3] Of course, others have also argued and have empirically found that smaller boards are more effective than larger boards. We will discuss these papers later in our paper.

[4] Of course, many others have also argued and have empirically shown that boards that are more independent are more effective than boards that are less independent. We will discuss these papers later in our paper.

size and structure might be endogenous, and shareholder law quality might be one of the important determinants.

As noted by Lehn, Patro, and Zhao (2003), empirical papers that *attempt to explain* board independence and board size are scant. Therefore, treating corporate boards as endogenous represents a significant contribution to the corporate board literature, in and of itself. Lehn, et al. consider firm-specific factors (such as firms size, etc.), while we consider a country factor (i.e., the country's legal environment). However, we do recognize the potential importance of firm-specific factors. Therefore, we also incorporate into our study firm-specific variables, such as firm-risk, leverage, and growth potential, to see if they explain European corporate boards. Testing these firm-specific explanatory variables is important in and of themselves, but using them as control variables to study the relationship between law and boards improves the quality of evidence that the legal environment and firm-level governance are related. For example, if a firm's agency cost is low (e.g., low-risk firms), then it may *not* need strong legal protection *nor any other* governance mechanisms.

Two minor notes merit brief mentioning. In our paper, we also include ownership concentration in our empirical analyses. Our interest in ownership concentration is two-fold. First, we simply wish to reconfirm LLSV's hypothesis that strong country laws and concentrated ownership are substitutes. Second, we wish to see if the LLSV substitution hypothesis between laws and ownership concentration implies a substitution between ownership concentration and 'good' corporate boards. The other minor issue we wish to highlight is that we are focusing on European corporate governance. Compared to what academics know about U.S. corporate governance, relatively less is known about European corporate governance.[5]

Overall, we find that ownership concentration and law quality are negatively related, consistent with LLSV. This finding holds even when we include firm-specific variables, which means that we are able to add to the existing evidence that laws and ownership concentration are substitutes. More importantly, we find that board quality and law quality are positively related, consistent with our contention. Specifically, in countries with high quality minority shareholder laws, corporate boards have (i) more independent directors and (ii) fewer directors. These findings also hold even when we incorporate firm-specific factors. We also find that board quality and ownership concentration are negatively related. Taken together, our findings importantly show how ownership concentration, boards, and shareholder laws interact.

Finally, we also provide some simple evidence showing that strong laws do empower shareholders, and we show that these empowered shareholders choose smaller and more independent boards. This final evidence serves two purposes. First, it reveals the causal link between laws and boards (albeit, it will be in a simple way). Second, it confirms our implicit assumption that shareholders want small boards and independent boards.

Papers most similar to ours come from two lines of research: those that conduct inter-country analysis (using country-wide factors) and those that conduct intra-country analysis (using firm-level factors). Papers from the first line of research use the governance,

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[5] There are papers that study corporate governance from various *individual* European countries, but few papers that study multiple European countries in a pooled cross-sectional setting to identify country-specific effects. Denis and McConnell (2003) provide a most comprehensive international literature review on corporate governance, and the lack of cross-country European studies is quit evident. Faccio and Lang (2002) is one exception, as they examine ownership structure throughout Europe. Most empirical corporate governance studies use U.S data and, to some extent, data from Pacific-Asia due to the recent Asian financial crisis of 1997.

disclosure, and transparency ratings of Credit Lyonnais Securities Asia (CLSA) and Standard & Poors (S&P) (e.g., Durnev and Kim (2004), Doidge, Karolyi, and Stulz (2004), Krishnamurti, Sevic, and Sevic (2004), and Klapper and Love (2004)). Doidge et al. and Klapper and Love find that firms located in countries with better shareholder protection laws have higher CLSA and S&P governance ratings, which is entirely consistent with our contention that good laws leads to good firm-level governance. Doidge et al. highlight countries' economic and financial development as an important determinant to firm-level governance. One important difference between our analysis and this line of research is our use of board characteristics instead of governance ratings. Our board data represents specific governance variables, while governance ratings are aggregated measures of many characteristics (e.g., CLSA is based on 57 characteristics covering issues from discipline and transparency to fairness and social awareness). One advantage to using specific governance variables instead of an aggregate index is that it allows for narrower and more specific investigations. Our focus is on corporate boards in particular. In addition, our contention that ownership concentration is a substitute for shareholder laws while board quality is a complement to shareholder laws is not testable using an aggregate index.

Related papers from a second line of research study the determinants of board structures (e.g., Hermalin and Weisbach (1988, 1998), Lehn, Patro, and Zhao (2003), and Coles, Daniel, and Naveen (2004)). However, these studies do not explicitly consider the role of country factors or shareholder protection laws as potential determinants of board structures. Our study could be viewed as a merging of these two streams of research.

The rest of our paper proceeds as follows. The next section briefly discusses the relevant literature and all of our variables. Section 3 describes our data. Section 4 presents and discusses our findings. The last section concludes.

. The relevant literature and discussion of variables

This section provides a brief overview of the existing literature on firm-level corporate governance and its determinants. Though we recognize that the governance literature is large and continuously expanding, for the sake of brevity we only attempt to provide a succinct discussion that sufficiently satisfies our paper's needs.

2.1 Firm-level corporate governance

Ideally, the interests of managers and investors should be perfectly aligned, but firms likely suffer from the well-known agency problem (Jensen and Meckling, 1976). However, there are purported remedies (i.e., governance mechanisms) to mitigate the agency problem. In addition to effective laws, which we discussed above, investors can be protected by several other means, such as incentive contracts, concentrated ownership, engaged boards of directors, disciplinary debt, and so forth. In our paper, we discuss three firm-level governance mechanisms: concentrated ownership, board independence, and board size.

Concentrated ownership. Concentrated ownership is commonly considered a governance mechanism in the academic literature. When a public firm's ownership is concentrated into the hands of a few large shareholders, then these large shareholders should have both the incentive and the power to monitor the firm effectively. Classic papers that discuss ownership concentration as a governance device include Demsetz and Lehn (1985) and Shleifer and Vishny (1986). For more contemporary findings, see Denis and McConnell's (2003) literature review. For our measure of ownership concentration, we calculate the total percent of shares held by the firm's five largest shareholders.

Board independence.   Boards of directors are the ones that have the specific charge to monitor firms on behalf of the firm's shareholders (Kim and Nofsinger (2004)).   Boards have two primary functions: to advise management on business strategy and to monitor management (Lehn, et al. (2003)).   With regard to the latter function, it is contended that specific board structures are most effective at monitoring firms.   In particular, when a board has a higher fraction of independent (i.e., outside) directors, then it is presumed to be more effective at monitoring management.   There are *many* papers that contend and empirically support this contention.[6]   The logic is pretty straight-forward.   For example, one of the board's primary responsibilities is to fire poorly-performing CEOs.   If the firm's CFO or a CEO's friend is on the board, then it is less likely that s/he will vote to fire the CEO for poor performance.   Outside directors are more objective at evaluating management.   To measure board independence, we calculate the percent of the firm's directors that are independent directors.   Our definition of an independent director is someone who is not employed by the firm, nor is related to someone who is employed by the firm.

Board size.   Smaller boards (i.e., ones with fewer members) have been found to be better boards.   We recognize that small boards are usually not thought of as a governance mechanism, but the academic literature hypothesizes, and finds, a negative relationship between board size and firm valuation.[7]   Jensen (1983) is perhaps the most outspoken on this front.   A simple explanation is as follows.   With smaller boards, each board member may feel inclined to exert more effort, as they realize that there are only a few others monitoring the firm.   With larger boards, it may be more difficult to reach consensus and thus to get anything meaningful done.   In addition, with larger boards, members may simply assume that the many other members are monitoring.   Therefore, smaller boards may be more dynamic and more active.

Measuring board size is not as straight forward as studies examining U.S. firms because firms from several European countries have a two-tier board system.   German firms have a management board (*Vorstand*) and a supervisory board (*Aufsichtsrat*).   Hopt and Leyens (2004) describe the responsibility of the management board as running the business. The supervisory board appoints and supervises the management board.   The supervisory board controls the firm's compliance with the law and articles of the corporation, and its business strategies. Membership in the supervisory board is incompatible with simultaneous membership in the management board.   The normal functions and responsibilities of boards in the U.K. or the U.S. are therefore divided into two boards in these two-tier board structures. The Netherlands also has a two-tier system with a *Raad van Bestuur* (management board) and a *Raad van Commissarissen* (supervisory board).   In France, corporations have the choice between a one-tier board and a two-tier structure, but most choose the one-tier board.   If the firm has only one board, board size is simply the number of directors that sit on that board.   If the firm has a two-tier board structure, we measure board size (and also board independence) using directors from both boards.

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[6] For example, Fama (1980) and Fama and Jensen (1983) provide theoretical arguments and Dahya, McConnell, and Travlos (2002) and Weisbach (1988) offer empirical support.

[7] Examples of empirical papers include Huther (1996), Yermack (1996), and Eisenberg, Sundgren, and Wells (1998).   Mak and Kusnadi (2004) also find a negative relationship between firm value and board size for firms in Malaysia and Singapore.

2.2 Determinants of firm-level governance mechanisms

This section describes some of the hypothesized determinants of the three firm-level governance mechanisms that we discussed above. We divide our discussion into two subsections. The first subsection describes country-wide legal environments that may lead firms in that country to either adopt or not adopt firm-level governance mechanisms on an aggregate (country-wide) level. The second subsection describes firm-specific variables that may lead individual firms to either adopt or not adopt governance mechanisms.

We treat firm-level governance as endogenous. While there are many papers that treat ownership concentration as endogenous, there are fewer papers that consider board size and board independence to be endogenous. Hermalin and Weisbach (1988, 1998) represent important early exceptions. Lehn, et al., (2003) and Coles, Daniel, and Naveen (2004) are recent exceptions. Perhaps the lack of empirical research treating board size and independence as endogenous outcomes is due to a belief that all boards could improve with decreased membership and increased independence, i.e., that "one size fits all." For example, our paper makes the implicit assumption that minority shareholders want 'good' boards. Because the prior research shows that boards with fewer members and independent members are representative of 'good' boards, the implication is that shareholders want boards with fewer members and independent members (before concluding our paper, we show some evidence that shareholders do desire independent boards and small boards, thus confirming the paper's implicit assumption that empowered shareholders opt for independent and small boards). However, independent and small boards might not be best for all firms, which is why we try to control for firm-specific factors in our empirical tests.

2.2.1 Country-wide variables: Quality and enforcement of shareholder laws

Our study's primary focus is the relationship between the legal environment and firm-level corporate governance. With respect to the legal environment, it can be thought of as comprising two components: (i) do the laws provide shareholders with strong legal rights, and (ii) are these laws well enforced? We discuss variables that proxies for each, in turn.

Shareholder rights. LLSV (1998) provides a measure of a country's overall quality of shareholder rights. They use the expression "minority shareholder rights" and "antidirector rights" interchangeably. An index is created to measure "how strongly the legal system favors minority shareholders against managers and dominant shareholders in the corporate decision-making process, including the voting process." Specifically, the quality of a country's laws to protect minority shareholders is determined by whether stockholders can (1) send proxies by mail, (2) sell their shares around shareholder meeting days, (3) allow others to vote their shares, (4) challenge perceived oppression by directors, (5) have preemptive rights to new issues, and (6) to call meetings. In total there are six attributes, where each is a discrete variable of either 0 or 1.[8] The overall minority shareholder rights index is determined by adding these numbers. We use their index to proxy for the quality of a country's law to protect minority shareholders. An index score

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[8] In LLSV (1998), they measure the percentage of share capital that is required to call extraordinary meetings. If only 10 percent or less is required, then this shareholder rights variable is equal to 1, and 0 otherwise.

of 6 (0), the maximum (minimum) score, means that the country's laws protect shareholders well (poorly).

LLSV find a negative relationship between a country's law quality and the firm's ownership concentration. We have no compelling reason to predict otherwise for our own investigation of ownership concentration. That is, we hypothesize that ownership concentration and law quality are substitutes for one another. However, this is not to say that any, or all, firm-level governance devices can be substitutes for law quality. We believe that some firm-level governance devices can only exist in countries where the laws assist investors. Having a good corporate board is one such example. For example, shareholders have stronger voices when it comes to board composition and board size when the law provides them the ability and the power to do so. Therefore, we predict that law quality and board quality are positively related. Doidge, Karolyi, and Stulz (2004) make a similar prediction, and they find empirical support. Specifically, they find that a firm's governance score is positively correlated to LLSV's shareholder's rights index. Klapper and Love (2004) and Krishnamurti, et al. (2004) report similar findings.

Enforcement. This variable pertains to how well a country enforces their shareholder laws. A strong system of legal enforcement makes strong laws more meaningful, or it could substitute for weak laws. Our measure of judiciary efficiency also comes from LLSV (1998). It is a ten-point scale, from 1 to 10, with 10 indicating strong legal enforcement. LLSV also have other measures of enforcement, but these other measures primarily pertain to the government's attitude toward business and about the business environment in general, not to the enforcement of laws per se (e.g., they have a measure of government corruption).

LLSV are unable to identify a relationship between a country's quality of law enforcement and their firms' ownership concentration. It appears that rules rather than enforcement are more relevant in affecting corporate and investor behavior. Nonetheless, to be consistent with our discussion of laws and corporate governance in the previous subsection, we predict a negative relationship between enforcement quality and ownership structure, and a positive relationship between enforcement quality and board quality.

2.2.2 Firm-specific variables

Due to differences in national laws, specific countries may find firm-level governance mechanisms to be more useful than other countries. There may also be instances when specific firms require firm-level governance mechanisms more than other firms, both across and within countries. With respect to choosing firm-specific explanatory variables, we draw on the existing ownership concentration literature and the existing board literature. Neither literature is particularly large (here, we are referring to the literatures that treat governance mechanisms as endogenous), which may make our choices of firm-specific variables appear ad hoc, but we believe there is sufficient reason to include our the following variables: (1) firm-specific risk, (2) leverage, (3) market-to-book ratio of assets, (4) R&D, and (5) firm size. A description and discussion of each of these variables, along with their hypothesized relationship with our firm-level governance variables, can be found in the Appendix.

2.3 Summary

We have discussed two aspects of the legal environment (quality of laws and quality of enforcement), three types of firm-specific governance mechanisms (ownership concentration, board independence, and board size), and several firm-specific determinants of firm-level governance mechanisms. To recap, we are testing to see whether firm-level

governance mechanisms are substitutes or complements to national laws and/or to legal enforcement. Firm-level governance mechanisms are assumed to be concentrated ownership, small boards, and independent boards. As such, they represent our dependent variables. An additional question that we ask is: Are country's laws and firm's corporate governance related even after we control for other firm-specific variables? By including firm-specific determinants (such as firm size, firm growth potential, and firm risk) of firm-level governance, we provide a sharper test than one that aggregates firms by countries. For convenience, each table contains predicted signs on each of the explanatory variables.

. The data

Our initial search for firms' ownership and board information comes from the Deminor universe of firms. Deminor is an independent consulting practice that provides information to assist minority shareholders in Europe. An advantage of using this database for board information, as opposed to the firm's own annual reports, is that it is more likely to be more objective when identifying a board member as being independent. Naturally, Deminor tracks the larger European firms. We are able to include 229 firms from 14 European countries for the year 2000. The law variables come from LLSV (1998). Financial statement data comes from Thomson Financial's Worldscope database. For the financial statement data, we use country-adjusted measures, where we subtract out the country's median value for each variable. This procedure eliminates firm-specific country factors (e.g., a 'big' company in one country may not be deemed a 'big' company in another country). However, our main results are robust regardless of whether or not we make these country adjustments. The financial statement data is all U.S. dollar denominated.

Table 1 shows the law and enforcement indices for our 14 European countries. A higher index denotes better laws and enforcement. Table 1 also shows summary statistics on our firm-level corporate governance variables. A few observations of the firm-level governance variables are noteworthy. For example, note that U.K.'s boards are quite independent. Three out of every four U.K. board members are outsiders. However, this observation may not be surprising. Since 1992, the U.K. has had a *Code of Best Practice* pertaining to corporate boards (Dahya, et al. (2002)). The *Code* recommends that U.K. firms to have at least three outside directors on their boards. The London Stock Exchange requires that listed-firms reveal whether or not they are *Code* compliant. This point underscores our contention that country-level governance policies and laws aimed at protecting shareholders lead to good boards.

[Insert Table 1 Here]

The German firms in our sample have no independent directors and large board sizes. However, it is well known that Germany's governance system is a bank-based system. Franks and Mayer (1998) provide an excellent illustration of how German laws might favor banks rather than minority shareholders. In their study, they find that banks had the power to influence takeover decisions without much regard to minority shareholder desires. The firms from the Netherlands also have few independent directors. The larger

Dutch firms fall under the structural regime (*structuurregeling*) regulation. These firms must set up a supervisory board which consists of at least three members. New board members are appointed by existing members (called cooptation) and at least one of them are to be government appointees. Jong et al. (2001) conclude that the structural regime gives minority shareholders very little say in the appointment or removal of board members.

Some countries, such as Belgium, have large ownership concentrations. Belgium's public ownership is significantly family-oriented (Bauwhede, Willekens, and Gaermynck (2003)). LLSV find that countries where family ownership of public corporations is significant (e.g., Korea), then their ownership concentration is high.

From Table 1, we can also detect some patterns among the law and firm-specific governance variables consistent with our discussions above. For example, countries with strong shareholder laws, as revealed by its high shareholder rights index such as the UK, seem to have lower ownership concentrations but more independent directors and smaller boards. These observations suggest that when a country has strong shareholder laws, then they rely less on ownership concentration, and they are able to create 'good' boards. These observations are consistent with our hypotheses. However, these observations should be interpreted with caution. For example, it could be that firms in the UK specifically require good firm-level governance due their unique business operations and not due to their strong legal environment, which means that any correlation between law quality and firm-level corporate governance could be spurious. Our regression analyses that control for firm-specific factors should provide more reliable empirical evidence into the relationship between country law and firm-level corporate governance.

We also observe unequal sample sizes across countries, which potentially creates problems in empirical tests. Obviously, we have no say in Deminor's coverage of firms, just as prior papers using CLSA governance scores could not dictate CLSA's coverage of firms, but we acknowledge the potential problem and we will address it later in the paper when we conduct our empirical tests.

Table 2 shows descriptive statistics for the firm-specific control variables used in our study. Risk is the standard deviation of each firm's annual stock returns from the period 1997-2000. Leverage is the firm's total leverage to total assets ratio. M-to-B is the firm's market-to-book value of total assets. R&D is the firm's R&D expenditures to total assets ratio. Firm Size is the firm's book value of total assets. A casual look at this data suggests that they may not subsume our prior preliminary findings that laws and firm-level corporate governance are related. For example, firms in our U.K. sample do not have a particularly high level of risk, leverage, or growth potential. That is, country law might explain firm-level corporate governance more than firm-specific factors.

[Insert Table 2 Here]

Table 3 presents some additional preliminary evidence on the relationship between law quality and firm-level corporate governance. We sort firms into three groups based on country shareholder rights index and also by country enforcement index. The subgroups represent firms that operate in the highest, mid-level, and lowest law quality environments. For each group, we identify the mean ownership concentration, mean board independence percentages, and mean board sizes. The results are reported in Table 3.

[Insert Table 3 Here]

From Table 3, we see that firms from countries with the strongest (weakest) shareholder rights have the lowest (highest) ownership concentrations, highest (lowest) percent of independent directors, and smallest (largest) board sizes.   These results provide preliminary evidence that countries with strong shareholder rights have low ownership concentrations, but 'better' boards.   For the enforcement rights groups, a pattern between enforcement rights and firm-level governance is less obvious.   However, all of these results should be viewed cautiously, as they do not consider important confounding factors. We discuss regression findings subsequently.

. Empirical methodology and results

4.1 Methodology

Each of our firm-level corporate governance variables is a dependent variable in a regression model.   For each firm-level governance variable, we test three regression models.   Model 1 simply tests firm-level corporate governance as a function of the country's shareholder rights and enforcement quality.   Model 2 essentially repeats Model 1, but includes firm-specific control variables added to ensure the robustness of Model 1 findings.   Finally, Model 3 contains only the firm-specific variables, and the firm-level governance variable not being used as the dependent variable.   The inclusion of the "other governance variable" in Model 3 tests the hypothesis that ownership concentration and 'good' boards are substitutes for one another.   When testing this last hypothesis, we do not include country law variables which would induce multicollinearity, as laws and firm-level governance are hypothesized to be related.   All models include industry dummies, but all results are robust regardless of whether or not industry dummies are used.[9]

4.2 Regression results on ownership concentration

Table 4 reports regression results when ownership concentration is the dependent variable.   The parameter coefficients are estimated using the Tobit regression method, as our dependent variable, ownership concentration, is a censored variable from 0 to 100 percent.10   Model 1 shows a negative relationship between a country's shareholder rights and its firms' ownership concentration.   However, there does not seem to be a statistically significant relationship between a country's enforcement quality and its firms' ownership concentration.   Both results are consistent with those of LLSV.   Our findings suggest that when a country has weak shareholder laws, then their firms have large shareholders.   That is, a large shareholder that presumably has the power and the incentive to oversee the firm is a substitute monitor for the country's weak laws.   Also like LLSV, we find that

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[9] Our industries include the following (with sample sizes reported in parentheses): Financial (57), Industrial (30), Consumer Cyclical (46), Basic Materials & Energy (22), Technology (26), Consumer Non-Cyclical (31), and Utilities (17).

[10] OLS yields the same qualitative findings.

enforcement does *not* seem to be a statistically significant factor in explaining ownership concentration.

[Insert Table 4 Here]

Model 2 is a repeat of Model 1, but it includes firm-specific explanatory variables. We want to make sure that we are capturing country factors while controlling for firm-specific factors. From the results, we see that countries with strong shareholder rights have lower ownership concentrations even after we include firm-specific control variables. Therefore, our findings here improve upon the quality of findings in Model 1. For the firm-specific variables, we see some weak evidence that high market-to-book firms have higher ownership concentrations. Surprisingly, R&D-intensive firms have lower ownership concentrations.

Model 3 shows the firm-specific variables and it includes board independence and board size as explanatory variables. Firm size is statistically significant, indicating that it is more difficult (i.e., more costly) to be a large shareholder of a larger company. However, the most interesting finding in Model 3 is that board independence and ownership concentration are negatively related. Thus, these two governance mechanisms are substitutes for one another. Note that if ownership concentration is a governance device in countries with poor laws, then this finding suggests that board independence is a governance device in countries with strong laws. We will explore this contention further in the board regression models.

Before moving on to the board regressions, we address a potential concern with our empirical tests. Unequal samples sizes across countries may be affecting our findings. Because some countries have more firms than others in our test sample, we randomly eliminate firms until we are left with three firms from each country to leave us with a total of 41 firms (Denmark has 2 firms to begin with). Regression results on the reduced sample yield qualitatively similar results (though statistical significance is reduced). Further, other cuts to the data (e.g., eliminating the large U.K. sample, etc.) yield the same findings. Therefore, we believe our reported findings are not due to a sample selection nor sample size issue. As such, we continue to use our entire sample (in part, for the sake of statistical power) when reporting our results.

4.3 **Regression results on board independence**

Table 5 reports results where board independence is the dependent variable. As before, the parameter coefficients are estimated using the Tobit regression method, as our dependent variable, board independence, is a censored variable from 0 to 100 percent. Model 1 shows a positive relationship between a country's shareholder rights and its firms' board independence ratio (measured as the percent of the firm's directors that are independent directors). This finding suggests that it is more likely for firms to have 'good' boards (assuming that independent boards are better than non-independent boards) in countries with good laws. Laws can help shareholders get the boards that they want. The enforcement variable is also positively related to board independence. Shareholder-influenced boards can be more effective when laws back their actions. In fact, it might be worth knowing that when we used OLS to estimate these parameter coefficients, the adjusted R^2 of this model was an economically significant 58 percent. Overall, 'good'

boards and good laws and enforcement appear to go hand-in-hand, i.e., they are complements.

[Insert Table 5 Here]

Model 2 shows that Model 1's main findings are robust even after the inclusion of firm-specific explanatory variables. In fact, law quality appears to be more important than the firm-specific factors in explaining board composition, because none of the firm-specific variables are statistically significant. Of particular note is the fact that the inclusion of the firm-specific explanatory variables does not improve the model much. That is, the log-likelihood statistic is very different between the two models. When we estimate this model using OLS, the adjusted-R^2 is again 58 percent as it was with Model 1. Country factors seem to be more important than firm-specific factors in explaining a firm's board composition. Doidge, et al. (2004) similarly find that country factors explains firm-level governance scores more than firm-specific factors. Finally, the statistically significant ownership concentration variable in Model 3 confirms that ownership concentration and board independence are substitute firm-level governance mechanisms.

As we did before, we make sure that unequal samples sizes and a censored dependent variable do not lead to misleading findings. Various cuts to the data to address the unequal sample size issue, and subsequent regression tests, yield qualitatively similar results to the reported results. Thus, we believe our reported board independence findings are not due to a sample selection (nor sample size) issue.

4.3.1   Are our findings due to country-specific board regulations?

Along with the passage of the Sarbanes Oxley Act of 2002 in the United States, many markets around the world also assessed or reassessed their governance regulations and made various changes. Note that these new or revised regulations do not affect our analysis because we use data from the year 2000. Nevertheless, we conduct a thorough review of European rules and regulations pertaining to corporate boards. Do some countries have independent directors simply because their government mandates it? Complete country-specific governance task-force studies, proposals, and regulations are available in English from the European Corporate Governance Institute (www.ecgi.org).

The U.K. is probably most similar to the U.S. in its emphasis on independent directors. The U.K.'s *Combined Code on Corporate Governance*, released in July 2003, states that "Except for smaller companies, at least half the board, excluding the chairman, should comprise non-executive directors determined by the board to be independent." Before the passage of the Combined Code, the Cadbury Committee issued a *Code of Best Practice* recommending that each firm should have at least three independent directors. For our U.K. sample, an average of nine independent directors sits on a board of 12 total directors.

The governance codes in most European countries, even today, do not explicitly require a specific number or fraction of independent directors. Instead, they make "recommendations" or "suggestions" pertaining to independent directors. For example, the 1998 Cardon Report, commissioned by the Brussels Stock Exchange suggests that "The number of independent directors should be sufficient for their views to carry significant weight in the board's decisions." In the most recent version of Belgium's *Corporate Governance Act*, it states, "the composition of the board should be determined on the basis

of the necessary diversity and complementarily." For France, the Viénot report of July 1999 recommends that at least a third of the directors be independent. French firms do not seem to embrace this recommendation as our French sample only has an average 15% of their board being independent directors. Later, an October 2003 report released by the French Association of Private Enterprise "suggests" that for widely-held firms, at least half of its directors be independent. Italy's *Corporate Governance Code* of 2002 states that "an adequate number of non-executive directors shall be independent." The Code seems to define an "adequate number" as being one, or in some cases two, independent directors. Spain's *Aldama Report* of 2003 suggests "a very significant number of independent directors, considering the company's ownership structure and the capital represented on the Board."

Clearly, the wide attention on director independence is a recent phenomenon, furthermore the recommendations pertaining to director independence with regard to their number and/or fraction are vague, and finally they are not explicit regulations. We also find that these regulations and codes do *not* speak to board size. Therefore, we do not think our findings reported in Table 5 are due to country-specific board regulations. Nonetheless, we did try to create an index based on board regulations. We approached this task with the idea that the more 'teeth' a country's policy or commission recommendation had with regard to improving board structure, the higher should be its index value. However, as we studied every country's policies and commissioned reports, we found that all countries generally fell into only one of two categories: it either recommended that there be more board independence, or it did not. Therefore, instead of an index, we then decided to create a Board Law Dummy variable which we set equal to 1 if the country's policy report recommends greater board independence, and equal to 0 if it did not.[11] This dummy variable is included in Models 1, 2, and 3 and reported in Panel B of Table 5. The predicted sign on this dummy variable is not necessarily straight-forward. On the one hand, the coefficient could be positive indicating that countries where board independence is advocated have more independent boards. On the other hand, the coefficient could be negative indicating that countries that do not have independent boards are the ones whose policy reports are now trying to advocate them. And finally, as these recommendations are new, the coefficient may not even be significant because firms may not have had the time to react to them.

From Panel B of Table 5, we see that the Board Law Dummy variable is significantly positive, suggesting that some countries might have greater board independence simply because their countries' policy study advocates it. Therefore, we acknowledge that the Board Law Dummy variable is an important control variable. More importantly, however, note that the Shareholder's Rights Index and Enforcement Index are still statistically significant, indicating their sustained importance in explaining board independence. That is, even when explicit (and apparently effective) policy recommendations pertaining to board independence exist, shareholder rights still plays a significant role in ensuring board independence. That is, explicit board regulations and/or policy recommendations do not subsume our paper's main findings – strong shareholders rights can lead to 'better' boards.

4.4 Regression results on board size

Table 6 shows regression results when board size is the dependent variable. We use the OLS regression method to estimate the parameter coefficients. From Model 1, we see that countries with strong laws have firms with *fewer* directors. This result again shows

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[11] Board Law Dummy is equal to 1 for the following countries: Belgium, Denmark, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal, Spain, and the U.K.

that countries with strong laws are the ones whose firms have better boards (assuming that small boards are better than large boards).   Countries with better law enforcement also have firms with smaller boards.   Model 2 includes firm-specific explanatory variables.   Overall, the main findings are robust.   Countries with good laws have firms with fewer directors.   We also see that larger firms have *more* directors.   This result confirms the hypothesis that larger firms need more 'eyes to mind the business.'   Finally, Model 3 reveals that board size and ownership concentration are not related.   It appears that when it comes to boards, only board independence (not board size) is a substitute for governance via large shareholders.   A battery of data cuts and subsequent re-running of regressions confirms that unequal sample sizes across countries do not drive our findings.

[Insert Table 6 Here]

Could board regulations affect our board size regression findings?   When we reviewed each country's policy recommendations, we never came across a recommendation explicitly advocating smaller boards.   However, there were five countries whose policy reports recommended either a maximum number of board members or that boards not be too large.[12]   A dummy variable capturing this potential influence (the variable is equal to one for these five countries) is significantly positive in our board size regressions, which is somewhat surprising, but it probably reveals that countries with large boards are the ones whose policy reports are trying to curb board size.   More importantly, the importance of shareholder rights is sustained in these new regressions (i.e., they remain statistically significant negative).   Therefore, the potential existence of a board size regulation or policy recommendation does not subsume our main finding that board size is a function of shareholder rights.   Due to the marginal information contained in these additional regressions, we do not report them.

4.5 Additional robustness checks: Testing other country-specific factors

In this subsection, we consider other country-specific factors that might explain, or subsume, our primary findings.   Recent research finds that a country's accounting standards (LLSV (1998)), reliance on foreign capital (Doidge, et al., (2004)), cultural factors measured by religion and language (Stulz and Williamson (2003), and degree of economic development (Doidge, et al. (2004)) might play important roles in a firm's corporate governance, financial, and investment policy.   In regard to the influence of culture, our firms are from countries that each speaks its own language.   So language is not an effective measure of culture for this sample.   In addition, the degree of economic development is not an issue as our sample includes only developed countries.   Therefore, as we consider additional factors in this subsection, we focus on accounting standards, reliance on foreign capital, and religion.

Making ex ante predictions for each of these additional country factors is not straightforward.   How might accounting standard quality impact the ability and the desire for minority shareholders to create good boards?   On one hand, better country accounting standards could create the incentive for shareholders and firms to adopt good governance practices (consistent with stories offered by Doidge, et al. (2004) and our own "complementary hypothesis" contention). Alternatively, better country accounting standards could partially eliminate the need for good firm-level governance (consistent with a substitution hypothesis of LLSV (1998)).   Without a clear ex-ante prediction for the

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[12] These countries include Belgium, France, Germany, Greece, and Spain.

impact of accounting standards on firm-level governance, we consider this to be an empirical matter.

If a country's economy has a strong reliance on foreign public capital, then there may be a greater need for better governance. Foreign investors may require good firm-level corporate governance and minority shareholder protection as a prerequisite for providing capital (Lins and Warnock (2004)). For religion, Stulz and Williamson (2003) find that protestant countries protect creditors better than other countries, but we are not sure if religion plays a role in determining corporate boards. In our examination of these additional country factors, we only focus on the following: "Do the inclusions of these additional country-factors subsume our overall finding that law quality and boards are related?"

Table 7 reports summary statistics of our additional country-factors. Accounting standards come from LLSV (1998). A higher number indicates better standards, as indicated by the firms' disclosure quality. Our information on foreign public capital comes from Doidge, et al. (2004). The variable shows the percentage of public foreign capital that is raised outside the home country for the years 1995-2000. We also report each country's primary religion, which is information we get from Stulz and Williamson (2003).

[Insert Table 7 Here]

Ownership structure, board independence, and board size are dependent variables in a regression analysis. Because ownership concentration and board independence are censored dependent variables from 0 to 100 percent, we use Tobit regression models to estimate their parameter coefficients. The board size model uses the OLS regression estimation. Both the shareholder rights index and the enforcement index are explanatory variables, and they represent our key variables of interest. The additional country-specific variables are accounting standards, percent of foreign public capital, and a dummy variable equal to one if the primary religion in the country is protestant. We also include industry dummies, though our findings are invariant to whether or not we include industry dummies. Table 8 reports the results.

[Insert Table 8 Here]

From Table 8, we see that the shareholder rights index still has a strong influence on ownership concentration (first column of results) and on board independence (second column of results). With regard to the board size regression, all of our variables are statistically significant. Countries with good accounting standards have smaller boards. Countries with greater reliance on outside capital and countries whose primary religion is Protestant have larger boards. However, the most important result from Table 8 is that the inclusions of these additional country variables do not subsume our law variable findings (though, for the board independence model the enforcement variable is no longer statistically significant). That is, higher quality shareholder rights lead to smaller ownership concentrations, more board independence, and smaller board sizes, consistent with the evidence presented earlier, even after we incorporate other differences among countries. Of course, our models in Table 8 could suffer from multicollinearity, as prior papers have shown that many of our explanatory variables in Table 8 are correlated. Therefore, we execute one-factor regression models for each of our explanatory variables, but the results (not shown) come out qualitatively the same. Additionally, the inclusion of firm-specific control variables (not shown) does not change the main findings of this subsection either.

4.6 Linking laws and firm-level governance: A simple test

We have been arguing that if a country has good shareholder protection laws, then their shareholders should have the ability to get the board that they desire. We've also contended that these empowered shareholders will select independent and small boards. In this subsection, we show some simple evidence on how laws empower shareholders, and we also show that these empowered shareholders choose smaller and more independent boards. In other words, we will illustrate one mechanism for how 'good' laws lead to 'good' boards.

In our sample, there are two primary ways directors can get elected to boards. Directors can be elected via a shareholder meeting or they can be appointed by top management or other employees. Directors that get selected by the shareholders are likely to be more representative of minority shareholders' desires and interests as opposed to directors that get selected by management. If good laws lead to empowered shareholders, which, in turn, leads to independent and small boards (i.e., the link in question), then we should observe the following: (1) countries with good laws should have more directors that were selected by shareholders rather than by management, and (2) when shareholders do select directors, they select independent directors and smaller boards.

For the firms in our study sample, Table 9 shows the percent of directors that were selected by shareholders within each country. Note that Denmark, Germany, and the Netherlands have the lowest fraction of directors that were appointed by shareholders. These three countries have weak shareholder rights and they have no independent directors (see Table 1). In other countries, particularly where shareholder rights are stronger, they have more shareholder-selected directors, and they tend to be independent directors.

[Insert Table 9 Here]

Panel B of Table 9 shows non-parametric (Spearman) correlation coefficients between key variables. The statistically significant positive correlation between the percent of shareholder-selected directors and the shareholders' rights index suggests that good laws do give shareholders more power to affect board composition. The positive correlation between the percent of shareholder-selected directors and director independence shows that shareholders elect independent directors as opposed to insiders. The negative correlation between the percent of shareholder-selected directors and board size suggests that empowered shareholders opt for smaller boards. These simple results show one process by which strong shareholder laws might lead to good firm-level governance. These results also confirm that shareholders do desire independent and small boards, which was an implicit assumption that we made throughout the paper.

. Conclusions

LaPorta, Lopez-de-Silanes, Shleifer, and Vishny (1998) argue that firm-level governance may be a substitute for weak shareholder laws. Similar to LLSV, we find that in countries with poor laws, firms are more likely to have large shareholders. Thus, ownership concentration and laws are substitutes. If laws can't help the shareholders, then the shareholders must help themselves. However, for other firm-level governance devices, it might be difficult for them to exist and to operate when laws are weak. For example, corporate boards of directors represent another firm-level governance mechanism.

Without strong laws to help minority shareholders get the boards that they want, and without strong laws to help these boards be effective, countries with weak laws may have firms with 'weak' boards. In other words, we think board quality and law quality are complements. In our paper, we simply define a 'good' board as one that has more independent directors and fewer directors.

We study a sample of 229 firms from 14 European countries with a high degree of variation in shareholder law quality. We find that in countries with strong laws and enforcement, firms have more independent directors and fewer directors. This result confirms that board quality and law quality are complements. These results hold even when we incorporate firm-specific factors such as firm size, firm risk, and the firm's growth potential. We also find that board independence and ownership concentration are substitutes. This finding makes sense if law quality is driving each of these governance mechanisms in different directions. Finally, for illustrative purposes, we document one explicit link between laws and corporate boards by showing that countries with strong laws have more shareholder-elected directors than management-appointed directors, and that these shareholder-elected directors are independent directors, not insiders.

Our findings have policy implications. If countries want their firms to get better oversight and monitoring from corporate boards, then these countries should consider re-evaluating and/or possibly strengthening their shareholder protection laws to empower shareholders so that they can effectively influence corporate board composition and structure.

Appendix

Hypothesized Firm-Specific Determinants of Firm-Level Governance

Firm-specific risk.   If the firm's operations are risky, then there is more to be gained by monitoring this firm (Demsetz and Lehn (1985) and Grossman and Hart (1986)). Therefore, riskier firms should employ an active governance mechanism.   Many ownership structure papers find empirical evidence consistent with this hypothesis.   For example, Demsetz and Lehn (1985), Holderness, Kroszner, and Sheehan (1999) and Himmelberg, Hubbard, and Palia (1999) find a positive relationship between ownership concentration and firm risk.   It is optimal for a riskier firm to have large shareholders monitoring it.

The recent board literature, however, primarily discusses firm size and firm growth opportunities as the key determinants to board size and composition.[13]   Larger firms need more directors because they need more individuals to monitor the greater scope of their activities, and growth firms need more *inside*-directors because they need more monitors with specialized knowledge and expertise.   Because neither hypothesis speaks directly to the relationship between firm-specific risk and boards, we do not know what to expect, but we could make cursory predictions.   Riskier firms could conceivably require engaged and active directors, but also directors with intimate knowledge of the firm's activities.   This implies that risky firms could benefit from having smaller boards, but with *fewer* outside directors.

In short, the extant governance literature hypothesizes a positive relationship between firm risk and ownership concentration, but there is no pre-existing hypothesis on the relationship between boards and firm risk (at least none that we are aware of).   We conjecture a negative relationship between firm risk and board size, and a negative relationship between firm risk and board independence.   Our measure of firm-specific risk is the standard deviation of annual stock returns from 1997 to 2000.

Leverage.   Leverage potentially plays a significant role in firm-level governance, but its hypothesized effect is not necessarily straight-forward.   On the one hand, firms with more debt in their capital structure are riskier.   As such, highly levered firms might require effective governance.   Consistent with this contention, the prior empirical literature finds a positive relationship between a firm's ownership concentration and its debt ratio (e.g., Agrawal and Mandelker (1987)).   As for board structure, if smaller boards and independent boards are supposed to be better at monitoring, then we might expect firms with more leverage to have fewer directors and more outside directors.[14]   However, Coles et al. (2003) and Klein (1998) offer a different view regarding optimal board size for highly-levered firms.   They suggest that firms with more debt need *more* directors.   Specifically, a firm with more debt relies on more external contracts, which requires more monitors. Thus, firms with more debt may optimally have larger boards.

However, Jensen (1986) argues that leverage can mitigate the agency problems associated with free cash flow.   Here, leverage in and of itself can be viewed as a firm-level governance mechanism.   Therefore, firms with more debt may be less reliant on boards for governance.   In summary, while debt is a potentially important factor in determining

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[13] For example, see Lehn, et al. (2003).   These variables will be discussed shortly.

[14] There is evidence that bankers on boards benefit debt-dependent firms (e.g., Booth and Deli, (1999)).

board structure, we cannot be unambiguously sure of the relationship, ex ante. We use an industry-adjusted leverage ratio. For each firm, this ratio is the firm's total debt to its total assets, less the median debt-to-assets ratio for the industry in that firm's country.

Market-to-book ratio of total assets. Some researchers (e.g., Morck, Shleilfer, and Vishny (1988), and more recently, Coles, et al., (2004), but there are others as well) believe that certain governance structures and governance mechanisms can lead to greater firm value (i.e., firm value is endogenous to the firm's governance), while other scholars believe that governance structures are endogenous (Demsetz and Lehn (1985) and more recently, Lehn, et al., (2003)). Cho (1998) tackles this issue using a simultaneous systems approach and finds that ownership concentration is endogenous to a market-to-book ratio, not the other way around. Firms with high market-to-book ratios have greater ownership concentration. While we do not address this debate here, we cannot ignore a potential positive empirical relationship between the market-to-book ratio and ownership concentration.

With respect to the recent board literature, the market-to-book ratio is viewed as either a standardized measure of firm value (as in Coles, et al. (2004)), or as a proxy for growth opportunities (as in Lehn et al. (2003)). Despite the slightly different views on what the market-to-book ratio measures, both Coles et al. and Lehn et al. make similar predictions with regard to the market-to-book ratio and boards. Firms with more growth opportunities need smaller boards (i.e., smaller boards are nimbler, which is necessary for young growing companies), but they also need more inside (not outside) directors (i.e., growing firms have greater information asymmetry, so insiders are potentially better monitors than outsiders). That is, the market-to-book ratio is negatively related to board size and board independence. Our market-to-book ratio of total assets comes from the year 2000. The ratio's numerator is the market value of equity plus the book value of debt (market value of debt is unavailable) and the denominator is the book value of total assets.

R&D. In papers that study firms' corporate governance scores, growth opportunities is often considered one of the most important firm-specific factors in whether or not a firm adopts good governance (e.g., Durnev and Kim (2004), and Doidge, Karolyi, and Stulz (2004)). Firms that rely more on research and development, as compared to other firms, can be viewed as growth firms. This, in and of itself, implies that R&D intensive firms require significant monitoring (see our discussion of market-to-book ratio of assets above). Note also that R&D represents discretionary spending. Such expenditures require monitoring. Himmelberg, Hubbard, and Palia (1998) find a positive relationship between a firm's ownership concentration and the firm's R&D spending, consistent with this hypothesis. With regard to board size and structure, Lehn et al. (2003) suggest that growth firms need smaller boards that act nimbly. However, they also feel that growth firms benefit from *inside* directors, *not* independent outside directors, as growth firms need those familiar to its growth prospects to effectively monitor the firm. Coles et al. make the same predictions with regard to board size and composition. Finally, another way of looking at R&D intensive firms is that they are riskier firms that require specialized knowledge to monitor them (Klein (1998)). As such, inside-directors may be better than outside directors. Note that this argument is similar to those that contend that inside-*ownership* can benefit risky firms (a la Demsetz and Lehn (1985)). R&D-to-total assets is our measure of a firm's R&D intensity.

Firm size. The larger the firm, the greater is the cost of obtaining a given fraction of ownership. Therefore, a negative relationship between firm size and ownership concentration simply reveals wealth constraints. Thus, firm size could be viewed as an important control variable for regressions on ownership concentration. For board size and composition, however, firm size may be a key firm-specific explanatory variable. For board size, Lehn, et al. (2003) contend that larger firms need more, not fewer, directors

because larger firms are engaged in higher volume and more diverse activities. That is, they need more eyes to mind the store. Others have previously made similar arguments (e.g., Booth and Deli (1996)). For board composition, Lehn, et al. (2003) contend that larger firms need more, not less, board independence, as larger firms have fewer large shareholders and greater cash flows, both of which potentially causes agency costs to be quite significant. We use the log of total assets for our firm size measure.

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Table 1. Corporate Governance Variables

This table reports the countries used in our study, the number of firms for each country, and the country's shareholder rights index and enforcement index. The indices measure country-level corporate governance. The source of the law indices data is LaPorta, Lopez-de-Silanes, Shleifer, and Vishny (1998). This table also presents within-country summary statistics of firm-level corporate governance variables for the year 2000. Ownership Concentration is the percent of shares held by the firm's five largest shareholders. Board independence is a percentage of the firm's directors that are independent directors. Board size is the firm's number of board members. Means and (standard deviations) are reported.

| Country | n | Country-Level Governance | | Firm-Level Governance | | |
		Shareholder Rights Index	Enforcement Index	Ownership Concentration	Board Independence	Board Size
Belgium	7	0	9.5	45.21 (-13.8)	18.63 (-11.2)	18.29 (-5.4)
Denmark	2	2	10	17.55 (-10.7)	0 0	13.5 (-3.5)
Finland	4	3	10	21.48 (-27.5)	0 0	9 (-1.8)
France	39	3	8	26.96 (-26.7)	14.98 (-19.4)	15 (-4.2)
Germany	23	1	9	27.85 (-22.2)	0 0	26.13 (-3.8)
Greece	3	2	7	0 0	0 0	13.67 (-4.7)
Ireland	4	4	8.75	4.88 (-5.8)	64.41 (-11.7)	13.5 (-1.3)
Italy	22	1	6.75	31.43 (-24.8)	4.84 (-10.37)	15.59 (-4.5)
Netherlands	19	2	10	23.33 (-22.5)	0.03 (-0.1)	12.68 (-3.5)
Portugal	3	3	5.5	18.38 (-22.9)	0 0	12.67 (-4.7)
Spain	9	4	6.25	12.39 (-22.5)	22.9 (-20.1)	21.33 (-7.1)
Sweden	12	3	10	32.48 (-23.1)	0 0	11.25 (-1)
Switzerland	13	2	10	20.06 (-25.2)	0 0	10.08 (-2.2)
UK	69	5	10	10.43 (-17.5)	76.05 (-29.2)	12.36 (-2.9)

Table 2. Firm-Specific Control Variables

This table presents summary statistics of firm-specific variables. Risk is the standard deviation of the firm's stock annual stock returns from the years 1997-2000. Leverage is the firm's total debt to total assets ratio during the year 2000. M-to-B is the firm's market-to-book ratio during the year 2000. R&D is the firm's ratio of R&D expenditures to the total book value of assets for the year 2000. Firm size is the firm's book value of total assets (in millions of U.S. dollars) during the year 2000. Means and (standard deviations) are reported.

Country	n	Risk	Leverage	M-to-B	R&D	Firm Size
Belgium	7	0.29	0.23	1.13	0.02	6.22
		(-0.18)	(-0.22)	(-0.77)	(-0.03)	(-1.72)
Denmark	2	0.46	0.32	2.36	0.07	10.02
		(-0.1)	(-0.35)	(-2.43)	(-0.09)	(-2.8)
Finland	4	1.27	0.32	3.86	0.03	7.78
		(-1.18)	(-0.22)	(-5.12)	(-0.06)	(-0.36)
France	39	0.43	0.27	1.28	0.01	5.73
		(-0.3)	(-0.14)	(-1.56)	(-0.02)	(-1.55)
Germany	23	0.39	0.25	1.24	0.03	10.12
		(-0.23)	(-0.2)	(-1.45)	(-0.05)	(-1.8)
Greece	3	0.72	0.14	1.33	0	3.09
		(-0.34)	(-0.16)	(-1.54)	(0)	(-1.81)
Ireland	4	0.46	0.31	1.08	0.01	10.37
		(-0.18)	(-0.08)	(-0.87)	(-0.02)	(-1.26)
Italy	22	0.72	0.32	1.46	0	2.73
		(-0.62)	(-0.17)	(-1.62)	(-0.01)	(-1.59)
Netherlands	19	0.55	0.29	1.88	0.02	8.98
		(-0.5)	(-0.17)	(-1.27)	(-0.03)	(-1.82)
Portugal	3	0.33	0.36	0.96	0	4.68
		(-0.2)	(-0.06)	(-0.3)	(0)	(-0.86)
Spain	9	0.41	0.39	0.91	0	5.46
		(-0.16)	(-0.07)	(-0.25)	(0)	(-1.41)
Sweden	12	0.46	0.27	1.65	0.01	8.6
		(-0.31)	(-0.18)	(2.34))	(-0.01)	(-1.98)
Switzerland	13	0.37	0.26	1.4	0.02	10.52
		(-0.19)	(-0.17)	(-1.11)	(-0.03)	(-1.62)
UK	69	0.37	0.3	1.65	0.01	9.62
		(-0.2)	(-0.2)	(-1.65)	(-0.04)	(-1.61)

Table 3. Law Sorted Evidence

This table presents governance summary statistics by law quality. Panel A shows subsample means when the sample is separated into three groups based on the Shareholders Rights Index. Panel B shows subsample means when the sample is separated into three groups based on the Enforcement Index. Ownership Concentration is the percent of shares held by the firm's five largest shareholders. Board independence is a percentage of the firm's directors that are independent directors. Board size is the firm's number of board members. F-values indicating statistically significant differences among the three subsamples are also reported. ** indicates statistical significance at the 1 percent level.

Panel A: Shareholder Rights Index			
Highest Shareholder Rights Index (n=69)	10.43	76.05	12.36
Medium Shareholder Rights Index (n=71)	24.13	14.76	14.65
Lowest Shareholder Rights Index (n=89)	26.83	2.67	16.99
F- value	11.43**	269.55**	14.18**
Panel B: Enforcement Index			
Highest Enforcement Index (n=119)	16.26	44.1	11.96
Medium Enforcement Index (n=34)	28.72	11.41	23.03
Lowest Enforcement Index (n=76)	25.12	11.8	15.78
F-value	5.72**	25.65**	90.36**

Table 4. Ownership Concentration Regressions

This table shows Tobit regression results when Ownership Concentration is the dependent variable. Ownership Concentration is the percent of shares held by the firm's five largest shareholders. The shareholder rights index and enforcement index come from LLSV (1998) (or see our Table 1). Firm Risk is the standard deviation of the firm's annual stock returns from the years 1997-2000, less the country's median firm risk. Firm's industry-adjusted leverage is the firm's total debt to total assets ratio during the year 2000, less the industry median leverage ratio, less the country's median industry-adjusted leverage ratio. Market-to-book ratio is the firm's market-to-book ratio during the year 2000, less the country's median market-to-book ratio. Firm size is the firm's book value of total assets (in U.S. dollars) during the year 2000, less the country's median firm size. Board independence is a percentage of the firm's directors that are independent directors. Board size is the firm's number of board members. Industry dummy variables are also included in the regression models. The regressions' parameter estimates and (standard errors) are presented. ** and * denote statistical significance at the 1 and 5 percent levels, respectfully.

