The 2006 KDI-KAEA Conference on
"Enhancing Productivity and Sustaining Growth"

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Foreword

This collection of conference papers is an accumulation of materials from *"The 2006 KDI-KAEA Conference on Enhancing Productivity and Sustaining Growth"* held on August 8, 2006 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 2006 major research agenda such as Trade and FDI Issues, 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 had 6 sessions. Session I- *Trade and FDI Issues*; Session II-*R&D and Productivity Growth*; Session III-*Entereprenuership and Business Practice Engineering;* Session IV-*Bank Capital Regulation and Lending Practices;* Session V-*Stock Ownership Structure and Exchange Rate Policy;* Session VI-*Sectoral Shifts and Entry Regulation.* 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 Kang Hoon Park, Vice President of KAEA and 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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Contents

Table of Contents

CHAPTER 1-3

CHAPTER 2-1

CHAPTER 2-2

CHAPTER 3-1

CHAPTER 3-2

CHAPTER 4-1

CHAPTER 4-2

CHAPTER 5-1

CHAPTER 5-2

CHAPTER 6-1

CHAPTER 6-2

Figure of Contents

CHAPTER 1-1

CHAPTER 1-2

CHAPTER 2-1

CHAPTER 2-2

CHAPTER 3-1

CHAPTER 4-1

CHAPTER 1-1

Trade, Investment and Economic Integration of South Korea and China

by

Joon-Kyung Kim, Yangseon Kim** and Chung H. Lee****

Abstract

The emergence of China has had a significant effect on the Korean economy. China is now the largest market for Korean exports and an important supplier of its imports. It has also become a serious challenger of Korea in the global markets for manufacturing exports. This paper investigates the effect of the rapid industrialization of the Chinese economy on its export structure and the bilateral trade between the two countries and examines the role that Korea's investment in China has played in transforming the export structures of the two economies. It presents evidence of increasing trade in parts and components and expanding production networks spanning the two economies. The paper concludes with a discussion of the prospects for future economic integration of China and Korea.

Keywords: China, Korea, trade, investment, economic integration
JEL Classification: F10, F21

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I. Introduction

Economic relations between South Korea (henceforth Korea) and the People's Republic of China (henceforth China) have been on a rapid growth path ever since the establishment of a formal diplomatic relationship between the two in 1987. Their bilateral trade has grown steadily in both the volume and the variety of goods traded. Capital flows between the two have also increased although they are mostly from Korea to China in the form of direct investment. Between 1989 and 2003, for instance, Korea's merchandise exports to China grew from $1.3 billion to $35.1 billion while China's merchandise exports to Korea grew from $472 million to $20.1 billion (UNCOMTRADE). In fact, in 2005 China was Korea's largest trade partner with its exports to China amounting to $62 billion and its imports from China $38.6 billion (*The Korea Times* 1/12/06). In 2004, Korea invested $2.0 billion in China with the total stock of investment in China amounting to $8.9 billion at the end of that year. These increases in both trade and investment are signs of growing economic interdependence and integration of China and Korea.

The emergence of China has had, as observed by Gaulier, Lemoine and Ünal-Kesenci (2005) and Lall and Albaladejo (2004), far-reaching consequences on the East Asian economies: It has accelerated the restructuring of production in these economies and led to the expansion of their intra-regional trade as well as trade with the rest of the world. Korea, one of the East Asian economies, has likewise been significantly affected—both positively and negatively—by this development in the region.[1] While China is now the largest market for Korean exports and a major supplier of low-cost imports for Korean firms and consumers, it has begun to challenge Korea in the global markets for manufacturing exports.

These developments naturally raise a number of questions about the effects of China's emergence on the Korean economy. Has the overall effect been beneficial to Korea? Has Korea met China's challenges by making the necessary structural changes and gaining a comparative advantage in new high tech industries? How are they partaking in cross-border production sharing? How will it affect the future course of the Korean economy? These are some of the questions that we need to address in looking into the multi-faceted effects of rapid industrialization in China on the Korean economy.

In this paper, as a first step toward answering these questions, we examine the effect of rapid industrialization in China on its export structure and its bilateral trade with Korea and the nexus between Korea's investment in China and their trade and cross-border production sharing. In the following section we examine the trends and characteristics of the overall export structures of Korea and China. We also examine bilateral trade between the two economies and report that it has increased more rapidly than their respective trade with the rest of the world. We explain this as due in part to increasing trade in parts and components and as a sign of expanding production networks and increasing economic integration of the two economies. In section III we discuss various linkages between foreign direct investment (FDI) and bilateral trade between home and host countries as a prelude to examining the trade-investment nexus connecting China and Korea. In section IV we examine the motives for Korea's investment in China, shedding light on the linkage between Korea's investment in China and bilateral trade between the two and their cross-border production networks. We offer some concluding observations in Section V.

II. Rapid Industrialization in China and Its Effect on the Korean Economy

To find out how rapid industrialization in China has affected Korea's trade vis-à-vis China and the rest of the world, we examine the changes in the export structures of the two countries, their bilateral trade, and the production networks spanning the two.

2.1. Changes in the export structure

To learn about the changes in the export structures of China and Korea we examine the sectoral distribution of exports for 1992, 1997, and 2003, classified by the level of production technology. Following the OECD classification system we group products into the following four categories: 1) low technology, (2) medium-low technology, (3) medium-high technology, and (4) high technology products.[2] We find that in 1992-2003 China, and Korea to a lesser extent, went through a major change in their export structure while that of Japan remained relatively stable over time (Table 1).