	Prediction	Model 1	Model 2	Model 3
Intercept		31.00**	27.70**	26.73**
		(-10.44)	(-10.24)	(-5.85)
Shareholder Rights Index	(-)	-5.17**	-5.05**	
		(-1.01)	(-1.00)	
Enforcement Index	(-)	0.21	0.91	
		(-1.22)	(-1.21)	
Firm Risk	(+)		5.28	4.43
			(-4.63)	(-4.66)
Firm's Industry-Adjusted Leverage	(?)		0.3	3.3
			(-8.56)	(-8.6)
Firm's Market-to-Book Ratio	(?,+)		2.06	1.71
			(-1.13)	(-1.13)
Firm's R&D	(+)		-156.45**	-126.27*
			(-51.52)	(-51.49)
Firm Size	(-)		-1.85	-2.35*
			(-1.22)	(-1.2)
Board Independence	(-)			-19.18**
				(-4.05)
Board Size	(-)			0.06
				(-0.27)
Industry Dummies		yes	yes	yes
# of Observations		229	229	229
Log Likelihood		5.05	4.6	4.48

Table 5 Board Independence Regressions

This table shows Tobit regression results where Board Independence is the dependent variable. Board independence is a percentage of the firm's directors that are independent directors. The shareholder rights index and enforcement index come from LLSV (1998) (or see our Table 1). Firm Risk is the standard deviation of the firm's annual stock returns from the years 1997-2000, less the country's median firm risk. Firm's industry-adjusted leverage is the firm's total debt to total assets ratio during the year 2000, less the industry median leverage ratio, less the country's median industry-adjusted leverage ratio. Market-to-book ratio is the firm's market-to-book ratio during the year 2000, less the country's median market-to-book ratio. Firm size is the firm's book value of total assets (in U.S. dollars) during the year 2000, less the country's median firm size. Ownership Concentration is the percent of shares held by the firm's five largest shareholders. Industry dummy variables are also included in the regression models. The regressions' parameter estimates and (standard errors) are presented in Panel A. Panel B shows the same models as Panel A but includes an additional explanatory variable Board Law Dummy, which is equal to 1 if the country is Belgium, Denmark, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal, Spain, and the U.K, and 0 otherwise. ** and * denote statistical significance at the 1 and 5 percent levels, respectfully.

Panel A:

	Prediction	Model 1	Model 2	Model 3
Intercept		-0.52**	-0.50**	0.30**
		(-0.12)	(-0.12)	(-0.06)
Shareholder Rights Index	(+)	0.17**	0.17**	
		(-0.01)	(-0.01)	
Enforcement Index	(+)	0.03**	0.03**	
		(-0.01)	(-0.01)	
Firm Risk	(?,-)		-0.06	-0.06
			(-0.05)	(-0.08)
Firm's Industry-Adjusted Leverage	(?)		0.14	0.08
			(-0.1)	(-0.14)
Firm's Market-to-Book Ratio	(-)		-0.01	0.01
			(-0.01)	(-0.02)
Firm's R&D	(-)		1.03	-0.22
			(-0.59)	(-0.86)
Firm Size	(+)		-0.02	0.02
			(-0.01)	(-0.02)
Ownership Concentration	(-)			-0.01**
				0
Industry Dummies		yes	yes	yes
# of Observations		229	229	229
Log Likelihood		40.49	25.52	3.61

Panel B:

	Prediction	Model 1	Model 2	Model 3
Intercept		-1.05**	-1.03**	0.04
		(-0.13)	(-0.13)	(-0.08)
Shareholder Rights Index	(+)	0.15**	0.16**	
		(-0.01)	(-0.01)	
Enforcement Index	(+)	0.07**	0.07**	
		(-0.01)	(-0.01)	
Firm Risk	(?,-)		-0.06	-0.07
			(-0.05)	(-0.07)
Firm's Industry-Adjusted Leverage	(?)		0.08	0.02
			(-0.09)	(-0.14)
Firm's Market-to-Book Ratio	(-)		-0.01	0.02
			(-0.01)	(-0.02)
Firm's R&D	(-)		0.58	-0.46
			(-0.54)	(-0.83)
Firm Size	(+)		-0.02	0.02
			(-0.01)	(-0.02)
Ownership Concentration	(-)			-0.01**
				0
Board Law Dummy	(?)	0.33**	0.33**	0.30**
		-0.05	-0.05	-0.07
Industry Dummies		yes	yes	yes
# of Observations		229	229	229
Log Likelihood		48.39	31.66	5.1

Table 6. Board Size Regressions

This table shows OLS regression results where Board Size is the dependent variable. Board size is the firm's number of board members. The shareholder rights index and enforcement index come from LLSV (1998) (or see our Table 1). Firm Risk is the standard deviation of the firm's annual stock returns from the years 1997-2000, less the country's median firm risk. Firm's industry-adjusted leverage is the firm's total debt to total assets ratio during the year 2000, less the industry median leverage ratio, less the country's median industry-adjusted leverage ratio. Market-to-book ratio is the firm's market-to-book ratio during the year 2000, less the country's median market-to-book ratio. Firm size is the firm's book value of total assets (in U.S. dollars) during the year 2000, less the country's median firm size. Ownership Concentration is the percent of shares held by the firm's five largest shareholders. Industry dummy variables are also included in the regression models. The regressions' parameter estimates and (standard errors) are presented. ** and * denote statistical significance at the 1 and 5 percent levels, respectfully.

	Prediction	Model 1	Model 2	Model 3
Intercept		25.84**	25.96**	15.97**
		(-2.46)	(-2.41)	(-0.96)
Shareholder Rights Index	(-)	-1.10**	-1.21**	
		(-0.24)	(-0.24)	
Enforcement Index	(-)	-0.64*	-0.81**	
		(-0.29)	(-0.29)	
Firm Risk	(?,-)		1.07	1.25
			(-1.09)	(-1.2)
Firm's Industry-Adjusted Leverage	(?)		0.68	1.18
			(-2.02)	(-2.22)
Firm's Market-to-Book Ratio	(-)		-0.11	-0.32
			(-0.27)	(-0.29)
Firm's R&D	(-)		10.28	15.72
			(-12.15)	(-13.44)
Firm Size	(+)		0.95**	0.51
			(-0.29)	(-0.31)
Ownership Concentration	(-)			0.03
				(-0.02)
Industry Dummies		yes	yes	yes
# of Observations		229	229	229
Adj. R^2	0.2	0.24	0.08	
F-Statistic		8.00**	6.39**	2.61**

Table 7. Other Country-Wide Characteristics

This table shows various characteristics for the countries in our sample. Accounting Standards reflects the disclosure quality of the firms in each country (source: LLSV (1998)). % of Foreign Public Capital is the percent of total pubic capital raised outside the country (source: Doidge, Karolyi, and Stulz (2004)). The Primary Religion of each country is reported (source: Stulz and Williamson (2003)).

Country	Accounting Standards	% of Foreign Public Capital	Primary Religion
Belgium	61	72.2	Catholic
Denmark	62	54.9	Protestant
Finland	77	62.2	Protestant
France	69	69.8	Catholic
Germany	62	45.4	Protestant
Greece	55	63.5	Greek Orthodox
Ireland	n/a	68.6	Catholic
Italy	62	34.3	Catholic
Netherlands	64	92	Catholic
Portugal	36	31	Catholic
Spain	64	43.4	Catholic
Sweden	83	59.3	Protestant
Switzerland	68	57.5	Catholic
UK	78	68.7	Protestant

Table 8 Additional Country Factors: Regression Evidence

This table shows regression results when Ownership Concentration, Board Independence, and Board Size are dependent variables. Tobit is used to estimate parameter coefficients for the Ownership Concentration and Board Independence models. OLS is used to estimate the parameter coefficients for the Board Size model. Ownership Concentration is the percent of shares held by the firm's five largest shareholders. Board independence is a percentage of the firm's directors that are independent directors. Board size is the firm's number of board members. The Shareholder Rights Index and Enforcement Index come from LLSV (1998) (or see our Table 1). Accounting Standards comes from LLSV (1998) (or see out Table 7). % of Foreign Public Capital comes from Doidge, Karolyi, and Stulz (2004) (or see our Table 7). Protestant Dummy is a dummy variable equal to if the country's primary religion is Protestant, otherwise it is equal to zero. The country's primary religion information comes from Stulz and Williamson (2003) (or see our Table 7). Industry dummy variables are also included in the regression models. The regressions' parameter estimates and (standard errors) are presented. ** and * denote statistical significance at the 1 and 5 percent levels, respectfully.

	Ownership Concentration	Board Independence	Board Size
Intercept	-9.63	-0.13	46.79**
	(-27.72)	(-0.17)	(-3.81)
Shareholder Rights Index	-10.79**	0.11**	-1.91**
	(-2.51)	(-0.02)	(-0.35)
Enforcement Index	-1.99	0.001	-3.14**
	(-4.05)	(-0.02)	(-0.57)
Accounting Standards	0.91	-0.001	-0.14*
	(-0.49)	(-0.003)	(-0.07)
% of Foreign Public Capital	0.12	0	0.15**
	(-0.28)	(-0.002)	(-0.04)
Protestant Dummy	-0.1	0.06	10.03**
	(-8.76)	(-0.05)	(-1.24)
Industry Dummies	yes	yes	yes
# of Observations	225	225	225
Log Likelihood	-758.56	44.7	
Adj. R2			0.41
F-Statistic			14.87**

Table 9. Percent of Directors Selected by Shareholders Meeting

For each country, Panel A of this Table reports the mean percent of directors that were elected by a shareholders meeting. Standard deviations are reported in parenthesis. Panel B reports Spearman correlations coefficients between the percent of directors elected by shareholders meetings with the following variables: the firm's country shareholder rights index, the firm's ownership concentration, the firm's percent of independent directors to total directors, and the firm's board size. ** denotes statistical significance at the 1 percent level.

Panel A: Summary Statistics

Country	n	% of Directors Elected by Shareholders Meeting (std. dev. in parentheses)	
Belgium	7	100	0
Denmark	2	67.6	-7.2
Finland	4	100	0
France	39	95.8	-13.9
Germany	23	51.7	-10.7
Greece	3	100	0
Ireland	4	100	0
Italy	22	98.1	-5.5
Netherlands	19	36.8	-49.6
Portugal	3	100	0
Spain	9	100	0
Sweden	12	78.3	-12.5
Switzerland	13	98.3	-6.2
UK	69	96.4	-15.2

Panel B: Correlation Coefficients

	Shareholders Rights Index	Board Independence	Board Size
Percent of Directors Elected by Shareholders Meeting	0.32**	0.41**	-0.23**

Comments on "Shareholder Protection Laws and Corporate Boards: Evidence from Europe"

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The authors find that country-specific factors have greater explanatory power than firmspecific factors in explaining corporate board structure. They also find that European firms in countries with strong shareholder protection laws have (1) more independent directors, and (2) fewer directors.

LLSV (1998) indicated that firms in countries with poor investor protection have higher ownership concentrations. In the aspect of controlling shareholder, LLSV (1998) emphasizes the corporate governance mechanism as a substitute for poor legal protection.

However, this paper focuses on the aspect of minority shareholders, which makes this paper differentiable from the previous study. They argue that 'good' shareholder laws and 'good' boards bust be complements. In other words, corporate boards in countries where the law supports board oversight and actions are more likely to be effective.

Given this argument, they empirically examine the board independence and board size across 14 European countries with different qualities of shareholder laws. The main hypotheses to be jointly tested are (1) minority shareholders are 'good' boards, and (2) boards with few members and independent members are 'good' boards.

Overall, this paper raises an important issue in terms of investor protection, and focuses on an interesting question, of which empirical examination provides a reasonable result. Thus, I think this paper is publishable in your journal, with minor revisions.

The comments for minor revisions are as follows:

1. It would be helpful for readers to provide more convincing argument or evidence explaining why 'good' boards are featured by fewer directors. This paper provides some explanation for the argument. However, readers still can have question on the issue.

2. Sample size issue: 7 countries of 14 sample countries have observations fewer than 10. If possible, the authors can increase the number of observations in the countries. If the additional data work is limited, at least, justify why the reported result can be robust even in the limited sample size.

3. There seems to be a small variation in the enforcement index in European countries. Justify why the reported result can be convincing, even with the small variation.
4. In the sample, 7 countries have zero Board independence variables. The variation mainly comes from board size and ownership concentration. Thus, the reported result might reflect the fact that firm level board size and ownership concentration has a little variation in the firm-level of each country. Provide an explanation on this issue.
5. The paper provides the country factor regressions without firm-level factors. To confirm the comparison result, it can be more convincing to run regressions with both country factors and firm-level factors, and check the relative economic implications of the coefficients.

Corporate Distress and Restructuring Policy of Korea SMEs : Role of Credit Guarantee Scheme

By

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. Introduction

Korean small and medium-sized enterprises (SMEs) are at a crossroad. On average, SMEs have been experiencing a secular downturn in their financial health and business profitability. From a business cycle perspective, the current difficulties faced by the SMEs are to some extent understandable: weak domestic consumption since early 2003, on top of recent price hikes in raw materials like oil and steel have placed many SMEs in a "nowhere-to-go" situation in terms of both revenue and cost. More seriously, this sector faces structural challenges: first, a relative underperformance of SMEs in productivity and profitability to large corporations attributable to a lack of innovation capacities, second, restructuring following the 1997-98 financial crisis has resulted in inefficient factor utilization, and third, emergence of fiercely growing competitors like Chinese counterparts. In addition, benign financial assistance offered by the government to SMEs such as public credit guarantee program has only provided temporarily relief. In the long run, it has been more detrimental, for it has gradually eroded the competitiveness, self-independence, and viability of those firms receiving assistance.

Despite structural problems deeply rooted in Korean SMEs, the sector has been less restructured even amid the wave of massive corporate restructuring efforts undertaken after the crisis. To prevent contagion of defaults among the SMEs, the government has offered various bailout programs such as additional credit guarantees, structured financing instruments, etc. Debt restructuring of large corporations has also created a favorable financial environment for SMEs: financial institutions have tried to provide more funding than before.

This paper will examine where the current distress among Korean SMEs stems from after briefly laying out the overall landscape of the sector. The questions posed include: how serious is the distress among SMEs relative to large companies?; has the differentiation of corporate performance among SMEs, or the so called polarization between good and bad performers, deepened over time?; to what extent has the distress persisted?; and, is the distress a structural problem or just a business cycle phenomenon? After answering to these questions, this paper will discuss the main issues and challenges ahead in restructuring the troubled SMEs, focusing on the credit guarantee system and bank-led corporate workout program for rehabilitating pinched but viable firms. Finally, it will

suggest policy recommendations for expediting the restructuring of SMEs, considering existing institutional obstacles.

II. Korean SME Sector

1. Overview

The relative importance of small and medium-sized businesses is high in Korea like other northeast Asian countries. As of the end of 2003, about 3 million SMEs were operating businesses, employing 12 million people (see <Table 1> and <Table 2>). Since large companies employ about 1.57 million workers, the SME sector contributes to 87% of the national work force. Out of all SMEs, small businesses with less than 50 workers amount to 2.91 million firms, from which micro businesses with less than 10 employees comprise 2.67 million of the total number of firms. Therefore, Korean SMEs are characterized as being "too small" on average. In terms of the number of entities, most SMEs are categorized in service industries such as wholesalers and retailers, restaurants, hotel and lodging, education, transportation, etc.

-<Table 1> here-

Despite the low share (10.8%), manufacturing firms show a relatively high share of employment (28.1%) compared to other industries. Especially, medium-sized manufacturing firms employ around 100 workers on average.[1]

The average number of employees per SME is only 4. It is by far the smallest, relative to that of Taiwan and Japan.[2] The declining trend in firm size in terms of the number of employees has been reinforced in the course of recent financial and corporate restructuring efforts following the 1997-98 crisis. The massive restructuring of financial institutions and large corporations lead to layoffs, where many of the workers were forced to find jobs in the SME sector or start their own businesses. In order to improve cost efficiency, large corporations have also spun-off businesses which have been classified as new SMEs due to sales turnover size and/or number of employees. Consequently, both the number of SMEs and their employees are growing substantially.

-<Table 2> here-

2. Polarization of Corporate Performances

Polarization is one of the most comprehensive and compact descriptions of the recent economic phenomena in Korea. Differentiations in various categories have taken place and have deepened over time, including the standards of living in Seoul Metropolitan areas vs. provincial regions; the compensation level and working conditions for permanent employees vs. temporary employees; the profitability of goods manufacturers vs. services suppliers; the corporate performances of export goods producers vs. domestically

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[1] Many economists and policymakers pay close attention to the medium-seized manufacturing firms in relation to taking SME policy measures. This paper also focuses on these firms in relation to corporate restructuring.

[2] Japan has slightly more than 4.7 million SMEs that hire about 30 million as of 2001, thus the number of employees per firm being 6.4. In Taiwan 1.1 million SMEs are run by 7.4 million employees. The average number of employees is 6.7.

consumed goods producers, etc. Also, the polarization in corporate performance between large corporations and SMEs should receive major policy consideration.

<Table 3> summarizes a comparison of the two sectors using the data collected from their financial statements. Briefly put, large companies have outperformed SMEs except for the period where structural reforms were implemented following the financial crisis. For large corporations, the business activity index measured by sales growth rate and profitability measured by net profits had been more brisk and solid prior to the crisis. During the restructuring period, large corporations had booked financial problems as losses, which helped in revitalizing them, and to regain profitability. However, SMEs on average have not gone through a period of restructuring. Rather, SMEs were financially assisted by government policy measures including extension of credit guarantees and other forms of financial support to lower their burden. As assistance was given to SMEs, policymakers were concerned about systemic risk bringing about a contagious failure of solvent but temporarily illiquid SMEs in the event of a credit crunch. Though the policies worked in successfully deterring a domino effect among marginal firms, it turned out that the profitability and, ultimately, long-term viability of SMEs, were eroded. As of 2003, the major financial ratios for large companies are shown in <Table 3> including financial soundness, robustness of profitability, and resilience to financial shocks relative to SMEs that have also achieved partial recovery from the crisis.

Despite the useful statistical summary describing the overall landscape of Korean SMEs, <Table 3> does not provide detail on the performance of SMEs. As a matter of fact, the business makeup of SMEs is fairly diverse. Some SMEs are comparable to large high-tech companies with global competitiveness and networks, while some are just small neighborhood grocery stores or restaurants. From the perspective of policymakers who are more concerned about social stability on top of economic efficiency, the differentiation among various groups of SMEs rather than the polarization between the SMEs and large corporations may be of more importance.

<Table 4> and <Table 5> provides a snapshot of core items showing the polarization among well- and poorly-performing SMEs in terms of the income statement and balance sheet, respectively. Return on equity (ROE) and debt-to-equity ratio are calculated from the annual financial statements of externally audited SMEs from 1991 to 2003.[3] The SMEs are divided into ten groups after being ordered by performance. Decile 1 for 1991 in <Table 4>, for example, stands for average ROE of the group of SMEs, where the highest ROE is 10% in that year. Decile 2 shows the average ROE of the firms in the 10 to 20 % range from top to bottom, and so on. The figures in <Table 4> illustrate the polarization among well and poorly performing SMEs: the performers in the top 10 % were able to enhance profitability while the bottom 10% extended even larger losses over time. Note also that the share of firms with capital being depleted has tended to increase for the last decade or so. As of 2003, 12.6% of the externally audited SMEs lost all equity, and more than 20 % of the firms with positive equity were making losses. This means that around 20 to 30 % of the SMEs are facing difficulty in the ability to generate profit, which in turn calls for major turnaround efforts.

<Table 5> tells a similar story about the need for debt restructuring. The performers in the top 30% that were financially sound look fairly good with the level of debt being less than their equity. Their equity base has even strengthened over time. In contrast, the bottom 10% performers display absolutely poor creditworthiness. Additionally, the firms in the 7 to 9 Decile show high indebtedness which would seriously undermine their

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[3] According to Korean legislation, common stock companies of which the assets exceed 8 billion Won, around 8 million US dollars, should be annually audited by accounting firms.

repayment capability provided their profitability does not improve greatly. Even though the debt-to-equity ratio has a tendency to decline among the under-performing group of firms, the speed of improvement appears slower than well-capitalized firms.

Other statistical data not displayed here but reported in Kang (2004d) echo similar sounds of polarization taking place among the SMEs. While overall sales growth rate has been gradually declining, the sales growth rate for under-performers has dropped remarkably. The interest payment costs out of the total sales have become negligible for top performers due to lower debt in addition to the recent low interest rates. However, the interest payment burden for under-performers has become even larger despite the historic low level of interest rates. All of the micro-data on the SMEs imply a desperate need for restructuring, on average, not only on the financial side but also business and employment aspects.

-<Table 3~5> here-

3. Persistence of SME Distress

Corporate distress tends to persist for quite a long time. In order to identify the dynamic pattern of performance among SMEs, this study calculates a decile transition matrix for financial ratios. The transition matrix is a table which summarizes the changes in decile ranking for a given period of time. The one-year ahead decile transition matrix of interest coverage ratio shown in the Panel A of <Table 6> displays the movement of firm's marginal density in each decile, ranked in order by the interest coverage ratio in the base year to the deciles of the ratio one year later. For example, the firms in Decile 1 in the current year will be located in Decile 1 with a probability of 60%, in Decile 2 with a probability of 18%, in Decile 3 with a probability of 6.1%, and so on, in the following year.

The transition matrices showing the interest coverage ratio in <Table 6> have some noteworthy features. First, the probabilities on the diagonal cells are higher than the other cells in the same row. The further away a cell is located from the diagonal line, the smaller the probability. Furthermore, the transition matrices look quite symmetric. All of the facts do not show of any drastic changes in the ranking of operating profits relative to interest expenses.

Second, high and low ranked firms tend to retain the same ranking with a higher probability than firms ranked in the middle. The firms in the top 10% and those in the bottom 10% are likely to remain in the top and bottom 10% in the following year with probabilities of 60.0% and 29.6%, respectively. In contrast, firms within the range of 40% to 80% are less likely to stay put, or with the probability of about 20%. This fact implies that the top and bottom ranked firms tend to maintain their relative profitability measured by interest costs, but the firms in the middle fluctuate in a volatile fashion.

Third, comparing the one-year ahead and three-year ahead transition matrices, we could infer that the current deciles for the firms are anticipated to remain the same over a longer period of time than what the first-order Markov model predicts. Suppose that the economy changes over time according to the law of motion following the Markov process. Mechanically, the three-year transition matrix could be obtained by multiplying the one-year matrix by three times. Similarly, we could also anticipate what would happen in ten years by ten-fold iterated multiplications. Then, the resulting hypothetical matrix would be close to the unit matrix with most numbers being almost equal to 8 to 10%, which means that a firm's ranking would be nearly unpredictable in ten years no matter how well or poorly a firm was performing now. The phenomenon does not, however, occur in the real world. The persistence of ranking implies that corporate performance does not depend a great deal on recent activities and the ever-lasting characteristics of firms have influenced

on the current results in a cumulative way. To interpret the reasoning in a slightly different manner, we could argue that distressed firms should carry out large-scale changes in their policies and approaches to revitalize themselves in a short period of time.

Fourth, it is very difficult for those experiencing losses to regain profitability in the short run. More than 50% of the firms which recorded operating losses are prone to continue the trend in the following year. According to Kang (2004d), more than three quarters of the SMEs which have depleted their own capital entirely do not have a positive equity base in the following year. Note also that these figures are underestimated since the firms that defaulted or shut down are not included in the sample.

-<Table 6> here-

4. Causes of SME Distress

As shown previously, financial distress in the SME sector has been growing over the last decade. This tendency has been intensified by the recent unfavorable macroeconomic environment such as a decline in consumption demand for almost two years due to the consumer credit bubble bursting and emergence of China whose enterprises are direct competitors to Korean counterparts domestically and overseas. The effects have been very immediate. Many SMEs have lost market share, which is the most often cited cause for distress according to surveys. Indeed, declining sales is the number one reason driving corporate difficulties. Some other causes include the inability to collect trade receivables or default of counter-parties that are liable to the sellers (see <Table 7>).

-<Table 7> here-

The survey results, however, do not address the fundamental causes in that the survey describes superficial and immediate factors which directly affect the performance of businesses. That is to say, other underlying factors seem to exist that ultimately weakens sales capability and reinforces credit risks. In general, businesses face uncertainties from all directions and, thus, the core competency lies in managing these various risks. As the survey shows, since the causes for the distress reveal the inexperience and inability of SMEs to cope with unexpected but foreseeable events, the problems affecting the bottom-line at SMEs stem from a lack of management skills and competencies.

In addition, the absence of financial instruments and institutions that allow SMEs to manage risks worsens the situation. In order to properly manage the risks associated with counter-party defaults, collection of credit receivables, asset price changes, etc., enterprises should be provided with financial facilities and vehicles like credit insurance, outsourced debt collection services and financial derivatives markets. The demand for these services is even more desperate at SMEs that lack in-house expertise and resources to manage risks. However, the market offering these financial services and products has not yet been well developed in Korea. Briefly, there are two main reasons. First, Korean financial markets have not yet fully matured to accommodate the diverse range of needs for risk management. This problem would be easily addressed once competition in the financial markets for exploiting arbitrage opportunities, if any, is triggered. A more serious problem lies in the second reason: government intervention in SME financing. The efforts taken by the government to remove the financial difficulties of SMEs has distorted the development of market-friendly financial services. For instance, the publicly supported credit guarantee program lowers the cost of financing for SMEs compared to private financial arrangements, in which the market is crowded. Also, managers at SMEs to some extent expect to be given preferential treatment and, therefore, take the assistance for granted. Consequently, the

government's over-involvement may have weakened the development of a well-functioning financial market, as well as, increasing the over-dependency of SMEs on government policy considerations. The Korea's SME credit guarantee system and its importance in corporate restructuring will be explained more in detail in Chapter 3.

More fundamentally, productivity in the SME sector has not improved as much in comparison with that of large companies. The Korea Development Institute (2003), for example, reports large evidence that the corporate distress experienced at SMEs is highly likely to stem from the structural problems, or stagnant productivity and dwindling profitability. [Figure 1] displays prominent productivity differences in terms of plant size. It is found that larger plants recorded higher productivity during the period from 1985 to 2001, and that the gap between large and small plants has been widening. Analysis on the growth rate of labor productivity also showed a similar pattern: larger plants recorded higher growth rates. However, if the whole sample period is divided into three pieces, it is found that smaller plants showed higher growth rates in the first sub-period (1985-89). The trend reversed in the second sub-period (1989-97), until the gap widened in the third sub-period (1998-2001) when productivity growth rate was led mostly by large firms. [4] Therefore, the currently distressed SMEs account for the declining productivity and thus lower profitability

- [Figure 1] here -

III. SME Credit Guarantee Scheme

1. Characteristics of Korea's Credit Guarantee Scheme

The credit guarantee scheme in Korea was officially introduced in 1976 when the Korean Credit Guarantee Fund (KCGF) was established.[5] The primary and immediate objective of the scheme in Korea is to enhance the accessibility of SMEs to external financing like many other countries, but it ultimately targets for balanced development of the national economy between large and small corporations. The other credit guarantee fund or the Korea Technology Credit Guarantee Fund (KOTEC) was established in 1989, also aiming at contributing the national economy by providing credit guarantees to facilitate financing for new technology-based enterprises while promoting the growth of technologically strong SMEs and venture businesses.

Information asymmetry between lending financial institutions and borrowing SMEs and lack of tangible collaterals to secure creditors' confidence in borrowers' creditworthiness keep SMEs from mobilizing external resources with which to invest in prospective but risky businesses. The existence of fixed administrative costs in lending such as information gathering, credit evaluation, monitoring credit migration, etc., renders banks hesitant to supply funds for SMEs. On top of these general rationales for necessity of the credit guarantee scheme toward SMEs, Korea has used it as a microeconomic instrument in response to macroeconomic fluctuations, especially in bad times. For example, the supply of credit guarantee had been greatly increased in the course of corporate sector

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[4] KDI (2003) also report the differences of capital productivity and total factor productivity according to the size of plants. The results are analogous to the case of labor productivity.

[5] Before the establishment of KCGF, there was a credit guarantee scheme. The Credit Guarantee Reserve Fund System was founded in accordance with the Presidential Decree for the Industrial Bank of Korea in 1961.

restructuring after the outbreak of financial crisis in 1997. Unless credit guarantee had not alleviated financing difficulties of the SME sector, the restructuring focused on large companies might have brought about massive failures in this sector.

Economic justification for the public credit guarantee is that the social return on the recipient firm would be higher than its private one once credit guarantee is provided at the price below its inherent credit risks. The importance of SMEs such as substantial share of employment, innovating capacities driving an economy more dynamic and vigorous, etc., makes policymakers pay close attention to financial assistance sponsored by public resources. Thus, the level of assistance might be different across countries, depending on the contribution of SMEs to national economy, structure of economic system, economic development stage, social consensus on risk sharing and so on.

As of the end of 2004, the outstanding balance of credit guarantee supplied reached 47.1 trillion won, or 6.1% to nominal GDP (see [Figure 2]). The ratio was 7.6% at the hike of corporate sector restructuring in 2001 and then has declined ever since, but the absolute amounts of credit guarantee have not been seriously adjusted yet. As shown in [Figure 3], the Korea's credit guarantee balance relative to GDP size is one of the highest levels in the world with that of Japan. Just after the Japanese government introduced the Stability Special Guarantee Program, the outstanding balance to GDP ratio was highest at 8.5% in 1999 but it has been gradually curtailed to 5.9% at the end of fiscal year 2004. Taiwan, another major country that runs a publicly sponsored credit guarantee system, has fairly large amounts of credit guarantee to SMEs recently, but it remains less than 3% to GDP. Except for the three North East Asian countries, these ratios are normally less than 1% at most in most countries regardless of the type of credit guarantee system, either public credit guarantee or mutual credit guarantee.

- [Figure 2] here -

- [Figure 3] here -

Why is it in Korea there are so much supplies of the SME credit guarantees? By and large there are four reasons. First, Korea is one of the countries that have grown most expeditiously. During the high-powered growth era profitable investment opportunities are not rare so that high financial leverage tends to pay. Credit guarantee plays an instrumental role in increasing external debt financing with which firms exploit the favorable business opportunities when capital is not sufficiently accumulated and its intermediation is not properly functioning due to the lack of efficient financial markets.

Second, abundant supply of credit guarantee could be understood by the fact that virtually almost all credit risks had been shared by the state in the economic development periods. Since the credit risks are shouldered by the government via either through *de facto* nationalized banks or implicit institutional arrangements, creditors did not assess risks in a great deal. Despite the high likelihood of mispayment due, large companies had been accessible to borrowing loans from banks or issuing bonds in the market with the ultimate loss sharing by the state. The type of state risk sharing is rather explicit in the SME sector: the SME credit guarantee scheme. Thus, large volume of SME credit guarantee does not look odd in view of risk sharing system in Korea.

Third, the policymakers that do not acquiesce in long lasting business recessions have tended to utilize the credit guarantee scheme as a salvage tool during recessions. In principle, this policy should not be badly criticized since the scheme has a flavor of counter-cyclical measures to reduce business cycle fluctuations. The problem in Korea, however, lies in the fact that credit guarantees supplied to respond to recessions have not been

contracted yet in favorable times. Therefore, the outstanding balance has always been growing over time as seen in [Figure 2].

The dramatic increase for the last seven years is not just a business cycle measure. It is called rather naturally, a crisis resolution tool. During the surge in 1998, the additional guarantee of 15.7 trillion won, is absolutely true to this assertion. It is also a right policy reaction to the crisis. But the guarantee amounts did not decrease even when the crisis became quite resolved; we observe another surge in 2001 that saw 12.3 trillion won in guarantee, at least part of which seems to serve policymakers' incentives to maintain macroeconomic business conditions and to hide the failures of venture policies in the late 20th century.[6]

Forth, the generous SME financing has been widely accepted by the nation because the sector has been viewed as isolated in economic development along with agriculture and fishery. The sympathy toward SMEs has prevailed since the late 1970s and strengthened in the wave of political democratization in the mid 1980s. In some respect, SME credit guarantees have been recognized as a compensation for the earlier sacrifice. The arguments for policy to reduce the SME financing have seemed politically infeasible until quite recently.

2. Eligibility for Credit Guarantee

Inherent problems in the Korea's credit guarantee scheme have been widely argued by domestic researchers, policymakers and practitioners but have not received international attention until IMF (2004) submitted a report asking for a structural change in its size and operation. In contrast to the large companies that engaged in financial deleveraging in the aftermath of the crisis, Korean SMEs were not pushed to reduce overcapacity in spite of dwindling productivity and profitability as shown in Chapter   . It was pointed out that cheap credits to SMEs led by the generous credit guarantee scheme are located at the center of the criticism against sluggish SME restructuring. IMF suggested that Korea should reduce the ratio of credit guarantee amounts to GDP by one percentage point for the next five years and that the scheme should be changed in a more market-friendly way such as levying higher premium and lowering loan guarantee coverage ratio.[7]

Theoretically, public credit guarantee programs face challenges to justify whether it is socially desirable. As Vogel and Adams (1997) argue, a variety of possible credit market imperfections do not constitute a sufficient justification for establishing a credit guarantee program. Should distortions in the credit market stem from information asymmetry, the *first best* policy would be the one that directly focuses on the main cause: supplying and upgrading information needed for financial institutions which make loans to SMEs.[8] Credit

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[6] The financial restructuring after the crisis makes policymakers less capable of intervening in the loan- supply decision of private banks. The only instrument left at the Ministry of Finance and Economy is the two credit guarantee funds. In order to sustain business cycles that toped down after the burst of venture bubbles, the government presumably tried to pump credits to SMEs by way of increasing credit guarantees. Banks were also incentive compatible with this government policy because they had difficulties in managing assets by losing major clients, or large companies, that opted out for issuing bonds in the direct capital markets.

[7] Currently the guarantee premium levied on the recipient firms ranges from 0.5 percent to 2.0 percent while its average is 1.07 percent in 2004. In view of the high default rates reaching above 6 percent, the premium seems significantly underpriced. The loan guarantee coverage ratio, or 86 percent on average in 2004, is relatively low in comparison with that in many other OECD countries. Levistsky (1997) defines international best practice as the coverage ratio of 60 to 70 percent.

[8] In this respect recent policy introduced by the Korean government to establish a SME specialized

guarantee could be at most a *second best* policy in the sense that it does not target for fundamental causes but relieves their side effects.

Still, there remain second best arguments for interventions. For the credit guarantee programs to be second best, it is necessary to demonstrate that the first best remedy is not available and that they are the best among other alternative measures. Also the credit guarantee programs should actually enhance social welfare as they might introduce other imperfections in the process of reducing problems caused by information asymmetry. For example, the existence of generous public credit guarantee programs could cause malfunction of private transactions in the financial markets and deter emergence of innovative financial commodities. In such a case, the long-term economic efficiency might be seriously eroded.

Among various features regarding the evaluations of Korea's credit guarantee scheme, this article scrutinizes the performance of guaranteed SMEs to get advice and insights for future reforms at the micro level. [Figure 4] shows the performance of guaranteed firms depending on the number of years of credit guarantee. Panel A shows that operating profits to sales ratio in the non-guaranteed has outperformed that in the guaranteed over the entire periods. Among the guaranteed, as the guarantee period increases, the ratio tends to deteriorate, especially the ones with more than ten years of guarantee. Panel B shows the comparison in borrowing to asset ratio. The overall performance is similar: the non-guaranteed are less indebted and the longer guarantee period, the higher external borrowing.

- [Figure 4] here -

[Figure 5] illustrates the two ratios according to the asset size of firms. As seen in Panel A, fairly large SMEs with the asset of over 50 billion won are very profitable compared with the non-guaranteed. In contrast, the smaller firms with the asset of less than 20 billion won performed very badly, especially in the new millennium. This observation seems to reflect polarization among SMEs discussed in Chapter 2. The borrowing to asset ratio in Panel B also echoes the relative outperformance of larger SMEs.

- [Figure 5] here -

These empirical findings suggest the following implications. First, the credit guarantee scheme may not improve the corporate performance. Second, its effectiveness has become less stringent recently. Third, the periods of credit guarantee should not be longer in consideration of performance, let alone theoretic justification.

3. Recent Reforms on Credit Guarantee Scheme

As discussed previously, the necessities for reforming credit guarantee scheme in Korea are full-fledged in various respects. First of all, Korea has already passed through an

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credit bureau, Korea Enterprise Data Co., Ltd., is classified within the first best policies. The controlling shareholder is KCGF while KOTEC, the Industrial Bank of Korea, the Korea Development Bank, the Small Business Corporation, Korea Federation of Banks, and several other banks pay the equities. It gathers SME information from KCGF, KOTEC and other various financial institutions, compiles into KED database and provides financial institutions and other business enterprises with credit reports of individual SMEs.

expeditious growth phase in economic development so that credit risk management is more relevant than further credit expansion. The empirical analysis on guaranteed firms implies that long-term guarantee does not help the recipient firms improve performance over time. There seem to exist many established firms among medium-sized businesses that have already resolved information asymmetry and made comparable profitability with non-guaranteed firms. As such, credit guarantees may be viewed as just a subsidy to non-eligible entities. Also, the excessive emphasis on public assistance toward the economically weak distorts financial markets. Some government officials raise the issue of cost effectiveness, arguing for reducing the contributing amounts to KCGF and KOTEC from the national budget.

According to recent announcements by the Ministry of Finance and Economy, the scheme is to change recipient firms of loan guarantee with special considerations on innovation-oriented SMEs and new entrants. With the recognition that current credit guarantee amounts exceed socially desirable level, the government tries to adjust overall size, which does not necessarily mean uniform reduction in loan guarantees over the guaranteed firms. Significant cut in guarantee supply will be targeted for relatively large companies that banks have full incentives to assess and monitor credit risks for lending and established ones that have already resolved information asymmetry due to long-term relationship with banks. For example, the firms of which the annual sales turnover exceeds over 30 billion won and the ones that have received credit guarantee for more than 8 to 10 years will not be eligible any longer. Marginal firms in serious financial distress are also subject to termination of credit guarantees. Part of the reduction in credit guarantee amounts is supposed to be channeled toward technology-based small firms and new enterprises, of which the social returns are anticipated to be higher than private returns. This change has important implications for the Korea's SME policy to put more emphasis on potential entrants than existing firms. In this context, it is also consistent with the so called *Entrepreneurship Policy* prevalent in most European countries.

The blueprint for guarantee reforms also contains market-friendly operations. First of all, the average guarantee coverage ratio is planned to decrease over time for the purpose of triggering banks' incentives to manage credit risks over guaranteed firms. Obviously, banks' role in credit evaluation and monitoring is utmost important in reducing mispayments of the borrowers since the publicly sponsored guarantee funds are not incentive compatible with, and skillful enough for credit risk management. One of the most effective tools to align the incentives of guarantee funds consistent with those of banks is to make the latter shoulder more costs when the loans become sour.

But the lower loan guarantee coverage ratio may diminish the guaranteed loan amounts supplied because banks become less interested in providing loans with higher potential losses than before. This would be an unintended shock at least in the short run that may increase SME defaults, resulting in resistances to the reform. This scenario, however, is not highly probable in that banks are enjoying direct and indirect benefits from current system. As long as the reduction in loan guarantee coverage ratio is not drastic, banks would not be better off by deviating from the guarantee programs. If the government is to reduce the ratio up to the level of international best practices, or 60 to 70 percent, annual contribution by financial institutions should also be readjusted to a lower level.[9]

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[9] In Korea, banks must pay annual contributions to the two credit guarantee funds by law. The contributing amounts are in tandem with the corporate loan supply of each bank. Currently, the rate is 0.2% to KCGF and 0.1% to KOTEC. The existence of annual contribution by banks is a peculiar institution unlike Japan and Taiwan. Due to the contribution the loan guarantee coverage ratio could not be reduced down to the level of international best practices.

The guarantee premium that the guaranteed should pay is supposed to increase further. Over time the rate will be positioned between 1.5% and 2%, on average, from current 1.07%. More importantly, the differentiation among the guaranteed will be deepened commensurate with their creditworthiness. The ceiling of guarantee premium will be raised by 3.0%, in order to contain technology-based firms and start-up companies with high uncertainties and to put the penalty of long-term guarantee.

The aforementioned reform is closely related to the supply side of credit guarantee. In practice, this type of reforms is likely to confront aggressive resistances from the demanders that are used to the old regime. In addition, government should take burdens to correctly sort out the firms that are not eligible for guarantee. For example, presumably insolvent firms with guarantees should not be assisted any longer. It is quite difficult to exactly distinguish non-viable firms from viable ones. Under uncertainties, the government is exposed to committing errors such as supplying credit guarantee to non-viable companies (Type I Error) while withholding it to viable companies (Type II Error), then the government should be blamed for selection failure.

One of the potential way-outs is to extend guarantees to all incumbent users for longer periods, say 3 to 5 years, and to have them amortize the guaranteed loans until maturity. This method has many benefits. First, it helps not only the demanders but also the suppliers. Distressed but viable firms have a chance to get revitalized. Non-viable firms take part in loss sharing by paying back part of debts so that the final losses born by the guarantee funds will be lessened. Thus, it actually facilitates corporate restructuring in the distressed SMEs. Second, government officials and guarantee funds do not take on the burden to verify the viability of financially distressed firms. The verification responsibility lies with the firms. In this sense this method is more practically applicable. Third, the financially distressed and guaranteed firms do not find any substantial reason to reject this offer. Therefore, the credit guarantee reforms will face less resistance.

IV. Current Efforts to Restructure Distressed SMEs

1. Ways to Restructure Distressed SMEs

Corporate restructuring efforts aimed at rehabilitating firms consist of numerous types: debt restructuring, [10] employment downsizing, business reorganization and even management and governance reshuffling. Depending on the origin of difficulties, particular methods or some combination of methods are chosen to tackle the problems. In general, debt restructuring is a necessary component of most of the reform efforts, since signs of corporate distress surface when firms have difficulty in making repayments on debt. Accordingly, debt restructuring comes first in the turnaround process.

Despite corporate rehabilitation being the main ingredient, restructuring is often seldom sufficient in restoring profitability at distressed enterprises, especially when the underlying causes of distress stem from structural and operational aspects. The current Korean SMEs seem to fit this mold. As seen in the previous section, productivity and profitability at SMEs have been on a secular downturn over the last decade. Changes in the business environment such as the rapid growth of Chinese competitors and structural decline in domestic economic growth potentials have not been favorable to the SMEs. Although historic low interest rates have, for the time being, alleviated the financial burdens of SMEs,

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[10] Debt restructuring comprises maturity extension, interest relief, debt write-off, debt-to-equity conversion, etc.

once interest rates begin to rise their financial health will surely be undermined drastically. The unprecedented low interest rates also imply that restructuring debt passively, like debt relief or maturity extension alone, would not be effective enough to revitalize the problematic SMEs. An all out restructuring effort including more active debt restructuring like debt-to-equity swaps and business reorganization is required at many marginal enterprises.

In order to stress the importance of business restructuring at SMEs that face fundamental constraints, this study scrutinizes the operating profits of SMEs by using their revenue and cost components and ranking their correlation. The Spearman's rank correlation coefficient in [Figure 2] compares the ranking of firms by operating profits relative to total assets in the order of sales and interest costs relative to total assets, respectively. Among various items from the financial statements, the firms' ranking for operating profits correlates most highly with rankings for sales. The rankings for cost items weakly negatively correlate with rankings for operating profits. Furthermore, the interest cost ranking correlated with operating profits ranking turns out to be positive recently: the less interest costs, the higher operating profits. All of the observations combined imply that, in order to enhance profitability, more efforts need to be taken in reorganizing businesses rather than just relieving the debt burden. Without boosting sales via refocusing the main business and expanding the demand base, there is little hope of revitalizing the distressed SMEs.

2. Differences in Restructuring SMEs and Large Companies

The fact that the causes of the current distress at SMEs are more fundamental calls for expeditious restructuring main business lines rather than just cosmetically changing the financial structure of the firms. However, it is well known that painful restructuring is easier said than done: despite the long-term overall gains in economic efficiency, restructuring generally demands sacrifices, at least in the short-term, from relevant stakeholders. It also brings about inevitable wealth redistribution. Thus, a compatible incentive scheme in which every stakeholder would not be at least worse off by participating in the workouts is of practical importance. In this regard, we need to diagnose deeply buried complexities that keep not only the SME owners and managers but also creditor financial institutions from revealing any corporate distress and expediting turnarounds.

-[Figure 6] here-

Notwithstanding commonalities in restructuring SMEs and large companies, there also exist numerous specifics that apply when restructuring SMEs. Generally speaking, problematic SMEs are less likely to be revitalized. The reasons are manifold. First, they do not have a lot of intangible assets. Compared with SMEs, large companies invest more in research and development (R&D) and marketing to add more value in terms of intangible assets like goodwill, patent rights, sales network, etc. The SMEs' low level of intangible assets then implies that economic benefits gained through painful restructuring may not be rewarding. Second, the fact that the business size and scope of SMEs are smaller suggests they could experience difficulties in business and employment reorganization. Since SMEs specialize in at most a few business lines with a limited number of workers, large-scale downsizing of business lines and/or employment is neither feasible nor affordable. Third, SME restructuring is not cost effective in most cases. Even though the target firms for restructuring are small, there exist basic sunk costs once stakeholders determine to participate in the procedure. Also, there would be more uncertainties for distressed SMEs

relative to weak large corporations, thus asking for an even larger certainty equivalent premium. Forth, SMEs are less resilient to bad news. Once a small firm is known to be financially distressed and undergoing restructuring, their trading partners stop doing business using credit and creditors try to freeze or curtail available credit lines. In contrast, large companies are more likely to maintain marketing operations at a normal level even under financial hardship. Thus, large companies have a better chance of proceeding with restructuring while maintaining sales turnover.

On top of the inherent disadvantages of restructuring of distressed SMEs, the external conditions and incentive structure play a role in retarding their successful rehabilitation. Since SME failures are hardly related to systemic risks unless they are susceptible to contagion on a large scale, policymakers pay less attention to restructuring the sector from the perspective of economic efficiency. If they do, they are more concerned about social stability and individual welfare of the disadvantaged. The incentives of SME owners and managers work to keep them from taking part in the restructuring process up until the firms are about to be liquidated. Without the possibility of restarting the business, corporate failure is regarded as a personal failure. Then, it would be completely rational for them to be interfered as little as possible no matter how poorly the firm was performing. These behaviors are not checked and controlled by any other stakeholders due to a lack of a well-functioning monitoring and compliance system for SMEs.

3. Firm Size and Choice of Restructuring Methods

As mentioned above, SMEs are not a homogenous group. They consist of very diverse enterprises in terms of size, location, industry, degree of competitiveness and so on. Thus, choosing a restructuring strategy should be deliberate by considering a firm's characteristics. This section tries to specifically relate the firm size to restructuring methods.

By and large, SMEs are categorized into three groups in terms of size: relatively large firms whose total credit amount borrowed from financial institutions reach more than 30 billion Won, or close to 30 million US dollars; medium sized firms whose total credit range from 2 billion to 30 billion Won, or 2 million to 30 million US dollars; and, small firms whose total credit are less than 2 billion Won, or 2 million US dollars. In terms of restructuring, credit size matters. Because it constrains the potential reservation costs involved in restructuring. In other words, as the amount of credit borrowed from financial institutions is greater, the benefits that could be gained from restructuring is greater, since any form of restructuring involves a certain amount of administrative costs.

In the case of large SMEs under financial distress, the restructuring business attracts financial and strategic investors. In Korea, the representative investors targeting these kinds of opportunities, among others, are corporate restructuring companies (CRC) that were established after the financial crisis, according to the Industrial Development Act.[11] To illustrate the activities of CRC, consider the following hypothetical example. A typical profile of one of these large but distressed SMEs looks like this: a firm with an asset size of about 40 billion Won is financially constrained from borrowing more due to the high debt-to-equity ratio of 400% in spite of the firm's development of high technology materials. It is desperate to attract the equity needed to merchandise the materials to recoup the initial

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[11] In addition to CRC, there are many other restructuring instruments which have been activated in the course of recent financial and corporate restructuring. Corporate restructuring fund (CRF) and corporate restructuring vehicle (CRV) are some of examples. In that all of these financial arrangements follow market-friendly approaches, they are differentiated from the preexisting restructuring methodologies led by either government or banks. See Kang (2004a) more in detail.

investments. Here, a CRC can play a role. The CRC injects an equity capital of 10 billion Won and participates in the management of the firm with the initial owners. Once, business returns to normal, the CRC sells its equity back to the owners, and recoups its initial investment. This case offers a situation where financially distressed but operationally viable SMEs that are comparable in size to large companies could be reorganized by market forces.

The restructuring strategy for medium sized firms could be different since investors would not participate in corporate restructuring due low returns on investment. Instead, typically original credit grantors try to reorganize the viable part of firms with less active restructuring methods. One advantage of pursuing this type of restructuring for creditor financial institutions, usually banks, is that they have access to more information and debt restructuring instruments than outside investors. Since the banks have had a long relationship with the obligor, related administrative costs are smaller. If the firm needs to write-off debt or be given additional credit, the banks may help meet these needs once the assistance has proven to be effective. However, bank-led corporate restructuring efforts do not always achieve the best results because the benefits could be offset by the action of bankers who try to make up for their failures by not lending to prospective and creditworthy borrowers. Or, loan officers tend to evergreen the corporate distress in favor of their own incentives. Despite these shortcomings, bank-led corporate workouts offer the most feasible solution in most of the cases involving medium sized enterprises.

As for small enterprises under financial distress, an effective restructuring method does not exist because the benefits from restructuring do not seem large enough to cover the costs associated with it. In essence, credit extended to small enterprises is almost analogous with credit given to consumers. Considering this, passive restructuring methods like debt relief and maturity extension are the norm. When debt restructuring does not succeed in rehabilitating the firm, the remaining option seems to be liquidating the businesses.

4. Current Institutions for SME Rehabilitation

In restructuring the financially distressed medium sized enterprises, Korean policymakers are taking a close look at the corporate workouts scheme[12] that has proven to be a useful tool for turning around large corporations after the crisis. Basically, corporate workouts are collaborative efforts taken by creditor financial institutions and led by the main banks to relieve the debt burden of obligor firms and to return their businesses back to normal status. The scheme is not only effective but also inevitable when facing systemic risks, in which court-led reorganization or composition do not take into concerns of overall economic performance. For this reason, the adage of "Too-big-to-fail" has prevailed. Despite the drawback that this scheme undermines the equality of creditors at least in the short-run, it also has the potential to promote their individual interests in the long-run and to contribute to social and financial stability.

In Korea, the use of corporate workout scheme on distressed SMEs is driven by two reasons: benefits gained from cost effectiveness as explained above and Korea's intimate knowledge of the system. The experiences gained in the course of carrying out corporate restructuring following the crisis have endowed most banks with restructuring expertise and techniques. Many bankers have become accustomed to handling non-performing assets and harmonizing relevant stakeholders. Above all, they have benefited from the corporate workout program by having disposed of their own financial distresses. Thus, the

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[12] Regarding the procedures and performances of the corporate workouts for large corporations, see Lee (2000) and Kang (2004b), respectively.

corporate workout scheme is the first candidate for corporate rehabilitation programs in the case of SMEs as well.

Kang (2003b) provides strong empirical evidence that the key success factor of corporate workouts is simplifying the creditor structure. The reason is clear. Since the scheme is an out-of-court arrangement consisting of participating financial institutions based on a private agreement, harmonization among the creditors and the negligibility of outside credits from the agreement determine its performance. Consequently, the more simple the debt structure in terms of the number of creditors, the less administrative costs involved, hence the higher probability a firm has of being revitalized. This result is in accordance with the analysis done by Gilson, John and Lang (1990) which states that private workouts did not perform well in the U.S., because the creditor structure at companies is complicated due to the issuance of bonds.[13]

In order to successfully rehabilitate SMEs, it is imperative to encompass as many financial institutions as possible. The participation of KCGF and KOTEC, however, may be debatable, for they are not creditors legally, until they acquire indemnity rights after making subrogation payments on behalf of the guaranteed borrowers. That is to say, as long as the financially troubled firms are able to make interest payments, the funds do not need to share the losses. Looking at the issue from a different angle, however, these firms are doomed to fail without assistance. Additionally, the size of the losses even to the funds would be enlarged after the firms default. Even if the funds are not responsible for their revitalization in the ex ante sense, they are better off by taking part in the collaborative corporate workouts. The debate as to whether they should be included in the agreement or not with creditors had long been protracted. But, in June 2004 the funds were allowed to be included in the agreement.

The structure of the SME corporate workout scheme resembles that of the corporate workout for large corporations with minor adjustments which take into the specificities of SMEs. [Figure 7] summarizes the scheme's flowchart from beginning to the end. The workouts can be initiated by both the debtors and creditors. The firms facing financial difficulties may apply for a corporate workout with their main banks. Also, the main banks or the financial institutions of which the combined loans exceeding 25% of a firm's total debt may initiate a workout. After the workout application is submitted by an SME, the process of rehabilitation proceeds more rapidly than large company workouts and in-court corporate reorganization. Within seven business days, creditors hold the first meeting and decide whether they will provide the debtors with an automatic stay for debt collection. The debt is suspended for normally a month, and two months if due diligence is needed. And the suspension period may be extended for one more month based on approval from creditors holding 75% or more of the debt. During this period, the main banks prepare the restructuring plan that usually contains a range of options including debt relief, debt-to-equity conversion, additional loan provision, business restructuring, employment adjustment, etc. After an agreement is reached between the creditors' committee and the debtors,[14] the main banks implement the restructuring plan and monitor the progress periodically.

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[13] Asquith, Gertner and Scharfstein (1994) also find the consistent observation that the financially troubled firms issuing bonds publicly are more prone to file for Chapter 11 rather than being privately restructured out of court.

[14] When there exist opposing creditors against the restructuring plan while more than 75% of creditors approve it, the dissentient creditors may ask the creditors' committee for purchasing their credits of which the price is greater than the liquidation value. This arrangement is borrowed from the similar article in the Corporate Restructuring Promotion Act.

-[Figure 7] here-

One of the most distinguishing features of the SME corporate workout scheme is the treatment of incumbent owners and managers. No corporate owner and manager is willing to be subjected to reconstruction led by creditors even if the risk of default is imminent, but this type of behavior is even more striking in the SMEs. Also, changing management is quite costly from the creditors' perspective. To offer incentives and accommodate demands, the SME workout agreement contains a clause that allows incumbent managers to keep management right and the original owners to buy back converted equity from debt prior to other investors.

<Table 8> shows the firms participating in the SME corporate workout program as of April in 2005. Since the collaborative SME workouts commenced in the second half of 2004, the number of restructured firms in the program is just 30. Out of these collaborative workout firms, there is only one successful case and eight suspended cases. The workouts for the remaining firms are still under way. Most of debt restructuring is quite passive: maturity extension is the most popular and there is no case for debt-to-equity swap. In view of the statistics collaborative workouts are not effective yet.

<Table 8> also supplies information on internal workouts in which the main banks confidentially assist their troubled client firms in terms of debt restructuring. The internal workouts were popular even before the collaborative workout scheme was instituted. According to the number of firms being worked-out, internal workouts are preferred: 1,670 firms have been restructured within the program and 11% of them has successfully graduated from the internal workouts. But most of the cases are still under way so that it will take time to evaluate the performances of SME workouts.

-<Table 8> here-

V. Issues and Challenges in Restructuring SMEs

Because at least in the short-term restructuring takes a toll on most stakeholders, numerous factors both internally and externally deter them from taking early actions for corporate rehabilitation processes. Also, the institutional and systematic imperfections have delayed expeditious and effective restructuring. Consequently, financially stressed firms tend to fall in deeper operational trouble. This chapter concentrates on the main obstacles to restructuring SMEs, focusing on banks' incentive problems, institutional constraints and market imperfections.

1. Banks' Incentives

One of the most salient features among distressed Korean SMEs is that the actual occurrences of a corporate default are less frequent than what the data imply. As seen in the chapter 2, the financial and operational health of Korean SMEs has become so serious that currently 20 to 30% of the SMEs should have been under reconstruction. However, most financial indices on the SME sector look fine. As of the end of October 2004, the substandard SME loan ratio of commercial banks was 2.8%, which is an increase of 0.7%p from a year ago but it still does not hurt the banks' soundness. The dishonoring rate for trading bills issued by SMEs was 0.15% in December 2004, which does not send a bad signal, either.

Then, how should we treat the discrepancy over the health of SMEs between the financial data at the micro firm level and the aggregate indices of the sector? Before examining the way banks responded to SME distress, we need to keep in mind that Korea is experiencing a historic low in interest rates. As seen already in <Table 3>, the SMEs' average borrowing rate in 2003 was 6.57%, the lowest level ever, in which their share of interest costs out of sales was only 1.81%. Thus, as long as financially distressed firms were not asked to pay back the principals, they could still manage to make timely interest payments. This situation, however, is not sustainable, since as we recall, the cash flow at SMEs would not be able to fully keep up with the repaying schedules due to declining productivity and increasing competition.

Based on these rational expectations, banks are right to tightly manage the credit risks associated with SME lending. The problem lies, however, in inadequate implementation stemming from tension among bankers in the headquarter and branches. The bankers at branches are directed to intensely manage non-performing loans (NPLs) in the SME sector by evaluations of their performance and enforcing it. However, the bankers try to reduce the NPL ratio in the short run by all means. Sometimes they supply additional loans to insolvent debtors who are able to make interest payments, so called *financial pyramiding* or *kiting*. These behaviors absolutely go against the banks' long-term profits.

The banks' passive approach toward SME restructuring could also be due to the loss structure, which makes banks almost immune to SME defaults. By and large, 60% of SME loans are backed by collaterals and 25% by public credit guarantees. Only the remaining 15% of loans are purely based on credits but these types of loans are skewed toward extremely healthy companies. In the case of guaranteed loans provided by KCGF and KOTEC, these funds bear losses from loans up to 85%. Even with the remaining 15% of unguaranteed loans, the banks are in a better position compared to the funds, for which are notified of overdue interest payments only after two months. That is to say, the banks have plenty of time to guard against bad SME loans, which means they bear negligible losses in the ex post sense. Therefore, the banks are incentivized enough to run on financially distressed SMEs even if it is known that bankers at the branches acquiesce in hopeless evergreening.

How do we overcome the incentive problems at banks and their employees? Based on the premise that initiating restructuring of SMEs at an early stage is desirable from the perspectives of both financial institutions and taxpayers, financial supervisory authorities ought to begin singling out problematic but viable SMEs. In Korea, companies with credit from financial institutions exceeding 2 billion Won should be under review quarterly by the Financial Supervisory Service (FSS) according to the Corporate Restructuring Promotion Act. That is to say, FSS has information on the financial soundness of most candidate firms. Currently, since only firms deemed to be hopeless are undergoing workouts, it might be too late. Since early action and confidentiality are elemental in SME restructuring, FSS should force commercial banks to implement measures on the SMEs at an early stage by strengthening loan classification standards applied to them.

2. Institutional Constraints

After KCGF and KOTEC participated in the SME collaborative workout agreement, the probability of workouts was largely enhanced, but the legislative constraints give the guarantee funds little room to move. As publicly sponsored institutions, both funds were established by special acts that dictate their scope of businesses and activities. According to the acts, they are not allowed or at least not explicitly stated to exercise major debt restructuring instruments. For example, they are authorized to relieve delinquent debts but not to reduce them. This article is interpreted as their inability to haircut the principal

amounts. The only measures at their disposal are interest rate reduction or maturity extension or both. In addition, no explicit clause exists that allows them to convert debt into equity or to provide unsound firms with additional guarantees. The absence of capabilities to restructure debt has been determined to be the cause of their limited participation, too. Furthermore, the KCGF is not allowed to sell subrogation rights. As for the KOTEC, they can sell the credit but only to specified agents by law. These constraints also limit the effectiveness of the SME workouts.

In September 2004, the Ministry of Finance and Economy (MOFE) sent to the two funds directives that gave them the ability to exercise debt restructuring instruments popularly used in the workout system. However, since the directives are subordinate to the fund's founding acts, they are still fairly understood as being illegal. Thus, the MOFE should propose amendments to the acts.

In addition, the massive issuance of asset backed securities (ABS) for SMEs acts as an institutional constraint. In order to relieve the financing problems of many SMEs in 2000 and 2001, the government introduced securitization techniques to finance SMEs, which are called Primary Collateralized Bond Obligation (P-CBO) or Primary Collateralized Loan Obligation (P-CLO). The basic structure of the securities is illustrated in [Figure 8]. Initial credit grantors, consisting of mostly banks and investment trust funds, pool together the loans or bonds issued by hundreds of SMEs and transfer them to special purpose company (SPC) established by the creditors. Then they issue ABS with credit enhancements and sell them to other institutional investors. The credit enhancements are usually provided by the Korea Development Bank (KDB) and their credit enhancements are again guaranteed by KCGF or KOTEC. These ABSs with credit enhancements are called P-CBO or P-CLO, depending on the type of underlying security.

-[Figure 8] here-

Then, why should we call attention to P-CBO or P-CLO in the context of corporate restructuring? The reason is that the existence of these securitized assets complicates and eventually deters restructuring. The sources of complication originate from the number of creditors and the involvement of credit guarantee funds. Compared to the initial number of the original creditors, the number of creditors holding the securitized assets increases since they are publicly sold. Furthermore, the investors are not necessarily financial institutions so they are not cooperative with the revitalization of the distressed SMEs.[15]

More specifically, we need to thoroughly consider the role of KCGF and KOTEC in restructuring the distressed SMEs, in which the liabilities are underlying assets of the P-CBO and P-CLO. In principle, all the losses up to a certain amount should be born by these guarantee funds, once they occur. But the question is whether these funds are legally allowed to participate in ex ante loss sharing in terms of the restructuring part of SMEs in the pool. The answer is no. It is the asset management company (AMC), or usually the main bank, that manages the entire process including delinquency and collection management. It should fulfill the fiduciary duty as a trustee. Otherwise it would be accused of negligence. Thus, in this case, the credit guarantee funds are not doomed to bear any losses in the course of restructuring. Even if early payments are triggered on the P-CBO and P-CLO due to downgrades in asset quality and it is evident that KCGF and KOTEC will ultimately bear the losses, these funds are not allowed to participate in this type of SME workouts and trim their credits. This kind of credit owned by the funds is not against the

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[15] This argument is consistent with the findings by Gilson, John and Lang (1990), Asquith, Gertner and Scharfstein (1994) and Kang (2004b).

SMEs but against the bankruptcy trustee which holds the claims against the defaulted SMEs. Thus, the funds cannot directly collect the debt from SMEs. As a matter of fact, they do not participate in the workouts with the subrogation rights, which means loss sharing that could otherwise be avoided. Therefore, this kind of P-CBO and P-CLO undermines the probability of a successful SME corporate workout.

How do we cope with the problem? As long as the contract does not include the contingent responses to default or bankruptcy, there does not exist any enforceable measure that facilitates the restructuring of SMEs. Hence, the covenant of P-CBO and P-CLO should specify the resolution of distressed firms of which the debts are underlying securities. In the case of large companies, where the amount of credit borrowed from financial institutions, is greater than 50 billion Won, according to the decree of the Corporate Restructuring Promotion Act, the special purpose companies which hold underlying assets securitized should be involved corporate workouts scheme. This looks to be a way to bypass the difficulties caused by P-CBO or P-CLO but should not be applied to the SME corporate workouts scheme due to its characteristics of voluntary agreement by only participating financial institutions. Therefore, restructuring measures should be seriously considered at the time when asset backed securities are issued.

3. Imperfections of Corporate Restructuring Markets

Suppose that creditors would be willing to take part in SME restructuring at an early stage, and the legal and institutional structures are perfectly supportive. Then, would restructuring of SMEs be prevalent? Not quite. Even though corporate restructuring is led mostly by creditors, the participation condition that debtors would be at least worse off under the restructuring should be satisfied. Otherwise, debtors would not be cooperative. In this vein, we have to investigate the SME owners' and managers' incentive compatibility condition.

SMEs lack the resources and expertise needed for risk management. The SME's business size and volatile profitability requires them to hedge against unfavorable events but they do not have the necessary tools for risk management. In many cases, SMEs do not even perceive the need for such measures. When it comes to producing goods and services managers at SMEs are experts, but when it comes to protecting themselves from risk they are novices. Once managers find themselves in distress, they do not seek out appropriate consultants to help them overcome the difficulties. In fact, managers are very reluctant to reveal bad news about their firms because the creditors may cut them off from loans and trading partners may reduce their credit lines. Despite these circumstances, consulting and financial services related to credit risk management and distress resolution are not fully established in Korea.

One of other reasons that SME owners are reluctant to restructure their businesses is that they are concerned about losing not only wealth but also the opportunity to get back to normal. The absence of proper rehabilitation opportunities and existence of social stigma on defaulters would force him to a stalemate. Thus, the system that provides cooperative defaulters with opportunities to restart their businesses should be pursued in order to bring about expeditious restructuring.

As for the solutions, many suggest the implementation of institutional reforms to systematically resolve incentive problems and promote the introduction of dynamically consistent policies to facilitate corporate restructuring in the SME sector. For example, consulting services for managers at distressed firms that would help them initiate revitalization at an early stage. This would contribute to benefit both the firms and their creditors, for they seem to reduce not only the probability of default but also the size of losses even after default. Another major recommendation on expediting corporate

restructuring is to provide bona fide defaulters with a second opportunity to restart businesses. The opportunity of restarting after default could lead management to liquidate hopeless businesses much earlier. This idea takes more importance, especially considering that the drive for entrepreneurship has slowed. Corporate managers may have taken on the attitude of being overly risk-averse to restructuring which is fueled by the absence of opportunity for rehabilitation after failure.

VI. Conclusion

This study examines various aspects regarding restructuring Korea's distressed SMEs. The restructuring methods applied on SMEs should not be standardized so much as their diversities. The main target group for restructuring in this study includes medium-sized manufacturing firms. For this confined target group for restructuring, it does not suggest a "one-size-fits-all" policy prescription. Despite the limitations, it tries to draw attention to a desperate demand in turning around SMEs that face fundamental and structural problems along with cyclical ones. During a period when economic growth rate is going through a secular downturn, it is of utmost importance to regain the dynamism in SME sector in order to revitalize Korea's diminishing growth momentum.

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Table 1. Distribution of Enterprises: Firm Size and Industry (as of 2003)

(unit: thousand firms, %)

	Total	SMEs				Large Company
		Micro Business	Small Business[1]	Medium Business	Subtotal[2]	
All Industries	**3,004,105** **(100.0)**	**2,670,990** **(88.9)**	**2,913,850** **(97.0)**	**85,447** **(2.8)**	**2,999,297** **(99.8)**	**4,808** **(0.2)**
Manufacturing	325,819 (100.0)	266,177 (81.7)	316,468 (97.1)	8,578 (2.6)	325,046 (99.8)	773 (0.2)
Construction	82,182 (100.0)	65,340 (79.5)	80,595 (98.1)	1,488 (1.8)	82,083 (99.9)	99 (0.1)
Wholesale & Retail	889,661 (100.0)	806,176 (90.6)	863,037 (97.0)	25,834 (2.9)	888,871 (99.9)	790 (0.1)
Accommodation & Foodservices	647,411 (100.0)	587,598 (90.8)	635,874 (98.2)	11,150 (1.7)	647,024 (99.9)	387 (0.1)
Business Services	81,442 (100.0)	49,451 (60.7)	68,072 (83.6)	12,387 (15.2)	80,459 (98.8)	983 (1.2)
Education	97,019 (100.0)	76,940 (79.3)	90.373 (93.1)	6,219 (6.4)	96,592 (99.6)	427 (0.4)

Note: 1) Small business includes micro business

    2) SMEs = Small Business + Medium Business

    3) (　) : % by industry

Source: Korea National Statistical office

Table 2. Distribution of Employment: Firm Size and Industry (as of 2003)

(unit: thousand people, %)

	Total	SMEs				Large Company
		Micro Business	Small Business	Medium Business	Subtotal	
All Industries	**12,041,387** **(100.0)**	**5,232,697** **(43.5)**	**7,695,568** **(63.9)**	**2,779,062** **(23.1)**	**10,474,630** **(87.0)**	**1,566,757** **(13.0)**
Manufacturing	3,389,088 (100.0)	825,997 (24.4)	1,826,929 (53.9)	858,687 (25.3)	2,685,616 (79.2)	703,472 (20.8)
Construction	702,138 (100.0)	222,488 (31.7)	504,359 (71.8)	142,815 (20.3)	647,174 (92.2)	54,964 (7.8)
Wholesale & Retail	2,511,326 (100.0)	1,465,653 (58.4)	1,818,302 (72.4)	531,797 (21.2)	2,350,099 (93.6)	161,227 (6.4)
Accommodation & Foodservices	1,731,432 (100.0)	1,193,702 (68.9)	1,485,494 (85.8)	198,411 (11.5)	1,683,905 (97.3)	47.527 (2.7)
Business Services	850,215 (100.0)	112,042 (13.2)	228,856 (26.9)	324,958 (38.2)	553,814 (65.1)	296,401 (34.9)
Education	390,020 (100.0)	151,997 (39.0)	235,446 (60.4)	123,302 (31.6)	358,748 (92.0)	31,272 (8.0)

Note and Source: The same as in <Table 1>

Table 3. Comparison of Financial Ratios between Large Corporations and SMEs

(unit: %)

		1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Sales Growth	Large	17.81	11.67	11.23	18.96	22.25	11.27	12.92	1.97	6.58	16.68	0.84	7.21	6.55
	SME	16.79	6.31	7.13	16.47	15.9	7.82	7.02	-2.01	10.79	12.45	3.38	10.21	5.39
Interest Costs / Sales	Large	6.12	6.79	6.51	6.17	6.1	6.34	7	10.45	8.49	5.62	4.98	2.95	1.9
	SME	4.44	4.78	4.61	4.34	4.19	4.58	5.03	5.56	3.94	2.94	2.58	1.93	1.81
Salary / Sales	Large								8.62	8.72	8.21	8.43	8.85	8.89
	SME								12.3	11.71	12.48	12.89	12.28	12.67
Raw material Costs / Sales	Large								50.29	49.43	51.05	50.92	49.99	53.28
	SME								47.35	48.08	47.86	47.51	49.6	47.6
R&D / Sales	Large								2.02	1.77	1.47	1.52	1.72	2.02
	SME								0.62	0.47	0.71	0.99	0.85	0.78
Operating Profits / Sales	Large	7.2	7.44	7.95	8.62	9.75	7.31	9.72	6.53	7.38	8.21	6.03	7.54	8.16
	SME	4.73	4.1	4.97	5.26	4.61	4.62	4.98	5.15	5.23	5.83	4.54	5.29	4.64
Ordinary Profits / Sales	Large	1.84	1.86	1.87	3.06	4.4	0.98	-67	-2.91	1.01	0.26	-0.58	5.42	5.96
	SME	1.47	0.47	1.32	1.94	1.49	0.99	0.4	0.55	2.92	3.28	2.16	3.39	2.49
Net Profits / Sales	Large	1.55	1.25	1.24	2.2	3.46	0.51	-1.26	-6.08	-1.26	-4.34	-0.7	8.37	4.84
	SME	0.9	-0.05	0.82	1.4	1.18	0.59	-0.52	-0.45	2.37	2.6	1.37	2.48	2.08
Debt-to-Equity Ratio	Large	290.6	302.53	273.5	282.88	268.29	301.56	390	295.38	208.94	224.59	201.63	128.88	113.49
	SME	415.5	418.353	388.13	394.18	380.6	387.43	418.4	334.37	232.38	179.71	144.74	152.08	147.57
Current Ratio	Large	96.1	93.06	94.97	95.51	96.23	92.25	90.86	86.1	84.95	70.96	84.9	98.47	105.5
	SME	94.5	91.55	91.95	92	92.88	90.88	94.24	100.49	107.63	114.57	123.96	119.29	116.57
Fixed Asset Ratio	Large	216.4	224.63	214.84	217.41	210.2	237.65	268.23	251.23	214.53	224.7	213.11	154.61	137.47
	SME	235.7	244.39	234.69	233.16	224.36	234.01	235.95	206.47	164.24	140.71	120.9	120.91	119.35
Borrowing-to-Asset Ratio	Large	45.0	47.8	47.67	45.72	45.98	49.31	56.45	52.92	44.46	43.64	41.96	31.2	25.85
	SME	43.1	44.23	43.69	40.25	39.98	41.49	46.76	43.01	37.82	35.04	34.55	32.89	33.46
Average Borrowing Rate	Large	12.68	12.18	10.99	11.23	11.53	10.95	10.26	13.45	11.93	10.83	9.89	7.77	6.97
	SME	14.25	13.13	11.86	12.01	12.3	12.24	11.8	13.8	10.22	9.4	8.07	7.32	6.57
Interest Coverage Ratio	Large								62.2	86.88	146.05	121.07	255.42	428.83
	SME								3.92	2.83	2.04	175.56	273.7	255.93
Return on Equity	Large	5.42	4.33	4.04	7.28	11.77	1.69	-4.52	-19.27	-3.18	-11.64	-1.99	21.08	10.8
	SME	6.15	-0.33	5	8.88	7.44	3.54	-3.05	-2.45	10.15	9.41	3.99	8.32	6.54
Equity Growth Rate	Large	16.73	9.78	19.26	14.12	23.18	5.49	-0.06	28.61	36.3	-12.53	3.46	27.3	11.47
	SME	11.73	1.71	10.94	14.12	12.86	7.02	5.21	16.64	39.31	23.03	9.71	11.8	9.18

Source: Bank of Korea

Table 4. Return on Equity of the Externally Audited SMEs

(unit: %)

Decile \ Year	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
1	51.7	51.1	60.6	60.9	56.7	63.5	58.3	69.3	89.4	74.6	69.1	73.3	78.4
2	28.5	27.7	29.1	30.2	29.2	29.4	27.8	31.0	36.6	32.7	32.8	34.9	31.1
3	21.0	20.3	21.0	22.7	20.7	20.9	18.8	20.8	25.3	22.4	22.6	23.9	21.9
4	16.4	15.6	16.1	17.5	16.1	15.2	13.7	14.6	18.9	16.2	16.2	17.5	16.3
5	12.6	11.8	12.2	13.7	12.1	11.3	9.6	10.3	14.6	11.6	11.7	13.0	11.9
6	9.5	8.2	8.8	10.2	8.9	8.1	6.1	6.7	10.9	8.1	8.1	9.2	8.4
7	6.1	4.9	5.7	6.9	5.5	4.9	3.5	3.8	7.5	4.6	4.5	5.5	5.2
8	2.5	1.9	2.5	3.1	1.8	1.9	0.4	1.3	3.8	1.6	1.7	3.0	2.1
9	-2.5	-6.5	-3.0	-1.3	-5.3	-7.2	-15.2	-8.3	0.2	-5.8	-7.0	-5.4	-5.4
10	-52.8	-61.6	-59.3	-35.1	-59.2	-65.8	-104.7	-86.7	-64.8	-62.5	-67.5	-87.7	-71.8
Mean	12.1	10.4	12.1	13.1	10.4	10.0	7.3	9.5	7.5	11.7	11.0	12.3	13.5
Medium	11.1	10.0	10.5	12.0	10.4	9.7	7.9	8.4	12.6	9.7	9.9	11.0	10.2
No. of normal firms (A)	2,444	2,766	3,114	3,497	3,547	3,736	4,164	4,329	6,036	6,656	7,114	7,511	6,959
No. of firms with capital depleted (B)	228	285	309	346	399	424	572	526	628	675	861	1,039	1,002
No. of sample firms (A+B)	2,672	3,051	3,423	3,843	3,946	4,160	4,736	4,855	6,664	7,331	7,975	8,550	7,961
Ratio (=B/(A+B))	8.5	9.3	9.0	9.0	10.1	10.2	12.1	10.8	9.4	9.2	10.8	12.2	12.6

Source: National Information & Credit Evaluations, Inc., *Raw Data*

Table 5. Debt-to-Equity Ratio of the Externally Audited SMEs   (unit: %)

Decile \ Year	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
1	46.9	41.7	42.8	43.5	45.7	44.7	42.3	32.9	28.5	22.2	20.8	20.7	18.3
2	105.1	104.9	103.1	105.2	109.1	106.7	109.9	84.9	67.7	55.7	55.2	57.6	49.8
3	157.4	159.9	156.0	161.2	164.7	172.0	171.5	129.3	108.8	92.4	90.4	95.6	83.2
4	219.2	221.6	216.6	224.0	230.9	231.7	238.2	178.7	151.6	131.2	128.9	138.2	124.3
5	295.5	290.8	283.1	295.0	303.2	303.0	310.5	228.5	199.1	178.3	174.4	190.5	176.0
6	378.4	372.2	365.9	380.2	390.2	387.9	399.5	294.8	257.5	232.8	230.2	256.3	235.0
7	479.4	468.5	471.3	489.0	504.7	494.7	521.9	376.9	325.4	302.0	304.4	340.7	313.3
8	639.8	605.8	613.2	636.7	664.8	642.1	694.7	498.7	433.3	412.2	415.4	472.2	438.2
9	979.2	881.2	886.6	924.4	978.4	960.5	1068.2	780.1	650.6	640.8	650.0	796.5	704.3
10	2,873.8	2,334.5	2,610.5	2,434.7	2,465.3	2,773.9	3,063.3	2,440.4	1,760.6	1,823.5	1,979.6	2,823.6	2,249.7
Mean	316.7	311.3	298.0	308.9	324.1	328.5	332.0	250.8	185.9	186.1	170.2	158.6	164.0
Medium	333.4	332.8	321.6	335.5	347.3	344.1	350.2	259.2	228.4	204.5	201.8	222.3	203.3
No. of normal firms (A)	2,457	2,776	3,123	3,531	3,651	4,034	4,536	4,441	6,039	6,724	7,254	7,554	6,959
No. of firms with capital depleted (B)	229	286	311	350	409	449	602	539	629	681	869	1,039	1,002
No. of sample firms (A+B)	2,686	3,062	3,434	3,881	4,060	4,483	5,138	4,980	6,668	7,405	8,123	8,593	7,961
Ratio (=B/(A+B))	9	9	9	9	10	10	12	11	9	9	11	12	13

Source National Information & Credit Evaluations, Inc., *Raw Data*

Table 6. Decile Transition Matrix of Interest Coverage Ratio

A. One-year ahead

(unit: %)

1 year later / Base year	Dec. 1	Dec. 2	Dec. 3	Dec. 4	Dec. 5	Dec. 6	Dec. 7	Dec. 8	Dec. 9	Dec. 10	Loss(-)
Dec. 1	60.0	18.0	6.1	3.5	1.9	1.3	0.9	0.4	0.5	0.1	7.3
Dec. 2	19.4	37.0	17.7	8.3	3.7	2.4	1.5	1.1	0.8	0.9	7.1
Dec. 3	5.7	19.7	27.4	16.7	9.1	5.2	3.4	2.0	1.2	1.1	8.4
Dec. 4	1.6	8.7	18.8	21.8	15.3	9.8	5.9	3.7	2.6	1.6	10.1
Dec. 5	1.1	3.9	9.5	17.4	19.8	15.0	9.8	6.2	4.5	2.5	10.3
Dec. 6	0.7	2.0	5.0	9.5	16.2	19.5	14.2	9.6	6.2	4.1	13.0
Dec. 7	0.3	1.2	2.8	5.6	10.1	15.8	19.5	15.4	8.6	6.1	14.6
Dec. 8	0.3	0.8	1.3	3.3	6.2	9.8	15.1	20.3	16.2	9.7	17.0
Dec. 9	0.2	0.3	1.2	2.0	3.0	5.7	10.6	16.1	23.4	16.6	20.8
Dec. 10	0.1	0.4	0.8	1.5	2.0	3.8	5.5	9.6	18.0	29.6	28.6
Loss(-)	1.8	2.3	2.7	3.3	4.1	4.0	4.7	5.8	6.9	10.2	54.1

B. Three-year ahead

(unit: %)

1 year later / Base year	Dec. 1	Dec. 2	Dec. 3	Dec. 4	Dec. 5	Dec. 6	Dec. 7	Dec. 8	Dec. 9	Dec. 10	Loss(-)
Dec. 1	41.1	16.8	9.8	6.9	4.4	3.6	2.2	1.9	1.6	1.5	10.3
Dec. 2	20.4	21.0	14.4	9.8	7.2	4.4	4.1	3.0	2.0	2.0	11.5
Dec. 3	9.9	15.3	16.4	12.3	9.7	7.0	5.6	3.9	2.9	2.9	13.9
Dec. 4	5.4	10.6	11.9	13.9	10.7	8.7	7.1	6.2	5.2	4.2	16.0
Dec. 5	3.7	7.6	10.8	11.7	10.8	11.0	9.5	7.9	6.1	5.1	15.8
Dec. 6	2.1	5.3	7.7	9.7	11.8	12.3	10.6	10.0	9.3	6.5	14.9
Dec. 7	1.7	3.2	5.7	7.4	9.5	11.4	11.8	12.4	10.8	9.0	17.1
Dec. 8	1.0	2.5	4.3	6.2	7.8	10.3	12.0	14.0	12.1	12.3	17.6
Dec. 9	0.4	1.9	3.3	3.8	5.6	9.0	10.2	13.2	17.2	15.5	19.9
Dec. 10	0.5	1.6	2.1	3.9	5.1	6.1	8.7	11.1	15.6	21.0	24.3
Loss(-)	2.9	3.8	4.4	5.1	5.8	6.5	6.6	7.5	8.2	10.4	38.8

Table 7.   Causes of SME Default before and after the Financial Crisis

(unit: %)

		Sales decline	Poor collection of receivables	Counter-party default	Improper risk manage-ment	Invest-ment failure	Worsening profit-ability	Manage-ment failure	Others
Main	98.9~12	47.7	26.7	6.9	6.9	4.2	3.7	2.9	1.2
	98.4~8	50.7	24.6	8.7	4.0	4.5	4.3	2.0	1.0
	97.12~98.3	32.7	21.7	23.4	3.7	7.7	6.6	2.7	1.5
	95	28.4	22.3	7.2	4.2	15.9	14.0	4.8	3.2
Secondary	98.9~12	29.2	32.2	3.5	9.9	7.6	9.4	7.0	1.2
	98.4~8	24.1	35.6	6.1	10.1	5.0	13.3	4.7	1.1
	97.12~98.3	25.3	24.0	9.0	11.5	3.8	21.5	2.1	2.8
	95	19.6	3.1	8.8	10.4	11.9	27.6	14.0	4.6
Average	98.9~12	38.5	29.4	5.2	8.4	5.9	6.6	4.9	1.2
	98.4~8	37.4	30.1	7.4	7.1	4.8	8.8	3.4	1.1
	97.12~98.3	29.0	22.9	16.2	7.6	5.8	14.0	2.4	2.2
	95	24.0	12.7	8.0	7.3	13.9	20.8	9.4	3.9

Source: Industrial Bank of Korea (1999); Korea Federation of Small and Medium Business (2000)

Table 8. Summary of SME Corporate Workouts (as of April in 2005)

A. SMEs under Workouts

(unit: no. of firms)

	Graduation	Suspension	Under Pross	Total
Collaborative Workout	1	8	21	30
Internal Workout	182	148	1,340	1,670
Total	183	156	1,361	1,700

B. Debt Restructuring under Workouts

(unit: 100 million Won)

	Debt-to-Equity Swap	Maturity Extension	Interest Reduction	Fresh Loan	Principal Haircut	Total
Collaborative Workout	-	2,191	620	10	100	2,921
Internal Workout	32	15,136	1,867	1,195	211	18,441
Total	32	17,327	2,487	1,205	311	21,361

Note: Internal workouts are corporate restructuring led by main creditor banks alone when the loans are classified as substandard or below.
Source: Financial Supervisory Commission

Figure 1. Labor Productivity and Its Annual Growth Rate: by Firm Size

(Labor Productivity)   (Average Annual Labor Productivity Growth Rate)

Source: Korea Development Institute (2003)

Figure 2.   Outstanding Balance of Credit Guarantee in Korea

Figure 3. International Comparison of Credit Guarantee Balance to GDP Ratio

Figure 4.   Performances of Guaranteed Firms by Guarantee Periods

Panel A. Operating Profit to Sales Ratio

(unit: %)

Panel B. Borrowing to Assets Ratio

(unit: %)

Figure 5.   Performances of Guaranteed Firms by Asset Size

Panel A. Operating Profit to Sales Ratio

Panel B. Borrowing to Assets Ratio

Figure 6. Spearman's Rank Correlation Coefficient with Operating Profits

Figure 7. Flowchart of the Collaborative SME Corporate Workouts

Figure 8. Structure of P-CBO and P-CLO for SMEs

Comments on "Corporate Distress and Restructuring Policy of Korean SMEs : Role of Credit Guarantee scheme"

Soon- yeong Hong,
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It is acceptable to argue, as Dr. Kang points out, that the current distress of Korean SMEs largely stems from the dismal restructuring of troubled SMEs, the excessive supply of public credit guarantee to bad SMEs, and the incompetency of bank-led corporate workout.

Dr. Kang suggests that we need the help of institutional reforms to resolve the imperfections of corporate restructuring markets. I would like to add to this suggestion another important policy, a policy to improve labor market structure and thus to settle a manpower shortage in SMEs.

The Korea's credit guarantee scheme has been used as an instrument not only to enhance the financial accessibility of SMEs but also to alleviate macroeconomic fluctuations. According to Dr. Kang, we are facing with the problem that massive credit guarantees supplied in recessions have not been decreased yet in booms. Thus, it could be the first best policy if credit guarantee scheme is well operated reflecting the recent governmental reforms and if the volume of credit guarantees is properly supplied responding to business cycle fluctuations. The reason is that the credit guarantee scheme can execute the role of fiscal policy that maximizes the policy effectiveness with relatively less budget.

To avoid the committing errors (type error or type   error) of credit guarantees, Dr. Kang recommends the policy that the government extend all the incumbent users for longer periods, say 3 to 5 years, and amortize the guaranteed loans until maturity. I think that such idea can be effective in that it is able to minimize the shocks of change in public credit guarantee policy to SMEs.

IMF's recommendation that the Korean government need to reduce the ratio of credit guarantee amounts to GDP by one percentage point for next five years is unreasonable in the light of Korea's financial market structure and the financing circumstances of Korean SMEs.

The reduction of credit guarantees has to be gradually carried out with build-up of well-developed and various financial markets that SMEs can easily finance. Thus, the reform of financial market structure is promptly requested.

For the further reformation of credit guarantee scheme, the government should consider the followings: the comparison of effectiveness between public credit guarantee scheme and other supporting policies to SMEs, the analysis of the effect of credit guarantee

on national economy and industries, the estimation of proper size of credit guarantee to GDP or SMEs' loan, and so on.

Solving the essential problems, with which Korean SMEs is facing, is the right path for enhancing their competitive power. In this respect, it is correct for Dr. Kang to argue that SMEs' existing distress is likely to stem from the structural problems rather than a business cycle phenomenon.

In addition to Dr. Kang's good suggestion of restructuring method to give SMEs a boost, the policies to approach economies of scale in small firms have to be strongly promoted. Namely, the activation of M&A, the promotion of business conversion and so on.

Dr. kang's another suggestion to provide bona fide defaulters with a second opportunity to restart business is also effective and thus has to be quickly propelled for the recovery of entrepreneurship that has been slowed. However, the choice of bona fide defaulters needs the construction of transparent and efficient selection system to prevent the repetition of policy failure, as shown in the massive issue of P-CBO introduced to relieve the financing problems of SMEs (especially venture firms) in 2000 and 2001.

Sources of SME Innovations in the Globalization Era

by
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I. Introduction

The Korean economy has recovered markedly from the economic crisis, successfully overcoming much of the system-risk factors threatening the basic macro-viability through well-concerted efforts to restructure its corporate and financial sectors. However, even as Korea managed to come out of the crisis with better macro-fundamentals and institutional foundation, Korea is expected to face a stock of new challenges in maintaining the growth momentum and social integrity.

Korea already reached such a stage of development in which not only a lower, but also more uncertain rate of growth will be a norm. With natural depletion of inputs-growth sources (labor and capital), Korea's long-term growth rate is deemed to decline. While its growth performance thus will depend more on intangible sources of growth epitomized by technological progress, a higher degree of uncertainty is involved here, because the technological progress will be determined by Korea's yet-to-be known indigenous innovation capabilities.

Moreover in the upcoming decade or so, the global economy is expected to go through profound structural changes and the overall market condition is likely to be highly volatile and turbulent. Given that Korea is a small open economy with large external sector, such global market condition is deemed to exacerbate uncertainties inherent in Korea's long-term growth prospect. Stable and sustainable growth in Korea's future therefore requires higher innovation capabilities of Korean firms than ever before.

Another big and probably more profound challenge to Korea in its post-crisis era pertains to "social disparity" issue. Given that Korea still remains an egalitarianism-oriented society at large, maintaining social cohesion could cast another serious challenge. Some signs indicating the new 'digital divide' or 'knowledge divide' are already seen in the Korean society, as it opted to embrace more elements of free market competition in the wake of crisis management. Now if Korea should start to loose the present growth momentum somehow, the threat of new digital divide could easily turn into an imminent and daunting reality, which Korea may not be ready to handle yet.

In view of imminent and prospective challenges confronting Korea in its post-crisis era, upgrading the small and medium-sized enterprise (SME hereafter) sector is pivotal to Korea's strive to transform into an innovation-driven, knowledge-based economy. SMEs, in general, are conducive to production expansion, income increase, job creation and development of technology. In today's knowledge-based economy, there is a gained sense of importance of SMEs as the sources of persistent innovation and equitable economic growth. SMEs are less likely to suffer "lock-in" with respect to existing plants, technologies and organizational structures, making them important for innovation and commercial

experimentation with new technologies. Consequently, many countries, developed and developing alike, have stepped up their efforts to promote or revitalize SMEs with various support systems. For all acknowledged importance of SMEs and earnest promotion efforts by governments notwithstanding, however, few countries other than highly advanced OECD nations have actually succeeded in developing a competitive SME sector so far.

In Korea, SMEs have long been the object of special policy favor and legal position. The amended 1982 Constitution, for instance, states that the 'protection' and 'promotion' of small businesses shall be the government's 'responsibility' and 'duty'. Besides granting such extraordinary legal status, the Korean government actually has pursued a vigorous SME promotion policy since the early 1980s, introducing various support programs as well as making requisite institutional rearrangements.

However, the effects of such devoted policy efforts were mixed at least until lately. Although Korea's SME sector has been expanded notably since the mid 1980s, with steadily rising shares of SMEs in GDP, employment, and exports, such expansion was not accompanied by a substantial quality upgrading the Korean government aimed at. Although a group of technically competent, innovative SMEs started to spring up since early 1990s, the sweeping majority and increasing portion of SMEs remained to operate in the traditional low-tech industrial areas, producing a low-price commodity type of products under a subordinate contract with larger firms. Actually, productivity differentials between large firms and SMEs have increased in industries where technological competitiveness matters most.

Together with the economic crisis, however, there came a dramatic turnaround of such long-term trend. Some SMEs went bankrupt due to the severe credit crunch entailed by the crisis, but many Korean SMEs managed to change such a financial ordeal into a chance to greatly improve their financial status and cash flow. In addition, in endeavor to strengthen their competitive edges in a more proactive way, a substantial portion of SMEs started to increase investment in R&D and IT as well as stepping up their efforts to strengthen cooperation with overseas enterprises and to enter foreign markets. Overall market conditions have also changed in such a way to induce or support such self-redemptive efforts by SMEs.

As a result of financial and corporate restructuring, many Korean financial institutions came to find making loans to qualified SMEs more attractive. Also, large companies also came to change their attitude towards SMEs beginning to refrain from abusing their superiority towards their related SMEs, and instead trying to expand their cooperation with SMEs.

All these fundamental changes in Korea's SMEs culminate in the forming-up of a group of new technology-based small firms. Fostered amid the dramatic start-ups and venture boom, this group of SMEs emerged to make another pillar of Korea's growth locomotive, along side with a small number of big leading firms afflicted with *Chaebols*.

No doubt that the latest economic crisis was an epochal event that vindicated the potentials of Korean SMEs and the prospect of Korea's diversifying competitiveness base. Despite all these progressive developments, however, innovative SMEs with an independent and sustainable competitive base are quite limited in Korea compared to other advanced countries. It may be fair to say still that the absence of dynamic and innovative SMEs is a major weakness of Korea's industrial structures. Most SMEs in Korea are engaged in the production of technologically unsophisticated parts and components under a passive subcontract relationship with larger companies. Even with the best possible outcome from the ongoing structural reforms in Korea, the performance of SMEs is unlikely to improve markedly because of the grave elements of market failure intrinsic in

the SME sector. To the extent that new phase of economic development ahead requires a diversification of production and a broader base of industrial power and technological capabilities, there is a strong imperative for Korea to develop a comprehensive and innovative strategy to nurture a substantial pool of autonomous and innovative local SMEs.

II. Globalization and Restructuring of Korean SMEs

Since the 1960s, the share of Korea in the world exports market had continually increased. However, in the mid 1990s its growing tendency has ceased. Why did it happen? Taking into account the fact that the export of technology-intensive products such as memory chip, cellular phone, motor vehicle, etc. has increased very rapidly and that some of them are ranked at the top position in the world, the answer could be found in the reduction of exports of labor-intensive products such as textile, footwear, and so on. Korean industries have undergone, and are still undergoing serious restructuring triggered by the export promotion of developing countries such as China in the 1990s.

Before the 1990s, the rapid increase in Korean exports could be explained by the steadily growing rate of export of labor-intensive products, in addition to the new production of technology-intensive commodities whose production technologies are imported from advanced industrialized countries. Skyrocketing wages in Korea and industrialization of developing countries like China and Southeast Asian countries have crucially negative impact on the competitiveness of Korean labor-intensive products.

Figure 1. The share of Korea in the world exports volume

Source: National Statistical Office (Korea), Report on Mining and Manufacturing Survey

Understanding that the competitiveness of labor-intensive products would not be sustainable in the new economic environment, Korean firms began to make every effort on gaining competitiveness of technology-intensive products. It was in the 1990s that the Korean firms, especially large firms, altered their technology acquirement strategy from overseas purchasing to in-house development.

As the result shown in Fig. 2, the composition of Korean manufacturing sector has drastically changed. Whereas labor-intensive industries such as textile and footwear have shrunk, production and employment in technology-intensive industries such as electronic parts and apparatuses, and motor vehicles have expanded.

Furthermore, intensified international division of production that has been brought about by the integration of the world economy has induced some Korean industries to specialize their products.

Figure 2. The composition of industries in the Korean manufacturing sector

Source: National Statistical Office (Korea), Report on Mining and Manufacturing Survey

Figure 3. The concentration ratio of top 5 and 10 commodities in export

Source: Korea International Trade Association, Trade Statistics (www.kita.net)

As we see in Fig. 3, the concentration ratio of top 5 and 10 commodities in Korean exports (counted on HS 6 code) has increased in the 1990s. Simultaneously, there have been increases in industries that have shown decreases in the growth rate of employment and value-added in the 1990s, compared with the 1980s.

Electronic parts and apparatuses manufacturing industry and motor vehicle manufacturing industry, considered the main pillars in the Korean economy, are known to assemble parts and components supplied by SMEs. Large assembling firms are much concerned about technological improvement of their suppliers.

At the early stage of industrialization, the priority of industrial policy was focused on large firms that assembled imported parts and components of which production was beyond SMEs' technological capability. In the past, it was believed that the industrial policies in Korea are more favorable to large firms. However, that belief no longer holds true. Presently, the Korean government puts focus on issues relating to SMEs as its top-priority policy agenda.

The share of SMEs in production had continued to increase until the 1990s when labor-intensive industries began to lose their competitiveness. Their growth was enabled by import substitution of technology-intensive parts. After the stagnant period in mid 1990s, SMEs resume to grow pass the economic crisis in 1997–98.

Figure4. SMEs' share of production in the manufacturing sector

Source: National Statistical Office (Korea), Report on Mining and Manufacturing Survey

In pursuit of re-gaining competitiveness, large firms reinforced the strategy of outsourcing from SMEs and reduced their in-house production. As is shown in Fig.4, while large firms reduced their production in most industries, there has been increase in the production of SMEs in all industries except textile, apparel and leather goods industries.

Figure 5. The growth rate of employment in industries (1999 – 2003)

Source: National Statistical Office (Korea), Report on Mining and Manufacturing Survey

As SMEs' share of production in technology-intensive industries increased rapidly the objective of SME policy is shifted to nurturing technology and innovation capacity of SMEs. This implies a paradigm shift of industrial policy in Korea. At the initial stage of industrialization, where the share of labor-intensive industries was dominant, the objective of industrial policy was to subsidize the expansion of production capacity, in particular large firms', in order to realize economies of scale. Policy tools mainly consisted of all kinds of financial subsidies.

However, as restructuring proceeds toward technology-intensive industrial structure, the priority of industrial policy is replaced by R&D and job training. Policy object is moved from large firms that are already equipped with their own R&D capability to secure a portion of the world market for SMEs that are not so.

Despite of the government's policy change, the performance of Korean SMEs in innovation capability including technological improvement did not turn out to be fruitful in the 1990s. On the contrary, the productivity of SMEs regressed and suffered from the shortage of financial resources. They asked the government to set priority on policies that alleviate the credit crunch.

The ratio of gross fixed capital formation to GDP of Korea in the 1990s was higher than any other periods. Even the ratio in the latter part of the 1970s, when Heavy-Chemical Industrialization Project was driven by Park Chung Hee administration, was lower than that of the 1990s. The project had been severely criticized to be a cause for overheated investment.

Figure 6. The ratio of gross fixed capital formation to GDP

Source: The Bank of Korea, National Accounts

Korean firms that were encountered with withering competitiveness caused by rapidly growing wage rate at the end of 1980s increased their investment drastically, in order to set up labor-saving production system on the one hand and to convert their production portfolio to high value-added products on the other hand.

In addition, there was a timely IT boom all over the world, which provided an attractive opportunity for the Korean firms that were eager in search of new products. The aggressive investment in the 1990s had a negative impact on funding of SMEs. Large firms whose running capital was exhausted by over-investment for expanding fixed capital issued trade bills rather than cash payment. Maturity of the trade bills issued at that time was usually 3 months. Even bills with longer than 6 month maturity were circulated. The government guided large firms to refrain from issuing long-term trade bill and provided special funds, by way of the central bank to commercial banks using the method of discount.

Under such circumstances, although the government pursued for technological development of SMEs, it could easily be expected that the result ended with poor performance. Large firms equipped with relatively profound resources successfully advanced in technology-intensive industries of high value-added including IT industry, whereas SMEs failed in restructuring.

Apparently, a lot of SMEs seem to be successful in restructuring in that they have changed their products from textile or footwear to electronic parts. But what actually

changed is their industrial classification, not their activities of production. A lot of SMEs continued their unskilled labor even in the IT industry. This is reflected in the fact that multi-layer subcontract systems are prominent presently. With their failure to employ resources for R&D and other knowledge-based activities, the productivity gap between the large firms and SMEs is becoming wider.

In Fig. 7, the relative position of labor productivity of SMEs compared with that of the large firms is shown. The labor productivity of SMEs were kept at 50% level of large firms

Figure 7. The labor productivity of SMEs relative to large firms(large firm=100%)

Source: National Statistical Office (Korea),   Report on Mining and Manufacturing Survey

Figure 8. The International comparison of relative labor productivity of SMEs

until the beginning of the 1990s. It was as though Korea was following the same footsteps of Japan. However, the labor productivity of SMEs relative to large firms has fallen year-on-year in the 1990s. The productivity of SMEs has become 33% of large firms in 2003.

From the perspective of international comparison, the productivity gap of Korea between large firms and SMEs is considerable. The labor productivity of Korean SMEs relative to large firms is 34.5%, while that of USA is 58.3%, 53.2% in Japan, 63.1% in Germany, and 65.2% in Italy, as is seen in Fig. 7.

It seems in Fig. 9 that the gap of tangible fixed assets per capita between large firms and SMEs is highly correlated with that of productivity. It suggests that the expanded productivity gap between large firms and SMEs comes from asymmetric availability of financial resource, which was utilized for new investment opportunities during the period of industrial reconstructing in the 1990s.

However, careful comparison between Fig. 7 and Fig. 9 reveals that high correlation of productivity gap and tangible fixed assets per capita does not hold after the economic crisis.

Figure 9. The ratio of tangible fixed assets per capita of SMEs relative to large firm

Source: National Statistical Office (Korea), Report on Mining and Manufacturing Survey

Large firms suppressed their aggressive investment behavior and then had their financial structure be stabilized. Their resources were allocated to upgrade knowledge-based activities such as R&D, rather than to expand their production capacity.

The gap of tangible fixed assets per capita between large firms and SMEs has not expanded. Nevertheless, the gap of productivity is still expanding. That means the cause of productivity gap has changed after the economic crisis. Presumably, the gap is due to technological capability.

Since the economic crisis, the decrease in investments has resulted in profound liquidity in the financial market. SMEs no longer suffer from credit crunch. Large firms do not need to issue trade bills to SMEs and thus the bankruptcy rate of SMEs is greatly reduced. But SMEs of low productivity are still unattractive to skilled workers.

The economic crisis of 1997 has fundamentally changed the Korean economic structure. The SME sector was not exceptional. There emerged a group of innovative SMEs, although its share among the entire SME sector is still small. Traditionally, the typical entrepreneurs of SMEs in Korea have low level of educational background. After long years of experience as a manual worker in factories, they started up their own business, usually as a subcontractor. But the new group of entrepreneurs is characterized to be young and highly educated. Based on their job experience in research labs and/or universities, their businesses are more of a technology start. Consequently, they are not subject to subcontract of large firms. Their products mostly belong to IT or closely IT-related industries that are growing fast.

As is shown in Fig. 10, the number of R&D institutes affiliated with SMEs increased rapidly just after the economic crisis. It is thought to be the result of many researchers released from large firms and public institutes who searched for jobs in the R&D institutes of SMEs. A number of these unemployed researchers started up their own businesses. In the case of Electronics and Telecommunication Research Institute, which is the largest

government-sponsored institute in Korea, there were about 200 researchers' spin-offs. The government supported their spin-off by subsidizing venture capital and setting up business incubators.

Figure 10. The number of SMEs R&D institutes

Source: Korea Industrial Technology Association, Major Indicators of Industrial Technology

It is noticeable that increase in R&D institutes of SMEs ceased when the Korean economy recovered. As large firms and public institutes stopped terminating their researchers, the number of R&D institutes of SMEs became stagnant. For instance, researchers with Ph.D. degree employed by SMEs increased from 739 in 1998 to 2,538 in 2001, but 2,592 in 2005.