It is clear that China's export structure has shifted rapidly toward technologically more sophisticated products. In 1992, for instance, more than a half of China's manufacturing exports was in low tech products such as textile, apparel & footwear with medium (medium-high and medium-low) and high tech products accounting for 23.1 and 10.9 percent, respectively. By 2003, however, China made a significant change in its export structure, increasing the share of exports in medium-high tech and high tech products, especially in ICT (information and communication technology) products. Among ICT products, the share of computers & office products and radio, TV & communication equipments increased the most in 1992-2003. The combined share of these exports increased from less than 6 percent in 1992 to more than 24 percent in 2003.

A note of caution is warranted here, as although computers & office products and radio, TV & communication equipments are classified as high tech products the technologies actually involved in their production in China may not be of high technology. Many of the products may simply be assembled at the plants of foreign multinational firms, involving only simple labor-intensive assembly processes.[3] China will eventually acquire the capability to produce many of the high tech products on its own, but at present we need to be careful in inferring "Made by the Chinese" from the label of "Made in China."[4]

Between 1992 and 2003 Korea also experienced a steady increase in the export shares of both high and medium-high tech products—from 25.8 to 37.9 percent and from 20.4 to 33.8 percent, respectively. In the high tech group the largest increase took place in radio, TV & communication equipments—from 8.5 to 14.5 percent—while in the medium-high tech group it was the exports of autos, the share of which more than doubling. In contrast, the shares of both low and medium-low tech products decreased with the steepest decline taking place in low tech products. Indeed, the export share of textile, apparel & footwear alone, which had been major export products up until the early 1990s, decreased from 25.4 percent in 1992 to 8.0 percent in 2003.

Japan, a global leader in the exports of high and medium-high tech products,

particularly automobiles and home appliance & machinery equipments, has continued to maintain its dominant position as an exporter of high-tech products. Although China and Korea are apparently catching up with Japan in industrialization, as seen in their increasing share of exports in technology-intensive products, Japan has been able to maintain its dominant position in the exports of high tech products with new technology and products.

Table 1. Distribution of Total Exports by Technological Category (Share in total exports, %)

	China			Korea			Japan		
	1992	1997	2003	1992	1997	2003	1992	1997	2003
Total Exports	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**
Manufacturing									
High technology	**10.9**	**16.6**	**31.8**	**25.8**	**30.0**	**37.9**	**29.6**	**30.6**	**28.0**
-Aircraft and spacecraft	0.5	0.2	0.1	0.9	0.7	0.3	0.2	0.5	0.5
-Pharmaceuticals	1.3	1.1	0.9	0.4	0.5	0.4	0.6	0.7	0.9
-Computers and Office products	1.3	5.1	14.4	4.0	5.0	9.9	9.0	9.1	5.2
-Semiconductor, Electronic Valves	0.8	1.8	3.3	10.6	16.0	11.2	6.0	9.5	9.0
-Radio, TV, Communication Equipments	4.5	5.6	10.4	8.5	6.0	14.5	9.0	5.6	6.5
-Precision, Medical, Optical Instruments	2.6	2.8	2.6	1.3	1.7	1.7	4.7	5.3	6.0
Medium-High technology	**12.4**	**15.7**	**19.1**	**20.4**	**30.0**	**33.8**	**50.9**	**50.4**	**52.4**
-Electrical Machinery	3.3	4.9	5.7	2.2	2.8	3.0	5.4	6.2	5.7
-Chemical Products	4.1	4.7	3.8	7.2	9.7	9.8	6.7	8.1	8.6
-Motor vehicle and Trailer	0.8	1.0	1.7	5.8	9.9	12.6	23.4	19.7	22.8
-Other Transport Equipment	0.7	0.7	1.1	0.2	0.3	0.2	1.6	1.4	1.4
-Home Appliance and Machinery Equipments	3.5	4.4	6.8	5.0	7.2	8.3	13.9	15.0	14.1
Medium-Low technology	**10.7**	**13.5**	**11.0**	**18.7**	**19.1**	**16.2**	**12.1**	**11.4**	**11.2**
-Shipbuilding and repairing	0.6	0.9	0.7	5.4	5.1	6.1	2.3	2.4	2.1
-Coke, Petroleum products	0.9	0.8	0.5	0.2	0.1	0.2	0.1	0.1	0.1
-Rubber and plastic products	2.0	2.8	2.6	2.8	2.6	2.5	2.0	2.2	2.5
-Non-metallic mineral products	1.9	2.1	1.7	0.8	0.5	0.6	1.2	1.2	1.1
-Basic metal and Fabricated metal products	5.3	6.8	5.5	9.7	10.8	6.9	6.4	5.4	5.3
Low technology	**53.4**	**47.1**	**34.4**	**31.6**	**20.2**	**11.4**	**5.3**	**4.4**	**3.5**
-Textile, Apparel, Footwear	37.5	32.2	23.0	25.4	15.0	8.0	2.2	1.6	1.4
-Food, Beverages, Tobacco	6.4	4.8	2.9	2.1	1.9	1.2	0.5	0.5	0.5
-Wood and Paper products	2.0	1.9	1.7	1.0	1.4	0.7	0.9	0.7	0.6
-Other Miscellaneous Manufacturing Product	7.5	8.1	6.8	3.2	1.8	1.5	1.7	1.5	1.1
Non-manufacturing products	**11.2**	**6.3**	**3.4**	**1.5**	**0.7**	**0.4**	**0.2**	**0.2**	**0.2**

Source: Yangseon Kim (2004)

Changes in the export structures of China and Korea may further be elucidated with the help of the revealed comparative advantage (RCA). We take, with the usual caveat, an increasing value of a country's RCA in a product as an indication that it is gaining a comparative advantage in that product, and conversely when the RCA is decreasing.