Korean industries have grown, coping promptly with the change of economic environment. Aggressive investment drove firms' entry into the higher value-added industry. Even today some firms are still growing to become global companies and expanding their competitive scope. However, industry as a whole seems to be losing dynamics of the past after the economic crisis.

In Table 1-a and 1-b, the growth rates of value-added per capita before and after the economic crisis are shown. For 1992–1996, the period before the economic crisis, average annual growth rate of the manufacturing sector was 15.1% (based on nominal price), while it was 2.9% for 1999–2003, the period after the crisis. There has been a striking decline in growth rate.

Table 1-a.   The annual growth rate of value-added per capita for 1992-1996

Industry / Firm Size	Total	5-19	20-99	100-299	300-499	Above 500	Standard Deviation
Manufacturing	**15.1**	14.4	14.4	14.1	20.5	17.9	**2.8**
Food Products	11.4	16.2	16.7	10.8	15.7	7.2	4.2
Tobacco	17.2	-	12.2	-1.2	-	18	9.9
Textiles	12.1	15	14	14.1	23.6	7.9	5.6
Sewn Apparel	17.8	13.9	14.4	15.9	18.9	34.7	8.7
Leather, Footwear	16.1	11.2	12	21	10.9	35.4	10.5
Products of Wood	13.8	17.1	14.8	10.4	-	9.4	3.6
Pulp, Paper Products	13.4	14.2	14.4	11.1	13.7	15.2	1.6
Printing, Recorded Media	15.1	12.2	12.2	21.4	21.6	17.7	4.7
Refined Petroleum	6.5	15.6	3.8	14.1	-	2.7	6.8
Chemicals and Chemical Products	14	13.5	12.3	14.4	21.4	12.6	3.8
Rubber, Plastic Products	11.5	14.6	13.4	8.8	1.2	14.7	5.8
Non-Metallic Mineral Products	12.8	12.2	11.2	13.7	18.6	18.8	3.6
Basic Metals	11.4	18.5	18.8	12.6	10.7	11.1	4
Fabricated Metal Products	13.9	14.9	11.8	14.2	11	25.5	5.8
Machinery and Equipment	13.5	15	14.2	14.4	12.2	14.9	1.2
Computers, Office Machinery	24.5	16.2	13	20.6	43.4	24.1	11.9
Electrical Machinery and Apparatuses	12.9	15.5	13.3	17.1	18.9	11.9	2.8
Electronic Components and Apparatuses	29.9	15.9	17.1	16.8	16.5	32.7	7.2
Medical, Precision, Optical Instruments	13.1	13.6	14.5	14.2	33	6	10
Motor Vehicles, Trailers	12.4	14.7	13	15.6	14.9	11.8	1.6
Other Transport Equipment	2.2	12.8	9	3.3	16	2.1	6
Furniture, Articles	10.9	13.6	15.1	2.3	18.8	9.2	6.3
Recycling	39.1	32.1	36.5	-	-	-	3.1
Standard Deviation	**7.5**	4.1	5.7	5.7	8.9	9.6	

Source: National Statistical Office (Korea), Report on Mining and Manufacturing Survey

Table 1-b.   The annual growth rate of value-added per capita for 1999-2003

Firm Size \ Industry	Total	5-19	20-99	100-299	300-499	Above 500	Standard Deviation
Manufacturing	**3.9**	6.1	5.9	4.2	2.3	6.5	**1.7**
Food Products	0	7	3.7	-2.2	-4.5	7.8	5.5
Tobacco	4.2	-	21.7	7.3	-20.4	8.8	17.7
Textiles	0.7	7.2	3.6	1.1	-7.5	-8.6	6.9
Sewn Apparel	12.2	7.2	14.6	13	12.1	19.4	4.4
Leather, Footwear	7.6	5	10.3	0.7	25.4	13.6	9.4
Products of Wood	0.9	4.1	1.8	5.1	-	-7.1	5.6
Pulp, Paper Products	2.2	4.2	2.5	3.8	11.3	1.6	3.9
Printing, Recorded Media	2.7	5.3	4.4	8.8	9	-3.8	5.2
Refined Petroleum	-5.7	-10.6	-0.1	36.8	-	-3.8	21.3
Chemicals and Chemical Products	5.9	4	4.9	10	2.5	11.2	3.9
Rubber, Plastic Products	1.7	4.9	4.7	2.7	-3.1	1.6	3.3
Non-Metallic Mineral Products	6	8.6	7.5	8.6	5	5.7	1.6
Basic Metals	6.8	7.6	5.9	2.5	11.8	10.6	3.7
Fabricated Metal Products	2.4	4.6	3.7	1	-6.4	7.6	5.3
Machinery and Equipment	6.1	6.9	5.9	6	6.4	12.4	2.7
Computers, Office Machinery	1.5	7.7	5	-5.1	-6.4	3.9	6.4
Electrical Machinery and Apparatuses	2.2	5.4	6.3	0	3.5	3.6	2.4
Electronic Components and Apparatuses	1.9	4.6	5.8	8.1	0.7	3.2	2.7
Medical, Precision, Optical Instruments	3.8	5.7	5.9	0.7	16.3	10.9	5.9
Motor Vehicles, Trailers	9.5	6.1	6	8.9	5.6	12.4	2.9
Other Transport Equipment	1.7	11.5	6.2	-0.4	-13.1	3	9.2
Furniture, Articles	3.8	5.1	4.4	5.7	7.4	4.2	1.3
Recycling	5.9	7.2	4.4	-	-	-	2
Standard Deviation	**3.6**	4	4.5	8.3	10.7	7	

Source: National Statistical Office (Korea), Report on Mining and Manufacturing Survey

The point is that the standard deviation of growth rates of value-added per capita between industries is reduced. The fact that standard deviation was high before the economic crisis means that resource allocation into high value-added industry was vigorous. Lowered standard deviation after the crisis implies that vigor of the past through active investment disappeared.

Reduction of standard deviation does not seem to be the result of industrial restructuring during the crisis that is the shrink of low value-added industries. If that was the case, then the average annual growth rate should have been higher after the crisis.

Another point is that while the standard deviation of the group of SMEs has no change, that of the group of large-sized firms, in particular above 500 employees, is lowered. As is well known, the growth rate of investment has been reduced after the economic crisis. When businessmen are asked about the cause, their answer is that they cannot find investment opportunities. Such an answer seems to be convincing, considering that even though market interest rates is lowered, investment has not increased.

Now in the open and globalized economic structure, large firms in general whose domestic market position was secured in the closed economy begin to lose their markets. It can be said that the impact of globalization extends to large firms, and not confined to SMEs only.

Recently, in Korea the economic and social issue on polarization is being raised. From the viewpoint of industrial structure it is not thought that the issue is not on the gap between large firms in general and SMEs. It is believed that the issue should be interpreted to be the gap between a few globalized and worldwide firms with brilliant performance and most firms, of course including SMEs.

In order for the Korean economy to maintain high growth rate of the past, a new industrial policy should encourage business startups based on technology, aiming at the world market. That means a totally different approach should be taken from the traditional policy that has heavily depended on the growth of large firms.

III. Policy Agendas for Innovative SMEs

The Korean government launched economic reform programs in order to cope with the economic crisis. Reforms in the financial sector were most comprehensive and drastic. The transparency of corporate governance structure was improved. Policy programs to support innovative SMEs were developed. Except for the time during the crisis when the government increased credit guarantee to prevent a chain bankruptcy of SMEs, SME policy was concentrated on the promotion of innovative SMEs.

Main contents of SME policies were:
1. to expand government's subsidy for venture capital in order to promote venture business
2. to set up business incubators in university campuses and research institutes in order to promote new technology-based startups
3. to establish regional innovation system in order to encourage local networks between universities, research institutes and SMEs

1. Policy to promote venture business

When KOSDAQ was open in July 1996, adopting NASDAQ of the U.S., it hardly drew public's attention. The Korean government declared new policy direction to promote venture businesses as a means to overcome the economic crisis and actually began to support fund raising of venture capital.

Stimulated by the policy, investors expanded their investment to listed firms in KOSDAQ. The KOSDAQ composite index went up sharply in 1999. It took only three years

since its opening to rise up to 2,000 (from 1,000 at the initial period, July 1996). It was over 2,500 in the year 2000. But with the IT business recession in 2001, it collapsed to the level of 600 and has been sluggish since then. Judging from the trend of KOSDAQ index speculation of a bubble during that time is possible.

Identical pattern was repeated in the number of venture business firms listed in KOSDAQ. After the increase in 1999 reaching the peak in 2001, it stopped at its track.

Figure 11.　The trend of KOSDAQ composite index

Source: KOSDAQ Market

Figure 12.　The number of venture business firms listed in KOSDAQ

Source: KOSDAQ Market

The so called "venture–bubble" at that time could be explained partially by the Korean government's active publicity for investment to venture business firms and thus highly inflated expectation of investors. It was believed that a lot of SMEs suffered from lack of financial resources in spite of their technological capacity. However, it turned out that even the technological capacity has been overly exaggerated. Considering that the scientific and technological base of Korea is weak, it should have been recognized that poor performance of venture business is a natural consequence.

Table 2. Top 10 sales growth rate of venture business firms listed in KOSDAQ

Year	Ra nk	Firm	Start up	Sales (Mil W)	Growth rate(%)
2001	1	AUCTION	1998	126,479	415
	2	INTERPARK	1997	97,225	294
	3	SSI	1994	15,928	293
	4	DAUM	1995	90,962	220
	5	Serome	1994	38,654	182
	6	Modia	1998	53,795	171
	7	AXESS Telecom	1992	9,091	147
	8	KEBT	1998	31,298	139
	9	C&C Enterprise	1994	22,667	131
	10	NST	1996	14,293	122
2002	1	E-RON TECHNOLOGY	1988	81,028	437
	2	LOTOTO	1999	22,241	318
	3	SSI	1994	64,945	308
	4	TGICC	1992	10,931	298
	5	NEXCON TECHNOLOGY	1996	53,746	291
	6	Modottel	1998	44,980	225
	7	DASAN Networks	1993	50,229	222
	8	DM Technology	2000	87,119	208
	9	NHN	1999	74,614	207
	10	TJ Media	1991	53,696	174
2003	1	Mtekvision	1999	56,358	669
	2	Reigncom	1999	225,929	183
	3	SEKONIX	1988	30,070	149
	4	LASEMTECH	1993	14,631	149
	5	OSUNG LST	1994	42,705	137
	6	SangHwa Micro Technology	1997	18,232	135
	7	PSK	1996	24,979	132
	8	ATTO	1991	41,544	126
	9	NHN	1999	166,311	123
	10	ACTOZSOFT	1996	46,417	116

Source: KOSDAQ Market

Indeed, it is easily found that the performance of venture business is not so great. In Table 2, venture business firms in the top 10 are listed annually. As seen none of the firms continued to uphold their positions in the top 10 for 3 consecutive years. However, there were two firms that continued to hold their position in the top 10 for 2 consecutive years. This goes to prove the fragility of Korean venture business firms. Their core competence is not sufficient enough to maintain their growth.

Therefore, a need for a though review in the venture promotion policy is crucial. It is thought that the government's supporting programs are no less various and effective compared to other countries'. Presumably, the reason of poor performance does not lie in that the volume of investment is not enough, but in that investment opportunities provided by venture business firms are not plentiful. When interviewed with venture capitalists, they argue that there is difficulty in finding firms with good performance.

The Korean government's current position that places priority on supporting investment to venture business should be reconsidered. Priority should be placed on both encouraging new technology-based startups and strengthening networks between universities, research institutes and industries.

2. Establishment of Business Incubation Center

In response to rapid changes of economic circumstances for Korea in the 1990s, a consensus was reached that SMEs should play a greater role in sustaining industrial competitiveness. Impetus to establish business incubators was presented as an effective policy tool for facilitating the birth of technology-intensive SMEs.

The Small Business Promotion Corporation (SBPC), which was created in 1979 as a non-profit government agency to implement policies for the promotion of SMEs, founded three business incubators in 1993. The number of business incubators continued to increase since then, but the number did not take off until after the economic crisis.

After the crisis, which revealed the problems of the growth strategy relying upon *chaebols*, the government forcefully supported increasing investment in venture businesses and facilitating creation of new SMEs. As a result, the number of business incubators increased rapidly. As Fig. 13 shows, the number of business incubators reached 289 (as of year 2004), two-thirds (220 business incubators) of which were established during the three-year period from 1999-2002.

Figure 13. The number of business incubating centers

Source: Small and Medium Business Agency (Korea).

The aim of establishing business incubators is to systematically provide financial and non-financial supports for start-up enterprises. Business incubators support start-ups and endeavor to increase their post-entry survival rates by sharing financial burden of starting a business and/or by helping start-ups create links with universities, research institutes, designers, business consultants, financial institutions, etc. In particular, one of the most important roles for business incubators is to increase cooperation between universities / research institutes and start-up enterprises and to strengthen the industry-science linkages. For this purpose, most of the business incubators are located within university campuses or research institutes.

Out of 289 business incubators in Korea (as of 2004), those established by universities have a dominant share (83.4%, 241 incubators). 17 incubators (5.9%) were established by research institutes, 9 (3.1%) by the Small Business Corporation, and 7 (2.4%) by local governments. They are incubating 4,179 start-ups (which means 14.5 start-ups per incubator on the average). Those incubators have produced 6,803, among which 3,560 start-ups have survived (showing a survival rate of 52.3%). As many as 1,810 up-and-comers are still waiting to move into one of these business incubators. This number amounts to 43.3% of those that are being incubated. As a general rule, the incubating period is two years.

In perspective of creating clusters, business incubators are being induced to specialize in a specific industry. 90 business incubators (31.3%) are specializing in "information processing and computer operation business." 48 incubators (16.6%) are in "machinery and equipment manufacturing," 39 incubators (13.5%) in "bio-technology and environment," and 33 incubators (11.4%) in "electronic parts."

As comparison for the effectiveness of a business incubator, one can compare pre- and post-incubation sales. Overall, 219 incubators (75.8%) showed increase in sales after incubation (on average). In the case of 241 incubators established by universities, 186 incubators (77.2%) showed increase in sales. In the case of 9 incubators established by the Small Business Corporation, 7 incubators (77.8%) showed increase in sales. Incubators established by public research institutes turned out to be most effective: 15 (88.2%) out of 17 incubators showed increase in sales.

On the other hand, 4 (57.1%) out of 7 incubators established by local governments, and only 2 (33.3%) out of 6 incubators established by private institutions or firms showed increase in sales. Business incubators in research institutes are more effective than other incubators mainly due to abundant human resources accumulated in research institutes. For example, the Korea Research Institute of Bioscience and Biotechnology (KRIBB) is well known for its renowned business incubator.

A very interesting result is found from a comparison of business incubators' effectiveness and the level of regional economic development. Figure 14 shows that the correlation between the average sales increase of incubated firms and the per capita GRP (Gross Regional Product) is very low. It means that the effectiveness of business incubators does not depend on the level of regional economic development, at least at the stage of starting a business. In other words, it seems to suggest that, at the beginning stage of a business start-up, business incubators matter more than surrounding economic environment. That is, business incubators could play a significant role in less developed regions as well, while further post-entry growth of firms after the incubation could rely more on regional economic environment. However, due to insufficient data on firms which graduated the incubation, it is difficult to test this conjecture.

Figure 14. Relation between performance of incubating center and regional economy

Source: Small and Medium Business Agency (Korea).

A business incubator should have: i) deep understanding of the specific needs of start-ups including their unique demands in the areas of technology, funds, marketing, design, business service, etc.; ii) information on specialized suppliers for such demands; and iii) ability to make appropriate matches between aforementioned demands and supplies. When a business incubator plays such a role successfully, it becomes a focal point attracting start-up enterprises. Business incubators in Korea, however, seem to have structural problems in fulfilling such functions effectively.

In general, a business incubator has a director and a manager. The manager is in charge of operation of the incubator, while the director is the nominal head of it. In the case of business incubators in universities or in research institutes, the director usually holds plural offices and cannot afford sufficient time for managing the incubator. In this case, the manager will take over the actual operation of the incubator. Average annual salary of managers of business incubators in Korea is 25.5 million Won, which is the entry level salary rate of a university graduate. Managers of business incubators in Korea are typically in their 20's or 30's. It is difficult to expect that human resources at this level could play a sufficient role in identifying the needs of start-ups in providing necessary guidance on technology and management, and in helping them create links with specialized supporting institutions. These managers are currently playing no more than a simple administrative role. Managers of business incubators should be recruited from the pool of professionals with experience and specialties.

According to the results of a survey taken on start-ups under incubation, the most point out that expected benefits from business incubators was not the actual service from the business incubators but advantages in transactions coming from the good impression of a promising start-up. To be accepted by a business incubator in Korea, applicants must pass

the screening process. Hence, the fact that a start-up company is under incubation indicates superiority of its technology level and high marketability of its products.

Considering low level of financial capacity of business incubators in Korea, it is presumed that their in-house facilities such as test equipment have not reached a level of great use. But, further investigation on this presumption is yet to be made.

3. Policy to build up regional innovation system

It was argued that the economic crisis resulted from economic inefficiency which was the outcome of rent-seeking behavior pursued by the business group of large firms. It was believed that countervailing power should be raised. That is the reason why the government was eager in promoting innovative SMEs such as supporting venture business. Another policy of the government was decentralizing the industrial policy.

Traditionally, the central government directly supported the production activities of firms, for instance subsidizing long-term loans for production facility investment. The high performance of government support could be partially explained by close monitoring. Since beneficiaries of government support were confined to a few numbers of large firms the cost of monitoring was very low. Furthermore, the government induced competition of firms for subsidies. The government sometimes threatened poor-performing firms by stop curtailing support.

However, when the target of industrial policy concentrated on SMEs the traditional monitoring system was no longer sustainable. SMEs are distributed all over the country as well as all industries. With the centralized policy mechanism, it was impossible to monitor performance of supported SMEs. Hence, decentralization is a natural consequence. Nevertheless, the decentralization of SME policy had been deferred for the reason that the policy implementing system of local governments was not prepared.

It was just after the crisis that the decentralization of SME policy was implemented by the government. The central government approved the industrial development plans projected by local governments; the textile industry of Daegu in 1999, footwear industry of Busan in 2000, machinery industry of Gyongnam in 2000, and optical industry of Gwangju in 2000.

Daegu, located in the southeast of Korea, is the largest producing site of synthetic fiber textile in the world. Firms specialized in spinning, weaving and dyeing are clustered in the Daegu area. Textiles produced in Daegu are supplied to firms in the garment industry located in Seoul where the final products are developed and exported.

There are some problems in the textile industry of Daegu such as simple design, low skill of dyeing, etc. The most notable problem is that its mass production system is too rigid to enter into high-end markets of short-term fashion cycle. Producers of developing countries are occupying low-end markets. It is urgently necessary to shift to a flexible production system.

Major contents of textile industry development plan are to upgrade designing capability, to enhance dyeing skills, to convert mass production system into a production system with small-size lot, and to expand education and training programs. In order to install these programs, networking between universities, R&D centers, and SMEs should be intensified.

Busan, the second largest city in Korea, used to be the largest producing site of footwear in the world until the end of the 1980s. But the problem of the footwear industry in Busan was that it consisted only of assembling firms. The industry was not equipped to produce their own design, nor manufacture chemical outsole. Marketing was entirely dependent on multinational enterprises. When multinational enterprises shifted production facilities to neighboring developing countries that offered low wages in the early 1990s, the footwear industry of Busan was hollowed out.

The goal of Busan's industrial development plan is to resurrect the footwear industry through knowledge-based activities. The plan includes the development of design, R&D for raw materials, local brand, and the expansion of education and training capacity.

In Gyongnam province, which is one of the most industrialized regions in Korea, machinery-related industrial clusters are formed. Manufacturing firms of motor vehicles, shipbuilding, machinery parts and components are clustered.

Figure 15. Location of Daegu, Busan, Gyongnam, Gwangju

Their competitiveness has been based on skilled manual labor works. In order to be competitive against firms of advanced countries they need to develop a technological base, in particular basic and generic technology of mechanics. Therefore, they project industrial development plan that is concentrated on cooperative researches of universities and industrial firms.

Gwanju, located in the southwest of Korea, has been alienated from industrialization. Unlike other regions whose industrial plan focuses on restructuring exiting industries, Gwanju aimed at creating a new industry. An ambitious photonics industry, which is at the frontier of advanced countries, was their choice.

Since it is a highly technology-intensive industry they concentrate on establishing a R&D base. They set up a specialized R&D institute, namely Korea Photonics Technology Institute. Cooperative researches of universities and industrial firms are strongly supported. R&D subsidy is utilized as a means to induce manufacturing firms of optoelectronic parts and of optical communication equipment to set up their plants. Since Korean microchip

industry is highly developed, they believe the photonics industry, which is closely to microchip, may have a great potential growth.

Stimulated by these four regions' industrial development plans, other regions began to set up their own plans. Decentralization of industrial policy seems to be successful so far. Except for the national projects such as the 'Next Generation Industry Development,' most of the industrial policy is being transferred to local governments.

Now the role of the central government is changed to approve plans set up by local governments and to monitor their performance. Evaluation function of the central government is most crucial. In order to induce competition among local governments, the Korean government plans to allocate budgets according to the performance evaluation.

While decentralizing is implemented, some problems appear. The most serious problem is the ineffective planning capability of local governments. It is essential to analyze local industries and local firms in detail. Based on the scientific analysis of current and potential competitors in domestic and foreign markets, local industrial development plan should be set up.

But such a careful analysis is not included in the current local industrial plans. Superficial and introductory statistics on local industry are provided instead of detailed analysis. Unproved episodes collected from local firms tend to be illustrated. Vision of local industries seems to be too optimistic.

It is thought that there lie structural problems behind the inadequacy of local governments to correctly assess their industries. In comparison, the central government is equipped with qualified human resources, accumulated years of experience on industrial policy, and at its disposal, advice of policy research institutes. Unfortunately, local governments are not equipped with those resources.

Another problem is that opinions of local firms are too much reflected on local industrial development plans. Other local interest groups show less participation on formulating the plans. Local incumbent firms have interest in the imminent policy issues, not in the long-term regional development. That is why current industrial development plans tend to place priority on short-term support, in particular financial subsidies.

Networks of universities and industrial firms tend to be confined within the region and outside expertise are not sought after.

Rather, ambition shown by local governments creates more problems. Real intention of local governments lies with taking in greater shares of budget allocation from the central government. Moreover, the rule of allocating budget of central government is ambiguous. It includes complicated criteria such as backwardness of local economy justifying local government's argument in receiving more budget allocation.

Therefore, the central government must set up a guideline to enforce local governments in submitting measurable objective before supporting their industrial plans and performance evaluation should be considered budget allocation before the next plan.

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Comments on "Sources of SME Innovation in the Era of Globalization"

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I am an economist like most of the participants in this conference. In my point of view, economics and medical science are similar in many respects. First of all, both disciplines belong in the field of applied science, primarily concerned with solving practical problems. Just as medical science aims at helping patients to recover from illnesses and maintain their health, economics aims at helping economies to deal with economic hardships and promote economic growth.

In general, to care for a patient the caretaker must have: (i) a thorough knowledge of the disease, such as the cause of its onset and a method of treatment, (ii) accumulated clinical experience of observing and treating a large number of patients with the same disease, and (iii) substantial understanding of the current situation as well as the medical history of the patient. As the medical science flourishes, the division of labor among doctors also becomes more and more diversified. While some doctors become specialists in specific areas, others become general practitioners.

Such fundamental concepts seem relevant in economics as well. At the risk of being somewhat arbitrary, one can categorize economists' approaches into the following three groups: (i) theoretical approach, (ii) empirical approach, and (iii) historical/policy-oriented approach. It seems to me that these three approaches in economics are in parallel with the three basic concepts of medical science reasonably well.

I have found that the three papers in this session (Session II: SME Policy in the Globalization Era) represent each of the three approaches adequately. Professor In Uck Park's paper ("What Motivates Start-up Firms when Innovations are Sequential?") is theoretical, and Dr. MoonJoong Tcha and Dr. Yongseok Choi's paper (Impact of Globalization: the Korean Experience) is empirical, while Dr. Joohoon Kim and Dr. Cheonsik Woo's paper takes a historical/policy-oriented approach.

As a discussant, it seems to be a daunting task to discuss Dr. Kim and Dr. Woo's paper because I feel that I am not qualified to discuss such a paper with historical/policy-oriented focus. I would feel much more comfortable if I could discuss Dr. Tcha and Dr. Choi's paper (which is in fact what I am going to do this afternoon). However, as I read the paper I have learned a great deal about SME policy issues for Korea and I would like to strongly recommend this paper to those who are seriously interested in these issues.

As succinctly shown in Kim and Woo's paper, (i) the share of Korea in the world exports volume has been increasing persistently, (ii) the concentration of top 5 (and top 10) commodities in Korean exports has increased, and (iii) SMEs' share of production in the manufacturing sector has been increasing from around 35% (in the early 1980s) to around 50% (in the early 2000s). While the share of SMEs grows in Korea, in the middle of intensifying global competition and of rapid structural changes, the performance of SMEs seems rather disappointing. The paper emphasizes that the average labor productivity of

the SMEs relative to large firms has declined from around 50% in the early 1990s down to 33% in 2003.

As an encouraging sign for the future of the SMEs in Korea, the post-crisis period witnessed a rapid increase in the number of SME-affiliated R&D institutes. The emergence of innovative SMEs requires policymakers, as the paper underlines, to take a "totally different approach" to encourage business startups based on technology. The paper points out that SME policy after the financial crisis was concentrated on the promotion of innovative SMEs. According to the paper, main contents of the government's SME policies consist of the following three elements: (i) to increase government support for venture capital and venture business, (ii) to set up business incubators and to promote new technology-based startups, and (iii) to establish regional innovation system for strengthening local networks between universities, research institutes and SMEs.

The paper provides a detailed description on the current situation of the government's SME policies as well as useful observations for improving the effectiveness of the SME policies. In particular, I believe that the following observations of the paper ask for special attention for further investigation. First, the main problem of the government's venture promotion policy does not lie in that the volume of venture investment is not enough, but in that promising venture business firms are not plentiful. Second, business incubators so far do not have the capacity to provide substantial incubating service beyond providing just needed 'space' and a 'label.' Third, according to the paper, the most serious problem in decentralizing the SME policy and establishing regional innovation system is the inadequacy of local governments in planning and assessing their industries. All in all, I have found that this paper provides many useful observations and insightful diagnoses, which need further empirical investigation and policy discussions.

What Motivates Startup Firms When Innovations are Sequential?

by
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Abstract

We present a dynamic analysis of the interaction between incumbent firms and successful new entrepreneurs, that can provide R&D incentives when innovations are cumulative/sequential. We argue that the insights of the basic model extend to varying market structures and regulatory environments.

I. Introduction

A distinguishing feature of modern high-tech industries, such as software and biotech, is that the technological progresses are made through sequential innovations that build upon previous innovations. Due to such sequential nature of innovations, the conventional approach and results on R&D that treat innovations as isolated events, are inadequate for modern high-tech industries.

The conventional wisdom is that strong protection of invention/innovation (e.g., by patents) promotes the incentives of R&D, thereby economic growth, by rewarding the successful entrepreneurs through monopoly rent for the duration of patents. On the other hand, more protection means larger dead-weight loss of monopoly. The optimal patent policy, therefore, would be to balance the positive effect of providing incentives for worthy R&D activities, and the negative effect of allowing the monopoly dead-weight loss.

When innovations are sequential (i.e., they build on previous innovations), strong patent protection has an extra, negative effect of discouraging R&D efforts of further innovation by anyone other than the patent-holder of the previous innovation, because the sequential nature of further innovation means that it will infringe on the previous patent. Bessen and Maskin (2004) show that this negative effect can be so large between major rival innovators of the industry, such that stronger patent protection reduces (rather then promotes) their R&D activities. Scotchmer (1991) argues that, unlike the conventional R&D literature, "breadth" of patent protection is an important policy dimension in sequential/cumulative innovation, and that the role of patent protection is more on determining the bargaining positions in ex ante joint venture agreement between the current patent firm and the potential next-generation innovator.

The patent's effect of discouraging further innovation is particularly important in industries in which many valuable discoveries are made by enthusiastic new entrepreneurs, such as internet and software industries. For such environments, the findings of Bessen and Maskin (2004) are not particularly useful because they analyze established rival firms in an industry, nor those of Scotchmer (1991) because it would be practically hard to identify the right joint venture partner from many unknown entrepreneurs. In this paper we present a dynamic mechanism between incumbent firms and successful new entrepreneurs, that may

provide R&D incentives of the latter, hence sustain innovation process in the industry. This is mainly done in Section 3, preceded by preliminary discussions on a single-innovation case in Section 2. Then, in Section 4 we extend the findings of the basic model and explore the roles of startup firms in innovation processes in varying market structures and regulatory environments. A brief overview of these sections follows below.

Successful amateur entrepreneurs (e.g., in Silicon Valley) will form small startup firms with a marketable product, however, they would be much less positioned to market their products than an established major player of the industry (e.g., Microsoft). Moreover, chances are that the new product is infringing on some patents in a large patent portfolio of the major firm. Instead of taking legal action that is costly and uncertain in practice (empirically patent litigations have about 50% chance of winning in the US), the major firm can reach a buyout deal with the startup firm.[1] The degree of patent protection affects the bargaining positions in this deal in two ways: stronger protection shifts the bargaining power to the current patent-holder (major firm); at the same time, the major firm is more eager to strike the deal because by doing so it enlarges its patent portfolio, thereby strengthens its bargaining position in future buyout deals. The latter improves the bargaining position of the startup firm. The expected value of such buyout deal provides incentives for the entrepreneurs.

In this dynamic context of sequential innovations, an optimal degree of patent protection is one that motivates the major firm for longest periods in buyout deals for future benefit, which in turn generates a share of the startup in the buyout deal that is sufficient to attract the entrepreneur at the beginning. As this outline of the analysis indicates, in industries where a pool of creative and open-minded entrepreneurs is important in successful innovations (relative to the in-house R&D of established firms), the successful small startup firms are at the centre of the engine of technological innovation. Accordingly, it is important to have entrepreneurial culture and financial systems that are favorable to small startups. This finding accords well with the observation that the software industry prospered much more in the US where venture capital for startups are developed, than in the EU where patent protection is much lower (which would be favorable for innovation in the context of Bessen and Maskin).

Note that in our setting the R&D incentives of the startups are essentially determined by the Nash bargaining outcome and the stronger future bargaining position rendered by enlarged patent portfolio. These essential forces are not affected by some realistic changes of the model, such as when multiple entrepreneurs engage in R&D race, when the firms negotiate licensing agreements rather than buyout deals, and when more than one major firms compete as rivals in the industry. Because some market power of the major firm is necessary for adequate surplus to sustain the R&D of startups (transmitted via Nash bargaining), one obvious concern is the reconciliation of limiting the market power without killing the R&D incentives. Competition by major firms may reduce the market power without dampening R&D incentives excessively, because the startup firm would have a stronger bargaining position with multiple potential partners. Existence of a rival firm, even of a medium-size, may ease this concern beyond the direct competition in current markets, especially if reputations of major firms matter for future demand.

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[1]Westbrock (2004), for example, reports that mergers in the semiconductor and computer industry during 1990-2000 are concentrated on the technology leaders like Intel, 3Com, and Apple Computers, ATI Technologies and Broadcom.

. **Preliminary: A Single-Innovation Model**

Consider an industry consisting of two asymmetric firms: Firm 1 is an incumbent (dominant) firm (e.g., Microsoft) and firm 2 is a startup. Firm 2 can engage in R&D at a cost $C > 0$, which will result in a successful innovation with probability $\pi > 0$. The value of successful innovation from the perspective of supplier is V if firm 2 commercializes it, whereas it is worth more, say $V^* > V$, if firm 1 does. The value of unsuccessful R&D is 0.

Due to the sequential nature, the new innovation builds on previous technology owned/patented by firm 1. If firm 1 litigates, therefore, firm 2 loses the case with probability p: In this case the new technology is freely available to anyone, lowering its actual value to firm 1 down to bV^*, $0 \le b \le 1$. Its value to firm 2 in this case would be much smaller, which we assume to be 0 for convenience. On the other hand, if firm 2 wins the case (which happens with probability $1 - p$), firm 2 gets a patented ownership of the innovation and captures the full value V. A stronger IP protection is captured by higher p. A litigation incurs costs of $c_i \ge 0$ to firm i, $i = 1, 2$, although we assume $c_1 = c_2 = 0$ here for expositional ease.

Instead of litigation, firm 1 can negotiate a buyout deal with firm 2. We model this process as a Nash bargaining as follows. Should they fail to reach a deal, they will end up in a court. Hence, the disagreement/threat points of the firms are the respective expected surpluses from litigation, i.e.,

$$d_1 := pbV^* \quad \text{and} \quad d_2 := (1 - p)V.$$

Since V^* is the maximum value of the technology for the suppliers, the two firms would bargain over how to split V^* between them, i.e., the Nash bargaining set is defined as

$$B := \{(u_1, u_2) \in \Re_+^2 \mid u_1 + u_2 \le V^*\}.$$

Since B is compact and convex, there is a unique Nash bargaining solution (s_1, s_2) that solves

$$\max_{(s, s') \in B} (s - d_1)(s' - d_2)$$

and the solution values are,[2] as functions of p,

$$s_1(p) = \frac{V^* + d_1 - d_2}{2} = \frac{1 + p(b + r) - r}{2} V^* \quad \text{and}$$

$$s_2(p) = \frac{V^* - d_1 + d_2}{2} = \frac{1 - p(b + r) + r}{2} V*$$

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[2]See, e.g., Myerson (1997).

where $r := V / V^* \in (0,1)$. These will be the equilibrium outcome of the single-innovation model. Hence, we have

PROPOSITION 1: *In the single-innovation model the firms would reach an equilibrium buyout deal that splits V^* into $s_1(p)$ and $s_2(p)$ above, hence firm 2 will invest in R&D if and only if $\pi s_2(p) \geq C$. Stronger IP protection decreases (increases) the share of firm 2 (firm 1) via weakening (strengthening) its bargaining position and thereby, reduces the innovation incentives of the startup firm.*

. A Sequential Model

We follow Bessen and Maskin (2004) closely in enriching the model to accommodate sequential innovation. There are infinite periods indexed by $t = 1, 2, \cdots$, in each period of which firm 2, if invested in R&D, succeeds in an innovation with probability π, that has commercial values of V^* and V to firms 1 and 2, respectively. Here, firm 2 is a new firm that arrives in each period while firm 1 is long-lived. To avoid the so-called *replacement effect,* as in Bessen and Maskin (2004), we suppose that these values are incremental values.

If there is no IP protection (i.e., $p = 0$), what can happen to firm 1 in the future is independent of what happens in the current period and, therefore, the two firms bargain over V^* in every period. With a positive level of IP protection, the value of owning the innovation to firm 1 is V^* (direct value) plus the increment in future bargaining share due to a strengthened bargaining position via an enlarged patent portfolio (which pushes up future p). Since the increased value of owning the new technology for firm 1 increases what the firms bargain over, it can improve the bargaining outcome of the firm 2. Hence, some positive level of IP protection may give more R&D incentive to startup firms than no protection. To capture this effect, we need to define p as a function of both the degree of IP protection and the size of firm 1's patent portfolio $L = 0, 1, 2, \cdots$.

We model the level of IP protection by a parameter $z \in [0, 1/2]$ in the following manner. Since $L = 0$ means no IP to protect, $p_z(0) = 0$ for all z, where the argument of p_z is L. Then, the k-th patent added to firm 1's portfolio increases p by z^k: that is, $p_z(1) = z$, $p_z(2) = z + z^2$, and

$$p_z(L) = \sum_{k=1}^{L} z^k.$$

REMARKS: (1) Not having a patent on an innovation would reduce p in reality but not modelled. This would only reinforce our message because firm 1 would have less bargaining power when it reduces p. (2) The impact of the k-th patent of firm 1 would differ depending on how many previous inventions are not in L, which we also abstract from. This should not matter for the qualitative results.

If $z = 0$, every period is separate as explained earlier, and the buyout deal would be the same as in Section 2 with $p = 0$. In particular, each period the surplus of the startup firm that undertook R&D is $\pi s_2(0) := \pi(1-r)V^*/2$. Depending on the size of R&D cost C relative to $\pi s_2(0)$, either there will be R&D by startup (hence, innovation with probability π) in every period, or there will be no R&D at all. For each of these two cases, we examine the effects of positive levels of IP protection, i.e., $z > 0$.

3.1 The case of R&D when $z = 0$

If $\pi s_2(0) > C$ there will be R&D every period when there is no IP protection, i.e., $z = 0$. Hence, IP protection ($z > 0$) does not induce any innovation that would not have been possible without it. Nonetheless, we examine the innovation incentives in this case, for it would help understand the analysis in the other case.

Let $\hat{z}$ be such that $\pi s_2(p_{\hat{z}}(\infty)) = C$. Then,

[A] for any $z < \hat{z}$, firm 2 invests in R&D in every period.

To see this, observe that in each period i) firms 1 and 2 bargain over a total surplus exceeding V^* if there is an innovation, ii) $p < p_{\hat{z}}(\infty)$, and iii) the disagreement points are the same as when there was no future (because once they go to the court, the firm 1 does not own the new innovation even if it wins the case as described in Section 2, hence the incremental value due to an enlarged patent portfolio is foregone). Since i) means that the surplus they bargain over is larger than that of the single-innovation case, and ii) and iii) imply that the bargaining position of firm 2 is better than that in the single-innovation case for $p_{\hat{z}}(\infty)$, it follows that the expected value of Nash bargaining outcome for firm 2 is larger than $\pi s_2(p_{\hat{z}}(\infty)) = C$.

If $z > \hat{z}$, on the other hand, for large enough L firm 2 would not find it profitable to invest in R&D, because the total surplus to bargain over becomes arbitrarily close to V^* and so do the disagreement points to those in the absence of future, while p exceeds $p_{\hat{z}}(\infty)$, hence the expected value of Nash bargaining outcome for firm 2 goes below $\pi s_2(p_{\hat{z}}(\infty))$, i.e., it would not recover the R&D cost. Let L^* denote the largest portfolio size for which R&D takes place. For any $L < L^*$, R&D takes place as well because, relative to L^*, the total surplus to bargain over is larger and p is lower (and the disagreement points are the same as when there was no future). That is,

[B] if $z > \hat{z}$, firm 2 invests in R&D until firm 1's portfolio reaches a certain size, then no more R&D takes place.

3.2 The case of no R&D when $z = 0$

In this case it seems plausible to anticipate that IP protection can promote innovation in early stages of technology development, i.e., for low L, by enlarging the total surplus to bargain over. The innovation process, though, would inevitably stop eventually, because the total surplus to bargain over will converge back to V^* as the value of an additional patent dwindles to nil. However, this reasoning is self-contradictory: in the last period that R&D is supposed to take place, firm 2 would not have an incentive to invest in R&D because it would bargain with firm 1 over no more than V^* and have a worse bargaining position than when $z = 0$ due to positive p. This appears to suggest a disturbing conclusion that, unlike the anticipation above, innovation would never take place in equilibrium.

This result, however, is an artifact of the simplifying assumption that all startups have the same cost of carrying out their R&D. Hence, we relax this assumption minimally as follows:

(α) In each period there is some chance, a probability $\eta > 0$, that the R&D cost of the startup (firm 2) in that period is small, normalized to 0, instead of C. The realized R&D cost is private information of the firm 2 in each period.

Note that firm 2 will engage in R&D in any period if the cost is 0, hence an innovation will come forth with at least probability $\eta\pi$ in every future period. Recall that we are currently considering the case in which firm 2 will not invest in R&D if cost is C when there is no IP protection ($z = 0$). Now, return to check the presumed equilibrium described above in this section. Again, the innovation process would inevitably stop eventually by the same reason. Consider the last period L^* that firm 2 would invest in R&D regardless of its cost. Since innovations will come forth with probability $\eta\pi$ in each future period, firm 1 would extract more surplus in the future if it had patent on the current innovation. Therefore, the total surplus to bargain over is larger than V^* by at least a certain amount, and firm 2 may still have an incentive to invest C in R&D even if its bargaining position is worse than when $z = 0$ (i.e., even if $p > 0$). This last period is one such that adding the current innovation to firm 1's patent portfolio will render firm 1's bargaining position strong enough that firm 2's share of the next pie to bargain over (which will be smaller than the current pie) does not recover C. Indeed such last period can exist in equilibrium. Furthermore, R&D takes place in any previous period because the pie is larger and firm 2 has a better bargaining position due to a smaller portfolio of firm 1.

For illustration, fix $V = 10$, $b = 0.5$, $r = 0.1$, $C = 5.5$, $\pi = 1$ and $\delta = 0.9$. Then, it is straightforward calculation to verify that, for all $0 < z < 0.5$, the startup firm will

invest in R&D regardless of its cost if $L = 0$, but not if $L \geq 1$ unless when the R&D cost is zero. Furthermore, for higher values of η and/or δ the future value of having a larger portfolio is greater for firm 1, enlarging the size of pie to bargain over. Hence, the startup may invest in R&D when $L = 1$ as well, and possibly for larger L: For instance, this is so for large $z(< 0.5)$ when $\eta > 0.6$ or δ is near 1. The calculations for these illustrations are done by *Mathematica* and are available from the author upon request.

One obvious question of interest is the level of IP protection (z) that maximizes L^*, i.e., that induces R&D investments from high-cost startups as long as possible. It is straightforward to see that higher z is not always better, because p will get high very quickly, which is detrimental for firm 2's bargaining outcome. Hence, the optimal IP protection would be an intermediate level such that the value of the first patent is large enough (i.e., the pie in the first period to bargain is large enough) to drive up the innovation process via motivating the early-arriving high cost startups, but not too large to give excessive bargaining power to firm 1 prematurely that will discourage R&D investment. However, it will be technically complex to give a full characterization or a general calculation formula of the optimal level of z. We summarize the discussions so far as below, which is a version of the findings in Panagopoulos and Park (2005).

PROPOSITION 2: *Consider the sequential model described above with the cost uncertainty as in (α). If $s_2(0) > C$, high-cost startup firms will always invest in R&D when IP protection is sufficiently low, including $z = 0$. If $s_2(0) < C$, high-cost startup firms will never invest in R&D for sufficiently low z. In this case, it is possible to induce R&D from high-cost startups by increasing IP protection, until firm 1's patent portfolio reaches a certain size: The optimal z that maximizes this critical portfolio size is an intermediate level such that early patents in the portfolio are valued sufficiently highly by firm 1 for their impact in strengthening firm 1' future bargaining position, but not too quickly to discourage startup firm's R&D incentives too soon.*

. The R&D Motives of Startup Firms

The analysis in the previous section suggests certain ways that may enhance and sustain the R&D motives of startup firms even when the innovations are sequential. Although the analysis is carried out on a simplified model in the previous section, the basic insights can be extended to varied market structures and regulation regimes.

4.1 Multiple startups in R&D race

In the base model we postulated that there is a single startup in each period. More generally, however, there may be multiple startup firms competing in R&D activities to be the first in succeeding in innovation. In the standard case that the startup firms are ex ante symmetric, each firm's incentive is lower than when there is a single firm because the probability of winning the R&D race is smaller when there are competitors. In equilibrium, the number of firms who engage in the race is the maximum number such that each firm's prospect of winning justifies the R&D cost, because any additional firm in the race would reduce the expected value of R&D investment below its cost. This does

not affect the fundamental roles of startup firms in industries with sequential innovations, but entails some changes in details as noted below.

Since the number of startup firms engaging in R&D is (weakly) larger than the case of a single startup,[3] the probability of innovation is higher in each period. This would speed up the innovation process for a given IP protection level.

When multiple startup firms invest in R&D, a question arises as to whether the individually rational multiple R&D decisions are inefficient from the perspectives of social welfare. It is possible, therefore, that the authority may find reducing IP protection desirable in the face of multiple potential startups, to prevent socially excessive, duplicative R&D activities.

4.2 Licensing instead of buyouts

The base model considered the case that the incumbent firm negotiates a buyout deal with the new innovator for a mutually beneficial outcome relative to the alternative of costly and uncertain legal proceedings, hence the incumbent retains the market power as long as a deal is reached. Although modelling out-of-court negotiations in this way allows cleaner analysis, such outright takeovers/mergers may not be prevalent for various reasons such as antitrust regulations. An alternative form of negotiation often observed in practice is licensing agreements. The essential findings of the previous section carry through when the firms negotiate licensing agreements instead of buyout deals, because the equilibrium terms of licensing agreement would be qualitatively the same bargaining outcome as the buyout deal, albeit over a different amount of total surplus. There are, however, the following additional considerations.

The equilibrium terms of licensing agreement would be a result of bargaining as before. The exact terms would depend on how the post-license market works, because it determines what they bargain over. If the two firms behave collusively (i.e., as if a cartel), then the analysis would be identical to the previous section. If the firms behave more competitively, the consumers would benefit but it may be harder to provide adequate R&D incentives due to reduced profit from competition. The overall effect would also depend on whether the new innovation provides a complementary product to the previous state of art or a substitute for it. We elaborate a little bit on this presuming that the incumbent firm behaves as a Stackelberg leader after the licensing agreement.

First, if the startup supplies a substitute for the previous state of art supplied by firm 1, then the two firms are in direct competition. The price of firm 1 would be lower compared with the case that the firm 1 solely supplies both products after a buyout deal. The price of firm 2, however, would be under a downward pressure from competition on the one hand, but at the same time under an upward pressure due to the higher marginal cost of firm 2 by the amount of royalty. (This upward pressure disappears if the royalty is lump-sum rather than per unit of sale.) Unlike the price of firm 1, therefore, firm 2's price may not be lower under licensing agreement than under a buyout deal, hence the comparison of social welfare may be ambiguous between the two scenarios. In addition, competition reduces the total surplus for the firms to bargain over, thereby the startup firm's share as well. Consequently, the R&D investment by high-cost startups may not be

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[3]Note that it cannot be smaller for any given IP protection: If a high cost firm were to invest in the base model and multiple firms would not engage in a race, then one firm would still find it profitable to invest.

sustained as long under license agreement, reducing the prospects of continued innovations.

A standard result for complementary products is that their prices are lower when supplied by a single firm than when supplied by separate firms, because the single supplier internalizes the positive effect of supplying one product on the demand of the other, hence produces more than two separate firms that do not benefit from such effect.[4] If the new innovation is a complementary product, therefore, both the consumer surplus and the producer surplus would be lower under licensing agreement than under buyout deal. Consequently, the R&D investment by high-cost startups would be lower under license agreement. All of these suggest that the social welfare would be lower under license agreement than under buyout deal if the innovations provide complementary products to the previous state of art.[5]

4.3 Oligopoly incumbents

Modern high-tech industries typically exhibit high market concentration among a small number of major firms, nonetheless the assumption of monopoly incumbent in the base model is a special case. When there are multiple incumbent firms, the competition among them would dampen the potential surplus from an innovation. Since this dampened surplus would be reflected in the bargaining share of the startup firm, it seems at first sight that multiple incumbents would reduce R&D incentives of the startup firms. This indeed would be the case if there is one clear incumbent firm whose patent portfolio the new innovation may have infringed on, hence any deal would be between the startup and this incumbent firm but no other. On the other hand, due to the interdependent nature of technology, if there are multiple incumbent firms that the innovation may have infringed on, then there are at least two reasons why this is not necessarily the case. The first is a relatively straightforward observation that the startup firm would be in a strengthened bargaining position when multiple firms compete to become a partner in the deal.[6]

The second reason comes from the fact that the value of owning the innovation for an incumbent firm is the difference in profit between when it owns the innovation and when one of its rival firms owns it. Since this difference is larger when there are significant rival firms, striking a deal may be more valuable for an incumbent when there are rivals than when there is none, which may in turn has a favorable effect on the bargaining share of the startup. This aspect may also have a dynamic strategic effect if an incumbent firm's good reputation shifts future demand in favor of that firm: current reputable behavior would improve a firm's position in future bargaining by reducing the potential value of innovation for rival firms, thereby their desirability as potential partners for the startup firm. Note that this reasoning would not be affected when some incumbent firms are smaller than others. Hence, existence of even a med-size firm may restrain the dominant firm's market power beyond its direct competition, by becoming a tougher rival in buyout deals the more market power the dominant firm exercises.

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[4]See, for example, Shapiro, C. (1989).

[5]When there exists a competing product (substitute) for one of the products, potential antitrust issues arise from the possible practice of refusing to sell the two products separately (foreclosure).

[6]In principle, there can patent-infringement litigation by another major firm on the acquired innovation through a buyout deal. We abstract from this complication, say, by assuming that the head-to-head court confrontation between two major firms are too costly for both parties.

. Summary

Reflecting the prominent features of modern high-tech industries, we consider environments in which innovations are sequential, hence further innovation efforts are discouraged due to the potential threat of patent-infringement litigation. We present a dynamic analysis of the interaction between incumbent firms and successful new entrepreneurs, that can provide R&D incentives of the latter, thereby sustain innovation process. We argue that the insights of the basic model on the degree of IP protection and the roles of startup firms in the innovation process, extend to varying market structures and regulatory environments. These discussions identify some of the main factors and their interactions that determine the R&D dynamics, which can be useful in policy considerations

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Comments on "What Motivates Start-up Firms When Innovations are Sequential"

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Nowadays one cannot emphasize too much the importance of innovation that is the major source of the technological progress and economic growth. Considering that start-up firms are the main actors of innovations in so-called high-tech industries, the paper deals with a pertinent and interesting question both theoretically and practically.

At the risk of over-simplification, I would think that there are two main areas of research on innovation. One is to examine and characterize the optimal amount of R&D investment under different appropriability conditions. The other is to design a patent system in order to induce efficient R&D decision through reward structures. This paper is a kind of amalgam of these two lines of research in the sense that the paper analyzes the investment decision and then suggests several implications for patent policy.

In the static setting, while the conventional wisdom is that strong protection of intellectual property is essential for innovation, the paper shows that this is not the case. That is, stronger protection of intellectual property deters the subsequent innovations. Then the paper moves on to the dynamic setting and shows that stronger protection may or may not promote innovations, depending on the economic environments. Extension of the main finding of the paper to different market structures and regulatory environments sheds lights on patent policy.

After careful reading, I have an impression that this paper is very interesting and well written. But a little change(no major revision) would be necessary for publication. So I would like to make a recommendation to encourage the author to revise a bit and clarify some expressions.

\<Comments on the Model and the Results\>
First of all, the sequential nature of innovations is one of the characteristics in high-tech industries and this observation is the motivation of the paper. As Bessen and Tirole(2002) note, in the high-tech industries, firms are not eager to protect product or process innovations through patents. Rather, they allow imitation, whether deliberately or not, and welcome the arrival of rival firms because of the spillover and market expansion.[7] Considering this, the analysis does not seem fit comfortably for the high-tech industries due

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[7] An interesting feature of Software industry is "open source production" in which firms do not rely on patents but disclose original material.

to the focus on patent. It might be better to give a concrete example/case for the motivation of the paper.

Secondly though the author mentions the difference between this paper and Scotchmer(1991), the paper is in line with Scotchmer in the sense that structuring bargaining positions is the most important role of patent design. Moreover, if one accepts the underlying implicit assumptions that the identity of an innovator is known, (that is, who innovates is known), Scotchmer's logic could be applied.

Of course, the application of Scotchmer's idea is limited when there are many potential innovators. If the incumbent does not know who is going to be a perfect match and the only one innovator is successful in making technical improvements, then Scotchmer's proposal for "prior agreement" through joint venture may not work well. In contrast, the result of the paper can be extended to the case where innovators are *ex ante* anonymous. But a little modification is needed for this, I think. When there are many potential innovators, it becomes very likely that that two or more start-up firms are successful, in which case competition among the innovators weakens the bargaining power and leads to different bargaining outcome. Though I don't think that this changes the results qualitatively, at least adding some remarks would help the readers to understand the paper.

The next one is a minor point. In section 4.3 Oligopoly Incumbents, the paper describes that when the innovation may infringe on multiple incumbents owing to the technical interdependence, then the start-up firm takes up a better position in bargaining because the incumbents rush to strike a deal. When the innovation builds on several prior arts, then reaching an agreement with only one incumbent does not make start-up immune to patent infringement. So it is not obvious that incumbents try to be the first in reaching a deal with the start-up and hence the start-up firm can exercise stronger bargaining power against incumbents.

Lastly the paper assumes that only the short-lived start-up is doing innovative activity. This might be a reasonable simplifying assumption in a static model. But in a dynamic setting, it is more realistic to suppose that the incumbent as well as start-up is engaged in innovation activities and as a result, firms compete each other at the stage of innovation.

Moreover, the choice of defense strategies to protect intellectual property is an issue. I understand that patent is one of the most common ways to protect intellectual property. However, there is another widely used defense, which is a secret. According to Cohen *et al.*(2000), patents are ranked lower than secrets as a mean to protect intellectual property. This suggests that patents be not the most effective way for intellectual property rights. More often than not, firms intentionally leak technical knowledge to protect innovative technical knowledge. Incorporating strategic disclosure by firms having secrets and responses by start-up firms would enrich the model, which improves our understanding of incentives to innovate.[8]

To conclude, it is very welcome to have a paper that analyzes the sequential nature of innovations in the modern high-tech industries. However, in order to give us a full picture and to provide policy guidance, a little modification and enlargement of the scope of the paper may be necessary.

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[8] Denicolo and Franzoni (2004) analyze the incumbent's choice of intellectual property right defenses.

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The China Impact and Korean Manufacturing Industries: Experiences of SMEs

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. Introduction

Korean industries and enterprises have been facing dramatic challenges since the economic crisis that beset the nation in 1997. While the crisis itself triggered the restructuring of industries, the various challenges continued after the crisis and played an important role for enterprises to determine whether to survive, close down or switch to a new industries by producing a new (combination of) product(s). In the middle of restructuring process lay the unprecedented expansion of trade relationship between Korea and China, which may be the most substantial among a variety of challenges that the nation experienced recently.

Due to its rapid pace of growth, the Chinese economy has affected growth and trade of many economies in the region. For example, in 1990 China's share of Korean exports and imports were a mere 0.9% and 3.2%, respectively (Figure 1). Throughout the last decade and a half, trading volume between Korea and China has increased dramatically. In 2004, Korea exported 19.6% of its total exports to China, recording US$ 49.8 billion while China's share of Korean import reached 13.2%, recording US$ 29.6 billion.[1] China has become Korea's biggest export market and at the same time the second largest import source.

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[1] These numbers do not include trading volumes with Hong Kong. When Korea's trading volume with Hong Kong is included, China's share in Korea's exports and imports in 2004 increase to 26.2% and 14.7%, respectively.

Figure 1. Korea's Biggest Trading Partner: China

We aim to analyze dynamic aspects of restructuring of manufacturing industries in the Korean economy between 2000 and 2003. As is well known, Korea has pursued an export-oriented growth policy since 1963. Since the crisis, the Korean government exerted even more strenuous efforts to liberate international trade and carry out regulatory reforms to enhance the efficiency and productivity of the economy. These efforts contributed to assisting the economy in incorporating into the globalized order of the world economy. This paper investigates what happened in Korean industries and enterprises since the economic crisis, with a special focus on the effect of China's penetration into the Korean market.

The opening and closure of manufacturing plants, in association with impact from the expansion of trade relationship with China, has attracted widespread attention in Korea. In particular, due to their structural weakness and inefficient performance, small and medium sized firms or plants (hereafter SMEs: small and medium-sized enterprises) have received attention of policy makers, researchers and the general public. It is argued that Korean SMEs in general have fragile foundations such as a low capital-labor ratio and low skill intensity, and accordingly have distinctive characteristics compared to large-scaled companies. We are particularly interested in SMEs in Korea's manufacturing sector. SMEs are important for Korean manufacturing as Table 1 indicates: SMEs account for more than 99 percent of total enterprises, employ more than 75% of total employment in manufacturing, and produce around 50% of total manufacturing product.

While appearing to be static, industries may experience substantial restructuring due to this continuous flow of entry and exit. The number of SMEs (plants) in Korean manufacturing industries increased from 64,093 at the end of 2000 to 72,299 three years later. While the number of net increase is only 8,206, in fact only 32,185 plants or just above 50% of those in 2000 survived three years. 31,908 plants either closed down or changed main products and categorized as another industries and, 40,114 new plants entered for the period.

In this paper, special attentions will be paid to entry, exit and switch of SMEs and exposure to import competition as a crucial determinant of a plant's decision making. According to neoclassical trade models, this entry and exit of plants can be explained by the trade patterns of the nation and factor endowments. The study uses two data sets: The first

is about industries and the second about plants. The former is used to analyze which factors affect entry and exit rates of firms in each industry. The latter is used to examine which factors affect the probability of plants to survive or switch. In both cases, the issues related to the impact of trade, in particular Korea's trades with developed countries (OECD) and China, and market structures at industry level are a focus in addition to plant specific characteristics.

This paper consists of five sections. Section 2 discusses major models adopted in this study, and introduces variables and data. Section 3 empirically investigates the restructuring of manufacturing industries and discusses the findings by concentrating on the entry and exit rates in each industry. The behavior of plants such as exit or switch is analyzed and discussed in Section 4. Section 5 concludes the study and suggests areas for further investigation.

Table 1 Share of SMEs and non-SMEs in Korean Manufacturing

Year = 2000

	Number of Plants	Number of Employees	Shipment (billion Won)	Number of Employees per Plant	Shipment per Plant (billion Won)
SMEs	64,093	1,261,184	163,597	19.7	2.6
	(99.3%)	(75.6%)	(48.7%)		
Non-SMEs	472	406,533	172,357	861.3	365.2
	(0.7%)	(24.4%)	(51.3%)		
Total	64,565	1,667,717	335,953	25.8	5.2
	(100.0%)	(100.0%)	(100.0%)		

Year = 2003

	Number of Plants	Number of Employees	Shipment (billion Won)	Number of Employees per Plant	Shipment per Plant (billion Won)
SMEs	77,753	1,387,270	216,633	17.8	2.8
	(99.4%)	(78.3%)	(51.5%)		
Non-SMEs	480	384,082	204,347	800.2	425.7
	(0.6%)	(21.7%)	(48.5%)		
Total	78,233	1,771,352	420,979	22.6	5.4
	(100.0%)	(100.0%)	(100.0%)		

Note: Numbers in parentheses are the share out of total.

Source: Report on Mining and Manufacturing Survey 2000 and 2003

. Models and Variables

2.1 Models for Industry Study

In an era of globalization, with the incorporation of firms into the world economy, exposure to foreign producers and subsequent competition become more intensified. Traditional Heckscher-Ohlin trade models provide explanations on patterns of trade and predictions for which industries will grow or fade away. In a country augmenting its physical capital, the least capital-intensive industries are predicted to have the highest exit rates. In contrast, industries with high capital-labor ratio are predicted to experience high entry rates. We develop the implications of endowment-based neoclassical trade models to discuss entry and exit rates for each industry, for SMEs in particular. The incorporation of Korea's trade relationship with China or the OECD countries is expected to provide different implications for entry and exit rates for industries.

In addition to trade models, this paper also considers market structure models, where entry costs are crucial in determining entry and exit probabilities. As Bernard and Jensen (2001) point out, existing market structure models do correctly predict that entry and exit rates will co-vary positively across industries. In other words, high entry costs cause both low entry and low exit probabilities, implying that the entry barrier also plays a role of exit barrier.

This study begins with research by Dunne, Roberts and Samuelson (1988, 1989) in discussing market structure models. Dunne *et al.* looked across industries and found that plant entry and exit rates are both significantly and positively correlated. However, once they control persistent industry effects, entry and exit rates are negatively correlated. As a result they conclude that there are substantial persistent structural factors that move entry and exit rates in the same direction. Dunne and Roberts (1991) find industry characteristics in regards to entry and exit rates: industries with lower entry and exit rates are more capital intensive, have a higher average firm size and higher price-cost margins.

In examining entry and exit rates for each industry, our study incorporates factors that are related to trade models and/or market structure models. Three questions are addressed for SMEs. First, is trade exposure or industry's factor intensity as explained in neoclassical trade models important in determining entry and exit rates of firms? Second, is any barrier recommended in a market structure model critical in determining entry and exit rates? Third, are the entry or exit rates for an industry affected by the export-orientation of the industry?

The entry rate (*ER*) and exit rate (*XR*) are established as the following:

$$ER_{it \rightarrow it+\tau} = c_0 + \Phi(IC_{it}) + H_E(IT_t) + u_{it}$$

$$XR_{it \rightarrow it+\tau} = c_1 + \Gamma(IC_{it}) + H_X(IT_t) + v_{it}$$

where *c* is constant, *IC* is the vector of industry characteristics, *IT* is the vector of interaction terms and *u* and *v* are error terms. Industry characteristics *IC* contain variables related to trade models and market structure models. Subscript *i* denotes industry, *t* means time and τ is the duration of period under observation.

2.2 Models for Plant Study

This study also investigates the reallocation of resources within manufacturing, especially among SMEs in the presence of expansion of trade with China, by looking at the exit and switch of plants. Three questions are addressed in this part of the research. First, is a plant more likely to die if China has greater Korea's import presence in the relevant industry? Second, within industries, are more capital-intensive (or labor-intensive) plants more likely to die/survive? Third, do Korean manufacturing plants adapt to imports from low-wage countries such as China by altering their product mix towards industries where Korea may possess comparative advantage?

Different from previous studies (for example, Bernard, Jensen and Schott [2003]), the models used in this research contain industry characteristics and interaction terms as well as plant characteristics and interaction terms for plant analyses. The previous studies are correct in the regard that the decision on survival or switch of a plant is associated with various conditions such as its age, size and trade related variables. Nevertheless, it is hypothesized in this study that the decision of the plant is also affected by the general conditions specific to each industry. For example, if the markup of an industry is generally high, then a plant recording low markup can have an incentive to stay in the industry to catch up. Therefore that plant will have a lower probability of closing down (or switching) compared to a plant with the same condition in an industry with a low markup.

The probability for a plant to close down (*Death*) and to switch its major product (*Switch*) is respectively formulated as the following:

$$Death_{i\,p\,t+\tau} = c_2 + F_D(\,IC_{it}\,) + G_D(\,FC_{ipt}\,) + H_D(\,IT_{it}\,) + w_{ipt}$$

$$Switch_{i\,p\,t+\tau} = c_3 + F_S(\,IC_{it}\,) + G_S(\,FC_{ipt}\,) + H_S(\,IT_{it}\,) + \varpi_{ipt}$$

where *FC* stands for plant characteristics and subscript *p* for plant. Therefore, the two equations account for the fact that the probability of death or switch of a plant is the function of industry characteristics that plants in the same industry share together, plant characteristics that are unique to the plant, and interaction terms. As already mentioned, variables related to neoclassical trade models and market structure models are included for *IC* and *FC* respectively.

2.3 Data Description and Variable Construction

The data employed in this paper consists of two different sources. The first one is the annual "Report on Mining and Manufacturing Survey" (henceforth referred to as Survey) conducted by KNSO (Korea National Statistical Office). This Survey covers all establishments (at plant level) with five or more workers in mining and manufacturing sectors and contains necessary information to construct variables used in this paper, including employment, wages, value of shipment, production cost, tangible fixed assets and so forth. In addition to this information on inputs and outputs, the Survey consistently keeps track of the identification code of each plant and its industry classification according to KSIC (Korea Standard Industrial Classification) over time which enabled us to identify which firm entered into or exited from a certain industry and which firm switched its industrial position. Most of the variables were constructed by utilizing this Survey.

Since the main focus of the empirical analyses is to assess the effect of expansion of trade, (especially whether import from foreign countries including China has a significant effect on SMEs), it would be necessary to obtain the data on export and import for which the Trade Statistics Database published by KCS (Korea Customs Service) has been employed.

This database provides the value of imports and exports both by commodity and trade-partner country.[2]

What follows is an explanation of how variables representing plant and industry characteristics were calculated.

Variables for Plant Characteristics

PKL (Plant's capital-labor ratio): There are four types of tangible fixed capital (land, building, machinery equipment and transportation equipment: in thousand won) in the Survey data. All types of capital were deflated by corresponding capital goods deflators (obtained from the Bank of Korea) with the base year of 2000 and were summed up to get capital stock. Labor is the number of employees.

PSI (Plant's skill Intensity): Skill intensity was proxied by the ratio of the total wage bill of non-production workers to that of production workers. Both wage bill figures are directly taken from the Survey (See Bernard, Jensen, Schott [2003]).

PMU (Plant's markup): Markup is calculated by {(shipment – total variable cost) / shipment} where total variable cost consists of labor cost, cost for material and energy cost.

PNE (Plant's number of employees): This variable was directly taken from the Survey.

PAG (Plant's age): Age is calculated by (2000 – year of establishment of the plant).

Variables for Industry Characteristics

IMO (Import Penetration Ratio from OECD countries): IMO is calculated by {import from OECD countries / (shipment + import from OECD countries)}.

IMC (Import Penetration Ratio from China): IMC is calculated by {(import from China / (shipment + import from China)).

INX (Industry Export): Industry export is directly taken from the Trade Statistics Database.

MKL, MSI, MMU, MNE, MAG: median value of KL, SI, NE, MU and AG, for each industry respectively

Finally, we define the industry entry rate and exit rate as follows.

$$ER_{it \rightarrow i\,t+\tau} = \frac{\text{Number of New Plants at year } t + \tau}{0.5 \times (\text{Number of Plants at year } t + \text{Number of Plants } t + \tau)}$$

$$XR_{it \rightarrow i\,t+\tau} = \frac{\text{Number of Disappearing Plants at year } t + \tau}{0.5 \times (\text{Number of Plants at year } t + \text{Number of Plants } t + \tau)}$$

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[2] The Trade Statistics Database follows Harmonized System of Korea (KHS) for commodity classification and thus it would be necessary to have concordance matrix between KSIC and HSK to combine the Survey data and the Trade Statistics Database. This concordance matrix was obtained from Lee (2003).

Ⅳ. Empirical Tests and Discussions-Industry Study on Entry and Exit

One of the most important means with which an industry can achieve restructuring may be the birth and death of firms. Predictions from the market structure and trade models presented are essentially medium to long run in nature. As discussed, we use data for two years of 2000 and 2003. Considering that entry and exit rates are always greater than or equal to zero, we estimate Tobit specifications with standard errors adjusted for potential heteroskedastcity.

The two estimations are:

$$ER_{it \to it+3} = c_0 + \beta_E \ IC_{it} + \gamma_E \ IT_{it} + u_{it}$$

$$XR_{it \to it+3} = c_1 + \beta_X \ IC_{it} + \gamma_X \ IT_t + v_{it},$$

where industrial characteristic (*IC*) consists of *MKL* (capital-labor ratio of a median plant in the industry), *MSI* (skill intensity of a median plant in the industry), *MMU*(markup of a median plant in the industry), *MNE* (number of employment of a median plant in the industry), *IMO* (import penetration ratio of the OECD countries into the industry), *IMC* (import penetration ratio of China into the industry) and *INX* (the value of export of the industry).

MKL, *MSI*, *IMO* and *IMC* are related to the Heckscher-Ohlin models of international trade. According to the neoclassical trade models, industries in line with the economy's comparative advantage have a higher entry rate and lower exit rate. While Korea has accumulated capital and developed technologies over time, it is not obvious yet whether this accumulation and development are sufficient for the economy to gain comparative advantage in capital-intensive or skill-intensive industries. In addition, it is not obvious either whether SMEs could benefit from accumulated capital and developed technologies. An estimation with these trade variables will provide some clues to this question.

However, the two trade related variables, *MKL* and *MSI*, may be entry barriers as well, since more capital-intensive or skill-intensive industries are in general closely associated with high-tech industries, or those with relatively high initial investment. More direct variables for market structure models are *MMU* and *MNE*. The Herfindahl index indicating the concentration ratio is used in previous studies, however, it is not used here as this study concentrates on SMEs, and the market share of a select number of large firms is not considered crucial in determining SMEs decision to enter or exit the market. The results of estimating the entry rate, with variations considering interaction between variables, are reported in Table 2.

Table 2.　Analyses of Industries' Entry Rates

Variables	Estimation (1)	Estimation (2)	Estimation (3)	Estimation (4)
MKL	- 0.004**	-0.005**	-0.004**	-0.004**
	(-2.70)	(-2.72)	(-2.50)	(-2.16)
MSI	0.178	0.180	0.112	0.119
	(1.02)	(1.04)	(0.64)	(0.68)
MMU	-0.158	-0.144	-0.178	-0.169
	(-0.38)	(-0.35)	(-0.44)	(-0.41)
MNE	-0.003	-0.003	-0.008	-0.008
	(-0.77)	(-0.72)	(-1.61)	(-1.45)
IMO	0.041	0.019	0.025	0.017
	(0.40)	(0.18)	(0.25)	(0.16)
IMC	-0.859	-1.329*	-3.028**	-3.051**
	(-1.66)	(-1.87)	(-2.13)	(-2.14)
INX	0.375	0.325	0.312	0.295
	(1.02)	(0.88)	(0.86)	(0.81)
MKL*IMC		0.035		0.017
		(0.96)		(0.43)
MNE*IMC			0.195	0.177
			(1.63)	(1.40)
Constant	0.770***	0.787***	0.857***	0.857***
	(5.68)	(5.80)	(5.97)	(5.98)
Prob. > Chi-sq.	0.111	0.126	0.071	0.102
Log-likelihood	23.184	23.644	24.551	24.642

NOTE: Numbers in parentheses are *t*-ratio. ***,** and * represent that the coefficients are significant at 1%, 5% and 10% respectively.

While the interaction terms are not significant in any case, the overall fitness of the model is the best with one interaction term (Est.(3)). Overall, only two variables appear to affect the entry rate of SMEs in the industries: the capital-labor ratio of the median plant in each industry and import penetration ratio of China have significant (not in Est.(1)) and negative coefficients.

As discussed previously, we expect two completely different impacts of the factor intensity to entry rate. First, as Korea is believed to accumulate more capital over the period and is equipped with more comparative advantage in capital-intensive industries, it is expected that plants are more likely to enter industries with a higher capital-labor ratio. Second, as the higher capital-labor ratio in an industry may play as a barrier to entry, it is expected that plants are less likely to enter the industry, all other things being equal.

Our finding suggests that capital stock accumulation in 1999 and 2000 after a sharp decrease in capital stock accumulation in 1998 should not be sufficient, at least in the global context, for the factor accumulation effect to dominate the barrier effect. Alternatively,

SMEs in Korea may have failed to accumulate capital while the economy as a whole enhanced the capital-labor ratio, and consequently did not enter the industry with high capital-labor ratio.

Our concern is also on the effect of Korea's trade with select economies on entry rates. The result indicates that trade expansion with the OECD countries does not systematically affect entry rate for any industry. However, market penetration of China in an industry significantly deters new entrants in the industry: it is evident that industries facing more import penetration of China experience a significantly smaller number of new entrants. Other variables such as industry's median skill intensity, markup, employment and exports are found not to affect entry rates for each industry.

In sum, it is concluded that the capital-labor ratio required for an industry plays an important role as an entry barrier to SMEs: The entry rate is likely to be low for industries with high capital-labor ratios. In addition, the China effect is substantial: The entry rate is likely to be low for industries where imports penetration of China is high. This result witnesses the serious situation that SMEs in Korea have been facing. Considering that imports from China are more likely labor-intensive, Korean SMEs in manufacturing are squeezed between the challenges from each side; the difficulty of getting in capital-intensive industries and pressure from imports from China.

Analyses on the exit rate also provide similar implications. Table 3 summarizes the findings from exit rate analyses at the industry level. First, the lock-in effect by higher factor intensity appears obvious. In other words, plants in the industries with high capital-labor ratio are less likely to close down. Alternatively, this can be explained that the exit rate of plants is higher in labor-intensive industries, as the economy moves into more capital-abundant regime. The result is also consistent with the China impact that plants are more likely to close down where import penetration of China is high.

Table 3 . Analyses of Industries' Exit Rate

Variables	Estimation (1)	Estimation (2)	Estimation (3)	Estimation (4)
MKL	- 0.005***	-0.004***	-0.005***	-0.004***
	(-5.18)	(-3.74)	(-5.13)	(-3.29)
MSI	-0.004	-0.001	0.004	-0.006
	(-0.04)	(-0.00)	(0.04)	(-0.05)
MMU	0.035	0.022	0.034	0.022
	(0.13)	(0.08)	(0.13)	(0.08)
MNE	0.001	0.002	0.002	0.001
	(0.69)	(0.53)	(0.74)	(0.33)
IMO	-0.033	-0.019	-0.031	-0.019
	(-0.48)	(-0.27)	(-0.46)	(-0.27)
IMC	0.781**	1.061**	0.966	0.970
	(2.31)	(2.33)	(1.17)	(1.19)
INX	0.169	0.201	0.176	0.199
	(0.70)	(0.84)	(0.73)	(0.83)
MKL*IMC		-0.021		-0.023
		(-0.91)		(-0.88)
MNE*IMC			-0.017	0.010
			(-0.25)	(0.14)
Constant	0.508***	0.502***	0.503***	0.504***
	(5.88)	(5.93)	(5.71)	(5.80)
Prob. > Chi-sq.	0.000	0.000	0.000	0.000
Log likelihood	44.999	45.407	45.029	45.416

NOTE: Numbers in parentheses are *t*-ratio. ***,** and * represent that the coefficients are significant at 1%, 5% and 10% respectively.

Combining these two results from entry and exit rate analyses, it is apparent that the entry rate is low and the exit rate is high in the industry with more serious challenges from China. If we have this trend for longer term, then the number of SME plants in these industries will become smaller and smaller. The overall effect of the capital-labor ratio of each industry on restructuring is not uniformly concluded. Our finding indicates that there is no evidence that SMEs in Korea are equipped with more capital during the period. If any, it is dominated by the entry barrier effect of capital intensity. However, different from China impact, it does not directly imply that industries will lose plants in the long run. While a high capital-labor ratio is a barrier to entry, it is also a barrier to exit. The absolute values of coefficients for factor intensity are slightly higher in case of the exit than the entry rate, which may indicate that industry with higher factor intensity is likely to keep more plants. Nevertheless, the differences between the two cases are not substantial.

. Empirical Tests and Discussions – Plant Study on Exit and Switch

4.1. Who Dies and Why? – China Impacts and the Games of Survival

The previous chapter examines the effects of variables on entry and exit rates, where variables are selected based on neoclassical trade models and market structure models. The results demonstrate an urgent situation that should be dealt with by the Korean SMEs. While the analyses using aggregated industry data provide wider perspectives on some important issues, analyses based on more disaggregated data (at the plant level) can provide more plant-specific findings.

This section uses plant data, and examines which factors account for probability of death of a plant. It should be noted that Death study considers all plants that appeared in 2000 data. If they appear again in 2003 in the same industry category, they are regarded as 'survivors' and if not they are regarded as death, even though some of those in 'death' in fact did not die but changed industries. We believe our method is proper as regardless whether they really close down or convert into different industries, it means that they could not survive in the initial industry.

Both industry specific and plant specific characteristics are employed to find the effect. The Probit specification is estimated as the following:

$$\Pr[Death_{i\,pt+3}] = c_2 + \beta_D\,IC_{it} + \delta_D\,FC_{ipt} + \gamma_D\,IT_{it} + w_{ipt},$$

$$\text{where } \Pr[Death_{i\,pt+3}] = 1 \quad \text{if the plant closes down by 2003}$$

$$= 0 \quad \text{otherwise (survival)}$$

For plant specific variables (*FC*s), all the variables used for industry analyses are symmetrically adopted at plant level: they include capital-labor ratio (*PKL*), skill intensity (*PSI*), number of employment (*PNE*) and markup (*PMU*) for each plant. In addition both the plant age (*PAG*) and the industry's median age (*MAG*) are added.

The results of analyses are reported in Table 4. Most variables included in the estimation appear to be significant. A plant is more likely to survive, as its capital-labor ratio is high. The effects of the industry's median factor intensity are found from the coefficients for *MKL* and interaction term *MKL*IMC*. For example, say in Estimation (4),

Table 4 . Who Dies?: The Determinants of Probability to Close Down

Variables	Estimation (1)	Estimation (2)	Estimation (3)	Estimation (4)
PKL	-0.001*	-0.001***	-0.001*	-0.001***
	(-1.81)	(-3.18)	(-1.82)	(-3.21)
PSI	-0.013**	-0.013**	-0.014**	-0.013**
	(-2.31)	(-2.28)	(-2.34)	(-2.31)
PNE	-0.007***	-0.007***	-0.007***	-0.007***
	(-25.69)	(-25.70)	(-17.88)	(-17.85)
PMU	-0.015	-0.015	-0.015	-0.015
	(-1.46)	(-1.47)	(-1.47)	(-1.48)
PAG	-0.016***	-0.016***	-0.016***	-0.016***
	(-19.02)	(-19.06)	(-19.04)	(-19.08)
IMO	-0.183***	-0.186***	-0.183***	-0.185***
	(-4.37)	(-4.43)	(-4.35)	(-4.41)
IMC	0.758***	0.597***	0.892***	0.733***
	(5.85)	(4.06)	(5.32)	(4.05)
INX	1.110***	1.090***	1.120***	1.100***
	(7.38)	(7.24)	(7.43)	(7.28)
MKL	- 0.011***	-0.010***	-0.011***	-0.010***
	(-15.78)	(-15.91)	(-15.76)	(-15.89)
MSI	0.095	0.094	0.095*	0.094
	(1.65)	(1.62)	(1.65)	(1.63)
MNE	0.014***	0.014***	0.014***	0.014***
	(5.83)	(5.81)	(5.76)	(5.73)
MMU	-0.710***	-0.719***	-0.707***	-0.716***
	(-4.06)	(-4.11)	(-4.04)	(-4.09)
MAG	0.019***	0.017***	0.019***	0.017***
	(3.32)	(2.94)	(3.32)	(2.93)
MKL*IMC		0.005**		0.005**
		(2.06)		(2.06)
MNE*IMC			-0.008	-0.008
			(-1.19)	(-1.23)
Constant	0.392***	0.411***	0.386***	0.405***
	(7.09)	(7.35)	(6.97)	(7.24)
Prob. > Chi-sq.	0.000	0.000	0.000	0.000
Log likelihood	-41250.445	-41246.645	-41249.27	-41245.375

NOTE: Numbers in parentheses are *t*-ratio. ***,** and * represent that the coefficients are significant at 1%, 5% and 10% respectively.

from the coefficients for the median plant's factor intensity and for the interaction term, it is computed that[3]

$$\partial \Pr[Death] \Big/ \partial(MKL) = -0.010 + 0.005 \, IMC$$

which is always negative as *IMC* cannot be larger than 1. All other things being equal, a plant in more capital-intensive industry is less likely to close down. The interaction term between industry's factor intensity and import penetration of China as shown in Estimations (2) and (4) additionally explains that the two variables complementarily work for death or survival of the plant. As

$$\frac{\partial \left[\partial \Pr(Death) \Big/ \partial MKL \right]}{\partial IMC} > 0 \; ,$$

the relationship indicates that a firm in an industry with higher capital-labor ratio is more likely to die when China penetrates into the market.[4]

The coefficient for skill intensity turns out to be significant with a negative sign in all cases, implying that a plant with a higher skill intensity or relatively more skilled labor is less likely to close down. With all other things being equal, however, the higher skill intensity in an industry leads to a higher probability to die for an individual plant in that industry. This result is plausible as a plant in an industry with high skill intensity will face more sever competition. Nevertheless, the coefficient is only marginally significant.

The effect on the survival probability of the level of employment shows the same pattern as that of skill intensity. A plant is less likely to die as its size increases, however, with all other things being equal, a plant operating in the industry where large size plants operate is more likely to die. This is particularly intuitive if the industry' production shows strong economies of scale where plants become more competitive as the size of production increases.

The markup of a plant shows the expected sign, however, it is not significant. In contrast, the coefficient for the industry's median markup is negative. Plants in an industry with a high markup in general are less likely to close down.

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[3] In fact the coefficients obtained in the table does not accurately indicate changes in probability as well known. We use this figure, however, due to convenience. We use more accurate figures when computing elasticities in following sections.

[4] Suppose that there are two plants, which are exactly identical except that they are in industries with different factor intensities. As their plant specific characteristics are exactly the same, a plant in a relatively labor-intensive industry is relatively more capital intensive than the other plant in each industry. When China penetrates into each industry, relatively more labor-intensive industry will get more impact, and be likely to close down.

A plant is more likely to survive as it has been operating in the industry for the longer period, as the plant with a longer history should have more information, better technology or advanced managerial skills, and is less likely to die. However, by the same logic, competition is intense if many plants in the industry have been operating for long periods. Therefore a plant is more likely to die if the median age of plants in the industry is high.

The effects of variables related to trade models, including factor intensities, appear to be substantial. While industries experiencing strong penetration of OECD economies in general enjoy a higher probability of survival, those facing penetration of China show a high probability of death. While it may sound awkward that plants in industries with a high penetration of OECD experiences a high probability of survival, similar findings are reported in Bernard *et al.* (2003). They find that exposure of US firms to imports from the OECD and the Asian Tigers are associated with an increased probability of plant survival, while exposure to low-wage imports increases the probability of plant death.

The effect of China is found to be very strong from both *IMC* and the interaction term. The impact is always positive, regardless of the magnitude of *MKL*, meaning that a plant is more likely to die when China penetrates relatively more. Also, the positive sign of the interaction term indicates that, as discussed previously, the impact of China is greater if a plant is relatively more labor-intensive in the industry.

The positive sign of the coefficient for industry's export indicates that plants in an industry with more exports are more likely to die. This explains that the SMEs in exporting sectors face more competition than those in non-exporting sectors. It may also explain that the size of plant is getting larger. Figure 2 provides a clue to this question showing that exports per plant for most industries increased from 2000 to 2003.

In summary, the probability to die or survive obviously depends on a variety of industry, as well as plant characteristics. If we create an imaginary plant, which has the highest probability of survival, the plant would be described in the following manner: Equipped with high capital intensity and high skill intensity, possess a large size of production and high markup level, and with a longer history of being in operation. In addition, the plant is in an industry where the capital-labor ratio is high, skill intensity

Figure 2 Changes in Exports per Plants: from 2000 to 2003

is low, the size of employment is small, markup is high and the age is low for the median plant. In regards to trade, a plant is more likely to survive when the industry faces less penetration of China and high penetration of developed countries, and exports relatively less products. In addition, a plant is more likely to survive from China' penetration as its relative factor intensity in the industry is higher.

4.2. A Third Option – Switching

While entry and exit rates were examined at the industry level, and the probability of death was analyzed at the plant level, there is in fact a third option for an enterprise: switch. This part of our study will analyzes the switch of plants, moving from producing certain products to other products classified as different industries.

In case of switch study, we compare those who changed their industries and those who stayed in the initial industry. It would be meaningless to group them - those who survived and those who died (excluding 'switch') - in the same category just because they did not switch. Therefore in switch study, those who stayed are compared with those who switched, and those who closed down were intentionally excluded from the analyses. This

analysis will show how plant and industry characteristics affect the probability of switch, which may be different from what was obtained from the survival/death study.

The model of switch is estimated using Probit as the following:

$$\Pr[Switch_{i\,pt+3}] = c_3 + \beta_S\,IC_{it} + \delta_S\,FC_{ipt} + \gamma_S\,IT_{it} + \varpi_{ipt},$$

where $\Pr[Switch_{i\,pt+3}] = 1$ if the plant switched to other industry by 2003
$\qquad\qquad\qquad = 0$ otherwise (stay).

The results of estimation are summarized in Table 5. All the estimation demonstrates very high levels of fit, with most variables being significant. The signs and significances of variables do not change substantially when interaction terms are included. Two variables, skill intensity of plants and import penetration of OECD never appear to be significant. All other significant variables have the same signs as those estimated for *Death*, except import penetration of China. However, the impact should consider the interaction term as previously discussed, for example in Est. (4), it is

$$\partial P(Switch)\Big/\partial IMC = -1.500 + 0.009\,MKL\;.$$

This indicates that a plant is more likely to switch by China' penetration if the industry it belongs to is more capital-intensive, or MKL is large. Alternatively, a plant in an industry with relatively low level of factor intensity is less likely to switch.

Both death and switch Study provide the results that the relative factor intensity ranking of a plant in each industry is important in predicting the probability to switch or die, when penetration of China increases. This result implies that the pressure from China did cause SMEs to close down, and is consistent with the US case reported by Bernard *et al* (2003), although they did not consider industry specific characteristics. To switch is one choice responding to penetration of China, however, it seems not to be a popular option for Korean SMEs. Table 6 shows that only a small portion of plants in the sample converted to new industries; 5,454 out of 64,093 plants or less than 9% of

Table 5 . Who Switches?:   The Determinants of Probability to Switch

Variables	Estimation (1)	Estimation (2)	Estimation (3)	Estimation (4)
PKL	-0.003*	-0.001**	-0.001*	-0.001***
	(-1.79)	(-2.55)	(-1.80)	(-2.57)
PSI	0.005	0.005	0.005	0.005
	(0.76)	(0.77)	(0.73)	(0.74)
PNE	-0.002***	-0.002***	-0.002***	-0.002***
	(-6.60)	(-6.58)	(-3.90)	(-3.83)
PMN	-0.006***	-0.006***	-0.006***	-0.006***
	(-4.12)	(-4.11)	(-4.13)	(-4.11)
PAG	-0.005***	-0.005***	-0.005***	-0.005***
	(-4.38)	(-4.41)	(-4.39)	(-4.42)
IMO	0.051	0.046	0.053	0.048
	(0.77)	(0.69)	(0.81)	(0.73)
IMC	-1.412***	-1.761***	-1.159***	-1.500***
	(-5.01)	(-6.50)	(-3.37)	(-4.64)
INX	2.660***	2.640***	2.680***	2.660***
	(12.56)	(12.35)	(12.61)	(12.41)
MKL	- 0.020***	-0.020***	-0.020***	-0.020***
	(-15.34)	(-15.77)	(-15.41)	(-15.84)
MSI	0.788***	0.789***	0.788***	0.788***
	(9.98)	(9.97)	(9.99)	(9.97)
MNE	0.020***	0.020***	0.020***	0.020***
	(5.92)	(5.94)	(5.87)	(5.89)
MMU	-0.669**	-0.667**	-0.662**	-0.660**
	(-2.10)	(-2.10)	(-2.09)	(-2.08)
MAG	0.117***	0.115***	0.118***	0.115***
	(13.01)	(12.28)	(13.03)	(12.31)
MKL*IMC		0.009**		0.009***
		(2.19)		(2.21)
MNE*IMC			-0.012	-0.013
			(-1.41)	(-1.48)
Constant	-1.353***	-1.325***	-1.366***	-1.338***
	(-13.77)	(-13.07)	(-13.89)	(-13.20)
Prob. > Chi-sq.	0.000	0.000	0.000	0.000
Log likelihood	-14668.546	-14664.338	-14667.13	-14662.782

NOTE: Numbers in parentheses are *t*-ratio. ***,** and * represent that the coefficients are significant at 1%, 5% and 10% respectively.

Table 6. Survival, Death and Switch of Plants

Appearance in 2000	Appearance in 2003	No. of Plants
Yes	Yes	32,185
Yes	No	26,454
Yes	No but Switched	5,454

the total moved into new industries. This figure is about 16% of those that disappeared (= death + switch) in the 2003 data.

4.3. Survival, Death and Switch – The Implications from Plant's Factor Intensity

According to trade models, restructuring of the Korean industries should be oriented towards more capital-intensive way of production, if the Korean economy gains comparative advantage in capital-intensive products. Each plant should become more capital-intensive, and if a plant switches, it should move from an industry with low factor intensity towards an industry with higher factor intensity.

However, an investigation into factor intensity of switched plants in the Korean manufacturing shows striking results. Table 7 and Figure 3 present that there is no evidence to argue that plants moved into industries with a higher capital-labor ratio, or they increased their factor intensity when they moved. More plants moved into industries with lower factor intensity. It is also evident that the number of plants experiencing factor intensity increased or decreased as both 'stayed' and 'switched' for 2000 and 2003 are not substantially different.

Table 7. Comparison of Factor Intensity When Switching

Factor Intensity of Median Plant	No. of Plants Switched
Origin < Destination	2,698
Origin > Destination	2,756

Factor Intensity	Number of Plants Stayed	Number of Plants Switched
(K/L) in 2000 < (K/L) in 2003	16,122	2,836
(K/L) in 2000 $\geq$ (K/L) in 2003	16,063	2,618
Total	32,185	5,454

Figure 3. Factor Intensity (K/L ratio) of Switching Plants

year: 2003

year: 2000

Combining these findings with Tables 4 and 5, which indicate that a plant with higher capital-labor ratio is less likely to close down or switch its products, it is found that relatively labor–intensive SMEs close down or switch, and they failed to accumulate relatively more capital by switching process.

This finding is different from what Bernard et al. (2003) found from the US. Plants moved into industries with higher capital-labor ratio and they increased their own factor intensity. There may be two main reasons for this difference. First, contrary to our general belief, Korea might have failed to grow to be a capital-abundant country. Second, Korea may be a capital-abundant country, however, SMEs in general failed to increase their capital intensity. It needs further investigation how capital is accumulated for the entire manufacturing, including large-scaled enterprises.

4.4   So, Is There a China Impact?

China's penetration demonstrates a powerful impact to entry, exit and switch of Korean SMEs in manufacturing industries. Considering the importance of the issue, we computed the elasticity of entry and exit rates with respect to import penetration of China. While the tables summarizing estimation results report this impact, the marginal effect of China's

penetration is not directly derived from Tobit or Probit estimation, as these estimators are computed based on certain conditions.

The elasticity is computed for industry's entry and exit rates and plant's decision of death and switch. With corrected coefficients (slopes) and China's market penetration ratio, mean values of entry and exit rates are used in calculating elasticities of industry's entry and exit rates. For plant's death and switch, mean values of death and switch probabilities are used, together with China's market penetration and corrected slopes. Interactions terms are not significant in industry study, but significant in plant study. Accordingly, corrected coefficients for interactions terms are also considered in computing elasticities for the latter. These elasticities are summarized in Table 8 for selected industries.[5]

It is striking that the elasticity of entry rate with respect to China's penetration is very close to that of the exit rate. The computation reports that a 1 percent increase in China's penetration into a certain industry's domestic market in Korea decreases the entry of new plants by 0.06 percent. At the same time, an increase in China's penetration encourages an exit of existing plants by 0.06 percent. The absolute values of elasticities are particularly high (or impacts are more substantial) for KSIC 182; (elasticities are –0.216 and 0.186 respectively), KSIC 201 (-0.191 and 0.192) and KSIC 311 (-0.211 and 0.196). For these industries, as China penetrates into the domestic market by 1 percent, entry decreases by about 0.19~0.22 percent, and an additional 0.18~0.20 percent of existing plants cannot survive.

In contrast, the market penetration of China does not give any serious impact to some industries. For industries such as KSIC 152, 160, 221, 222, 342, 343 and 351, the elasticity is either zero or infinitesimal, implying that entry and exit in these industries are not responsive to imports from China.

We discussed that the effect from China on stay/death or stay/switch decision of plants is associated with relative ranking of capital-labor ratio of plants in relevant industries. In addition we found that there is no evidence that plants increased their factor intensity or moved into more capital-intensive industries. While 'switch' does not seem to be a popular option for SMEs in Korea facing China's challenge, when

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[5] As we have four methods of estimation for each case, we can compute four different elasticities. For convenience, elasticities without any interaction term are reported in Table 8. Elasticities from estimation with interaction terms are higher than those without them in absolute values.

Table 8. The Impact of Import Penetration of China: Elasticities of Entry, Exit, Death and Switch

	Industry Entry Rate			Industry Exit Rate		
	KS IC3	Elast icity	Industries	KS IC3	Elast icity	Industries
Highest	182	-0.2160	Dressing and Dyeing of Fur,Manufacture of Articles of Fur	311	0.1962	Manufacture of Electric Motors, Generators and Transformers
Seven	311	-0.2112	Manufacture of Electric Motors, Generators and Transformers	201	0.1919	Sawmilling and Planing of Wood
Industries	201	-0.1906	Sawmilling and Planing of Wood	182	0.1856	Dressing and Dyeing of Fur, Manufacture of Articles of Fur
	333	-0.1880	Manufacture of Watches, Clocks and its Parts	272	0.1844	Manufacture of Basic Precious and Non-ferrous Metals
	192	-0.1679	Manufacture of Footwear	333	0.1787	Manufacture of Watches, Clocks and its Parts
	332	-0.1472	Manufacture of Other Optical Instruments and Spectacle, Photographic Equipment	332	0.1578	Manufacture of Other Optical Instruments and Spectacle, Photographic
	272	-0.1449	Manufacture of Basic Precious and Non-ferrous Metals	192	0.1509	Manufacture of Footwear
Lowest	160	0.0000	Manufacture of Tobacco Products	160	0.0000	Manufacture of Tobacco Products
Seven	222	0.0000	Printing and Service Activities Related to Printing	222	0.0000	Printing and Service Activities Related to Printing
Industries	152	-0.0003	Manufacture of Dairy Products and Ice cream	152	0.0005	Manufacture of Dairy Products and Ice cream
	351	-0.0006	Building of Ships and Boats	351	0.0008	Building of Ships and Boats
	221	-0.0010	Publishing	221	0.0014	Publishing
	342	-0.0030	Manufacture of Bodies for Motor Vehicles ; Manufacture of Trailers and Semitrailers	343	0.004 4	Manufacture of Parts and Accessories for Motor Vehicles
	343	-0.0031	Manufacture of Parts and Accessories for Motor Vehicles and Engines	342	0.004 5	Manufacture of Bodies for Motor Vehicles ; Manufacture

	Death			Switch		
	KSIC3	Elasticity	Industries	KSIC3	Elasticity	Industries
Highest	311	0.0796	Manufacture of Electric Motors, Generators and Transformers	182	-0.5942	Dressing and Dyeing of Fur, Manufacture of
Seven	182	0.0772	Dressing and Dyeing of Fur, Manufacture of Articles of	192	-0.4411	Manufacture of Footwear
Industries	201	0.0759	Sawmilling and Planing of Wood	201	-0.4358	Sawmilling and Planing of Wood
	333	0.0743	Manufacture of Watches, Clocks and its Parts	333	-0.3405	Manufacture of Watches, Clocks and its Parts
	272	0.0679	Manufacture of Basic Precious and Non-ferrous Metals	181	-0.3122	Manufacture of Sewn Wearing Apparel, Except
	332	0.0668	Manufacture of Other Optical Instruments and Spectacle,	171	-0.2565	Preparation and Spinning of Textile Fibers
	192	0.0611	Manufacture of Footwear	332	-0.2546	Manufacture of Other Optical Instruments and
Lowest	222	0.0000	Printing and Service Activities Related to Printing	222	0.0000	Printing and Service Activities Related to Printing
Seven	160	0.0000	Manufacture of Tobacco Products	160	0.0000	Manufacture of Tobacco Products
Industries	152	0.0001	Manufacture of Dairy Products and Icecream	152	-0.0002	Manufacture of Dairy Products and Ice
	341	0.0003	Manufacture of Motor Vehicles and Engines for Motor Vehicles	341	-0.0003	Manufacture of Motor Vehicles and
	351	0.0003	Building of Ships and Boats	351	-0.0006	Building of Ships and Boats
	221	0.0006	Publishing	221	-0.0010	Publishing
	343	0.0016	Manufacture of Parts and Accessories for Motor Vehicles	343	-0.0048	Manufacture of Parts and Accessories for

plants switch, they should take into account the potential competition that they will face from China in the new industry. If plants switch because they intend to avoid the pressure from China, they are expected to move from where China's penetration is high to low. Our investigation shows that 2,058 plants switched to where China's penetration is more severe, and 3,392 plants to where that is less severe.[6]

. Conclusion

Entry, exit and switch of plants are important sources of resource reallocation and restructuring. The impetus behind these moves is explored in this study, adopting neoclassical trade models and market structure models. For SMEs in Korea, this study reveals that overall entry and exit rates for manufacturing industries are affected by the capital-labor ratio of industry and import penetration by China. Both factor intensity and China's penetration deter the entry of new plants and the exit of existing plants.

Analyses using more disaggregated data at the plant level show that variables related to trade models and market structure models account for a plant's decision for survival, closing or switching. China impact is found to be significant and one of the most important forces behind the restructuring of industries through exit and switch. While most findings are consistent with our expectation based on economic knowledge and observations, some would benefit from more discussion.

First, the impact of China's penetration is significant, obviously obstructs entry of new SME plants into industries, and drives existing SMEs out of industries. China impact is also found significant in determining probability of death or switch of plants, in particular in association with the capital-labor ratio of the relevant industry. Imagine two plants that are exactly identical in plant specific characteristics and industry specific characteristics except that they are in different industries. When China's penetration increase by the same rate in each industry, the plant in relatively more capital-intensive industry is more likely to close down or switch. This finding insightfully explains that in each industry less capital-intensive plants are more damage by China impact.

Second, Korean SMEs in general failed to accumulate capital and increase their capital-labor ratios. As pressure from China is significant, one of the most practical methods to avoid competition is to move up the ladder by enhancing the capital-labor ratio. However, there is no evidence that the surviving plants significantly increased their factor intensities. They did not move into industries with higher factor intensity either. High factor intensity seems to work as both entry and exit barriers for SMEs.

Third, exposure to foreign competitors enhanced the dynamism of restructuring. In addition to China impact, export effects also exist. A plant is more likely to die or switch when the industry's exports are high. It is expected that export sectors are more competitive and likely to experience more exits and increase in shipment scales.

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[6] Either initial or new industries' factor intensity is missing for 4 observations.

This study concentrated on SMEs in Korea, explored relevant issues and analyzed the dynamics of entry, exit and switch. While some findings are insightful and implicative, nevertheless, some issues are yet to be resolved. In particular, it is yet to be clarified whether some findings are SMEs specific or can be generalized for the entire manufacturing industries in Korea. More intense and wider information of the entire manufacturing industries is necessary for further study and comparison.

Comments on "The China Impact and Korean Manufacturing Industries: Experiences of SMEs"

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As a researcher, I am interested in investigating the links between trade and growth. Apparently, my research interest has substantial commonality with the authors' paper. I have read this paper with great excitement and have found it very good. The paper is focused on a very important research topic (the China impact on Korean manufacturing), based on rich but "underused" data sets (*Mining and Manufacturing Survey* and Trade Statistics from the Korea Customs Service), and has applied rigorous empirical methods (Probit regression, Tobit regression, etc.).

Main findings of the paper can be summarized as follows:

1. The impact of increasing share of goods imported from China is found to be significant. The import penetration from China tends to obstruct entry of new domestic SMEs and drives out existing SMEs. Such effects are greater in more labor-intensive industries.

2. Plants in capital-intensive industries are less likely to close down or to switch out. And yet, the surviving plants do not appear to be significantly increasing their capital intensity.

3. A plant is more likely to die or switch when industry's exports are high.

4. While import penetration from OECD tends to raise the survival probability of domestic plants, import penetration from China tends to lower it.

I would like to make brief comments following the order of findings that I have summarized. I am being far more critical than I normally would be, in order to fulfill the role of a good discussant.

1. It must be quite alarming to observe that the import penetration from China lowers the entry rate and raises the exit rate of domestic firms. But, it should be confirmed first what is the cause and what is the result. If the observed pattern of entry and exit is the cause of increased import penetration from China, then the situation is not as serious as it looks at first. It simply means that imported goods from China fills the vacancy after Korean plants move to another sector with higher value-added. As the regression analysis part of the paper is not based on the panel data approach, it is not easy to tell the direction of the causation. What is found in the paper is contemporaneous correlation, not causality.

2. What is expected from traditional trade models is that, by increasing capital-intensity, Korean plants can overcome challenges coming from Chinese competitors having comparative advantages in labor-intensive sectors. However, the paper has found that Korean plants do not seem to be responding to the challenge by increasing capital intensity. Once again, it is a pity that the cross-sectional nature of the data does not give us enough room to check the long-run response of Korean producers.

3. It is also reported that a plant in a more export-oriented industry tends to have a exposure to global competition could make domestic competition fiercer. It remains to be confirmed by further investigation. Nonetheless, the third finding of the paper raises an important issue. As both Korea and China are major exporting countries in the global market, the main battlefield for Korean and Chinese producers will not be the small market of Korea. However, competition in the third country (especially in the US or Japan) is not considered in this paper.

4. The fourth finding seems to be consistent with my conjecture that changes in import things being equal, survival rate will be higher in growing industries and lower in declining industries. Under the presumption that high-tech industries are growing and that low-tech industries are declining in Korea, technology gap between China and OECD would quite naturally bring about higher import penetration from China in declining, low-tech industries.

Intentionally, I have emphasized conjectures that oppose the authors' interpretation. But, it may well be the case that the authors' interpretation is actually better supported by the facts. Therefore, I would like to end my discussion with some trivial suggestions for future study, which could prove that my exaggerated suspicion was in fact groundless.

1. Extending the length of the data would allow us to get some evidence on the direction of the causation between the increasing import penetration and the changing industrial structure.

2. All the interaction terms in some regressions of the paper are made of two industry-level variables. Interacting one industry-level variable with one plant-level variable, we might be able to get a sharper picture from the regression exercise.

3. To take the competition in the global market into consideration, ESI (Export Similarity Index) or its industry equivalence might be used as a regressor.

All in all, I have learned a lot from reading this paper and look forward to learning even more from the authors' future research.

Global Competition and Productivity Growth: Evidence from Korean Manufacturing Micro-data

by

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Abstract

The dynamism of Asian NIEs' (Newly Industrializing Economies) export-oriented growth paths has drawn substantial attention from researchers. But, empirical studies based on longitudinal micro-data in Asia are still rare, mainly due to the lack of readily available data. Based on the plant-level raw data underlying the *Annual Report on Mining and Manufacturing Survey of Korea* (1990-98), this study explores links between exporting and productivity. Main findings of the paper suggest that productivity gains associated with exporting tend to have strong intra-industry spillovers.

I.   Introduction

Does competition enhance productivity growth of a developing economy? Is global competition conducive to economic development? Especially, does competition with more advanced producers in the global market help productivity growth of domestic producers in a developing country? If the answer is a conditional yes, what makes global competition conducive to productivity growth and economic development? Many researchers have been working to find a better answer to these, perhaps quite controversial, questions.[1] The aim of this paper is to review recent empirical findings related to these questions, which have strong policy implications and to offer some new evidence from Korean microdata.