Between 1992 and 2003, China rapidly gained a comparative advantage in ICT products (Table 2). Within this group the most significant change in RCA took place in computers & office products, which rose from 0.30 to 2.94, signifying that China managed to upgrade these industries into globally competitive ones in a decade or so. A less dramatic change in RCA took place in radio, TV & communication equipments, which rose from 1.24 to 2.18 during that period. China is yet to acquire a comparative advantage in semiconductor & electronic valves, as indicated by the value of RCA less than one. But the direction of change is clear: its RCA in those products is steadily increasing. Not surprisingly, China's RCA in the low tech group decreased from 2.43 in 1992 to 1.86 in 2003, but it still has a strong comparative advantage in a number of industries in the group such as textile, apparel, & footwear and other miscellaneous manufacturing products.

In 1992-2003 Korea maintained a comparative advantage in all ICT products except in precision, medical & optical instruments. In particular, it gained a comparative advantage in computers & office products with RCA rising from 0.91 to 1.97. Korea's export share of medium-high tech products is small in comparison with that of Japan although it has steadily increased its RCA in these products. As of 2003, Korea had a comparative advantage in chemicals and auto industries but not in low tech products, especially in textile, apparel & footwear.

In comparing RCAs of the two countries we find that China has been gaining on Korea in some of the high tech, medium-high, and medium-low tech products. This suggests that China is following Korea in the "catching-up product cycle" development that began in Japan some years ago and was subsequently followed by Korea (Akamatsu, 1962; Yamazawa, 1990; and Kim, Kim and Lee, 2004).

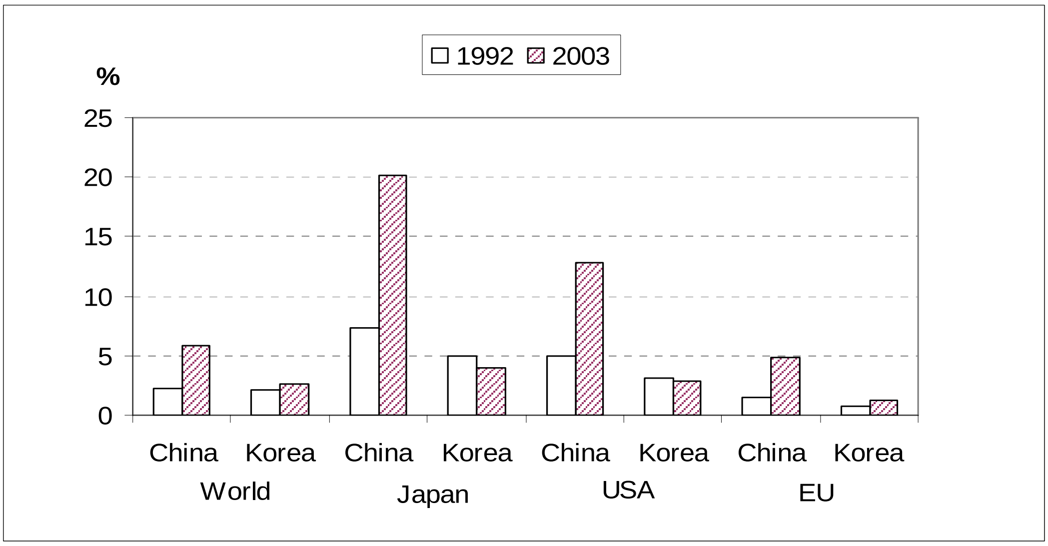
With China catching up with Korea in industrialization we would expect export competition between the two to increase with exports from the former displacing those from the latter in many of the world markets, in particular in Japan and the United States, two major markets for Korea's exports. In Figure 1 we present the export shares of China and Korea in the world, Japan, the United States, and the European Union for 1992 and 2003. It is clear that China has made significant gains in the market share in Japan and the United States at the expense of Korea. This took place mostly in labor-intensive, low-tech industries—the industries in which Korea no longer holds a comparative advantage (Figure 2-1). Even in industries such as medium-low tech industries in which it still holds a comparative advantage Korea has lost some of its market share to China (Figure 2-2).