Achieving a perfectly competitive outcome in theory will bring about allocative efficiency gains by forcing price to converge to marginal cost. Efficiency gains from competition, however, are not limited to such static and allocative gains. As was pointed out by Leibenstein who contrasted allocative efficiency with so-called "X-efficiency," the empirical evidence suggests that "the welfare gains that can be achieved by increasing only allocative efficiency are usually exceedingly small" (Leibenstein, 1966). In an early study, for example, the costs of static resource misallocation due to lack of competition in the United States were estimated to be much less than one percent of GNP (Harberger, 1954). Indeed, recent theoretical and empirical studies on gains from competition have been paying increasing attention to "productive efficiency" and "dynamic efficiency," which can

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[1] See Sachs and Warner (1995) and Rodrik and Rodriguez (2000), amongst many others, for contrasting views on this issue revealed in recent empirical cross-country studies.

be broadly defined in terms of productivity growth through innovations. In short, "productive (or, technical) efficiency" gains come from productivity-enhancing innovations which introduce new and better production methods, and successful innovations will eventually raise the level and growth rate of productivity in the long run (i.e., "dynamic efficiency" gains).[2]

The Korean economy has achieved strong economic growth for the past several decades and showed successful examples of rapid technology learning and productivity growth in industries such as automobiles, electronics, and semiconductors. In the process of the past several decades' economic development in South Korea, interestingly, it appears that competition played a strong role only in limited areas. Free competition did not prevail in domestic product markets or in factor markets. Product markets, financial markets, and labor markets were very highly regulated and price-control was widely used until the beginning of gradual reform in the early 1980s. Competition for corporate control in fact did not exist, either, until recently. If there were any substantial contribution of competition to the dynamic efficiency gains of Korean firms, perhaps the only important channel that we could consider would be the one through competition in the export market.

A growing number of empirical studies using longitudinal microdata confirm that firm dynamics (entry and exit, growth and decline of individual firms) is an important component of innovation and of aggregate productivity growth. The dynamism of Asian NIEs' (Newly Industrializing Economies) export-oriented growth paths has drawn substantial attention from researchers. But, empirical studies based on longitudinal microdata in Asia are still rare, mainly due to the lack of readily available data. Based on the plant-level raw data underlying the *Annual Report on Mining and Manufacturing Survey of Korea* (1990-98), this study explores links between exporting and productivity. The main findings of the paper suggest that productivity gains associated with exporting tend to have strong industry-wide spillovers. This paper consists of four sections. Section 2 summarizes the theoretical and empirical background. Section 3 reports the results of quantitative analysis using Korean data. Section 4 concludes the paper.

. Theoretical and Empirical Background

2.1 Competition, firm dynamics and productivity growth

A theoretical framework for links between competition, firm dynamics and economic growth can be found in Schumpeterian "creative destruction" models of innovation.[3] When incumbents who have already accumulated substantial experience with conventional technology, are less enthusiastic about taking risks in adopting new technology, new entrants aggressively experimenting with new technology can be a driving force for innovation. At the same time, competitive pressure from actual and/or potential entrants also forces incumbents to innovate themselves. If the innovation is successful, the innovators will be able to replace the incumbents. If not, they will fail to survive. In this way, competition weeds out the unsuccessful firms and nurtures the successful ones.

Economic growth models based on the usual assumption of a representative producer/consumer have difficulties in explaining widely observed heterogeneity of producers (in size, age, technologies, productivity levels) even in a narrowly defined sector.

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[2] For a further review of the literature from this perspective, see Ahn (2002).

[3] See Schumpeter (1934), Nelson (1981), Aghion and Howitt (1992) and Cabellero and Hammour (1994, 1996), amongst others.

Experimentation under uncertainty is an important source of micro-level heterogeneity and firm dynamics. Uncertainty about the demand for new products or the cost-effectiveness of alternative technologies encourages different firms to try different technologies, goods and production facilities. Experimentation by different firms generates differences in outcomes and competition drives firms to adjust themselves through learning about their environment and capabilities.[4]

The main findings of existing empirical studies using longitudinal microdata can be summarized roughly as follows.

There are large and persistent differences in productivity levels across producers even in the same industry.

Heterogeneity in technology use and in human capital is an important determinant of heterogeneity in firm-level productivity.

Aggregate productivity growth comes not only from within-firm productivity growth but also from firm dynamics, through which inputs and outputs are constantly reallocated from less efficient firms to more efficient ones.[5]

Results of comparative case studies of selected industries in the United States, Japan and Europe by Baily (1993) and by Baily and Gersbach (1995) suggest that competition (especially competition with best-practice producers in the global market) enhances productivity. Using micro-level panel data in the United Kingdom, Nickell (1996) and Disney *et al.* (2000) experimented with several indicators of competition in productivity regressions and concluded that competition has positive effects on productivity growth. Nickell (1996) found from a sample of 676 UK firms over the period 1975-86 that competition (measured by increased numbers of competitors or by lower levels of rents) was associated with higher productivity growth rates. From a more recent and much larger data set of around 143,000 UK establishments over the period 1980-1992, Disney *et al.* (2000) found that market competition significantly raised productivity levels, as well as productivity growth rates.

Micro data also provide rich information on the effects of competition-promoting regulatory reform, which is very likely to involve changes in firm dynamics. Olley and Pakes (1996) analysed the productivity dynamics in the telecommunications equipment industry in the United States using unbalanced panel data for 1974-87 from the Longitudinal Research Database (LRD). They found that aggregate productivity increased sharply after each of the two periods in which the industry underwent changes that decreased regulation. Furthermore, the productivity growth that followed regulatory change appeared to result from a reallocation of capital from less productive plants to more productive ones, rather than from an increase in average overall productivity. Their findings suggest that competitive selection processes via entry and exit facilitated the reallocation of production factors.

2.2 International trade, competitive selection, and productivity

A positive contribution of increased import-competition to productivity growth has been detected in a number of studies. MacDonald (1994) analysed the US Bureau of Labour Statistics (BLS) data on labour productivity growth in manufacturing industries during 1972-87 and observed that increase in the import penetration ratio had a large and highly significant effect on the next three-year period's productivity growth in highly concentrated industries. Using the annual census data, which cover all plants in the greater Istanbul area

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[4.] See Jovanovic (1982), Hopenhayn (1992), and Ericson and Pakes (1995).

[5] For an overview of the literature on firm dynamics, see Caves (1998), Foster et al. (2001), Bartelsman and Doms (2000), and Ahn (2001, 2002).

of Turkey from 1983 to 1986, Levinsohn (1993) demonstrated that the "imports-as-market-discipline" hypothesis was supported by the data spanning the course of a broad and dramatic import liberalisation in 1984. Bottasso and Sembenelli (2001) also found a jump in productivity growth rates of Italian firms in industries where non-tariff barriers were perceived to be high, after the announcement of the EU Single Market Programme, which proposed 282 specific measures to reduce non-tariff trade barriers in the EU. Applying the methodology of Olley and Pakes (1996) for avoiding selection bias (induced by plant closings) and simultaneity bias (induced by firm dynamics) to the case of trade liberalization in Chile, Pavcnik (2002) finds that the productivity in the import-competing sectors grew 3-10% more than in non-traded goods sectors after trade liberalization.

However, whilst import competition has been found to induce productivity growth, the evidence on the role of exports and export competition is more ambivalent. For example, Roberts and Tybout (1997) developed a model of exporting with sunk costs of entry. In the presence of such entry costs, only the relatively productive firms will choose to pay the costs and enter the foreign market. The implied relationship between exporting and productivity is positive in a cross-section of firms or industries, but the causality runs from productivity to exporting. In other words, exporting firms show higher productivity mainly because only firms with higher productivity can enter the export market and survive there. Empirical findings of Clerides *et al.* (1998) based on plant-level data from Colombia, Mexico, and Morocco also support the self-selection of the more efficient firms into the export market.

Similarly using plant-level data from the Longitudinal Research Database (LRD) in the United States, Bernard and Jensen (1999*a*) examined whether exporting had played any role in increasing productivity growth in US manufacturing. They found little evidence that exporting per se was associated with faster productivity growth rates at individual plants. The positive correlation between exporting and productivity levels appears to come from the fact that high productivity plants are more likely to enter foreign markets, as Roberts and Tybout (1997) suggested. While exporting does not appear to improve productivity growth rates at the plant level, it is strongly correlated with increases in plant size. In other words, trade contributes to productivity growth by fostering the growth of high productivity plants, though not by increasing productivity growth at those plants.[6]

For deeper understanding on the links between exporting and productivity growth in the context of technological learning and economic development, however, aforementioned selected cases from a few developing and developed countries seem to be far from comprehensive: Colombia, Mexico, and Morocco are not a good example for economic development driven by export promotion; For technologically advanced economies such as the US and Germany, room for technological learning from exporting would be rather limited. Probably more interesting and more relevant cases would be found from experiences of a number of East Asian economies (as a success story of export-oriented development strategy). Therefore, after reviewing theoretical and empirical studies on technology diffusion through trade (in Section 2.3) and on trade and growth in East Asia (in Section 2.4), we will focus on another specific case of Korea. If there are some actual cases supporting the idea of economic development based on technological learning through exporting, Korean experiences appear most likely to belong to those cases.

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[6] According to the results of a parallel study for Germany by Bernard and Wagner (1997), sunk costs for export entry appear to be higher in Germany than in the United States, but lower than in developing countries.

2.3 International trade and diffusion of technology

In growth theory, technological progress is typically conceived either as a "free goods," as a by-product (externality) of other economic activities, or as the outcome of intentional R&D activities pursuing profit (Fagerberg, 1987). While technological progress is treated as exogenous in neo-classical growth models, endogenous growth models have emphasized the importance of R&D in the production of knowledge for understanding technological progress and long-run growth. There have been various attempts to identify different types of spillover related to R&D activity. Griliches (1980) identifies two positive forms of spillovers. First, the quality of a new intermediate goods cannot be fully captured as monopoly rent to the innovator (unless they can exercise perfect price discrimination), thus providing a spillover effect from innovator to users of intermediate goods (namely, "rent spillovers"). Second, knowledge is sometimes freely borrowed from others. This type of spillover (namely, "knowledge spillovers") increases with the technical relatedness and geographical closeness of firms. International trade can contribute to technology diffusion through imported intermediate goods embodying new technology and/or through increased interactions between domestic and foreign firms in the global market of final products and production factors.

A number of researchers have attempted to measure to what extent knowledge spillovers are limited by international barriers. Some evidence suggests that technology diffusion is considerably faster within than between countries, implying that international barriers to knowledge spillovers may be quite large (see, for example; Eaton and Kortum 1999; and Branstetter 2001). Others have stressed that international R&D spillovers may nevertheless be important. Based on a sample of OECD countries (plus Israel), Coe and Helpman (1995) found that both domestic and foreign R&D capital stocks have important effects on total factor productivity. Based on estimates of international spillovers from previous studies, Bayoumi *et al.* (1999) ran simulations of a model of the world economy, which consists of the G-7 countries plus five industrial and developing country regions. The results imply that a country can raise its productivity not only by investing in R&D but also by trading with other countries that have large stocks of knowledge accumulated from R&D activities.

According to a recent review of literature in Keller (2004), however, the evidence on the importance of trade for technology diffusion is still mixed. Even though some studies have shown that imports play a significant role, not much is known about the quantitative importance of this effect. The overall evidence on the role of exports for technology diffusion is even weaker than that for imports. Not finding strong econometric evidence for "learning-by-exporting" effects in the existing studies based on microdata, Keller (2004) suspects that such results might be related with heterogeneity across industries or with heterogeneity across trading partners. We address this issue below, the links between exports, productivity, and spillovers[7] in our empirical analysis.

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[7] As another potentially important source of productivity growth (particularly in developing economies), technology spillovers coming from domestic activities of foreign multinational firms can be considered. After a broad review of empirical evidence, Blomström and Kokko (1996, 1998) conclude that the nature of technology diffusion from foreign presence varies substantially depending on country characteristics and the policy environment. Findings from a recent study based on firm-level data in Lithuania (Javorcik, 2004) suggest that backward linkages make an important channel for technology diffusion from foreign multinationals to local firms. The empirical analysis part of the paper (Section 3), however, is focused on trade and productivity simply because the dataset does not have FDI statistics.

2.4 International trade and productivity growth in East Asia

The potential causal link between trade openness and high growth in East Asian Newly Industrializing Economies (NIEs) has been pointed out by many researchers and tested by much empirical research based on cross-country regressions. For example, Lucas (1993) tried to explain the "East Asian miracle" focusing on the fact that those East Asian miracle economies have become "large scale exporters of manufactured goods of increasing sophistication." Viewing the growth miracles as productivity miracles, he offered the following explanation:

The main engine of growth is the accumulation of human capital, especially in the form of learning-by-doing on the job.

For such learning to persist, workers and managers should continue to take on new tasks.

For such learning to continue on a large scale, the economy must be a large-scale exporter.

However, except for a series of studies on manufacturing in Taiwan by Aw, Roberts, and their associates, however, few studies have used microdata to shed light on productivity and firm dynamics in East Asian NIEs.

Aw *et al*. (2001) measured differences in total factor productivity among entering, exiting, and continuing firms in Taiwan, using longitudinal firm-level data from the Census of Manufactures for 1981, 1986, and 1991. They found that the contribution of productivity differential between entering and exiting firms to aggregate productivity growth was more pronounced there than in other countries in previous studies. In a parallel study, Aw *et al*. (2000) examined and compared links between productivity and turnover in the exports market using the aforementioned data from Taiwan and comparable data from the *Korean Census of Manufactures* for 1983, 1988, and 1993. Interestingly, they found little evidence of links between plant productivity and export decisions in South Korea, while they found some significant evidence of selection and learning effects in the case of Taiwan.

Since the pioneering exploratory studies on firm dynamics in Korean manufacturing by Hahn (2000) and Joh (2000), Korean longitudinal microdata still remain rather unexploited. In fact, longitudinal microdata in South Korea are as rich as any other data used in existing studies. While Aw *et al*. (2000) focused on the 'five-yearly' census data, the Korea National Statistical Office compiles the plant-level data 'annually' covering all plants with no less than five employees (see the next section for further description of the data). Taking advantage of this higher frequency data, and using the methods of Bernard and Jensen (1999*a* and 1999*b*), Hahn (2004) detects evidence of self-selection and (short-lived) "learning-by-exporting" effects in the relation between exporting and plant-level productivity in South Korea.

The findings in Hahn (2004) from the Korean data are in fact qualitatively similar to those of Bernard and Jensen (1999*a* and 1999*b*) from US data in the following aspects:

Significant and positive contemporaneous correlations are observed between levels of exports and productivity.

While exporting plants have substantially higher productivity levels and bigger size than non-exporting plants, evidence that exporting increases plant productivity growth rates is weak.

New exporters grow faster around the time when they enter the export market.

According to Bernard and Jensen (1999*b*), these findings contain both good and bad news for long run economic growth. Exporting will contribute to aggregate productivity growth by facilitating the growth of high productivity plants, although such a reallocation effect would produce static rather than dynamic gains. In other words, Bernard and Jensen

(1999*a* and 1999*b*) and Hahn (2004) appear to suggest that exporting cannot be an engine for sustained economic growth, either for an innovating technology leader like the US or for an imitating follower like South Korea.

In fact, however, the degree and the channels of exports' contribution to technology spillovers and to productivity growth vary from industry to industry, and also from country to country, depending on the economic and technological environment. For example, exporting grain from the US to the People's Republic of China may well have little learning-by-exporting effects, while exporting cars from South Korea to the US seems far more likely to generate some technology learning. As Keller (2004) underlines, "an attempt to explain the post-World War II performance of South Korea, for instance, without making reference to its success in transferring technology from the rest of the world is bound to fall short." Thus international technology diffusion (where a firm employs technology that has been originally invented in another country) is expected to have played an important role at least in the case of export-oriented economic growth in East Asian NIEs, if not in the case of the US or elsewhere. However the existing empirical evidence from microdata does not seem to support the widely-shared conjecture that technology spillovers through exporting has been a major source of persistent high growth in East Asian NIEs. This puzzle is the starting point for the empirical exploration pursued in this paper.

. Testing for Spillovers from Learning-by-exporting in Korean Manufacturing

Using the same dataset hired in Hahn (2000, 2004) and Joh (2000), this paper aims to explore a plausible channel through which exporting could have made a substantial and persistent contribution to export-oriented economic growth in East Asian NIEs - namely, spillovers (or externalities) of learning-by-exporting. Our claim is that intra-industry spillovers of learning-by-exporting can provide an answer to the aforementioned puzzle and that the evidence from Korean microdata supports the existence of spillovers arising from exporting. This section explains this argument and tests hypotheses derived from it.

3.1 Spillovers of learning-by-exporting effects and aggregate productivity

A number of recent empirical studies have shown that there still exists a considerable degree of geographic localization in knowledge spillovers.[8] Similarly, it is reported that international barriers in technology spillovers are substantially higher than intra-national barriers. At the same time, as was reviewed in the previous section, trade (importing and exporting) and foreign direct investment (FDI) are considered as vehicles for overcoming such international barriers and facilitating technology diffusion. In other words, generally speaking, technology diffusion tends to be considerably faster within than between countries. To move one step further from this, we can expect that technology spillovers from abroad in the form of learning-by-exporting will also spillover to other domestic producers in the same or adjacent industries rather quickly. This is what is meant by "spillovers of learning-by-exporting."

If there are strong spillovers (or externalities) in the learning effects from exporting, then it will become quite difficult to detect a widening gap in productivity growth for an exporter firm over other non-exporter firms in the same industry. Bernard and Jensen (1999*a* and 1999*b*) and Hahn (2004) found that, after controlling for year effects and industry effects, the productivity gap between exporting firms and non-exporting

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[8] See, among others, Jaffee et al. (1993), Branstetter (2001), and Keller (2002).

firms did not increase over time. They interpreted this finding as evidence showing that learning-by-exporting effects are only short-lived. Such a pattern, however, could arise not only when learning-by-exporting effects are short-lived, but also when persistent learning-by-exporting effects are rapidly diffused to non-exporters in the same industry. Therefore the regression methods used in Bernard and Jensen (1999*a* and 1999*b*) and in Hahn (2004) are not adequate for testing the hypothesis of spillovers from learning-by-exporting.

If there exist large learning-by-exporting spillover effects within an industry, inter-industry variance of productivity levels will outweigh intra-industry variance. In addition, the gap between the average productivity level in exporting industries and that in non-exporting industries will tend to increase. Based on this reasoning we can derive the first hypothesis as follows.

Hypothesis 1. If learning-by-exporting effects have strong intra-industry spillovers, export-intensive industries will have substantially higher aggregate productivity levels or higher aggregate productivity growth than other industries with lower export-intensity.

We consider this simple hypothesis in a casual way in Section 3.3, however it is not possible to derive objective criteria for rejecting or accepting the hypothesis. Moreover, even when export-intensive industries turn out to have higher productivity levels or higher productivity growth, still one cannot say whether it is due to exporting itself or due to some other missing factor(s). To overcome such problems, we need a formal statistical hypothesis, which can be tested by multiple regression analysis.

3.2 Deriving testable hypothesis from productivity regression

A test of our hypothesis can be derived from specific regression equations for firm-level productivity. If there are no R&D spillovers, for example, other firms' R&D expenditures will be irrelevant in explaining an individual firm's productivity. On the other hand, if there exist strong R&D spillovers at the industry-level, a variable reflecting the industry-wide R&D expenditure will have a significant and positive coefficient in the regression for firm-level productivity.[9] In the same spirit, we can test for industry-wide spillovers of learning-by-exporting by looking at the estimated coefficient for industry-level export intensity in hypothesis 2.

Hypothesis 2. If knowledge/technology coming from learning-by-exporting is quickly diffused to other firms in the same industry, that is if such learning-by-exporting has strong externalities at the industry-level, then industry-level export intensity (in addition to firm-level export intensity) will have a significantly positive estimated coefficient in firm-level productivity regressions after controlling for other relevant variables which affect firm-level productivity.

Just as geographic and technical distance are considered for giving different weights to different sources of R&D spillovers, we could try using more sophisticated measures for sources of learning-by-exporting spillovers. In this paper, however, we use a relatively simple measure - industry-level export intensity. As will be shown in the following sections, however, even this simple variable gives quite strong evidence of the existence of learning-by-exporting spillovers. As a robustness check, we compare a variety of regressions and show that our basic findings on spillovers are robust across a broad set of specifications where R&D expenditures and a proxy for human capital quality are controlled for at both industry- and plant-level.

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[9] In a more sophisticated approach, one can create an indicator for the size of the source of spillovers by giving different weights (reflecting geographic or technical proximity) to external R&D expenditures.   For a literature review on measuring technology diffusion, see Keller (2004).

3.3 Data analysis for Hypothesis 1

The empirical part of this paper is based on the plant-level raw data, underlying the *Annual Report on Mining and Manufacturing Survey* by the Korea National Statistical Office. The *Survey* covers all plants with five or more employees in mining and manufacturing industries and contains information on outputs and inputs that are necessary to calculate plant-level total factor productivity. In general plant codes are followed consistently over time, so that it is possible to identify which plants first appeared in the data set and which plants disappeared. In addition, the industry code for each plant allows us to identify which plants moved to another industry. The National Statistical Office also conducts a census on all plants every five years, but they utilize a different plant coding system to those plants with less than five employees. [10] Therefore, this study will focus on plants with no less than five employees, as did previous studies such as Dunne *et al.* (1989) for the US, Joh (2000) for South Korea, and Hahn (2000, 2004) for South Korea. The data used in this paper is exactly the same data used in Hahn (2000, 2004).

Following Aw *et al.* (2001) and Hahn (2000, 2004), plant-level total factor productivity (TFP) is estimated by the chained-multilateral index number approach as developed by Good *et al.* (1996). It uses a separate reference point for each cross-section of observations and then chain-links the reference points together over time as in Tornqvist-Theil index. The reference point for a given time period is constructed as a hypothetical firm with input shares that equal the arithmetic mean input shares and input levels that equal the geometric mean of the inputs over all cross-section observations. Thus, the output, inputs, and productivity level of each firm in each year is measured relative to the hypothetical firm at the base time period. This approach allows us to make transitive comparisons of productivity levels among observations in a panel data set. The productivity index for firm i at time t is measured in the following way.

$$\ln TFP_{it} = (\ln Y_{it} - \overline{\ln Y_t}) + \sum_{\tau=2}^{t} (\overline{\ln Y_\tau} - \overline{\ln Y_{\tau-1}})$$

$$\left\{ \sum_{n=1}^{N} \frac{1}{2} (S_{nit} + \overline{S_{nt}})(\ln X_{nit} - \overline{\ln X_{nt}}) + \sum_{\tau=2}^{t} \sum_{n=1}^{N} \frac{1}{2} (\overline{S_{n\tau}} + \overline{S_{n\tau-1}})(\overline{\ln X_{n\tau}} - \overline{\ln X_{n\tau-1}}) \right\},$$

where Y, X, S, and *TFP* denote output, input, input share, TFP level respectively, and symbols with upper bar are corresponding measures for hypothetical firms. The subscripts τ and n are indices for time and inputs, respectively. In this case, the change in a plant's TFP level (productivity when all production factor inputs are controlled for) over time can be decomposed into two parts: (1) the change in a plant's TFP relative to that of the industry's representative plant and (2) the change in TFP for the industry.

Table 1 provides summary statistics for the dataset during the period of 1990-98. Table 2 shows the total numbers of plants, number of exporters, and export intensities in

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[10] A comparable database would be the Census of Manufactures in Japan. They have a very similar format. The Korean census/survey is richer in the sense that it has information on exporting and R&D for recent years while the Japanese census does not. On the other hand, the Korean census/survey does not have firm flags which are crucial for constructing a firm-level database, while the Japanese census has firm flags.

each year. Only around 11%-15% of the total plants are exporting each year, but the ratio of exports to shipments of exporters ranges around 35%-50%, suggesting that exporters are typically bigger than non-exporters.[11] As the comparison of exporters and non-exporters in Table 3 shows, on average, exporting plants are bigger, more capital intensive, hire more non-production workers, pay higher wages, and have higher labor productivity and higher total factor productivity.

As documented in various studies, and noted earlier, microdata evidence suggests that causation runs from more productive firms entering export markets (selection effects), rather than exporting makes firms more productive (learning effects). The somewhat weak evidence of learning effects reported in Bernard and Jensen (1999*a* and 1999*b*) for the US and Hahn (2004) for South Korea also suggests that such learning effects are only transient. However even without strong learning effects, selection effects from global competition could make a substantial contribution to aggregate productivity growth in the form of static efficiency gains. Previous studies, however, do not seem to have paid enough attention to heterogeneity across industries. Table 4 reveals great heterogeneity across industries in terms of their export intensity and also shows that the number of exporting plants can be relatively small even in high-export-intensity industries.

Table 5 shows reasonable support for the existence of learning-by-exporting spillovers presented in Hypothesis 1. Decomposition of productivity growth in Table 5 follows the method in Olley and Pakes (1996). The weighted aggregate productivity measure can be decomposed into two parts: (1) The unweighted aggregate productivity measure; and (2) the total covariance between a plant's share of the industry output and its productivity.

Aggregate productivity in a given industry can be represented by a weighted average of each individual plant's productivity in the industry. That is,

$$P_t = \sum_i \theta_{it} \, p_{it}$$

where P_t is an aggregate productivity measure for the industry at time t; θ_{it} is the share of plant i in the given industry at time t; and p_{it} is a productivity measure of an individual plant i at time t. Then, the decomposition method by Olley and Pakes (1996) is as follows.[12]

$$P_t = \sum_i \theta_{it} \, p_{it} = \overline{p_t} + \sum_i (\theta_{it} - \overline{\theta_t})(p_{it} - \overline{p_t})$$

In this decomposition, positive covariance means that more output is produced by the more productive plants (allocative efficiency).

Industries on the left column of Table 5 are high export-intensity industries and those on the right column are low (less than 10%) export-intensity industries. In moderate

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[11] In Table 2 and Table 3, non-exporters are defined as those whose export of the year was zero. A sharp increase in the weighted average of exports to shipments ratio in 1998 suggests that larger exporters responded more sensitively to the depreciation of the Korean currency during the Asian financial crisis. See Hahn (2004) for a further discussion. Our data covered the period of 1990 through 1998. For now, the data can be backdated to 1980 and updated to 2001. Accumulating more observation years after 1998 would enable us to analyze further on the impact of the Asian financial crisis of 1997-98.

[12] For further analyses based on an alternative decomposition method, see Appendix 1.

export-intensive industries such as textiles (38.5%) and apparel (25.9%), the weighted aggregate productivity growth is somewhat high and the covariance term shows improvement in allocative efficiency. In strong export-intensive industries such as computers (45.6%), electronic parts (54.3%), and other transportation equipments (55.3%), the weighted aggregate productivity growth is notably strong even with deterioration in allocative efficiency. In the case of low export-intensity industries such as foods (6.4%), tobacco (0.6%), wood (5.3%), publishing (1.7%), and non-metallic (7.0%), the weighted aggregate productivity growth is typically stagnant or even negative. At the same time, allocative efficiency is also deteriorating. As an exceptional case, the recycling industry also has low export intensity (5.8%), but shows strong productivity growth along with an improvement in allocative efficiency.

The findings in this subsection can be summarized in the following three points.

Exporting plants are a small portion of an industry and, when they are compared with non-exporting plants, they have distinct features such as bigger size, higher wages, higher capital intensity, and higher productivity. Interestingly, according to Bernard and Jensen (1999*a* and 1999*b*) and Hahn (2004), the average productivity gap between consistent exporters and consistent non-exporters is not widening over time. This is likely to be due to some form of spillover effect.

Export intensity (the share of exports in output) varies substantially from industry to industry.

Industries with higher export-intensity tend to show faster productivity growth.

These findings seem to be consistent with the conjecture that technology or knowledge spillovers coming from abroad through learning-by-exporting tend to spread to other domestic producers in the same industry faster than to those in other industries. To provide more objective evidence, we need a regression analysis for formal hypothesis testing.

[Further discussions based on Table A1 and Figure A1 through Figure A4 will be added here.]

3.4 Data analysis for Hypothesis 2

Starting from an unbalanced panel data for all manufacturing plants with employees no less than 5 over the 9-year period from 1990 to 1998, we ran pooled regressions with year dummies and industry dummies. The dependent variable is plant-level total factor productivity calculated with the aforementioned method of the chained-multilateral index number approach. What are the major determinants of plant-level productivity in addition to export intensity at the plant- and the industry-level?

First of all, plant-level productivity could be affected by macroeconomic conditions and these effects of the business cycle on productivity are controlled for annual dummies. A substantial part of plant-level productivity will also rely on the technological environment, which will vary from industry to industry. Industry dummies will control for such industry fixed effects. It is well known that plant size can be an important factor, which affects "measured" plant-level productivity either through static or dynamic economies of scale or through big producers' market power in setting higher price for their products. If the level of technology is one of the determinants of plant-productivity, some indicator of R&D will be a good explanatory variable. Based on the conjecture that more advanced plants or firms will hire more non-production workers in their total labor force, one can also use the share of non-production workers in employment as proxy for technology level. Finally, we wish to establish whether exporting at the plant and industry-level makes a positive contribution to plant-productivity. All these factors are considered in our regression exercise.

Table 6.1 contains the main results of our regression exercise. The total number of plant-year matches over the period 1990-1998 was 749,363. As our R&D data start only from 1991,

the total number of observations for R&D included regressions was 681,736. To test Hypothesis 2, we should check whether the coefficient for industry-level export intensity (B) has a significantly positive sign. To anticipate our conclusion, the null hypothesis that industry-level export intensity has no effect on plant-level productivity is always rejected, even at the 1% significance level. In case of Korean manufacturing in the 1990s, therefore, microdata suggest that there were significantly positive industry-wide contribution of exporting towards plant level productivity.[13]

Column I of Table 6.1 gives the most generic case, where plant-level total factor productivity is regressed on plant-level export intensity, industry-level export intensity, and year and industry dummy variables. Interestingly, even though both plant-level export intensity and industry-level export intensity have the correct sign with statistical significance, the industry-level export intensity turns out to have a much larger coefficient. Moreover, this basic pattern remains stable across different specifications. In Column II of Table 6.1, the size variable (natural log of number of workers) is added to control for scale effects. Indeed, the regression results suggest the existence of economies of scale, but adding the size variable does not affect our basic findings.

As revealed in Table 2, more than 80% of plants in our sample are non-exporters. Column III and Column IV of Table 6.1 separate them out using a dummy variable for "no exporting." In addition, we have added the share of non-production workers both at plant level and at industry level. Estimated coefficients for all the three added variables show the expected signs, while the coefficients for plant-level and industry-level export intensities remain stable.

R&D intensities at the plant level and at the industry level are added to the regression equations as extra explanatory variables in Column V through Column X. Both plant-level and industry-level R&D intensities were put into the regression equations along with plant-level and industry-level export intensities, so that we can compare spillovers in exporting and in R&D in a symmetric way. The coefficients for industry-level R&D intensity in Column V through Column X persistently show large R&D spillovers.[14]

Column V and Column VI of Table 6.1 have all of the variables export intensities, R&D intensities, and non-production worker employment shares together in the same format of plant-level and industry-level juxtaposition. It is noteworthy that the coefficients for plant-level and industry-level shares of non-production workers are similar in order of magnitude, while industry-level coefficients are much bigger than plant-level ones for R&D intensities and for export intensities. A casual conjecture suggests that such a difference

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[13] Positive coefficient for the plant-level export intensity may well raise the issue of causality, in the sense that high productivity of plant may cause higher export intensity at the plant level. Note that such argument does not apply in the case of the relation between plant-level productivity and industry-level export intensity. In other words, industry-level export intensity is more likely to be exogenous in the plant-level productivity regression, while plant-level export intensity could be endogenous.

[14] More intriguingly, however, coefficients for plant-level R&D intensity are persistently negative. This pattern, which was also observed from the Japanese data, certainly requires "furtheR&Deeper" analysis. My preliminary conjecture is that it might be due to learning costs in technology upgrading in technology-followers. For producers who are distant from the technology frontier, R&D expenditures are made typically when they try to adopt a new (but not frontier) technology from technology leaders. Discarding old and familiar technology and adopting a new technology often requires both tangible and intangible costs and these could have temporary negative effects on productivity at the initial stage of upgrading. The same pattern of positive size effects persists across different specifications in Columns IV, VI, VIII, and X, without weakening our basic findings on spillovers from exporting. See Ahn (2003) and the references there for a further discussion on technology upgrading with learning costs.

reflects the fact that labor spillover effects are not as important as spillovers in R&D and in learning-by-exporting.

The remaining four columns focus on comparing the contributions of export intensities and R&D intensities. Column VII and Column VIII are based on dummy variables for no-export and no-R&D plants, while Column XI and Column X are based on interaction terms for the plant-effect and the industry effect. Plants without exporting or without R&D activities tend to have a significantly lower productivity level. The positive contribution of an individual plant's exporting activity to productivity tends to be stronger when it belongs to a more export-intensive industry. However, such positive interaction is not observed in the case of R&D.

In general, the following patterns are observed persistently across different specifications.

Export intensities, both at the plant level and at the industry level, have positive and significant coefficients in explaining plant-level total factor productivity.

The coefficients for industry-level export intensity are around 5-7 times bigger than those for plant-level export intensity.

The coefficients for export intensity do not change greatly regardless of the inclusion or exclusion of the variables - size, and R&D intensity, and non-production workers' employment share at both the plant and industry-level.

In Table 6.1, industry was defined at the SIC 2-digit level and industry-level variables and industry dummy variables were calculated for each of the 23 industries in the manufacturing sector. Finally, as another robustness check, a more detailed industry definition at the SIC 3-digit level was used. Table 6.2 reports the results of regressions with industry-level variables and industry dummy variables calculated for each of the 61 industries at the 3-digit level. The basic findings from Table 6.1 do not change in this analysis. Perhaps the most notable differences at the 3-digit level are:

The coefficient on the industry-level export intensity variable, whilst it remains positive and significant, is now lower.

Contrary to this result the coefficient on the industry-level R&D intensity variable, whilst it remains positive and significant, is now higher.

The variable non-production workers' share in employment now has a larger coefficient at the plant level than at the industry level.

The first of these results is consistent with a-priori expectation since as the definition of an industry is narrowed to the 3–digit level, the scope for intra-industry externalities should be reduced. The second results work in the opposite direction and may imply that spillovers from R&D activity are more closely focused in technologically similar sub-sectors than are spillovers from exports. The relative shift in regard to the non-production workers variable is due principally to a fall in the coefficient on the industry-level variable. However this latter variable seems to be partly picking up the effect of the industry level R&D (when the non-production worker variable is excluded the coefficient on the latter rises) and the rise in the coefficient on the industry level R&D variable in the 3-digit level analysis may partly explain the fall in the coefficient on the non-production worker variable.

[Further discussions based on Table A2 and Table A3 will be added here.]

. Conclusions

Arguably, competition is a main source of innovation, technological progress, and economic growth, not only for an economy at the technological frontier, but also for a developing economy distant from the technology frontier. Increased global competition – either increased domestic competition with imported goods and services or fiercer

competition with foreign competitors in the export market – is expected to bring about higher aggregate productivity growth. If the persistently high economic growth in South Korea over the past several decades was due to high productivity growth and technology diffusion, there must be a strong expectation that export growth played an important role in this productivity performance. Until the 1980's in South Korea both product markets and factor markets were highly regulated and even now competition for corporate control remains relatively weak, so that until relatively recently competition really only existed in the export market.

A positive correlation between exporting and productivity has been reported in research on various countries. Recent studies such as Bernard and Jensen (1999*a* and 1999*b*) suggest the existence of both selection and learning effects around the point in time when a firm (or a plant) starts exporting. A very similar pattern is detected from Korean microdata in Hahn (2004). These findings, however, also suggest that such a learning effect (productivity gains from exporting) is temporary rather than persistent.

This paper explores a plausible channel through which exporting could have made both a substantial and a persistent contribution to export-oriented economic growth in South Korea and by extension, other East Asian NIEs: namely, the spillovers (or externalities) of learning-by-exporting. Plant-level data for Korean manufacturing show that more export-intensive industries tend to have a higher productivity level. In addition, a substantial part of the variance in plant-level productivity is explained by the variance in industry-level export intensity. These findings are consistent with the hypothesis that there exist spillovers of learning-by-exporting at least in some industries. As with the existence of the more usual intra-industry R&D spillovers, which are also demonstrated here, this raises the policy questions of how to get more benefits from such spillovers, whilst minimizing any side-effects from any policy intervention.

As in the case of other types of positive externalities, in theory a market solution will lead to a sub-optimal level of externality-generating output (in this case exports), so that government action could improve upon the market outcome. This is the implicit logic behind the active role played by the Japanese government or by the Korean government at the earlier stage of the economic development. Needless to say, however, the existence of such externalities does not justify the abuse or misuse of the government's intervention into the market. After all, as succinctly put by Stiglitz (1999), "the objective of the government is not to pick winners, but to identify externality-generating innovations."

It should be also emphasized that competition in one segment of the market may not be a permanent substitute for competition in other areas. In other words, dynamic efficiency gains from competition in the export market cannot be fully realized and sustained without emerging competition in other areas of the economy. An export-oriented development strategy has been highly successful for South Korea, and some other countries in East Asia, in the past, but lack of competition outside the export market, partly due to insufficient institutional development in areas such as the capital market, the labor market, and the market for corporate control, restricts the productivity gains from exporting. Perhaps this is one important lesson to be learned from the long economic stagnation in Japan and from the financial crisis in South Korea and other East Asian NIEs.

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Appendix. Aggregate TFP Growth Decomposition

Aggregate productivity changes can be decomposed into several factors including: *i*) within-firm productivity changes in continuing firms; *ii*) productivity changes resulting from changes in market shares of high-productivity firms and low-productivity firms; and *iii*) productivity changes resulting from the process of entry and exit.[15] Baily *et al.* (1992) used the following decomposition.

$$\Delta \ln TFP_t = \sum_{i \in C} \theta_{it-k} \Delta \ln TFP_{it} + \sum_{i \in C} \ln TFP_{it} \Delta \theta_{it}$$
$$+ \sum_{i \in N} \theta_{it} \ln TFP_{it} - \sum_{i \in X} \theta_{it-k} \ln TFP_{it-k}$$

where θ_{it} is the output share of firm *i* in the given sector at time *t*; productivity growth ($\Delta \ln TFP_t$) is measured between the base year *t-k* and the end year *t*; and *C*, *N*, and *X* are sets of continuing, entering, and exiting firms, respectively.

A problem with the above decomposition method was pointed out by Haltiwanger (1997). If the market share of the entrants is very low and if the market share of the exiters is very high, the net entry effect (sum of the third and the fourth terms in the above expression) could be negative even when entrants are more productive than exiters. To overcome this problem, a modified version of decomposition was offered by Haltiwanger (1997) as follows:[16]

$$\Delta P_t = \sum_{i \in C} \theta_{it-k} \Delta p_{it} + \sum_{i \in C} \Delta \theta_{it} (p_{it-k} - P_{t-k}) + \sum_{i \in C} \Delta \theta_{it} \Delta p_{it}$$
$$+ \sum_{i \in N} \theta_{it} (p_{it} - P_{t-k}) - \sum_{i \in X} \theta_{it-k} (p_{it-k} - P_{t-k})$$

where Δ refers to changes over the *k*-year interval between the first year ($t - k$) and the last year (*t*); θ_{it} is the share of firm *i* in the given sector at time *t*; *C*, *N*, and *X* are sets of continuing, entering, and exiting firms, respectively; and P_{t-k} is the aggregate (*i.e.* weighted

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[15] In productivity decomposition analyses, continuing, entering, and exiting firms are classified in the following way.

- Continuers: observed both in the first year (t k) and the last year (t) of the period.
- Entrants: observed in the last year (t), but not in the first year (t k).
- Exits: observed in the first year (t k), but not in the last year (t).

Under the above definitions, all firms that entered before the last year of the given period are regarded as entrants and all firms that exited after the first year are regarded as exiters. Therefore, the share of entrants or exiters is likely to increase as the length of the interval (k) increases.

[16] There exist several alternative decomposition methods in this vein, including those used by Griliches and Regev (1995), Olley and Pakes (1996), and Baldwin (1995, Ch.9). See Foster et al. (1998) for further discussions on alternative decomposition methods. They compare some of those alternative methods and conclude that the quantitative contribution of reallocation to the aggregate change in productivity is sensitive to the decomposition methodology that is employed.

average) productivity level of the sector as of the first year $(t - k)$. [17] Under this decomposition method, it is clear that an entrant [exiter] will contribute positively to productivity growth only when it has higher [lower] productivity than the initial industry average.

The five components of the above decomposition are defined as follows:

i)   The *within-firm effect* is within-firm productivity growth weighted by initial output shares.

ii) The *between-firm effect* captures the gains in aggregate productivity, which comes from the expanding market of high productivity firms, or from low-productivity firms' shrinking shares comparing the *initial* firm productivity level with the aggregate productivity level.

iii) The '*cross effect*' reflects gains in productivity from high-productivity *growth* firms' expanding shares or from low-productivity *growth* firms' shrinking shares.

iv) The *entry effect* is the sum of the differences between each entering firm's productivity and *initial* aggregate productivity, weighted by its market share.

v)   The *exit effect* is the sum of the differences between each exiting firm's productivity and *initial* aggregate productivity, weighted by its market share.

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[17] The shares are usually based on employment in decompositions of labour productivity and on output in decompositions of total factor productivity.

Table 1. Descriptive Statistics (1990-1998)

Variable	Unweighted Average	Std. Dev.	Number of observations
Production (million won)	3672.1	61089.3	758,987
Workers (person)	33.4	225.1	760,832
Production workers (person)	23.8	157.9	760,832
Non-production workers (person)	8.7	77.8	760,832
Capital (million won)	1849.9	36049.1	760,832
Materials (million won)	2597.7	44666.3	758,987
Export (million won)	942.9	28022.7	760,832
R&D (million won)	53.2	2820.5	692,142

Table 2. Number of Exporters and Export Intensity

Year	Total number of plants	Non-exporters	Exporters	exports/shipments ratio (percent) unweighted	Weighted
1990	68,690 (100)	58,392 (85.0)	10,298 (15.0)	54.8	37.3
1991	72,213 (100)	61,189 (84.7)	11,024 (15.3)	54.3	37.3
1992	74,679 (100)	63,241 (84.7)	11,438 (15.3)	51.7	36.3
1993	88,864 (100)	77,514 (87.2)	11,350 (12.8)	49.9	36.0
1994	91,372 (100)	80,319 (87.9)	11,053 (12.1)	47.2	35.9
1995	96,202 (100)	85,138 (88.5)	11,064 (11.5)	44.8	37.2
1996	97,141 (100)	86,502 (89.0)	10,639 (11.0)	43.6	35.3
1997	92,138 (100)	80,963 (87.9)	11,175 (12.1)	44.2	38.0
1998	79,544 (100)	67,767 (85.2)	11,777 (14.8)	44.7	48.7

Hahn(2004)

Table 3. Comparison of Exporters and Non-exporters

	1990		1994		1998	
	exporters	non-exporters	exporters	non-exporters	Exporters	non-exporters
Employment (person)	153.6	24.5	119.4	20.0	95.1	17.8
Shipments (million won)	11,505.5	957.0	17,637.1	1,260.3	25,896.8	1,773.8
Production per worker (million won)	50.5	26.8	92.4	47.0	155.0	74.2
Value-added per worker (million won)	16.5	11.3	31.0	20.4	51.3	29.6
TFP	0.005	-0.046	0.183	0.138	0.329	0.209
Capital per worker (million won)	16.8	11.9	36.0	21.9	64.6	36.7
Non-production worker / total employment (percent)	24.9	17.1	27.5	17.5	29.6	19.2
Average wage (million won)	5.7	5.1	10.3	9.2	13.7	11.5
Average production wage (million won)	5.5	5.1	10.0	9.2	13.1	11.4
Average non-production wage (million won)	6.8	5.3	11.6	9.4	15.6	12.4
R&D/shipments (percent)	a-1	b-1	1.2	0.6	1.4	0.6

Hahn (2004)

Table 4. Number of Exporting Plants and Export Intensity by Industry (KSIC 2-Digit)

Industry	1990		1994		1998		1990-1998
	Number of Plants	Number of Exporting Plant	Number of Plants	Number of Exporting Plants	Number of Plants	Number of Exporting Plants	Export Intensity
Food and Beverages	4,638	767	5,858	717	5,824	763	6.4%
Tobacco	20	8	16	7	14	5	0.6%
Textiles	7,621	1,368	9,838	1,557	8,103	1,485	38.5%
Apparel	6,607	816	8,460	604	6,781	462	25.9%
Leather, Luggage and Footwear	3,038	776	3,085	652	2,284	521	51.8%
Wood	2,050	137	2,505	105	1,677	81	5.3%
Pulp and Paper	2,128	219	2,600	251	2,300	257	10.3%
Publishing	2,900	73	4,366	47	3,962	30	1.7%
Coke, Petroleum& Nuclear Fuel	70	25	76	30	55	30	17.0%
Chemicals	1,804	466	2,644	657	2,694	802	28.5%
Rubber and Plastic	4,365	609	5,416	666	5,139	875	22.4%
Non-metallic Mineral Products	3,764	459	4,657	404	3,378	294	7.0%
Basic Metals	1,821	342	1,921	343	1,908	484	22.0%
Fabricated Metal Products	4,955	518	8,790	646	8,038	739	11.4%
Other Machinery	7,858	834	11,582	1,249	10,251	1,668	13.7%
Computers and Office Machinery	302	69	599	92	571	119	45.6%
Electrical Machinery	2,590	437	4,043	574	3,811	661	19.3%
Elect. components, Communication Equipment, etc.	3,208	755	3,434	754	2,829	754	54.3%
Medical, Precision, and Optical Instruments	1,104	282	1,801	400	1,779	498	27.1%
Motor Vehicles and Trailers	2,138	270	2,815	297	2,604	357	24.0%
Other Transportion Equipment	538	46	808	72	936	95	55.3%
Furniture	5,103	1,021	5,896	920	4,311	769	22.6%
Recycling	68	1	162	9	295	28	5.8%
Total	68,690	10,298	91,372	11,053	79,544	11,777	

Table 5. Decomposition of Aggregate Productivity Growth in Selected Industries

Industry	Year	Aggregate Productivity	Unweighted Productivity	Covariance	Industry	Year	Aggregate Productivity	Unweighted Productivity	Covariance
Textiles	1990	0.000	0.000	0.000	Food	1990	0.000	0.000	0.000
	1991	0.058	0.048	0.009		1991	0.130	0.056	0.074
	1992	0.119	0.094	0.025		1992	0.131	0.059	0.072
	1993	0.183	0.170	0.013		1993	0.110	0.092	0.018
	1994	0.194	0.188	0.005		1994	0.152	0.141	0.011
	1995	0.224	0.220	0.005		1995	0.186	0.196	-0.009
	1996	0.248	0.240	0.008		1996	0.160	0.184	-0.023
	1997	0.313	0.277	0.036		1997	0.173	0.176	-0.002
	1998	0.365	0.282	0.082		1998	0.133	0.150	-0.017
Apparel	1990	0.000	0.000	0.000	Tobacco	1990	0.000	0.000	0.000
	1991	0.022	0.006	0.015		1991	0.096	0.113	-0.016
	1992	0.132	0.060	0.072		1992	0.047	0.208	-0.161
	1993	0.129	0.060	0.069		1993	-0.044	0.368	-0.412
	1994	0.179	0.101	0.078		1994	-0.159	0.312	-0.471
	1995	0.203	0.150	0.053		1995	0.058	0.510	-0.453
	1996	0.272	0.173	0.099		1996	0.092	0.319	-0.227
	1997	0.218	0.112	0.105		1997	-0.026	0.355	-0.381
	1998	0.264	0.075	0.189		1998	-0.059	0.354	-0.413
Computers and Office Machinery	1990	0.000	0.000	0.000	Wood	1990	0.000	0.000	0.000
	1991	0.040	0.126	-0.085		1991	0.139	0.086	0.053
	1992	0.041	0.206	-0.165		1992	0.089	0.086	0.003
	1993	0.144	0.330	-0.186		1993	-0.205	-0.177	-0.028
	1994	0.307	0.477	-0.170		1994	-0.105	-0.085	-0.020
	1995	0.514	0.724	-0.211		1995	-0.038	-0.002	-0.036
	1996	0.738	0.810	-0.072		1996	0.011	0.044	-0.033
	1997	0.635	0.865	-0.230		1997	0.000	0.017	-0.017
	1998	0.818	0.945	-0.127		1998	0.000	0.019	-0.019
Electronics	1990	0.000	0.000	0.000	Publishing	1990	0.000	0.000	0.000
	1991	0.089	0.110	-0.021		1991	-0.045	0.077	-0.122
	1992	0.114	0.160	-0.046		1992	-0.079	0.094	-0.173
	1993	0.202	0.247	-0.045		1993	-0.004	0.191	-0.195
	1994	0.376	0.345	0.031		1994	0.036	0.167	-0.132

	1995	0.594	0.462	0.132		1995	0.021	0.121	-0.100
	1996	0.637	0.525	0.112		1996	-0.013	0.067	-0.079
	1997	0.603	0.607	-0.005		1997	0.020	0.097	-0.076
	1998	0.715	0.724	-0.010		1998	-0.008	0.043	-0.051
Other Transport Equipments	1990	0.000	0.000	0.000	Non-Metallic	1990	0.000	0.000	0.000
	1991	0.169	0.250	-0.080		1991	0.067	-0.010	0.078
	1992	0.223	0.158	0.064		1992	-0.003	0.006	-0.008
	1993	0.083	0.235	-0.152		1993	0.056	0.068	-0.012
	1994	0.214	0.357	-0.142		1994	0.111	0.175	-0.064
	1995	0.297	0.475	-0.178		1995	0.214	0.254	-0.039
	1996	0.255	0.578	-0.323		1996	0.168	0.262	-0.094
	1997	0.322	0.618	-0.296		1997	0.193	0.282	-0.088
	1998	0.436	0.713	-0.277		1998	0.207	0.300	-0.093
All manu-facturing	1990	0.000	0.000	0.000	Recycling	1990	0.000	0.000	0.000
	1991	0.067	0.057	0.010		1991	-0.051	0.071	-0.122
	1992	0.089	0.074	0.015		1992	0.042	0.105	-0.064
	1993	0.108	0.126	-0.019		1993	0.298	0.174	0.123
	1994	0.170	0.182	-0.011		1994	0.387	0.190	0.197
	1995	0.250	0.236	0.014		1995	0.620	0.330	0.289
	1996	0.252	0.247	0.005		1996	0.617	0.310	0.307
	1997	0.259	0.253	0.006		1997	0.484	0.285	0.199
	1998	0.280	0.265	0.015		1998	0.497	0.336	0.162

Reported growth figures are relative to 1990.