Table 2. Revealed Comparative Advantage (RCA) by Technology Group

	China			**Korea**			**Japan**		
	1992	1997	2003	1992	1997	2003	1992	1997	2003
Manufacturing									
High technology	**0.56**	**0.76**	**1.37**	**1.33**	**1.34**	**1.60**	**1.53**	**1.40**	**1.21**
-Aircraft and spacecraft	0.14	0.07	0.05	0.28	0.26	0.12	0.07	0.18	0.20
-Pharmaceuticals	0.74	0.61	0.30	0.26	0.28	0.12	0.37	0.39	0.30
-Computers and Office products	0.30	0.95	2.94	0.91	0.91	1.97	2.03	1.69	1.06
-Semiconductor, Electronic Valves	0.26	0.39	0.74	3.62	3.46	2.48	2.06	2.09	2.04
-Radio, TV, Communication Equipments	1.24	1.36	2.18	2.31	1.41	2.97	2.45	1.34	1.35
-Precision, Medical, Optical Instruments	0.75	0.83	0.74	0.39	0.50	0.46	1.38	1.55	1.69
Medium High technology	**0.36**	**0.48**	**0.57**	**0.60**	**0.89**	**0.99**	**1.50**	**1.53**	**1.57**
-Electrical Machinery	0.87	1.14	1.32	0.59	0.63	0.68	1.42	1.42	1.30
-Chemical Products	0.56	0.63	0.50	0.99	1.29	1.27	0.91	1.09	1.13
-Motor vehicle and Trailer	0.07	0.10	0.15	0.50	0.93	1.07	2.04	1.90	1.96
-Other Transport Equipment	1.26	1.47	1.99	0.35	0.62	0.29	2.76	2.82	2.58
-Home Appliance and Machinery Equipments	0.32	0.43	0.73	0.46	0.69	0.87	1.29	1.46	1.51
Medium Low technology	**0.83**	**1.12**	**0.96**	**1.45**	**1.55**	**1.38**	**0.93**	**0.94**	**0.97**
-Shipbuilding and repairing	0.61	1.19	0.87	5.77	6.54	7.41	2.52	3.12	2.64
-Coke, Petroleum products	1.30	1.30	0.96	0.30	0.20	0.32	0.21	0.21	0.21
-Rubber and plastic products	0.83	1.15	1.01	1.15	1.03	0.94	0.82	0.88	0.97
-Non-metallic mineral products	1.31	1.54	1.29	0.52	0.32	0.42	0.81	0.88	0.85
-Basic metal and Fabricated metal products	0.71	1.00	0.88	1.30	1.56	1.08	0.86	0.80	0.85
Low technology	**2.43**	**2.29**	**1.86**	**1.44**	**0.95**	**0.60**	**0.24**	**0.21**	**0.19**
-Textile, Apparel, Footwear	4.42	4.14	3.32	2.99	1.88	1.13	0.25	0.21	0.19
-Food, Beverages, Tobacco	1.08	0.87	0.58	0.35	0.33	0.23	0.09	0.09	0.09
-Wood and Paper products	0.45	0.46	0.48	0.22	0.33	0.19	0.20	0.17	0.17
-Other Miscellaneous Manufacturing Products	2.43	2.62	2.21	1.03	0.58	0.47	0.55	0.50	0.35
Non-manufacturing products	**1.34**	**0.74**	**0.38**	**0.18**	**0.08**	**0.05**	**0.02**	**0.02**	**0.03**

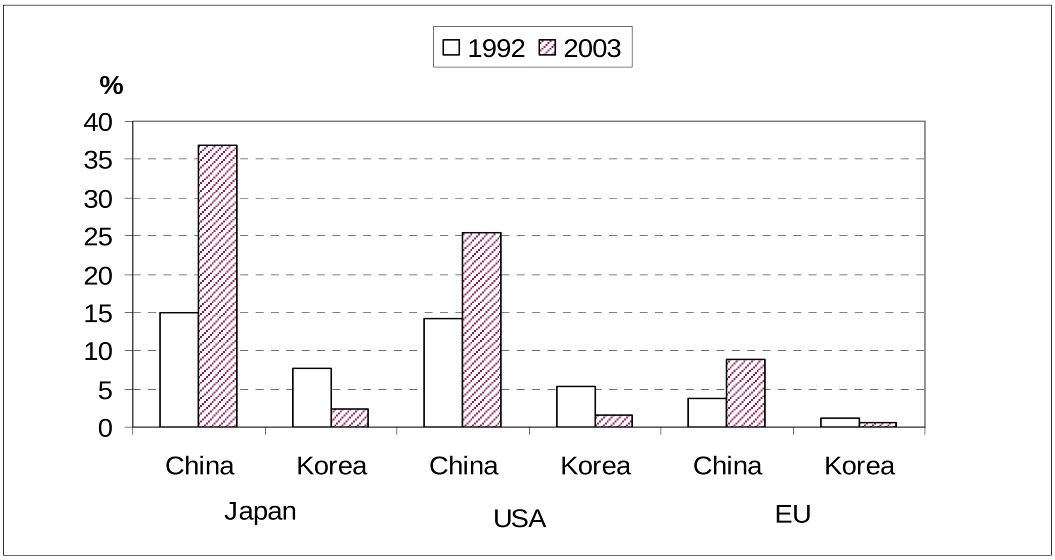
Source: Yangseon Kim (2004)