Table 6.1 Plant-level Total Factor Productivity Regressions (2-digit level)

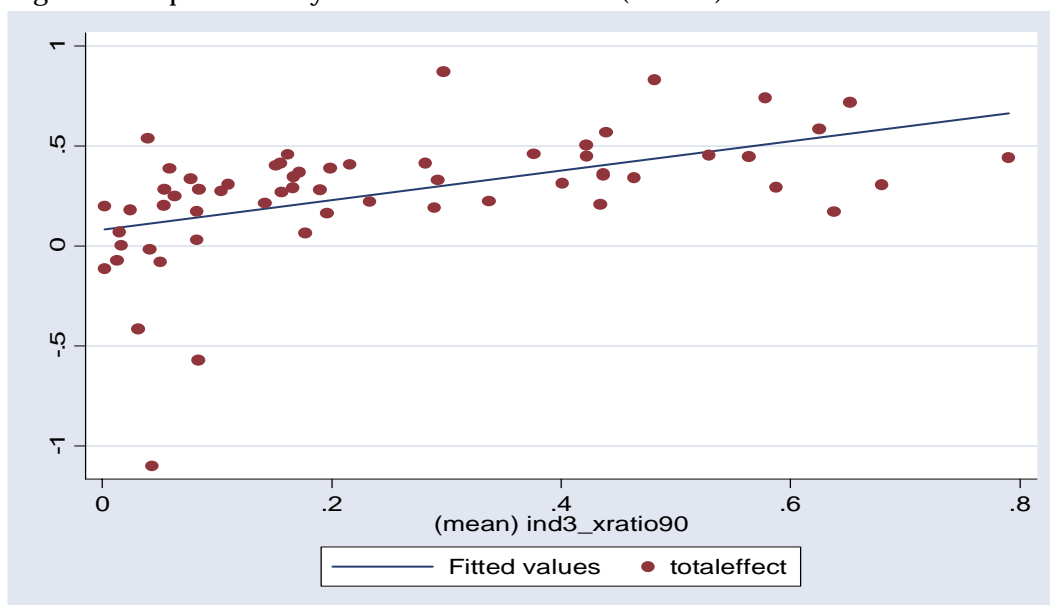|	I	II	III	IV	V	VI	VII	VIII	IX	X
Plant-level export intensity (A)	0.0935	0.0745	0.0575	0.0604	0.0731	0.0694	0.067	0.0733	0.0676	0.053
	(-45.12)	(-34.9)	(-18.05)	(-18.89)	(-32.98)	(-30.63)	(-19.67)	(-21.46)	(-15.01)	(-11.71)
Industry-level export intensity (B)	0.434	0.4258	0.474	0.4716	0.3713	0.3697	0.3537	0.3475	0.3425	0.3366
	(-40.35)	(-39.61)	(-43.07)	(-42.84)	(-29.17)	(-29.03)	(-27.97)	(-27.49)	(-26.91)	(-26.47)
Interaction term (A x B)									0.1104	0.1002
									(-7.91)	(-7.19)
No export dummy			-0.01	-0.003			-0.023	-0.006		
			(-4.73)	(-1.37)			(-10.71)	(-2.81)		
Plant-level R&D intensity (C)					-0.11	-0.11	-0.113	-0.11	-0.077	-0.079
					(-28.56)	(-28.6)	(-28.82)	(-27.91)	(-12.65)	(-12.96)
Industry-level R&D intensity (D)					1.1084	1.107	1.3293	1.3303	1.3644	1.3603
					(-8.82)	(-8.81)	(-10.71)	(-10.73)	(-10.99)	(-10.96)
Interaction term (C x D)									-1.251	-1.24
									(-4.94)	(-4.91)
No R&D dummy							-0.033	-0.021		
							(-16.97)	(-10.61)		
Size		0.0173		0.0054		0.004		0.0142		0.0161
		(-36.72)		(-10.6)	()	(-7.82)		(-26.42)		(-32.38)
Plant-level non-production worker share			0.2131	0.2062	0.2159	0.21				
			(-88.6)	(-82.73)	(-87.17)	(-81.16)				
Industry-level non-production worker share			0.5337	0.5376	0.3543	0.3565				
			(-14.68)	(-14.78)	(-8.71)	(-8.76)				
Year dummy	yes	yes	yes	yes	yes	yes	yes	yes	yes	Yes
Industry dummy	yes	yes	yes	yes	yes	yes	yes	yes	yes	Yes
R-squared (adjusted)	0.104	0.1056	0.1138	0.114	0.1003	0.1004	0.0908	0.0917	0.0902	0.0916
Number of observations	749,363	749,363	749,363	749,363	681,736	681,736	681,736	681,736	681,736	681,736

(*t*-ratio in parenthesis)

Table 6.2 Plant-level Total Factor Productivity Regressions (3-digit level)

	I	II	III	IV	V	VI	VII	VIII	IX	X
Plant-level export intensity (A)	0.0907	0.0711	0.0523	0.0556	0.0708	0.0659	0.0628	0.0687	0.0741	0.0583
	(-43.31)	(-32.95)	(-16.36)	(-17.33)	(-31.58)	(-28.75)	(-18.42)	(-20.12)	(-16.35)	(-12.79)
Industry-level export intensity (B)	0.3104	0.3028	0.3235	0.3205	0.2667	0.265	0.2519	0.2467	0.2436	0.2388
	(-31.63)	(-30.88)	(-32.29)	(-31.99)	(-22.9)	(-22.76)	(-22)	(-27.49)	(-21.11)	(-20.71)
Interaction term (A x B)									0.0714	0.0641
									(-5.52)	(-4.96)
No export dummy			-0.012	-0.004			-0.024	-0.007		
			(-6.10)	(-2.09)			(-11.29)	(-3.30)		
Plant-level R&D intensity (C)					-0.11	-0.11	-0.113	-0.11	-0.07	-0.072
					(-28.66)	(-28.71)	(-28.98)	(-28.07)	(-12.05)	(-12.32)
Industry-level R&D intensity (D)					1.1509	1.1425	1.4224	1.4158	1.4944	1.4781
					(-5.48)	(-5.44)	(-6.96)	(-6.93)	(-7.31)	(-7.23)
Interaction term (C x D)									-4.319	-4.33
									(-6.99)	(-7.02)
No R&D dummy							-0.032	-0.02		
							(-16.3)	(-9.93)		
Size		0.0174		0.0065		0.0052		0.0143		0.0162
		(-36.8)		(-12.57)		(-10.07)		(-26.57)		(-32.6)
Plant-level non-production worker share			0.1993	0.1909	0.2059	0.1981				
			(-80.68)	(-74.61)	(-80.68)	(-74.39)				
Industry-level non-production worker share			0.1315	0.1322	0.1671	0.1696				
			(-5.2)	(-5.23)	(-5.06)	(-5.14)				
Year dummy	yes	yes	yes	yes	yes	yes	yes	yes	yes	Yes
Industry dummy	yes	yes	yes	yes	yes	yes	yes	yes	yes	Yes
R-squared (adjusted)	0.1137	0.1153	0.1218	0.114	0.1092	0.1093	0.1013	0.1022	0.1008	0.1022
Number of observations	749,363	749,363	749,363	749,363	681,736	681,736	681,736	681,736	681,736	681,736

(*t*-ratio in parenthesis)

Figure A1. Export Intensity in 1990 and TFP Growth (1990-98): Total effect

(KSIC 3-digit)

Figure A2. Export Intensity in 1990 and TFP Growth (1990-98): Within effect

(KSIC 3-digit)

Figure A3. Export Intensity in 1990 and TFP Growth (1990-98): Redistribution effect ("Between" + "Covariance")

(KSIC 3-digit)

Figure A4. Export Intensity in 1990 and TFP Growth (1990-98): Net entry effect ("Entry" + "Exit" + "Switch-in" + "Switch-out")

(KSIC 3-digit)

Table A1. Export Intensity in 1990 and Decomposed TFP Growth (1990-98): Correlation Matrix

	Export Intensity ('90)	Total effect	Within effect	Redistribution effect	Net entry effect
Export Intensity ('90)	1				
Total effect	0.5074*	1			
Within effect	0.3022*	0.6777*	1		
Redistribution effect	0.2432	0.0566	-0.2537	1	
Net entry effect	0.3824*	0.7832*	0.1505	-0.0859	1

(*: significant at 5% level, KSIC 3-digit)

Table A2. Determinants of TFP Growth (Industry: KSIC 2-digit)

Dependent variable: ln(TFP)t-ln(TFP)t-1	(1)		(2)		(3)		(4)	
ln(TFP)t-1	-0.5093	***	-0.5043	***	-0.5173	***	-0.5099	***
	(-429.02)		(-425.7)		(-461.12)		(-429.33)	
(Export/Production)t-1			0.0352	***	0.0263	***	0.0299	***
			(-16.53)		(-13.24)		(-14.05)	
(Export/Production of the Industry)t-1			0.0211	***	0.0819	***	0.0237	***
			(-2.9)		(-12.99)		(-3.18)	
(R&D expenditure/Production)t-1	0.0178	***	0.0265	***			0.0177	***
	(-3.71)		(-5.5)				(-3.69)	
(R&D expenditure/Production of the Industry)t-1	1.1944	***	1.0206	***			1.0762	***
	(-14.1)		(-11.91)				(-11.86)	
(No. of non-production workers/No. of all workers)t-1	0.1253	***			0.1277	***	0.1235	***
	(-49.14)				(-52.44)		(-48.39)	
(No.of non-production workers/No.of all workers the Industry)t-1	-0.0779	***			0.0801	***	-0.0546	***
	(-3.84)				(-4.4)		(-2.61)	
ln(Number of workers)t-1	0.0038	***	0.0091	***	0.0027	***	0.0023	***
	(-8.09)		(-19.76)		(-6.06)		(-4.81)	
Intercept	-0.0861	***	-0.1008	***	-0.1569	***	-0.0909	***
	(-15.65)		(-39.93)		(-30.21)		(-15.84)	
Industry dummies (KSIC 2-digit)	Yes		yes		yes		yes	
Year dummies	Yes		yes		yes		yes	
Number of observations	474,879		474,879		532,564		474,879	
R squared	0.2856		0.2824		0.2905		0.2859	

1. The values in parentheses are t-statistics
2. *:P=.10, **:P=.05, ***:P=0.01.

Table A3. Determinants of TFP Growth (Industry: KSIC 3-digit)

Dependent variable: ln(TFP)t-ln(TFP)t-1	(1)		(2)		(3)		(4)	
ln(TFP)t-1	-0.5155	***	-0.5113	***	-0.5234	***	-0.5161	***
	(-272.64)		(-270.64)		(-294.97)		(-272.99)	
(Export/Production)t-1			0.0348	***	0.0259	***	0.0293	***
			(-15.32)		(-12.53)		(-13.17)	
(Export/Production of the Industry)t-1			0.0253	***	0.0518	***	0.0346	***
			(-3.66)		(-8.44)		(-4.97)	
(R&D expenditure/Production)t-1	0.0174	*	0.0251	**			0.0173	*
	(-1.72)		(-2.43)				(-1.7)	
(R&D expenditure/Production of the Industry)t-1	0.4666	***	0.4388	***			0.3667	***
	(-6.82(		(-6.4)				(-5.24)	
(No. of non-production workers/No. of all workers)t-1	0.1185	***			0.12	***	0.1166	***
	(-38.86)				(-41.68)		(-38.43)	
(No.of non-production workers/No.of all workers the Industry)t-1	0.0275	*			0.1072	***	0.0439	***
	(-1.79)				(-7.94)		-2.83	
ln(Number of workers)t-1	0.0043	***	0.0091	***	0.0032	***	0.0028	***
	(-9.44)		(-20.5)		(-7.19)		(-5.97)	
Intercept	-0.0822	***	-0.0786	***	-0.1373	***	-0.0896	***
	(-17.03)		(-20.05)		(-29.45)		(-17.70)	
Industry dummies (KSIC 3-digit)	Yes		yes		yes		yes	
	Yes		yes		yes		yes	
Number of observations	474879		474879		532564		474879	
	0.2889		0.2862		0.2941		0.2892	

Table A.4 Comparison of Total Factor Productivity Decomposition Results

Source	Country	Unit of analysis	Period	Annual TFP growth total (%)	Contribution of each effect							
					Within effect	Reallocation effect subtotal	Between effect	Covariance effect	Net entry effect subtotal	Entry effect	Exit effect
				a=b+c+f	b	c=d+e	d	e	f=g+h	g	h
Ahn, Fukao, and Kwon (2004)	Korea	Establishment	1990-98	3.51	1.42	0.08	-0.28	0.36	2.01	1.95	0.06
					(-0.4)	(-0.02)	(-0.08)	(-0.1)	(-0.57)	(-0.56)	(-0.02)
Foster, Haltiwanger, and Krizan (1998)	USA	Establishment	1977-87	1.02	0.49	0.27	-0.08	0.35	0.27		
					(-0.48)	(-0.26)	(-0.08)	(-0.34)	(-0.26)		
Fukao and Kwon (2004)	Japan	Firm	1994-2001	0.31	0.17	0.05	-0.01	0.06	0.09	0.16	-0.07
					(-0.56)	(-0.15)	(-0.04)	(-0.2)	(-0.29)	(-0.53)	(-0.24)
Barnes, Haskell, and Maliranta (2001)	Finland	Firm	1987-92	1.08	-1.02	1.27	0.57	0.7	0.82	0.58	0.24
					(-0.94)	(-1.18)		(-0.65)	(-0.76)	(-0.54)	(-0.22)
	France	Firm	1987-92	-1.54	-2.03	0.29	0.32	-0.03	0.2	0.18	0.02
					(-1.32)	(-0.19)	(-0.21)	(-0.02)	(-0.13)	(-0.12)	(-0.01)
	Italy	Firm	1987-92	3.1	1.64	0.43	0.71	-0.28	1.02	1.09	-0.06
					(-0.53)	(-0.14)	(-0.23)	(-0.09)	(-0.33)	(-0.35)	(-0.02)
	Netherlands	Firm	1987-92	0.54	0.83	-0.03	0.49	-0.52	-0.26	0.03	-0.29
					(-1.54)	(-0.06)	(-0.91)	(-0.97)	(-0.48)	(-0.06)	(-0.54)
	UK	Firm	1987-92	-0.9	-1.39	0.28	-0.21	0.49	0.21	0.05	0.15
					(-1.54)	(-0.31)	(-0.23)	(-0.54)	(-0.23)	(-0.05)	(-0.17)

Comments on "Global Competition and Productivity Growth: Evidence From Korean Manufacturing Micro-data"

Euysung Kim,
Yonsei University

The major contribution of this paper is to use previously unexploited data on Korean manufacturing firms to shed new light on the presence of export induced productivity spillovers.

The paper is very-well written in a very succinct manner. The methodological approach of this paper is employed in a very rigorous manner. This paper can be published without any major revisions. I would therefore strongly recommend the paper for publication in   .

I would however add the following comments for further improving the paper:

1. While this paper includes a very thorough literature review on empirical evidence on this issue. What is perhaps lacking is a discussion on theoretical debate on this very issue. The paper needs to clarify the theoretical justification for the empirical methodology employed in the paper. For example, it would be nice if the paper would clarify what is the exact hypothesis being tested with regard to the link between trade/FDI and technology spillovers. Moreover, if the mechanism for the spillover is increasing competition, it is not clear why the paper only focuses on exports and FDI and not on imports. We need more micro-details as to how trade impacts on technology spillovers. The lack of theoretical justification makes it difficult to interpret the regression results.

2. One of the most important contributions is to assess the relative strength of inter-industry spillover vs intra-industry spillover. The contribution could be further highlighted in the context of endogenous growth literature. In endogenous growth literature, the scope of technology hinges very importantly on whether trade would have positive or negative impact on economic growth. This paper helps us shed some light on this debate.

Growth Accounting for Some Selected Developing, Newly Industrialized and Developed Nations from 1966-2000: A Data Envelopment Analysis

by

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Key Words: Data envelopment analysis, growth accounting, technical efficiency, efficiency change, technological change, capital accumulation, human capital accumulation, kernel smoothing, cross country labor productivity distribution and counterfactual distributions

Abstract

We work out technical efficiency levels of 29 countries consisting of some selected South Asian, East Asian and EU countries using data envelopment analysis. Luxembourg has an efficiency score of one(most efficient) in all the years .Netherlands also has an efficiency score of one in 1966,1971,1976 and 1981.Japan,UK,Belgium,Ireland,Indonesia,Spain and Germany has an efficiency score of one in at least one of the years from 1966 to 2000.In the year 2000 though mean efficiency levels(without including life expectancy as input) of South Asian countries is higher than the European Union Countries and East Asian countries. Japan has the highest average efficiency followed by Hong Kong in the East Asian region in the period 1966-2000.

We also decompose labor productivity growth into components attributable to technological changes (shifts in the overall production frontier), technological catch up or efficiency changes(movement towards or away from the frontier),capital accumulation(movement along the frontier) and human capital accumulation(proxied by life expectancy).The overall production frontier is constructed using deterministic methods requiring no specification of functional form for the technology nor any assumption about market structure or the absence of market imperfections. Growth accounting results tend to convey that for the East Asian and the South Asian countries efficiency changes(technological catch up) have contributed the most, while for the European countries it is the technical changes which has contributed more to labour productivity changes between 1966-2000. We also analyze the evolution of cross country distribution for the 29 countries included in our sample using Kernel densities. It seems that there are other factors like trade openness,quality of governments,population rate of growth, savings rate, corruption perception indices, rule of law index, social capital

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and trust variables, formal and informal rules governing the society, among others, rather than the ones that are included below for the growth accounting exercise which may be responsible for productivity accounting on point to point basis. For all the seven periods(point to point basis) we see a major role played by technological changes and efficiency changes together to account for the current period counterfactual distributions and for the bimodal distribution in year 2000, and for the period 1966-2000(not point to point basis –an excercise done similar to Kumar and Russell(2002)) we find technical changes and its combination with other tripartite and quadripartite changes jointly account for the bimodal distribution in year 2000.However, from this growth accounting exercise, we do find that there is convergence in statistical terms of efficiency changes and human capital accumulation across countries of the EU, South Asian and East Asian regions.

I. Introduction

Very much in the spirit of Quah's (1993, 1996b, 1997) suggested approach (also adopted by Galor [1996] and Jones [1997]), we analyze the evolution of the entire distribution of the four growth factors: technological change, technological catch-up, capital accumulation and human capital accumulation[2]. We analyze the contribution of these four components to the growth of countries labour productivity and to the shift in the countries distribution of labour productivity over time. Data envelopment analysis has been used to estimate the best production frontier for some of the Developed(EU Nations),Developing(South Asians) and Newly Industrialized Countries(East Asian nations) included in our study. The countries production frontier is constructed using deterministic methods requiring no specification of functional form for the technology nor any assumption about market structure or the absence of market imperfections. Technological catch up signifies movement towards the frontier, technical change is movement of the frontier, capital accumulation is movement along the frontier and human capital accumulation implying changes in the efficiency of labor.

Quah has argued compellingly that analyses based on standard regression methods focusing on first moments of the distribution cannot adequately address the convergence issue. These arguments are buttressed by the empirical analyses of Quah and others posing a robust stylized fact about the international growth pattern that begs for explanation. A plot of the distribution of output per worker across 29 countries consisting of 5 South Asian,8 East Asian and 16 EU countries(country names are given in Appendix Table I at the last) in 2000 and 1966 appears in Figure 1 and II respectively, below. (The data and the kernel based method of smoothing the distribution is described below in the section on methodology). Over this 34 year period, the distribution of labour productivity was transformed from a tri-modal distribution in 1966 into a bimodal distribution in 2000 with a higher mean(data on output per worker is available in Table III below- column II and Column III)[3]. This transformation in turn means that, while in 1966 there

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[2] This approach to Growth Accounting is not dependent on particular assumptions about the technology,market structure,technological change and other aspects of the growth process.

[3] Two-Sample Kolmogorov-Smirnov Test(non parametric test) is used to test whether two sets of observations could reasonably have come from the same distribution. This test assumes that the samples are random samples, the two samples are mutually independent, and the data are measured on at least an ordinal scale. In addition, the test gives exact results only if the underlying distributions are continuous. data: x: output per worker in 1966 , and y: output per worker in 2000 ks = 0.5172, p-value = 0.0007 alternative hypothesis: cdf of x: output per worker in 1966 does not equal the cdf of y: out put per worker in 2000 for at

were countries in the lower, middle income and upper income groups, in 2000 the world had become divided, as a stylized fact, into two categories: the rich and the poor. It seems that

Figure I   Distribution of Output Per Worker , 2000(Bimodal)

Figure II   Distribution of Output Per Worker , 1966 (Trimodal)

that almost all of the East Asian economies have joined the elite 'rich group'. Quah (1996a, b, 1997) refers to this phenomenon as "two-club", or "twin-peak", convergence a phenomenon that renders suspect analyses based on the first moment (or even higher

least one sample point. We conclude from the test that two sample probability distributions of output per worker in 1966 and 2000 are indeed different statistically.

moments) of this distribution. Our analysis is aimed at explaining this bipolarization of the distribution of output per worker, as well as its growth pattern, in terms of the tripartite and quadripartite decomposition described below. As such, it builds upon Quah's insights about the need to examine the "dynamics of the entire cross-section distribution" (Quah, 1997, p. 29). In this study we will further identify policies which may reduce differential levels of per-capita income levels and growth rates of regions and work out the reasons for the existence of bimodal distribution of per capita income across countries. Also, related to the concept of labour productivity is the concept of efficiency, i.e amount by which outputs can be increased without requiring extra inputs. We will also work out the 'efficiency levels' of countries included in our sample by using linear programming method of data envelopment analysis .

The main variables in use in this study will be GDP at Constant 1995 US $,capital(Constant 1995 US $) labour, life expectancy in years(proxy for human capital) and labour productivity(GDP divided by labour force) prevailing in different countries⁄ regions included in our study.

The paper is organized as follows. Section II reviews literature on data envelopment analysis and on growth accounting without the need for specification of a functional form for the technology, for the assumption that technological change is neutral, or for the assumptions about market structure or the absence of market imperfections. Section III is on objectives of the study, Section IV states the hypotheses. Section V is on Methodology. Section VI describes the variables used in the study and in the efficiency analysis   and gives an account of the data sources. Section VII discusses the results for efficiency levels and changes and growth accounting of the countries included in our sample .Section VIII discusses the counterfactual probability distributions and contrasts it with the labour productivity distribution of 1966.   Section IX gives conclusions. References and Appendix Tables(available with author on demand) are at the end

II. Review of Literature: Data Envelopment Analysis and Growth Accounting Analysis

We have used DEA framework to work out efficiency indexes for countries included in our sample.

2.1 Data envelopment analysis (DEA)

DEA is a mathematical programming approach for estimating the relative technical efficiency (TE) of production activities. The term DEA was originally proposed by Charnes et al. (1978). The Charnes et al.(1978) work extended the Farrell (1957) multiple input, single output measures of TE to the multiple-output, multiple input technology. The DEA technique permits an assessment of the performance or TE of an existing technology relative to an ideal, "best-practice", or frontier technology (Coelli et al. 1998). The frontier or best-practice technology is a reference technology or production frontier that depicts the most technically efficient combination of inputs and outputs (i.e., output is as large as possible given the technology and input levels, or input levels are as small as possible given the output levels). The frontier technology is formed as a non-parametric, piece-wise, linear combination of observed "best-practice" activities. Data points are enveloped with linear segments, and TE scores are calculated relative to the frontier technology.

2.2 Growth Accounting

The results of total factor productivity estimation differ due to different assumptions made in respect of production functions and limitations of data availability on productivity of capital and labor and quality of workers. Kumar and Russell(KR,2002) and Henderson and Russell(2003) studies are exceptions.

Kumar and Russel (2002) use frontier methods to analyze international macroeconomic convergence. In particular, they decompose the labor-productivity growth of 57 industrial, newly industralized, and developing countries into components attributable to (1) technological change (shifts in the world production frontier),(2) technological catch-up (movements toward or away from the frontier), and (3) capital accumulation (movement along the frontier). These calculations amount to standard growth accounting with a twist—without the need for specification of a functional form for the technology, for the assumption that technological change is neutral, or for assumptions about market structure or the absence of market imperfections. Indeed, market imperfections, as well as technical inefficiencies, are possible reasons for countries falling below the world-wide production frontier. Taking a cue from the Quah critique spelled out in the introduction of this study, KR(2002) go on to analyze the evolution of the entire distribution of these three growth factors.

KR study yields somewhat striking results:

(1) While there is substantial evidence of technological catch-up (movements toward the production frontier), with the degree of catch-up directly related to initial distance from the frontier, this factor apparently has not contributed to convergence, since the degree of catch-up appears not to be related to initial productivity.

(2) Technological change is decidedly non-neutral, with no improvement—indeed, possibly some implosion—at very low capital/labor ratios, modest expansion at relatively low capital/labor ratios, and rapid expansion at high capital/labor ratios.

(3) Both growth and bimodal polarization are driven primarily by capital deepening.

Henderson and Russell(2003) introduce human capital into the Kumar and Russell(KR,2002) growth accounting analysis of international macroeconomic convergence. They amend the KR methodology by (1) adopting the Diewert(1980) approach to dynamic frontier analysis, thus precluding implosion of the worldwide production frontier over time and (a) changes in the mean and (b) mean-preserving shifts in the distribution of productivity. Their principal conclusions were

* Over half of the increase in mean productivity attributed to KR to the accumulation of physical capital was, in fact, the result of the accumulation of human capital.

* In contradiction to the KR conclusion that capital accumulation also accounts for the shift in the distribution, primarily from unimodal to bimodal, their analysis indicates that efficiency changes account for the qualitative shift from unimodal to bimodal, whereas the accumulation of physical and human capital account for the increased worldwide dispersion of productivity.

*There is evidence of technological progress in the developed nations only.

In this study we also do growth accounting with a twist-without the need for specification of a functional form for the technology, for the assumption that technological change is neutral, or for the assumptions about market structure or the absence of market imperfections. We use sample of 29 developing, newly industrialized and developed nations. The objective is to reconfirm whether indeed KR(2002) and

Henderson and Russel(2003) results holds for the sample of countries included in our study.

III. Objectives of the study

To work out technical efficiency index for each of the 29 countries in the sample and examine the impact of some of its determinants on the efficiency levels for five year interval period starting from 1966 and ending in year 2000.

To undertake growth accounting exercise which can decompose labor productivity growth into components attributable to technological changes(shifts in the overall production frontier),technological catch up or efficiency changes(movement towards or away from the frontier),capital accumulation(movement along the frontier) and human capital accumulation.

Identify reasons for the existence of bimodal labour productivity distribution prevailing across countries by particularly analyzing the evolution of cross country distribution over time for the 29 countries included in our sample consisting of some South Asian,East Asian and EU countries

IV. Hypothesis

1.South Asian and East Asian countries presently are more 'efficient' than the Developed nations included in the sample.

2.To test whether technological change, technological catch up, capital accumulation and human capital accumulation are primarily responsible for differential growth in labor productivity across countries and regions and are also responsible for the existence of bimodal labour productivity distribution across countries included in our sample.

V. Methodology

The level of efficiency for each country has been worked out using Data Envelopment Analysis(DEA)4 for five year interval period starting from 1966 and ending in year 2000.

Further, we decompose labor productivity into its components, efficiency change, technological change, capital accumulation and human capital accumulation. Technological change reflects shifts in the world production frontier, determined conceptually by the state-of-the-art, potentially transferable technology; while efficiency change reflects the movements toward (or away from) the frontier as countries adopt "best practice" technologies and reduce (or exacerbate) technical and allocative inefficiencies; and the third capital accumulation reflects movements along the frontier. The world production frontier at each point in time is constructed using deterministic, nonparametric (mathematical programming) methods (essentially, finding the smallest convex cone enveloping the data) and efficiency is measured as the (output-based) distance from the frontier. These data-driven methods do not require specification of any particular functional form for the technology, nor do they require any assumption about market structure or about the absence of market imperfections; market imperfections, as well as technical inefficiencies, are possible reasons for countries falling below the

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4 Our efficiency calculations were carried out using the Onfront software(demo version),available from Economic Measurement and Quality I Lund AB(Box 2134,S-220 Lund,Sweden(www.emq.se).

worldwide production frontier. We proxy human capital accumulation by life expectancy changes.Introduction of human capital results in a quadripartite decomposition of productivity growth.

5.1 Non Parametric Construction of Technologies and Efficiency Measurement

Our approach to constructing the worldwide production frontier and associated efficiency levels of individual economies (distances from the frontier), motivated in part by the first such effort in this direction by Fare, Grosskopf, Norris, and Zhang (1994b), Charnes et. al(1978),followed by Kumar and Russell(2002) and Henderson and Russell,(2003) which in turn is based on the pioneering work of Farrell (1957) and Afriat (1972).We follow mainly Kumar and Russell(2002). The basic idea is to envelop the data in the "smallest", or "tightest fitting", convex cone, and the (upper) boundary of this set then represents the "best practice" production frontier. Our technology contains four macroeconomics variables: aggregate output and three aggregate inputs – labor, physical capital, and human capital(proxied by life expectancy in years).

Let $\left(Y_t^j, L_t^j, K_t^j, H_t^j \right)$ t = 1, ..., T, j =- 1, 1... J, represent T observations on

these four variables for each of the J countries. In particular, we construct the constant-returns-to-scale, period-t technology using (in principle) all data up to that point in time :

$$\tau_t = \left\{ (Y,L,K,H) \in R_+^4 \mid Y \le \sum_{\tau \le t} \sum_j z_\tau^j Y_\tau^j \right.$$

$$\left. L \ge \sum_{\tau \le j} \sum_j z_\tau^j L_\tau^j \quad K \ge \sum_{\tau \le j} \sum_j z_\tau^j K_\tau^j, H \ge \sum_j z^j H, z^j \ge 0 \forall j \right\} \qquad (1)$$

This technology is the Farrell cone; other assumptions about returns to scale would incorporate an additional constraint on the activity level, t = 1, ..., T, j = 1, ... J (see, e.g., Fare, Grosskopf, and Lovell (1994)).

In this construction, each observation is interpreted as a unit operation of a linear process.zj represents the level of operation of that process and every point in the technology set is a linear combination of observed output/input vectors or a point dominated by a linear combination of observed points. The constructed technology is a polyhedral cone, and isoquants are piecewise linear.

The Farrell (output based) efficiency index for country j at time t is defined by

$$E\left(Y_t^j, L_t^j, K_t^j, H \right) = \min \left\{ \lambda \mid \left(Y_t^j \mid \lambda, L_t^j, K_t^j, H \right) \in \tau_t \right\} \qquad (2)$$

This index is the inverse of the maximal proportional amount that output Y_t^j can be expanded while remaining technologically feasible, given the technology τ_t and the input quantities L_t^j, K_t^l, and H ; it is less than or equal to 1 and takes the value of 1 if

and only if the jt observation is on the period t production frontier. In this case of a scalar output, the output based efficiency index is simply the ratio of actual to potential output evaluated at the actual input quantities, but in multiple-output technologies the index is a radial measure of the (proportional) distance of the actual output vector from the production frontier.

In our simple case, we deal with only three macroeconomic variables: aggregate output and two aggregate inputs: labor and capital. Let $\left(Y_t^j, L_t^j, K_t^j \right), t = 1, .., T, j = 1, \ldots J,$ represent T observations on these three variables for each of the J countries.

The Farrell efficiency index can be calculated by solving the following linear program for each observation:

$$\min_{\lambda, z^1, \ldots, z^j} \lambda \text{ subject to}$$

$$Y^j / \lambda \leq \sum_k z^k Y_t^k$$

$$L^j \geq \sum_k z^k L_t^k$$

$$K^j \geq \sum_k z^k K_t^k$$

$$z^k \geq 0 \forall k. [5]$$

The solution value of   in this problem is the value of the efficiency index for country j at time t.

5.2 Tripartite Decomposition of the Factors Affecting Labor Productivity

We decompose the ratio of labour productivity in current year to labour productivity in base year into its three components: efficiency change(catching up to the frontier),technical change(movement of frontier) and capital accumulation(movement along the frontier).Please refer to Kumar and Russell Paper(2002) for the derivation.

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[5] In DEA we maximize the weighted average of outputs divided by weighted average of inputs for each firm under the constraint that the same ratio is less than equal to one for other decision making units. The miax problem is dual of the min problem.

$$
\frac{y_c}{y_b} = \frac{e_c}{e_b} \left(\frac{\overline{y}_c(k_c)}{\overline{y}_b(k_c)} \times \frac{\overline{y}_c(k_b)}{\overline{y}_b(k_b)} \right)^{1/2}
$$

$$
\times \left(\frac{\overline{y}_b(k_c)}{\overline{y}_b(k_b)} \times \frac{\overline{y}_c(k_{c)}}{\overline{y}_c(k_b)} \right)^{1/2}
$$

$$
= : \textbf{EFF} \times \textbf{TECH} \times \textbf{KACCUM.}
$$

5.3 Quadriparite Decomposition of the Factors Affecting Labor Productivity Conceptual Decomposition

Further We can decompose the ratio of labour productivity in current year to labour productivity in base year into its four components: efficiency change(catching up to the frontier),technical change(movement of the frontier), capital accumulation(movement along the frontier) and Human Capital Accumulation. Please refer to Henderson and Russell(2003) Paper for the derivation.

$$
\frac{y_c}{y_b} = \frac{e_c}{e_b} \left(\frac{\overline{y}_c(k_c)}{\overline{y}_b(k_c)} \cdot \frac{\overline{y}_c(k_b)}{\overline{y}_b(k_b)} \right)^{1/2} \left(\frac{\hat{\overline{y}}_b(k_{c)}}{\overline{y}_b(k_b)} \cdot \frac{\overline{y}_c(k_c)}{\overline{y}_c(k_b)} \right)^{1/2} \frac{H_c}{H_b}
$$

$$
= : \textbf{EFF} \times \textbf{TECH} \times \textbf{KACC} \times \textbf{HACC.}
$$

5.4 Kernel Densities

We employ kernel based density functions for estimating the cross country labor productivity distribution for various years. The density estimates are computed using the Rosenblatt-Parzen kernel density estimator. We use an optimal bandwidth parameter chosen as $h=1.0592*\sigma*N^{(-.20)}$ where σ is the standard deviation of the data and N is the number of observations. Splus software has been used to estimate the Kernel smoothers.

VI. Data and Variable Description

For the technical efficiency and growth accounting exercise (labour productivity decomposition into four factors), we consider a sample of 29 countries(5 South Asian+8 East Asian+16 EU Countries) over the period 1966-2000,using data from the World Development indicators on CDROM(various years).The included countries are identified in Appendix Table I. For DEA, Our measure of aggregate output is GDP calculated at constant 1995 US \$. Aggregate inputs used in the DEA model are capital stock, labor force and life expectancy(proxy for human capital) .The capital stock for each country was calculated from gross capital formation(current US \$).The measurement method is as described in(Chou,1993) . Appropriate deflator was used to estimate capital stock at constant 1995 US \$.

VII. Discussion of the Results: Efficiency Levels and Changes, Technological Changes, Capital Accumulation and Human Capital Accumulation and Contribution of Such Factors to Labour Productivity Changes(1966-2000)

7.1 Empirical Results: Technological Catch Up(Efficiency Levels and Changes)

Table I and II lists the efficiency levels of each of the 29 countries for the years 1966,1971,1976,1981,1986,1991,1996 and 2000.Efficiency indexes are calculated from the input and output data for the 29 countries included in our study. The output and input data are given below in the Appendix Tables(available with author). For comparison purposes, we calculate these indexes both with and without life expectancy (denoted by LE and WLE in the tables, respectively). Human capital is proxied by life expectancy of countries in year

Table   . Technical Efficiency Indexes(1966-2000)

	WLE	LE	WLE	LE	WLE	LE	WLE	LE
Country	1966	1966	1971	1971	1976	1976	1981	1981
Bangladesh	0.29	0.29	0.37	0.37	0.71	0.75	1	1
India	0.11	0.56	0.19	0.53	0.46	0.58	0.67	0.86
Nepal	0.53	0.53	0.56	0.56	1	1	0.97	0.97
Pakistan	0.12	0.12	0.22	0.22	0.5	0.5	0.84	0.84
Sri lanka	0.1	0.1	0.21	0.21	0.51	0.51	0.59	0.59
Belgium	0.77	0.82	0.8	0.89	0.88	0.95	0.9	0.91
Austria	0.67	0.72	0.74	0.81	0.8	0.87	0.84	0.87
Denmark	0.98	1	0.92	1	0.91	0.98	0.86	0.86
Finland.	0.59	0.62	0.6	0.65	0.65	0.71	0.71	0.75
France	0.72	0.84	0.75	0.94	0.79	0.9	0.83	0.86
Germany	0.91	1	0.75	0.96	0.79	0.9	0.83	0.83
Greece	0.33	0.36	0.4	0.43	0.45	0.49	0.59	0.59
Ireland	0.41	0.42	0.43	0.44	0.48	0.48	0.83	0.83
Italy	0.48	0.77	0.52	0.81	0.57	0.79	0.7	0.86
Luxembourg	1	1	1	1	1	1	1	1
Netherland	1	1	1	1	1	1	1	1

Portugal	0.22	0.24	0.26	0.29	0.26	0.28	0.35	0.35
Spain	0.46	1	0.48	1	0.72	1	0.93	0.95
Sweden	0.82	0.86	0.77	0.86	0.78	0.85	0.76	0.78
UK	0.55	1	0.51	0.96	0.52	0.89	0.96	1
Norway	0.77	0.79	0.73	0.79	0.8	0.87	0.85	0.85
Malaysia	0.16	0.16	0.22	0.22	0.65	0.65	0.96	0.96
China	0.12	0.54	0.17	0.37	0.34	0.42	0.35	0.47
Indonesia	0.08	0.22	0.17	0.23	0.78	0.8	1	1
Japan	0.62	0.98	0.78	1	0.88	1	1	1
Phillipines	0.08	0.18	0.11	0.16	0.38	0.38	0.69	0.69
Singapore	0.25	0.25	0.34	0.34	0.42	0.42	0.7	0.7
Thailand	0.13	0.15	0.17	0.17	0.53	0.53	0.78	0.78
HongKong	0.3	0.3	0.31	0.31	0.75	0.75	1	1
Mean	0.46	0.58	0.50	0.60	0.67	0.73	0.81	0.83
SA (5)Mean	0.23	0.32	0.31	0.67	0.64	0.67	0.81	0.85
EU(16)Mean	0.66	0.78	0.67	0.81	0.71	0.81	0.81	0.83
EA (8)Mean	0.21	0.35	0.28	0.62	0.59	0.62	0.81	0.83

Note: Technical Efficiency is calculated using Onfront Software. Note higher values means higher technical efficiency while value one means that the country is on the best production frontier. Efficiency Indexes are calculated using inputs and output data. While the inputs are Labour force, Capital Stock(constant 1995 US$) and Life Expectancy(in years);output is GDP at constant 1995 US$; LE denotes Life Expectancy is included in efficiency measurement; WLE Denotes efficiency measurement without Life Expectancy

Table   (Continued): Technical Efficiency Indexes(1966-2000)

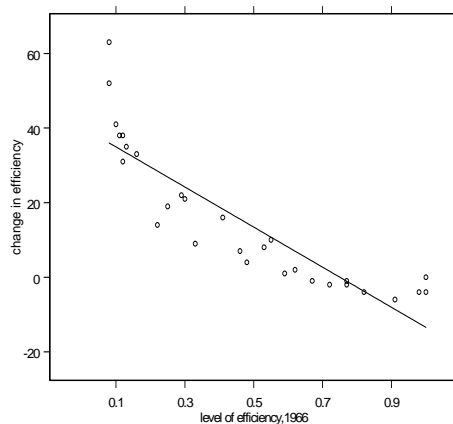|	WLE	LE	WLE	LE	WLE	LE	WLE	LE	Mean Effici ency WLE	Mean Effici ency LE
Country	1986	1986	1991	1991	1996	1996	2000	2000	1966-2000	1966-2000
Bangladesh	1	1	1	1	0.96	0.96	0.91	0.91	0.78	0.78
India	0.74	0.89	0.54	0.58	0.62	0.76	0.66	0.76	0.49	0.69
Nepal	0.92	0.92	0.8	0.8	0.69	0.69	0.73	0.73	0.77	0.77
Pakistan	0.84	0.86	0.77	0.79	0.8	0.85	0.73	0.74	0.60	0.61
Sri lanka	0.68	0.68	0.63	0.63	0.69	0.69	0.69	0.69	0.51	0.51
Belgium	0.81	0.86	0.73	0.96	0.75	1	0.68	0.93	0.79	0.91
Austria	0.77	0.86	0.75	0.96	0.74	0.97	0.63	0.87	0.74	0.86
Denmark	0.81	0.87	0.73	0.92	0.79	0.99	0.71	0.91	0.83	0.94
Finland.	0.69	0.77	0.64	0.8	0.59	0.77	0.61	0.8	0.63	0.73
France	0.76	0.82	0.68	0.92	0.7	0.98	0.63	0.9	0.73	0.89
Germany	0.76	0.81	0.7	0.94	0.7	1	0.59	0.86	0.75	0.91
Greece	0.53	0.56	0.64	0.68	0.68	0.78	0.57	0.63	0.52	0.56
Ireland	0.89	0.93	0.91	0.95	1	1	1	1	0.74	0.75
Italy	0.81	0.93	0.86	1	0.71	0.93	0.61	0.83	0.65	0.86
Luxembourg	1	1	1	1	1	1	1	1	1	1
Netherland	0.95	1	0.83	1	0.81	1	0.72	0.97	0.91	0.99
Portugal	0.4	0.43	0.58	0.6	0.61	0.7	0.51	0.56	0.39	0.43
Spain	0.9	0.98	0.97	1	0.75	0.92	0.61	0.78	0.72	0.95
Sweden	0.69	0.74	0.7	0.86	0.65	0.82	0.62	0.81	0.72	0.82
UK	0.87	0.99	0.9	1	0.8	1	0.86	1	0.74	0.98
Norway	0.82	0.87	0.67	0.77	0.65	0.89	0.67	0.89	0.74	0.84
Malaysia	0.67	0.7	0.65	0.66	0.7	0.78	0.55	0.59	0.57	0.59
China	0.47	0.59	0.4	0.46	0.58	0.73	0.61	0.77	0.38	0.54
Indonesia	0.67	0.73	0.6	0.63	0.7	0.84	0.47	0.53	0.55	0.62
Japan	0.93	1	0.89	1	0.78	1	0.68	1	0.82	0.99
Phillipines	0.5	0.53	0.53	0.54	0.72	0.79	0.61	0.64	0.45	0.48
Singapore	0.52	0.54	0.65	0.73	0.77	0.87	0.68	0.79	0.54	0.58
Thailand	0.7	0.74	0.73	0.74	0.68	0.81	0.44	0.49	0.52	0.55
HongKong	0.89	0.93	0.9	0.95	0.84	0.96	0.7	0.81	0.71	0.75
Mean	0.75	0.81	0.74	0.82	0.74	0.88	0.67	0.80	0.6651	0.7544
SA Mean	0.84	0.87	0.75	0.76	0.75	0.79	0.74	0.77		
EU Mean	0.78	0.84	0.77	0.90	0.75	0.92	0.69	0.86		
EA Mean	0.67	0.72	0.67	0.71	0.72	0.85	0.59	0.70		

Note: Technical Efficiency is calculated using Onfront Software. Note higher values means higher technical efficiency while value one means that the country is moving along the best production frontier. Efficiency Indexes are calculated using inputs and output data. While the inputs are Labour force, Capital Stock(constant 1995 US$) and Life Expectancy(in years); output is GDP at constant 1995 US;$;LE denotes Life Expectancy is included in efficiency measurement; WLE Denotes efficiency measurement without Life Expectancy

Luxembourg has an efficiency score of one in all the years with or without life expectancy(human capital).Netherlands also has an efficiency score of one in 1966,1971,1976 and 1981.Japan,UK,Belgium,Ireland,Indonesia,Spain and Germany   has an efficiency score of one in at least one of the years from 1966 to 2000.In the year 2000 though mean efficiency levels(without including life expectancy as input) of South Asian countries is higher than the European Union Countries and East Asian countries. Japan has the highest average efficiency followed by Hong Kong in the East Asian region in the period 1966-2000.
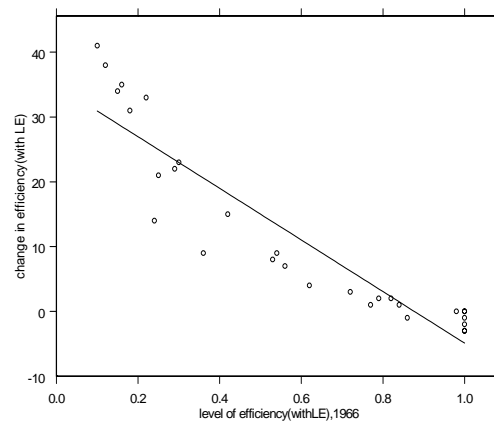
Bangladesh and India too have scores of one in atleast one of the years from 1966 to 2000.It seems peculiar that these countries are on the frontier. The interpretation of this finding is that Bangladesh and India have low per capita incomes because it seems that they are relatively undercapitalized and not because they make inefficient use of the relatively meager capital inputs that it has. Another(perhaps more plausible) interpretation is that the DEA method of constructing the best -practice frontier-a lower bound on the frontier under the assumption of constant returns-fails to identify the 'true' but unknown frontier, especially at low capital labour ratios[6].

The mean efficiency scores with life expectancy included as an input, in all the years included in our study, is always found to be greater than the efficiency scores which does not take into account life expectancy as an input. This seems to suggest that some of the measured inefficiency in the simpler model, in fact, have been attributed to a relative paucity of the quantity of human capital.

Figure   &   :Linear Fit Plot between Change in Efficiency and Efficiency index,1966

Figure   **Figure**

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[6] We should note that these mathematical programming methods take no account of measurement error, sampling error and other stochastic phenomena. Recent research(Leopold Simar,1996;Alois Kneip et.al,1998;Irene Gijbels,1999;Simar and Paul W.Wilson,2000) has made substantial progress on the use of bootstrapping method to construct confidence intervals around efficiency index .In this study, however ,we are more concerned about the statistical significance of changes in the distributions of efficiency indexes and the components of tripartite and quadripartite decomposition of productivity changes.

Ordinary least squares regression of the change in efficiency on the level of efficiency(without life expectancy) in 1966(Regressing Column VI of Table III on Regressing Column 2 in Table I) yields a coefficient of -53.760 with a t statistic of -9.74 while Ordinary least squares regression of the change in efficiency on the level of efficiency(with life expectancy) in 1966(Regressing Column VI of Table IV on Regressing Column 3 in Table II) yields a coefficient of -39.807 with a t statistic of -12.641, indicating that the less efficient countries in 1966 have, on balance, benefited from efficiency improvements than the more efficient countries.Figures III and IV confirm the negative relationship between the two.These two results seems to imply that there is a tendency for technology transfer to reduce the gap between the rich and poor countries in the sample.

7.2 Empirical Results for Tripartite and Quadripartite Decomposition of the Factors Affecting Labour Productivity

We have carried out the above calculations for the years 1966, 1971, 1976, 1981, 1986, 1991, 1996 and 2000 both with and without including life expectancy as an input besides the other inputs of capital stock and labour force. The conceptual decomposition is discussed in the section on Methodology. Appendix Tables (available with author) give the results for finding out the average efficiency changes, technological changes, capital accumulation and human capital accumulation from 1966 to 2000.The results of tripartite decomposition of labour productivity are summarized in Table III while the results of quadripartite decomposition are summarized in Table IV

Table III lists the percentage changes from 1966 to 2000 in labour productivity and each of the three components: (I) change in efficiency,(ii)technological change, and (iii) capital deepening,for all 29 countries,along with the sample mean percentage changes.The overall averages provide striking evidence that none of the three factors are primarily responsible for most of the productivity improvements over this period.The efficiency factor accounted for less than 16 %,technological change accounted for less than 15 % while the contribution of capital deepening is strikingly negative.One finds the same trend for the the South Asian and East Asian regions;the efficiency factor accounts for 29.40 % of their labour productivity growth,only 10.60% is accounted by technological changes while capital accumulation shows negative value for the South Asian region.For the East Asian region the efficiency factor accounts for 32 % of their labour productivity growth, 20.88% is accounted by technological changes while capital accumulation shows negative value.For the EU region the efficiency factor accounts for mere 2.31 % of their labour productivity growth,only 11.94% is accounted by technological changes while capital accumulation shows negative value.Such results seems to convey that there are some other factors besides the ones decomposed in the growth accounting exercise which may have profound affects on labour productivity growth rates across the countries included in our sample.We have found earlier in the conditional convergence analysis(Mathur,2005) that trade openness,population rate of growth and savings rate may be key in explaining differential levels of growth per capita across nations included in our sample .It seems that there are more important factors particularly for South Asian Region, besides the ones taken here in the growth accounting exercise, which can have greater impact on labour productivity and GDP per capita growth rates. These may be policies directed towards higher infrastructure spending, making bureaucracy efficient, reducing corruption, less restrictive labor regulations, achieving political stability, implementing rule of law, understanding institutions, among others.