Figure 1. Export Share of China and Korea in Major Markets



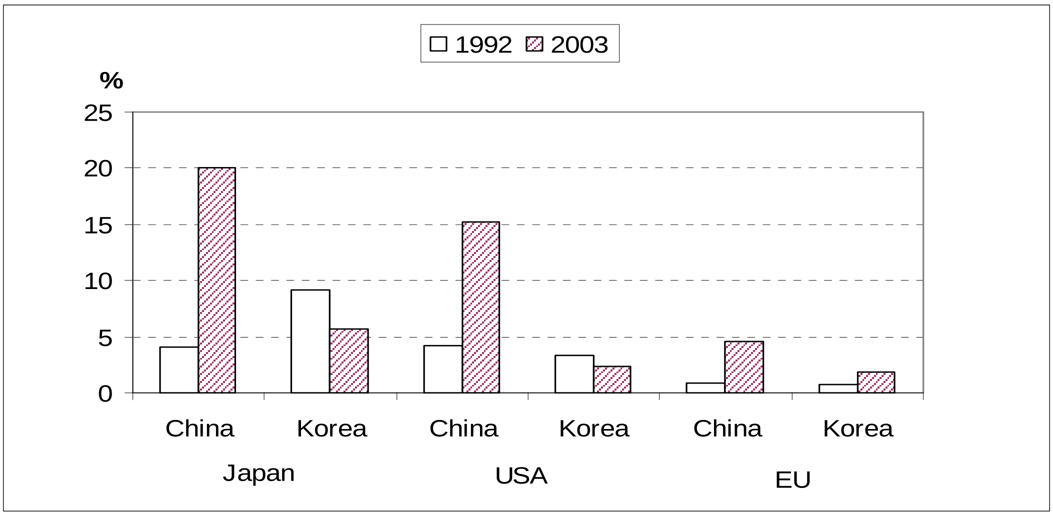
Source: Yangseon Kim (2004)

Figure 2-1. Export Share of China and Korea in Major Markets: Low Technology Industry



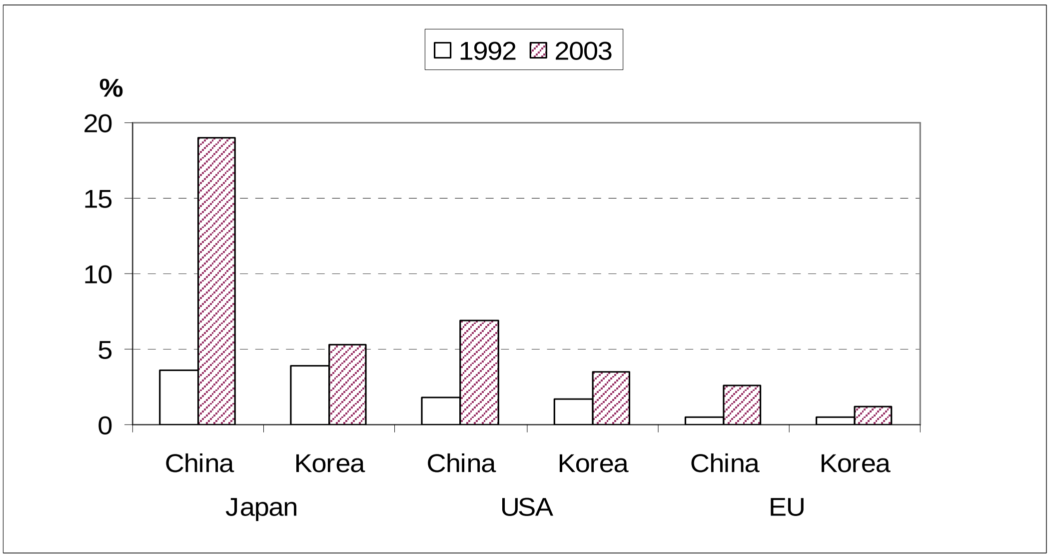
Source: Yangseon Kim (2004)

Figure 2-2. Export Share of China and Korea in Major Markets: Medium-Low Technology Industry



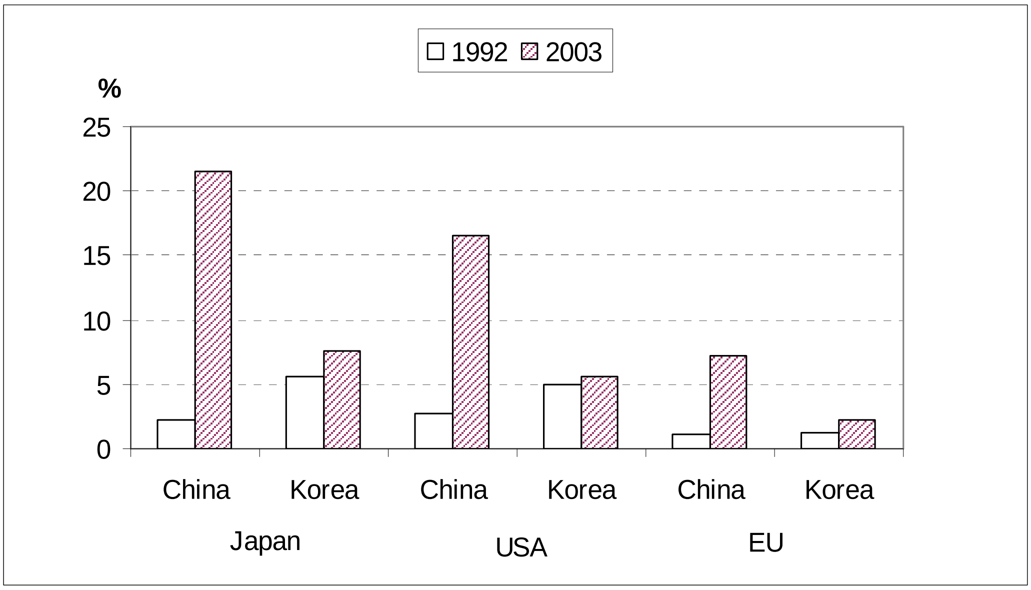
Source: Yangseon Kim (2004)