If we see the results of growth accounting in context of productivity changes on point to point basis(works to be average of 14.22 %) we find that efficiency changes along with technological changes and capital accumulation accounts for 24.03 % (15.17%+14.17%-5.31%).This needs explanation. Growth accounting factors accounts for more than point to point percentage change in productivity. This happens because if we take log(yc/yb)=log eff+log tech +log kacc and then we approximate log yc/yb by taylors expansion(with one term and could have had more) it works out to be (yc-yb)/yb .Similary log tech works out to be.5 ((ybarc(kc)/ybarb(kc)+ybarc(kb)/ybarb(kb))-1 and log kacc works out to be .5((ybarc(kc)/ybarc(kb)+ybarb(kc)/ybarb(kb))-1 Now these are approximations on both sides of the equations. If we work out further, (mean YC/YB -1)which works out ot be 14.22 %,(mean EFF-1) works out ot be 15.136 % and (mean KACC-1)*100 works out ot be 5.32 %.please see the left hand term and second term (mean TECH -1) *100 works out ot be nearly same as theoreticall they are same and they are correctly approximated by tailors expansion. However the sum of three terms on right hand sides does not equal to left hand side because of approximations.7

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[7] The decomposition of (yc/yb)=eff*tech*kacc takes place between seven periods IN OUR PAPER ,i.e if current period is 1971 and base is 1966 then the above relation holds.Similarly it holds for other 6 periods.Please see the   file phdjuly2005.xls(available with author) and look at columns v,w,X,Y,Z,AA,AB,AC,AD,AE,AF,AG,AH,AI and it is clear that product of the three decomposotion factors equals YC/YB. Growth accounting holds for each   of the seven periods. If we work out theoretically yc/yb=ec/eb*((ybarc(kc)/ybarb(kc)*ybarc(kb)/ybarb(kb)))^.5* ((ybarc(kc)/ybarc(kb)*ybarb(kc)/ybarb(kb)))^.5

=eff*tech*kacc will work out to be ec/eb*yc/yb*eb/ec=yc/yb which   we calculated and got it right for the seven periods.However,we have calculated these for seven periods and so we then work out the mean levels of eff ,tech and kacc.
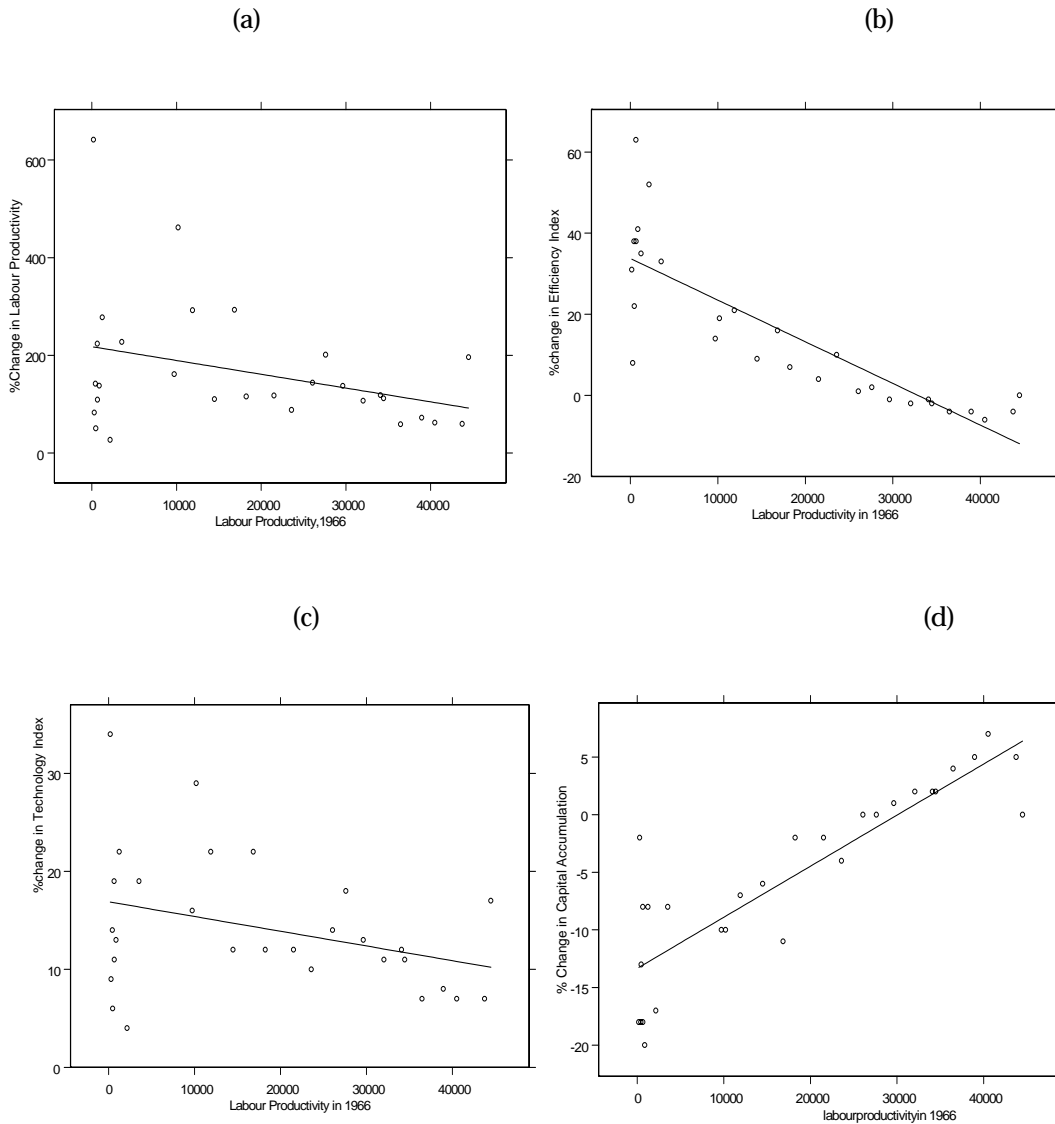
Table   . Percentage Change of Tripartite Decomposition Indexes
(Contribution to percentage change in productivity change(point to point basis)

Country	Output Per Worker, 1966	Output Per Worker 2000	Productivity Change (2000-1966)⁄1966* 100	Productivity Changes [8](point to point basis)	Contribution to percentage change in productivity change(point to point basis)		
					(EFF-1) *100	(TECH-1) *100	(KACC -1)*100
Bangladesh	468	706	50.65	6.24270	22	6	-13
India	428	1036	141.84	13.6021	38	14	-18
Nepal	285	521	82.6	9.11995	8	9	-2.
Pakistan	657	1376	109.23	11.3655	38	11	-18
Sri lanka	864	2055	137.86	13.2435	41	13	-20
Belgium	34083	74499	118.58	12.0159	-1	12	2
Austria	29628	70335	137.39	13.4291	-1	13	1
Denmark	43752	69814	59.57	7.05466	-4	7	5
Finland.	26063	63509	143.67	13.7553	1	14	0
France	32043	66330	107	11.1324	-2	11	2
Germany	40514	65671	62.09	7.21875	-6	7	7
Greece	14479	30449	110.29	12.0848	9	12	-6
Ireland	16835	66177	293.1	21.9151	16	22	-11
Italy	21508	46789	117.54	12.0191	4	12	-2
Luxembourg	44493	131722	196.05	17.0885	0	17	0
Netherland	38955	67133	72.34	8.32784	-4	8	5
Portugal	9721	25425	161.53	15.5585	14	16	-10
Spain	18238	39339	115.69	12.0087	7	12	-2
Sweden	36477	57916	58.77	6.93985	-4	7	4
UK	23580	44412	88.35	9.51808	10	10	-4
Norway	34465	72988	111.77	11.4082	-2	11	2
Malaysia	3541	11602	227.59	19.0818	33	19	-8
China	185	1375	641.68	34.3983	31	34	-18
Indonesia	647	2095	223.83	19.2180	63	19	-8
Japan	27609	83224	201.44	17.9613	2	18	0
Phillipines	2152	2731	26.91	4.01202	52	4	-17
Singapore	10194	57290	461.96	28.8233	19	29	-10
Thailand	1232	4656	277.69	22.0856	35	22	-8
HongKong	11891	46671	292.49	21.8570	21	22	-7
Grand Mean	18103	41649.86	166.53	14.22	15.17	14.17	-5.31
SA Mean	540.40	1138.8	104.44	10.71	29.40	10.60	-14.2
EUMean	29052	62031	122.11	11.96	2.31	11.94	-.44
EA Mean	7181	26205	294.20	20.92	32	20.88	-9.5

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[8] Point to point means periods means 1966,1971,1976,1981,1986,1991,1996 and 2000.Please see Phd.xls for details(available with author)

Figure V. summarizes these calculations by plotting the four growth rates(labour productivity and its three components against labour productivity in 1966.

Figure 5. Percentage Changes Between 1966 and 2000 in Labour Productivity and Three Decomposition Indexes Plotted Against 1966 Labour Productivity

(a)

(b)

(c)

(d)

OLS regression lines are also plotted. Figure V(a) indicates that the increases in average productivity reflects positive growth over this period for the countries included in our sample. The prominent spikes at the lower relative incomes reflect the economic emergence of the Asian "miracle" countries and is consistent with the observation about the movement of probability mass from lower and middle income group to higher income group in the cross country distribution(see section I on introduction).The negative slope coefficient of -.0282 with t value as 1.855,while not statistically significant

at 5% level of significance without inclusion of critical conditioning variables, is essentially the empirical result that led many to argue that productivity growth patterns support absolute convergence[9] among South Asian, European Union and East Asian countries together(Mathur,2004).

Figure V(b),shows the negative relationship between the percentage change in efficiency index and the initial level of productivity .The beta coefficient has negative value of -.00103 with t value of -8.255 and R^2 of .716.The results suggest that technological catch up is partly responsible for closing some of the gap between rich and poor nations, which is atleast true for the East Asian economies since the developed nations were partly responsible for technology transfers to their region(then underdeveloped) since the 1960s.Technological transfers, however, in the South Asian region   is relatively low but can play an important role in increasing their growth rates.

Figure V(C) shows that the relationship between technological changes and initial level of labour productivity is negative(-.00015) though not significant(t value -1.875).While for the East Asian region technological change is responsible for larger than average contributions to growth,it has been quite moderate for the South Asian and EU regions.

Figure V(d) shows that the relationship between capital accumulation and growth is positive and significant.(coefficient value is .000443 with t value of 9.120). The positive regression slope coefficient suggests that relatively wealthy countries have benefited more from capital accumulation than have less developed economies.

Table IV lists the percentage changes from 1966 to 2000 in labour productivity and each of the four components: (I) change in efficiency,(ii)technological change, and (iii) capital deepening and (iv)Human Capital Accumulation,for all 29 countries,along with the sample mean percentage changes.The overall averages provide striking evidence that none of the four factors are primarily responsible for most of the productivity improvements over this period.The efficiency factor accounted for less than 12 %,technological change account for less than 11 %,Human Capital accumulation accounted for less than 4% while the contribution of capital deepening is strikingly negative.One finds the same trend for the the South Asian and East Asian regions;the efficiency factor accounts for 23.20 % of their labour productivity growth,only 4.6% is accounted by technological changes,human capital accumulation accounts for 5.8% while capital accumulation shows negative value for the South Asian region.For the East Asian region the efficiency factor accounts for 23.25 % of their labour productivity growth, 15.50% is accounted by technological changes,human capital accumulation accounts for 5.38% while capital accumulation shows negative value.For the EU region the efficiency factor accounts for mere 2.56 % of their labour productivity growth,10% is accounted by technological changes,1.75 % is accounted by human capital accumulation while capital accumulation shows negative value.Such results convey that there are some other factors besides the ones decomposed in the growth accounting exercise which have important

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[9] If the poor country's initial income per head is below the rich country's income per head, then the poor country must grow more rapidly(higher marginal productivity and inviting capital from abroad) than the rich country, for both to ultimately achieve the common level of income per head (assuming same technology, production, population, preferences across countries). This is called absolute beta convergence (also called unconditional convergence because it implies that all countries/regions are converging to common steady state level of income).In its strongest form an implication of this hypothesis is that in the long run countries or regions should not only achieve same steady state level of income per capita but also same per capita growth rates. However, these structural parameters differ across countries and regions and countries may not converge to a common level of income per -capita but to their own steady state level(long run potential level of income).Therefore, economies with lower levels of per capita income(expressed relative to their steady state levels of per capita income) tend to grow faster. Such convergence is called conditional convergence.

bearing on the labour productivity growth rates   the countries of the EU,South Asian and East Asian region.

If we see the results of growth accounting in context of productivity changes on point to point basis(works to be average of 14.22 %) we find that efficiency changes along with technological changes , capital accumulation   and human capital accounts for 21.41   % (11.83%+10.62%-4.48%+3.44%).Again growth accounting factors accounts for more than point to point percentage change in productivity.This happens because   if we take log(yc/yb)=log eff+log tech +log kacc +log hacc and then we approximate log yc/yb by taylors expansion(with one term and could have had more) it works out to be (yc-yb)/yb .Similary log tech works out to be .5 ((ybarc(kc)/ybarb(kc)+ybarc(kb)/ybarb(kb))-1, log kacc works out to be .5((ybarc(kc)/ybarc(kb)+ybarb(kc)/ybarb(kb))-1 and log HACC works out to be (Hc-Hb)/Hb.

Now these are approximations on both sides of the equations. If we work out further, (mean YC/YB -1) which works out ot be 14.22 %,(mean EFF-1) works out ot be 11.83 % and (mean KACC-1)*100 works out ot be –4.48 %. And (mean HACC-1)*100 works out ot be 3.44% However the sum of four terms on right hand sides does not equal to left hand side because of approximations.[10]

It is in this context that we believe that there are other factors besides efficiency changes,technological changes,capital accumulation and human capital accumulation changes which may be responsible to account for the exact point to point productivity changes.Maybe we can approximate the changes in the productivity growth by adding more terms in the Taylors expansion or including other factors which are more pertinent to account for the productivity growth.

Figure VI summarizes these calculations by plotting the four growth rates (four labour productivity components) against labour productivity of 1966.This exercise includes life expectancy(human capital) as an additional input besides capital stock and labour force. OLS regression lines are also plotted.

Figure VI(a),shows the negative relationship between the percentage change in efficiency index and the initial level of productivity. The beta coefficient has negative value of -.000711 with t value of -6.369.The results suggest (as before) that technological catch up is partly responsible for closing some of the gap between rich and poor nations(then East Asian countries).

Figure VI(b) shows that the relationship between technological changes and initial level of labour productivity which is found to be negative(-.00002) though not significant(t value -.383).

Figure VI(c) shows that the relationship between capital accumulation and growth is positive and significant.(coefficient value is .00026 with t value of 4.343).The positive regression slope coefficient suggests that relatively wealthy countries have benefited more from   the capital accumulation than have less developed economies.

Figure VI(d) shows that the relationship between human capital accumulation and growth is negative and significant.(the beta slope coefficient is -.000123 and t value is -5.677).Countries which had lower labour productivity in the sixties accumulated human capital at faster rates than economies which were relatively developed in the sixties;apparently human capital accumulation has contributed to convergence of productivity

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[10] Kumar and Russell paper(AER2002) takes only two time period 1990 as current and 1965 as base periods although they say they have doneitfor 5year time periods more than that if we work out(eff*tech*kacc =ec/eb*yc/yb*eb/ec=yc/yb) for each country from their table 2page 536 the equality does not hold maybe ther have taken some other approximations of log YC/YB or logEFF, log TECH log KACC.Unlike our results, in their paper they have not taken means of different periods because they have used only two time table(last row) If we sww the figures, 58,54 is for(KACC)+6.14(TECG CHANGES) + 5.23 %(CHANGES IN EFF)dose not add up to 75.06 %(YC/YB-1)*100 . The same happens in Henderson and Russell paper of 2003 where HACC IS 26.5+ KACC IS 29.8 + TECH is 7.1+ EFF si 0.7 which does not add up to 78.6 (YC/YB-1)*100.

Table   . Percentage Change of Quadripartite Decomposition Indexes (Contribution to percentage change in productivity change(point to point basis)

Country	Output Per Worker, 1966	Output Per Worker,2000	Productivity Change(2000-1966)	Productivity Changes(point to point basis)	Contribution to percentage change in productivity change(point to point basis)			
					(EFF-1)*100	(TECH-1)*100	(KACC-1)*100	(HACC-1)*100
Bangladesh	468	706	50.65	6.2427	22.059	-0.0063	-12.5182	7.22386
India	428	1036	141.84	13.6021	7.4348	8.1658	-1.3036	5.7985
Nepal	285	521	82.6	9.11995	7.8686	2.83933	-2.19529	7.01254
Pakistan	657	1376	109.23	11.3655	38.214	5.74184	-18.2271	5.74433
Sri lanka	864	2055	137.86	13.2435	40.852	10.1639	-19.8226	3.08954
Belgium	34083	74499	118.58	12.0159	2.0525	10.3788	-1.5516	1.56185
Austria	29628	70335	137.39	13.4291	3.0168	11.3355	-2.39974	2.05808
Denmark	43752	69814	59.57	7.05466	1.11	6.14	1.5905	0.90261
Finland.	26063	63509	143.67	13.7553	3.7731	11.771	0.51439	1.92757
France	32043	66330	107	11.1324	1.301	9.28567	0.6812	1.88272
Germany	40514	65671	62.09	7.21875	-1.71	5.56903	2.59727	1.65536
Greece	14479	30449	110.29	12.0848	9.375	9.97447	6.68003	1.98042
Ireland	16835	66177	293.1	21.9151	15.175	20.3298	10.1506	1.78928
Italy	21508	46789	117.54	12.0191	1.3571	10.0399	0.85424	2.00609
Luxembourg	44493	13172	196.05	17.0885	0	15.2593		1.87106
Netherland	38955	67133	72.34	8.32784	-0.428	7.43309	0.44183	0.9459
Portugal	9721	25425	161.53	15.5585	14.491	12.6199	9.98481	2.48779
Spain	18238	39339	115.69	12.0087	-3.288	10.0483	3.83519	1.9285
Sweden	36477	57916	58.77	6.93985	-0.597	5.61939	1.10195	1.42244
UK	23580	44412	88.35	9.51808	0.1539	8.14544	0.14885	1.51054
Norway	34465	72988	111.77	11.4082	2.0386	10.3258	1.37678	1.17155
Malaysia	3541	11602	227.59	19.0818	34.524	14.4197	9.38514	4.69351
China	185	1375	641.68	34.3983	8.8014	25.2696	1.5509	12.1764
Indonesia	647	2095	223.83	19.218	33.3	11.4228	1.32113	7.58319
Japan	27609	83224	201.44	17.9613	0.2915	14.6808	0.28571	2.76964
Phillipines	2152	2731	26.91	4.01202	30.567	0.17605	10.0276	4.33349
Singapore	10194	57290	461.96	28.8233	21.215	24.9419	12.5545	3.19823
Thailand	1232	4656	277.69	22.0856	33.87	17.4731	7.09585	4.79865
HongKong	11891	46671	292.49	21.857	22.74	18.5511	9.142	2.87311
Grand Mean	18103	41649	166.53	14.22	11.97	10.97	4.58981	3.3929
SA Mean	540.4	1138.8	104.44	10.71	23.28	5.3809	10.8133	5.7737
EU Mean	29052	62031	122.11	11.96	2.849	10.268	1.72968	1.6938
EA Mean	7181	26205	294.2	20.92	23.16	15.866	-6.42036	5.3032

Figure   . Percentage Changes Between 1966 and 2000 in Labour Productivity and Four
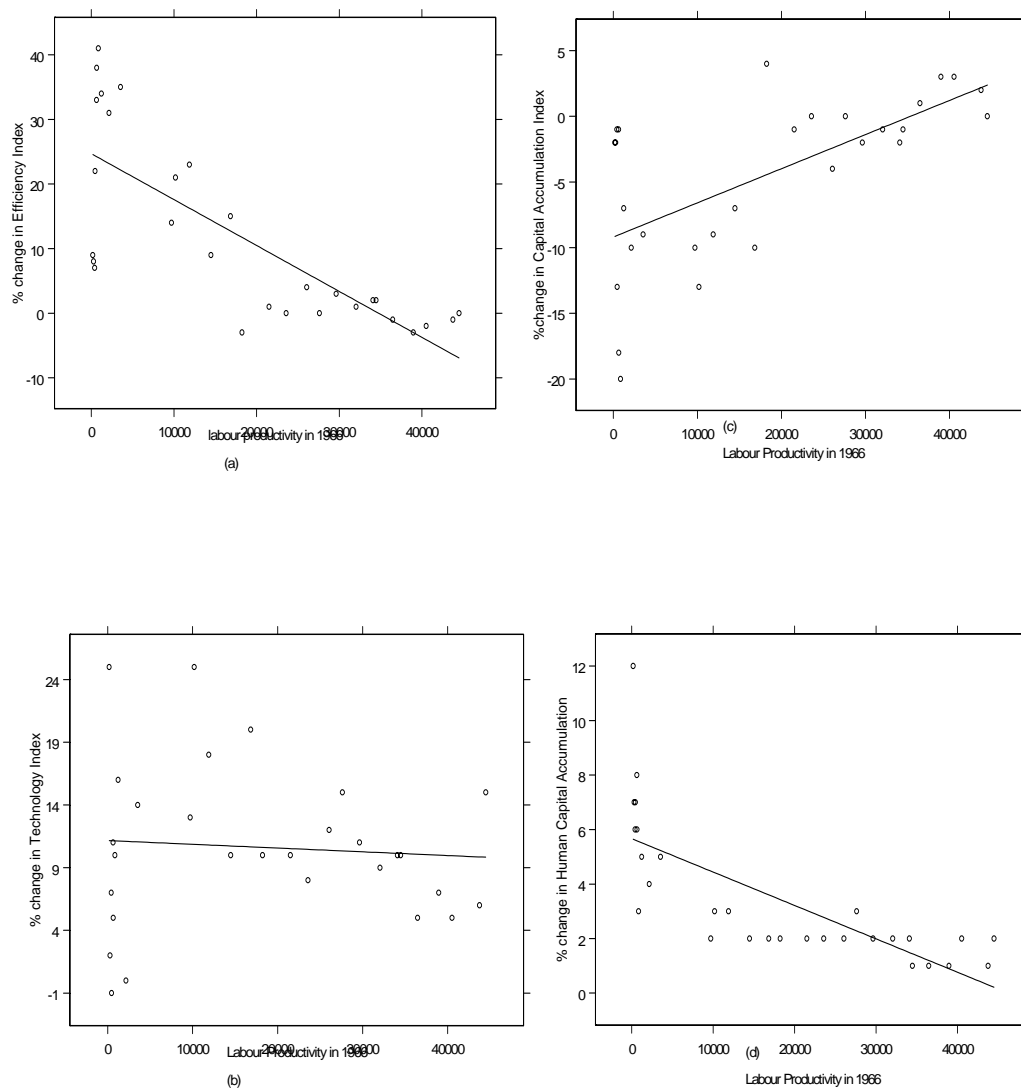Decomposition Indexes Plotted Against 1966 Labour Productivity

Table V.Percentage Change of Tripartite   Decomposition Indexes
(Contribution to percentage change in productivity change)

Country	Output Per Worker,1966	Output Per Worker,2000	Productivity Change(2000 - 1966)/1966*100	Contribution to percentage change in productivity change		
				Efficiency change(EFF-1)*100	Technical Change(Tech-1)*100	Capital Accumulation(KACC-1)*100
Bangladesh	468	706	50.65	213.7931	50.646507	-68.1318681
India	428	1036	141.84	500	141.83903	-83.3333333
Nepal	285	521	82.6	37.73584	82.601169	-27.3972603
Pakistan	657	1376	109.23	508.3333	109.22981	-83.5616438
Sri lanka	864	2055	137.86	590	137.85929	-85.5072464
Belgium	34083	74499	118.58	-11.6883	118.58079	13.23529412
Austria	29628	70335	137.39	-5.97014	137.38839	6.349206349
Denmark	43752	69814	59.57	-27.551	59.567662	38.02816901
Finland.	26063	63509	143.67	3.38983	143.66693	-3.27868852
France	32043	66330	107	-12.5	107.00307	14.28571429
Germany	40514	65671	62.09	-35.1648	62.09367	54.23728814
Greece	14479	30449	110.29	72.72727	110.2884	-42.1052632
Ireland	16835	66177	293.1	143.9024	293.09655	-59
Italy	21508	46789	117.54	27.08333	117.54091	-21.3114754
Luxembourg	44493	131722	196.05	0	196.05063	0
Netherland	38955	67133	72.34	-28	72.337093	38.88888889
Portugal	9721	25425	161.53	131.8181	161.53238	-56.8627451
Spain	18238	39339	115.69	32.60869	115.69085	-24.5901639
Sweden	36477	57916	58.77	-24.3902	58.77372	32.25806452
UK	23580	44412	88.35	56.36363	88.345556	-36.0465116
Norway	34465	72988	111.77	-12.987	111.76996	14.92537313
Malaysia	3541	11602	227.59	243.75	227.58914	-70.9090909
China	185	1375	641.68	408.3333	641.67725	-80.3278689
Indonesia	647	2095	223.83	487.5	223.83498	-82.9787234
Japan	27609	83224	201.44	9.677419	201.43684	-8.82352941

Phillipines	2152	2731	26.91	662.5	26.907154	-86.8852459
Singapore	10194	57290	461.96	172	461.96405	-63.2352941
Thailand	1232	4656	277.69	238.4615	277.68756	-70.4545455
HongKong	11891	46671	292.49	133.3333	292.48633	-57.1428571
Grand Mean	18103	41649.86	166.53	155.69171	166.53399	-31.02328
SA Mean	540.4	1138.8	104.44	369.972448	104.435161	-69.5863
EUMean	29052	62031	122.11	19.35261	122.11	-1.93668
EA Mean	7181	26205	294.2	294.4444	294.1979	-65.0946

Table V above gives an account of the **TRIPARTITE** decomposition of the labour productivity change by treating current year to be 2000 and base year as 1966.We concentrate here on the analysis of the change from the beginning to the end of our sample period 1966-2000(calculations are not done for each five year interval as above).We find that

1)Efficiency change(155.69 %) ,technical change(166.53%) and capital accumulation(-31.02 %) is able to account(155.69+166.53-31.02=291.2%) for more than the productivity change of 166.53 %.As explained earlier before because of the approximations the sum of efficiency change, technical changes and capital accumulation is not coming out to be equal to labour productivity change. **Maybe there are some other factors or better linear approximations of the decomposed factors which can account for the labour productivity changes**. It is upto future research studies to account for the latter.The surprising element in our study is that capital accumulation comes out to be negative. This may be due to the fact that KACC works out to be (eb/ec-1).Therefore, in most countries technical efficiency has increased over the sample period. ec works out to be greater than eb.If we put it in the formula KACC = (eb/ec-1),the value of KACC comes out be negative. Efficiency and technical changes are the main factors which can account for the decomposition.

2) As before if we regress efficiency changes(column V ,Table V) on initial level of labour productivity(column II,Table V) we find robust and significant negative relationship. Also,we find robust significant negative relationship between efficiency change and initial level of efficiency in 1966.Countries which   had modest initial conditions in 1966 grew fast and moved towards the best practice production frontier quickly as compared to those countries which had better initial conditions.However, We do find insignificant negative relationship between technical change and initial level of productivity. As before again capital accumulation has significant positive relationship with initial level of productivity signifying that countries which had higher capital labour ratio initially were the ones who grew rapidly.

Table   Percentage Change of Quadripartite   Decomposition Indexes (Contribution to
percentage change in productivity change)

Country	Output Per Worker,1966	Output Per Worker,2000	Productivity Change (2000-1966)	Contribution to percentage change in productivity change			
				(EFF-1)*100	(TECH-1) *100	(KACC-1)*100	(HACC-1)*100
Bangladesh	468	706	50.65	213.79	-1.9377	-68.13187	53.6233
India	428	1036	141.84	35.714	70.6979	-26.31579	41.6765
Nepal	285	521	82.6	37.735	19.4841	-27.39726	52.82457
Pakistan	657	1376	109.23	516.66	45.7447	-83.78378	43.55911
Sri lanka	864	2055	137.86	590	96.0088	-85.50725	21.35129
Belgium	34083	74499	118.58	13.414	96.809	-11.82796	11.06235
Austria	29628	70335	137.39	20.833	108.631	-17.24138	13.78359
Denmark	43752	69814	59.57	-9	50.6658	9.8901099	5.908338
Finland.	26063	63509	143.67	29.032	115.546	-22.5	13.04617
France	32043	66330	107	7.1428	84.3788	-6.666667	12.27052
Germany	40514	65671	62.09	-14	45.3945	16.27907	11.48537
Greece	14479	30449	110.29	75	85.8251	-42.85714	13.16466
Ireland	16835	66177	293.1	138.09	258.907	-58	9.525809
Italy	21508	46789	117.54	7.7922	92.6994	-7.228916	12.89129
Luxembourg	44493	13172	196.05	0	164.885	0	11.76533
Netherland	38955	67133	72.34	-3	62.4352	3.0927835	6.095843
Portugal	9721	25425	161.53	133.33	119.326	-57.14286	19.24363
Spain	18238	39339	115.69	-22	91.0959	28.205128	12.87048
Sweden	36477	57916	58.77	-5.813	45.5319	6.1728395	9.098866
UK	23580	44412	88.35	0	72.3471	0	9.282686
Norway	34465	72988	111.77	12.658	97.7617	-11.23596	7.08338
Malaysia	3541	11602	227.59	268.75	145.219	-72.88136	33.59025
China	185	1375	641.68	42.592	283.398	-29.87013	93.44839
Indonesia	647	2095	223.83	140.9	103.47	-58.49057	59.15584
Japan	27609	83224	201.44	2.04	151.61	-2	19.80276
Phillipines	2152	2731	26.91	255.55	-2.2157	-71.875	29.78276
Singapore	10194	57290	461.96	216	359.09	-68.35443	22.40802
Thailand	1232	4656	277.69	226.6	188.95	-69.38776	30.71

HongKong	11891	46671	292.49	170	224.725	-62.96296	20.86731
Grand Mean	18103	41649	166.53	106.8	112.98	-30.96617	24.18547
SA Mean	540.4	1138.8	104.44	160.7	26.797	-41.1257	38.3367
EU Mean	29052	62031	122.11	23.96	99.514	-10.6913	11.16114
EA Mean	7181	26205	294.2	165.3	181.78	-54.4778	38.72067

Table VI above gives an account of the quadripartite decomposition of the labour productivity change by treating current year to be 2000 and base year as 1966.We concentrate here on the analysis of the change from the beginning to the end of our sample period 1966-2000(calculations are not done for each five year interval as above).We find that 1)Efficiency change(106.8 %) ,technical change(112.98%), capital accumulation(-30.96 %) and human capital accumulation(24.18%) is able to account(106.8+112.98-30.96+24.18%=243.96% change)- far more than the productivity change of 166.53 %.As explained earlier before because of the approximations the sum of efficiency change, technical changes, capital accumulation and human capital accumulation is not coming out to be equal to labour productivity change. Maybe there are some other factors or better linear approximations of the decomposed factors which can account for the labour productivity changes. It is upto future research studies to account for the latter. The surprising element in our study is that capital accumulation comes out to be negative. This may be due to the fact that KACC works out to be (eb/ec-1). Therefore, in most countries technical efficiency has increased over the sample period. ec works out to be greater than eb.If we put it in the formula KACC = (eb/ec-1),the value of KACC comes out be negative. Efficiency and technical changes are once again the main factors which can account for the decomposition of labour productivity even if we bring human capital accumulation in the model.

2) As before if we regress efficiency changes(column V ,Table VI) on initial level of labour productivity(column II, Table VI) we find robust and significant negative relationship. Also, we find robust significant negative relationship between efficiency change(column V ,Table VI) and initial level of efficiency in 1966(column III Table I).Countries which had modest initial conditions in 1966 grew fast and moved towards the best practice production frontier quickly as compared to those countries which had better initial conditions. However, We do find insignificant negative relationship between technical change and initial level of productivity. As before again capital accumulation has significant positive relationship with initial level of productivity signifying that countries which had higher capital labour ratio initially were the ones who grew rapidly. Also, we find significant negative relationship between human capital accumulation and initial level of productivity signifying convergence of human capital accumulation across the 29 countries taken in the sample.

7.3 Analysis of Productivity Distributions:

Our objective is to assess whether the three components and then the four components of labour productivity can together change account for the deformation of the distribution of labour productivity from tri-modal distribution in 1966 to bimodal distribution in 2000 with higher mean. The distributions are reproduced again here for convenience(Figure VIIa:1966 distribution and VIIb 2000 distribution)

FigureVII(a)   **Figure VII(b)**
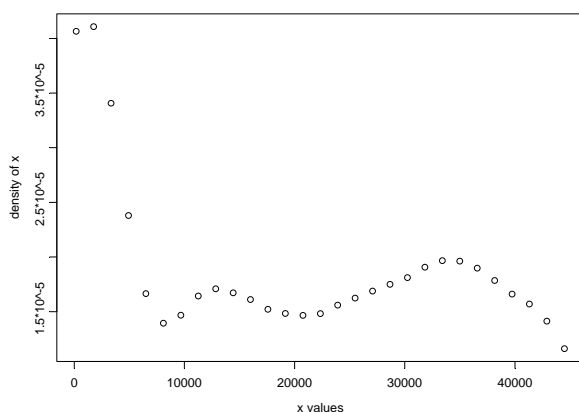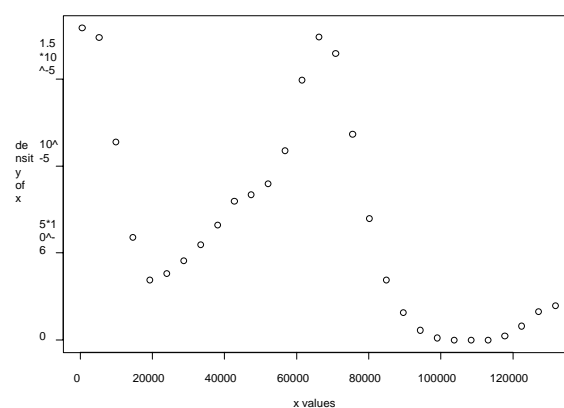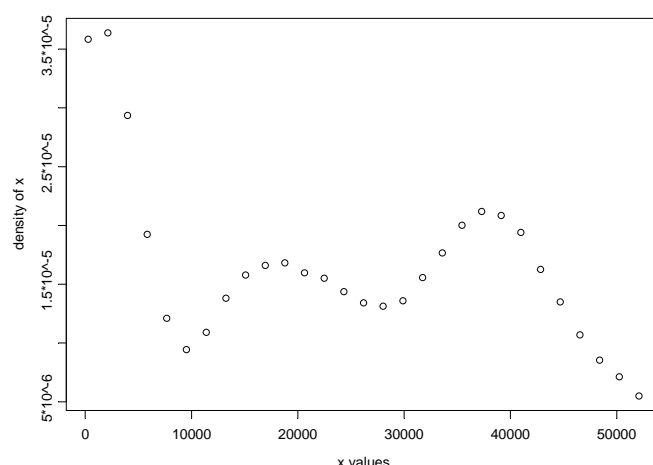

Figure VII: Counterfactual Distribution of Labour Productivity,2000(including LE)

The distribution we employ are nonparametric kernel based density estimates, essentially Rosenblatt Parzen kernel density estimator (details are given in the section on Objectives and Methodology).

Rewrite the quadripartite decomposition of labour productivity changes as follows:

$$y_c = (EFF \times TECH \times KACC \times HACC) * y_b$$

Thus, the labour productivity distribution in 2000 can be constructed by successively multiplying labour productivity in 1966 by each of the four factors. The counterfactual distribution of 2000 is constructed(Figure VIII) by multiplying the average decomposition figures successively with the labour productivity in 1966.It seems from the figure that the distribution remains tri -modal and therefore the four decomposition factors of labour

productivity: efficiency change, technological change, capital accumulation and human capital accumulation together have not been able to transform the 1966 distribution and bring it at par with the actual 2000 bimodal distribution of labour productivity[11].This means that some other factors like savings rate,trade openness and rate of growth of population may be are responsible for the transformation of tri modal distribution of 1966 into the bimodal distribution of 2000.It is found that by constructing counterfactual distribution of 2000 by decomposing labour productivity into three factors also do not change the results. This may be due to because we are trying to decompose labour productivity change by point to point changes in efficiency change, technical change and capital accumulation.

If we consider the current year as 2000 and base year as 1966 the counterfactual distribution of 2000 is constructed by multiplying the decomposition figures(not averages) successively with the labour productivity in 1966(eff*tech*kacc*y1966) we get some striking results different from the above analysis. All the three decomposed factors jointly(see figure IX) , efficiency change and technical change jointly(figure XII) and technical change with capital accumulation jointly(Figure XIII), can produce the counterfactual distribution of year 2000 similar to the 2000 kernel probability bimodal distribution .Efficiency change and capital accumulation jointly cannot however produce counterfactual distributions similar to 2000 kernel bimodal probability distribution. Counterfactual distribution of 2000 constructed by multiplying efficiency by labour productivity in 1966(see figure X below) although bimodal is different from the actual 2000 labour productivity distribution(result confirmed by the two sample Kolmogorov-Smirnov Test which shows p value of .007 and rejection of the null hypothesis that the labour productivity distributions of 2000 is different from counterfactual distribution. Counterfactual distribution of 2000 constructed by multiplying KACC by labour productivity in 1966(see figure XI below)   is different from the actual 2000 labour productivity distribution(result confirmed by the two sample Kolmogorov-Smirnov Test which shows p value of .02 and rejection of the null hypothesis that the labour productivity distributions of 2000 is different from counterfactual distribution. However, if we construct kernel probability distribution of 2000 by multiplying efficiency change with Technical change and labour productivity of 1966 we get the distribution which is statistically and figuratively(see figure XII below) same as labour productivity distribution of 2000.Technical change with efficiency change are responsible for the bimodal labour distribution of 2000(Figure XII).Also, Technical change with capital accumulation changes are responsible for the bimodal labour distribution of 2000(see figure below XIII) .However, efficiency change and capital accumulation jointly are not responsible for the bimodal distribution of 2000(see figure XIV below).

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[11] Two-Sample Kolmogorov-Smirnov Test confirms the acceptance of the null hypothesis- two sample kernel probability distributions are same; data: x: Counterfactual labour productivity distribution in 2000(V1), and y: Labour productivity distribution in 1966(V2) ks = 0.1034, p-value = 0.9985 alternative hypothesis: cdf of x: V1 in SP66 does not equal the cdf of y: V2 in SP66 for at least one sample point. Statistical software SPLUS has been used. The data set is in appendix Table (AVAILABLE WITH AUTHOR).

Figure   . Conterfactual Kernel probability distribution 2000=EFF*TECH*KACC*Y1966
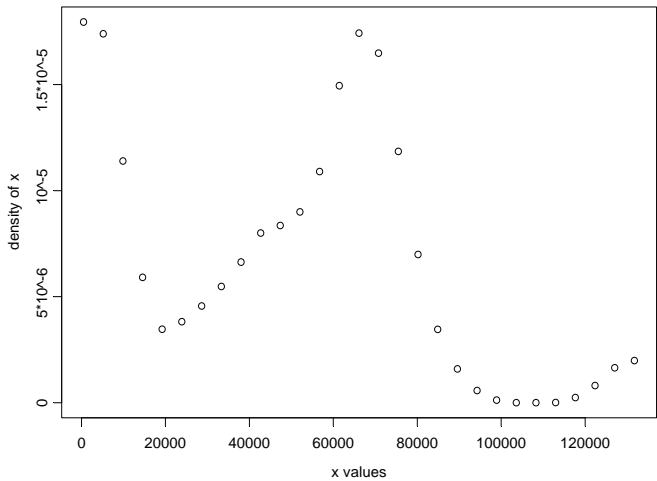

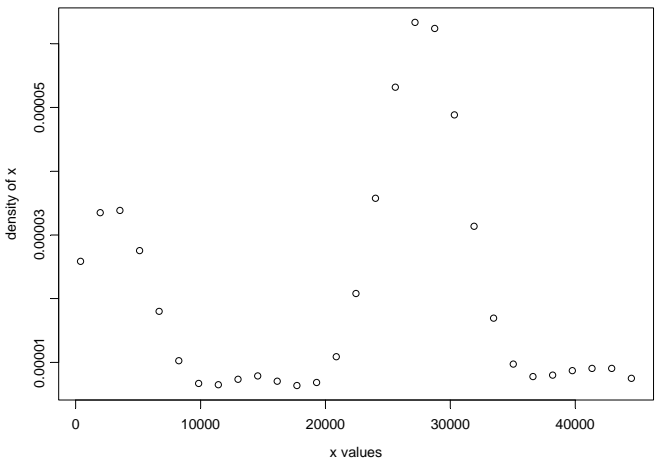Figure   . Counterfactual kernel probability distribution 2000=eff*y1966

Figure X. Counterfactual kernel probability distribution2000=KACC*Y1966
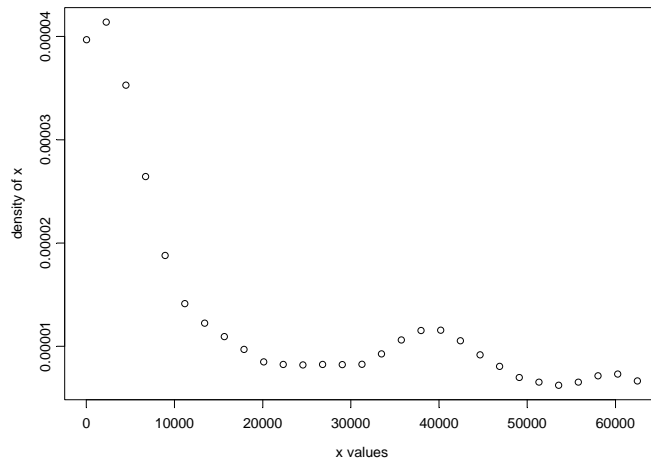

Figure XI. Counterfactual kernel probability distribution2000=Eff*Tech*y1966

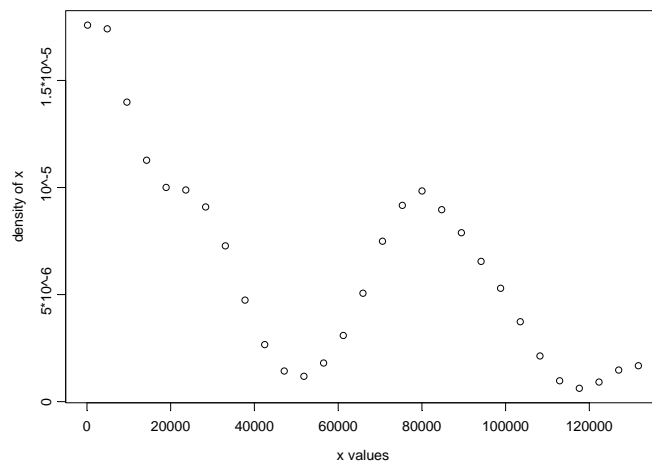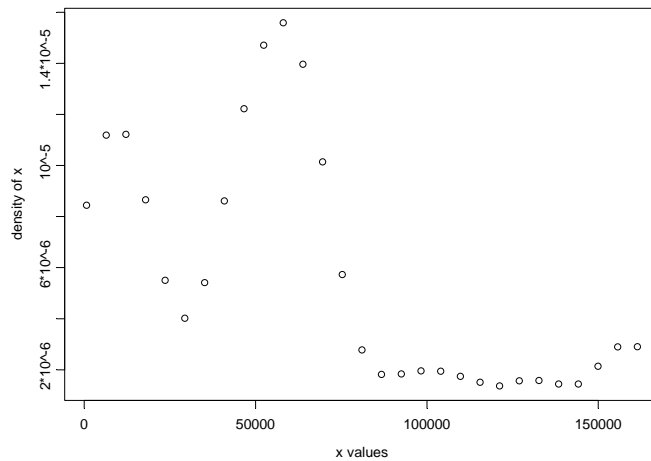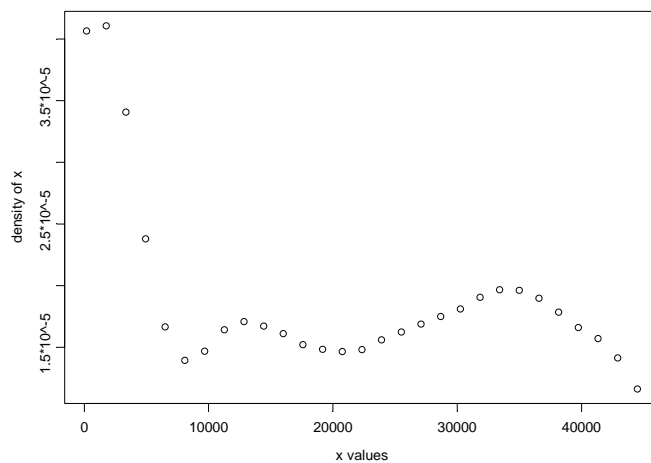Figure XII. Counterfactual kernel probability distribution2000=Tech*kacc*y1966

Figure   III. Counterfactual kernel probability distribution of 2000=eff*kacc*y1966

If we consider the current year as 2000 and base year as 1966 the counterfactual distribution of 2000 is constructed by   multiplying the quadripartite decomposition figures(not   averages)   successively   with   the   labour   productivity   in 1966(eff*tech*kacc*hacc*y1966). All the four decomposed factors jointly,technical change

alone, efficiency change and technical change jointly,technical change and capital accumulation jointly,technical change and human capital accumulation jointly ,efficiency change+technical change+capital accumulation jointly and technical change+capital accumulation+human capital accumulation jointly can produce the counterfactual distribution of year 2000 similar to the 2000 kernel probability bimodal distribution. .(all results,figues and data for this exercise is available with author on demand)

In summary,if we work out y_c= (EFF × TECH × KACC × HACC)*y_b and y_c= (EFF × TECH × KACC)*y_b

For all the seven periods(point to point basis) we see a major role played by technological changes and efficiency changes jointly to account for the current period counterfactual distributions and for the bimodal distribution in year 2000, and for the period 1966-2000(not point to point basis) we find technical changes and its combination with other changes together are responsible for the bimodal distribution in year 2000.

. Conclusions

We work out efficiency levels of 29 countries included in our sample using data envelopment analysis. Luxembourg has an efficiency score of one in all the years with or without life expectancy(human capital).Netherlands also has an efficiency score of one in 1966,1971,1976 and 1981.Japan,UK,Belgium,Ireland,Indonesia,Spain and Germany has an efficiency score of one in at least one of the years from 1966 to 2000.In the year 2000 though mean efficiency levels(without including life expectancy as input) of South Asian countries is higher than the European Union Countries and East Asian countries. Japan has the highest average efficiency followed by Hong Kong in the East Asian region in the period 1966-2000.Also, initial level of labour productivity and efficiency index in 1966 had significant impact on efficiency changes from 1966 to 2000 signifying that there is evidence of technological upturn among countries which were relatively backward in 1960s.This seems to hold for sure in respect of the East Asian economies which got the boost due to technological transfers from the developed nations during the same period and also because they started opening their economies at the same time. South Asian economies on the other hand remained closed in 1960s and could not grow at faster rates subsequently.Countries which had modest initial conditions in 1966 grew fast and moved towards the best practice production frontier quickly as compared to those countries which had better initial conditions.However, We do find insignificant negative relationship between technical change and initial level of productivity. As before again capital accumulation has significant positive relationship with initial level of productivity signifying that countries which had higher capital labour ratio initially were the ones who grew rapidly.There is tendency of absolute convergence among the 29 countries since 1966.

We decompose labor productivity growth into components attributable to technological changes(shifts in the overall production frontier),technological catch up(movement towards or away from the frontier),capital accumulation(movement along the frontier) and human capital accumulation(proxied by life expectancy).The overall production frontier is constructed using deterministic methods requiring no specification of functional form for the technology nor any assumption about market structure or the absence of market imperfections. Growth accounting results tend to convey that for the East Asian and the South Asian countries efficiency changes have contributed the most

while for the European countries it is the technical changes which has contributed to labour productivity changes between 1966-2000. We also analyze the evolution of cross country distribution for the 29 countries included in our sample consisting of some South Asian, East Asian and EU countries using Kernel densities. It seems   that there are factors like savings rate , trade openness, quality of institutions ,geography, among others rather than the ones that are included above for the growth accounting exercise which may be responsible for productivity accounting on point to point basis.This particular research problem may be taken up by researchers in future. For   all the seven periods(point to point basis) we see a major role played by technological changes and efficiency changes together to account for the current period counterfactual distributions and   for the bimodal distribution in year 2000, and for the period 1966-2000(not point to point basis) we find technical changes and its combination with other changes together accounting   for the bimodal distribution in year 2000.

Our results   contradicts the Kumar and Russel(2002) and Henderson and Russell(2003) results which found that different rate of capital accumulation and human capital across nations are primarily responsible for the existence of differential   levels of per capita income levels and growth rates across nations respectively and further such factors were also responsible for the evolution of   bimodal distribution of labour productivity today across nations. In a way their results(KR) confirmed the use of simple and extended Solow model(Solow,1956,Jones,2002) along with their factor accumulation assumptions in analyzing the convergence process of per capita incomes across nations.Our growth accounting exercise and regression exercise suggest that there is some evidence of absolute convergence(supports the use of Solovian model(1956) in this context) and convergence in statistical terms of efficiency changes and human capital accumulation across countries of the EU, South Asian and East Asian regions.

Generally, speaking policies that will increase labour productivity   and particularly in the services sector, open up trade with all countries, increase share of savings in GDP, reduce adverse administrative regulations,   increase infrastructure spending, policies that support private capital flows along with technology and human   capital skills transfers from rich to poor nations can increase efficiency levels of countries, help more in reducing per capita income differences and growth rates across countries and regions, and also help in achieving the basic goal of planning- i.e., improve the living standards of the people .

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Appendix Table I: Countries and Regions Included in the Study

Countries(44)/Regions(4)

South Asia(5)

Bangladesh

India

Nepal

Pakistan

Sri- Lanka

European Union(16includingUK)

Belgium

Austria

Denmark

Finland

France

Germany

Greece

Ireland

Italy

Luxembourg

Netherlands

Portugal

Spain

Sweden

United Kingdom

Norway

EAST ASIA(8)

Malaysia

China

Indonesia

Japan

Phillipines

Singapore

Thailand

Hong Kong

Comments on "Growth Accounting for Some Selected Developing, Newly Industrialized and Developed Nations from 1966-2000: A Data Envelopment Analysis "

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Although I was aware that this paper borrows most of its analytical frameworks from Henderson and Russell(2001) and Kumar and Russell(2002), I couldn't avoid thinking that some parts of the paper heavily(excessively) draws on them. Especially, Abstract, Introduction and Methodology (DEA) sections are almost same with either of the above two references. Thus, it is my general impression that the current version of the paper may not be appropriate to be published at KDI Journal conference and it needs a major revision.

Compared with Henderson and Russell(2001) and Kumar and Russell(2002), the paper by Dr. Mathur differs only in the data set(World Development Indicator) and the number of countries(29 countries) as well as the covered periods(1966-2000). In addition, this paper uses life expectancy as a proxy for human capital whereas Henderson and Russell(2001) adopts Bils and Klenow(2000) type representation of human capital.

The main contribution of this paper is in that it decomposes the labor productivity growth from 1966 to 2000 into the following four components. Technological changes, technological catch-up, physical capital accumulation, and human capital accumulation, these four components are calculated by measuring the relative position of a country from a production frontier, which in turn is obtained by DEA. The contributions of these four factors to the labor productivity growth are calculated with the data of 29 countries. In the meantime, the paper also deals with the convergence issues but it seems that the decomposition part is at the center of the discussion.

The main analytic tool is Data Envelopment Analysis(DEA), which is frequently used in management science. This technique, a sort of linear programming tools, is to find a minimum convex cone, which include all the observations. Accordingly, the tightest convex cone enveloping the production factors and outputs for the 29 countries is defined to be a production frontier. This production frontier or the technology to support the frontier is assumed to be a common factor to all the countries. However, each country differs from others in capital-labor or human capital-physical capital ratio as well as market institution.

Since the methodology used in the paper is rather mechanical, critiques on the paper will be focused more on the selection of data and a variable.

First, I would like to mention that the small sample size may distort the results. This paper considers 29 countries, which is smaller than 57 in Kumar and Russel(2002). By the

construction of DEA, the small number of observations tends to cause under-estimation of the production frontier. Thus, it should be noted that there may exist   measurement errors in technological change and catch-up and complete disentanglement is not achievable.

Second, the paper uses life expectancy as a proxy for human capital. Maybe the longer life expectancy implies longer tenure at jobs and more skilled labor (applying the learning-by-doing argument). However, to me, it seems that life expectancy is not so good a proxy for human capital but it might be a sign of aging economies. I suggest that the author should follow Bils and Klenow(2000) and use the return on schooling as a proxy. Of course, this is already what Henderson and Russel(2001) did.

Third, the negative contribution of physical capital accumulation to labor productivity growth is very very counter-intuitive. It needs logical explanations. See the numbers for China, Ireland and Hong Kong. I picked these countries because I believe these are most benefited countries by FDI in the last few decades. According to the calculation by Dr. Mathur, these countries have also recorded negative contributions of physical capital accumulations. Does that mean capital accumulation has been made much slower than the growth of labor force? The author claims this result distinguishes the paper from the aforementioned two papers, both of which sustains the positive contributions of physical capital accumulations. However, it is my rough guess that this idiosyncracy might be caused by the small and less balanced sample of the data. So, it would be appropriate to do some robust check with a bigger set of data

Based on these critiques, I suggest the following:

First, Draw a Production Frontier with more countries beyond 29 countries. Based on the Production frontier with a broader set of countries, you can decompose the labor productivity growth of the 29 countries you originally picked. That will definitely reduce bias, though I am not sure its direction.

Second, find another measure for Human capital. If it is not easy to find then, why not simply follow Bils and Klenow(2000)?

Third, change Introduction and Methodology parts. It would be enough just to refer to the relevant papers without repeating the arguments, which are already available in prominent publications like AER.