Figure 2-3. Export Share of China and Korea in Major Markets: Medium-High Technology Industry



Source: Yangseon Kim (2004)

Figure 2-4. Export Share of China and Korea in Major Markets: High Technology Industry



Source: Yangseon Kim (2004)

While undergoing significant changes in its export structure since 1992, as discussed above, Korea has managed to increase its share of total world exports—from 2.1 percent in 1992 to 2.6 percent in 2003. In fact, it increased its market share in high and medium-high tech products in spite of the fact that it was increasingly challenged by China in almost all the major markets of the world (Figures 2-3 and 2-4). This, that Korea has increased its share of total world exports especially by increasing its market share in high and medium-high tech products, suggests that it has been able to meet the challenges of the rapidly industrializing China by successfully making the necessary structural adjustment and moving up on the ladder of technology.

2.2. Expanding bilateral trade

While Korea has lost its market share in some of its exports to China in third markets, its bilateral trade with China has expanded. This is as to be expected since rapid economic growth in China has been accompanied with steadily increasing trade with the rest of the world, and we would expect that, other things being equal, its trade with Korea would also increase. What is thus of interest is whether for reasons yet to be investigated the China-Korea bilateral trade has increased more rapidly than their respective trade with the rest of the world. To answer this question we calculate the export- and import- intensity indices for China and Korea, respectively, for 1992 and 2003 (reported in parenthesis in Tables 3 and 4).[5]

Between 1992 and 2003, Korea's export-intensity with respect to China increased from 1.29 to 2.84 while its import-intensity also increased albeit at a more modest pace from 1.57 to 1.73. These increases in the export- and import-intensities indicate that bilateral trade between Korea and China has increased at a greater pace than their respective trade with other countries in the world.

During the same period China's export-intensity with respect to Korea increased from 1.04 to 1.6, indicating a growth rate of Chinese exports to Korea higher than that to the rest of the world and the growing importance of Korea as a destination for Chinese exports. China's import-intensity for Korean imports also increased much more rapidly from 1.24 to 3.21, indicating an increasing interdependency between the two economies.

Table 3. Exports by Destination (share in total exports, %) and Export Intensity (in parenthesis)

China's Exports	Destination							
	Korea	Japan	HK	ASEAN	NAFTA	Other America	Europe	Oceania
1992	2.8% (1.04)	13.7% (1.78)	44.2% (10.45)	5.5% (0.84)	11.1% (0.45)	1.1% (0.38)	13.1% (0.22)	0.9% (0.56)
1997	5.0% (1.56)	17.4% (2.32)	24.0% (5.08)	7.0% (0.86)	19.2% (0.72)	2.3% (0.53)	15.7% (0.31)	1.3% (0.77)
2003	4.6% (1.60)	13.6% (2.21)	17.4% (4.66)	7.1% (1.38)	23.2% (0.84)	1.9% (0.89)	20.1% (0.40)	1.7% (0.96)
Korea's Exports	**China**	**Japan**	**HK**	**ASEAN**	**NAFTA**	**Other America**	**Europe**	**Oceania**
1992	3.5% (1.29)	15.1% (1.96)	7.7% (1.82)	11.8% (1.80)	27.0% (1.10)	5.2% (1.86)	14.7% (0.25)	1.8% (1.05)
1997	10.0% (3.17)	10.8% (1.45)	8.6% (1.83)	15.0% (1.84)	18.2% (0.68)	5.1% (1.19)	17.3% (0.34)	2.0% (1.15)
2003	18.1% (2.84)	8.9% (1.51)	7.6% (2.10)	10.4% (2.11)	20.4% (0.77)	3.2% (1.51)	15.6% (0.32)	2.5% (1.51)

Source: Yangseon Kim (2004)

Table 4. Imports by Origin (share in total imports, %) and Import Intensity (in parenthesis)

China's Imports	Origin							
	Korea	**Japan**	**HK**	**ASEAN**	**NAFTA**	**Other America**	**Europe**	**Oceania**
1992	3.3% (1.24)	17.0% (1.46)	25.5% (6.23)	5.5% (0.87)	13.6% (0.63)	2.2% (0.71)	19.7% (0.34)	2.6% (1.43)
1997	10.5% (3.38)	20.4% (2.12)	4.9% (1.15)	8.7% (1.09)	13.0% (0.56)	2.5% (0.66)	17.6% (0.32)	2.6% (1.47)
2003	10.4% (3.21)	18.0% (2.27)	2.7% (0.70)	11.5% (1.73)	9.7% (0.50)	3.2% (1.17)	16.9% (0.30)	2.1% (1.37)
Korea's imports	**China**	**Japan**	**HK**	**ASEAN**	**NAFTA**	**Other America**	**Europe**	**Oceania**
1992	4.6% (1.57)	23.8% (2.06)	1.0% (0.24)	8.7% (1.39)	24.5% (1.15)	2.8% (0.91)	14.8% (0.25)	4.7% (2.61)
1997	7.0% (1.70)	19.3% (2.03)	0.6% (0.15)	8.7% (1.09)	22.9% (1.00)	2.6% (0.68)	16.3% (0.30)	4.7% (2.72)
2003	12.3% (1.73)	20.3% (2.67)	1.5% (0.41)	10.3% (1.62)	15.2% (0.81)	2.3% (0.88)	13.8% (0.26)	3.8% (2.59)

Source: Yangseon Kim (2004)

2.3. Expanding production networks and growth in parts trade

The rapid increase in the export- and import-intensities discussed above, a measure of growing bilateral trade between China and Korea, may be due to the geographical proximity of the two countries. Distance alone cannot, however, account for the increase in bilateral trade, and here we consider whether expanding production networks between the two have contributed to the growth in bilateral trade. Expanding production networks, which may be a consequence of international fragmentation of production processes, imply increasing parts trade between the two countries (Gaulier, Lemoine and Ünal-Kesenci, 2005; Ando and Kimura, 2003).[6]

In Table 5 we report the destinations for parts exported from Korea and China. In 1992, China accounted for a meager 0.9 percent of Korea's total parts exports but in 2003 its share jumped up to 21.9 percent. Particularly noticeable increases took place in computers & office products; in radio, TV & communication equipment; in precision, medical & optical instruments; and in electrical machinery. These increases are a sign that China has become a major assembler of parts and components manufactured in Korea for many of its high and medium-high tech products. This contrasts with Korea's meager share of China's parts exports, which increased only slightly from 1.3 to 4.5 percent between 1992 and 2003. That is, Korea is not so an important market for China's parts exports as China is for Korea's.

In 1992, Korea imported intermediates and materials mostly from Japan, NAFTA, and Europe while importing only a miniscule amount from China (Table 6). By 2003, however, imports from the former decreased considerably while those from the latter increased significantly. The most dramatic increase occurred in computers & office products; in radio, TV & communication equipment; and in electrical machinery. These changes took place while the share of parts imports in those groups from Japan and NAFTA declined, indicating growing production networks spanning China and Korea.

Table 5. Parts Exports by Destination (share in the parts exports to the world, %)

Korea's Parts Exports	Destination															
	China		Japan		HK		ASEAN		NAFTA		Other America		Europe		Oceania	
	1992	2003	1992	2003	1992	2003	1992	2003	1992	2003	1992	2003	1992	2003	1992	2003
Total parts	0.9	2 1.9	10.5	10.4	7.1	8.5	21.4	15.1	34.4	16.3	1.7	1.7	13.5	12.7	0.9	0.7
-Parts for Aircrafts	0.0	0.4	0.3	4.3	0.0	0.2	3.0	11.3	75.6	62.9	0.0	0.1	19.7	15.6	0.1	0.2
-Parts for Computers and Office products	1.5	26.3	11.2	5.7	3.2	7.8	13.8	13.8	42.1	18.1	0.1	0.6	26.6	16.5	0.7	0.2
-Parts for Semiconductor, Electronic Valves	0.8	14.0	9.3	14.8	10.5	13.9	30.2	22.0	33.1	13.7	0.5	0.6	8.0	8.8	0.1	0.0
-Parts for Radio, TV, Communication Equipments	1.0	39.6	17.4	5.7	2.8	5.9	14	9.6	31.5	9.5	5.4	5.2	18.4	15.4	0.9	0.7
-Parts for Precision, Medical, Optical Instrument	0.9	64.9	18.4	10.9	3.0	4.2	4.0	2.5	59.3	7.9	0.4	0.1	9.9	3.8	0.3	0.3
-Parts for Electrical Machinery	1.8	30.1	16.8	10.9	7.8	8.5	11.4	12.6	22	15.6	3.6	1.4	18	6.6	2.1	1.6
-Parts for Motor Vehicles and Trailers	0.9	21.8	20.2	7.2	1.7	0.3	5.8	5.5	31.8	20.6	3.1	2.5	19.4	14.0	3.5	1.8
-Parts for Home Appliance and Machinery Equip.	1.9	24.0	15.7	12.4	3.7	1.3	14.5	12.4	29.7	20.9	2.2	1.4	17.2	13.6	1.4	1.0
China's Parts Exports	**Korea**		**Japan**		**HK**		**ASEAN**		**NAFTA**		**Other America**		**Europe**		**Oceania**	
	1992	2003	1992	2003	1992	2003	1992	2003	1992	2003	1992	2003	1992	2003	1992	2003
Total parts	1.3	4.5	7.2	12.2	54.7	26.8	5.9	11.7	9.4	17.8	1.6	1.5	7.2	16.0	0.5	0.7
-Parts for Aircrafts	0.0	1.2	0.2	14.4	1.7	17.6	2.2	4.8	31.2	31.2	1.3	0.0	6.4	23.9	0.1	0.3
-Parts for Computers and Office products	1.6	1.8	2.6	7.9	73.4	33.5	0.6	13.9	10.6	20.0	0.0	0.5	10.8	18.0	0.0	0.4
-Parts for Semiconductor, Electronic Valves	0.6	7.0	4.2	8.6	80.0	43.1	3.6	17.7	4.5	7.7	0.1	0.4	3.3	7.2	0.1	0.1
-Parts for Radio, TV, Communication Equipments	2.1	7.1	13.2	19.1	73.7	27.8	2.6	8.4	2.9	11.8	0.1	1.8	1.9	18.9	0.0	0.3
-Parts for Precision, Medical, Optical Instrument	2.3	2.8	11.9	26.3	53.8	25.9	2.2	4.3	13.7	19.8	0.3	0.7	9.2	12.5	0.2	0.4
-Parts for Electrical Machinery	0.6	5.3	11.1	14.9	53.7	24.3	5.5	7.6	4.0	18.6	1.0	2.2	5.9	15.4	0.2	0.8
-Parts for Motor Vehicles and Trailers	1.5	2.0	6.6	14.4	11.0	1.8	17.8	9.4	28.5	41.0	2.5	1.6	14.1	12.0	0.7	1.7
-Parts for Home Appliance and Machinery Equip.	1.7	3.9	6.2	13.7	30.7	5.8	10.7	9.1	18.0	23.4	3.2	2.1	12.3	22.9	1.3	1.9

Source: Yangseon Kim (2004)

Table 6. Parts Imports by Origin (share in the parts imports from the world, %)

Parts Imports of Korea	**Origin**															
	China		**Japan**		**HK**		**ASEAN**		**NAFTA**		**Other America**		**Europe**		**Oceania**	
	1992	2003	1992	2003	1992	2003	1992	2003	1992	2003	1992	2003	1992	2003	1992	2003
Total parts	0.4	10.2	40.3	29.2	3.9	2.0	8.6	14.5	30.4	21.6	0.1	0.2	12.9	12.6	0.3	0.7
-Parts for Aircrafts	0.0	0.4	0.4	3.1	0.1	0.1	2.4	2.7	88.6	78.9	0.1	0.0	8.2	10.5	0.1	0.2
-Parts for Computers and Office products	2.7	35.9	46.5	13.5	2.8	3.6	3.0	14.5	34.6	13.9	0.2	0.3	3.8	4.1	0.2	0.1
-Parts for Semiconductor, Electronic Valves	0.2	5.6	35.9	25.2	8.7	2.6	18.5	22.5	28.3	24.1	0.1	0.3	4.7	6.3	0.0	0.1
-Parts for Radio, TV, Communication Equip.	1.1	19.1	65.4	45.9	1.8	1.9	3.7	8.1	13.0	13.2	0.3	0.2	9.6	9.2	0.1	0.1
-Parts for Precision, Medical, Optical Instru.	0.2	2.6	39.8	40.3	0.2	0.5	0.9	2.9	38.6	24.7	0.0	0.0	19.1	25.3	0.1	0.2
-Parts for Electrical Machinery	0.5	28.3	53.2	38.8	0.8	1.6	2.6	3.9	22.8	10.9	0.1	0.1	16.9	12.8	0.2	0.1
-Parts for Motor Vehicles and Trailers	0.3	1.5	62.9	39.8	0.0	0.0	0.2	1.2	16.0	14.1	0.6	0.1	16.1	32.7	3.1	9.7
-Parts for Home Appliance and Machinery Equip.	0.4	6.2	39.4	32.7	0.1	0.2	1.1	1.8	31.6	24.6	0.1	0.1	25.2	32.2	0.2	0.3
Parts Imports of China	**Korea**		**Japan**		**HK**		**ASEAN**		**NAFTA**		**Other America**		**Europe**		**Oceania**	
	1992	2003	1992	2003	1992	2003	1992	2003	1992	2003	1992	2003	1992	2003	1992	2003
Total parts	1.7	10.5	22.3	23.1	33.8	3.5	0.8	15.5	11.3	6.8	0.1	0.8	23.4	14.0	0.1	0.1
-Parts for Aircrafts	0.0	0.1	0.1	0.6	0.9	0.1	0.3	1.7	58.0	44.7	0.0	0.4	40.7	52.1	0.1	0.0
-Parts for Computers and Office products	1.5	7.0	32.9	18.2	49.8	2.4	0.6	18.5	7.5	7.0	0.0	0.3	3.1	2.2	0.0	0.0
-Parts for Semiconductor, Electronic Valves	4.7	12.0	19.6	21.1	60.5	4.1	1.0	24.8	2.6	4.8	0.0	0.9	4.1	3.4	0.0	0.0
-Parts for Radio, TV, Communication Equip.	2.3	16.4	15.2	22.9	53.9	5.8	0.7	6.4	5.2	6.6	0.0	0.1	15.7	12.1	0.3	0.1
-Parts for Precision, Medical, Optical Instru.	0.1	5.6	26.2	35.8	28.0	3.5	0.3	4.7	19.7	11.9	0.0	0.0	13.0	12.9	0.2	0.1
-Parts for Electrical Machinery	0.7	7.6	18.0	30.3	42.4	4.2	0.7	3.5	8.4	6.9	0.0	0.2	22.4	23.8	0.2	0.2
-Parts for Motor Vehicles and Trailers	0.2	10.2	46.6	31.1	1.0	0.0	0.5	0.7	6.2	7.3	0.1	3.7	43.9	42.5	0.0	0.3
-Parts for Home Appliance and Machinery Equip.	1.1	6.5	23.4	26.8	14.8	1.3	1.2	4.0	15.4	11.3	0.2	0.5	37.1	40.4	0.2	0.4

Source: Yangseon Kim (2004)

China's parts imports from Korea also increased between 1992 and 2003, the most dramatic increase taking place in high and medium-high tech products, albeit not as large as the increase in Korea's parts imports from China. This asymmetry suggests that by 2003 Korea has become much more dependent on China for parts for its high and medium-high tech products than China has on Korea. This may be due to the fact that Korea has transferred some of the parts production to China. We explore this possibility, among other things, in the following two sections by looking into various possible linkages among foreign direct investment, bilateral trade and economic integration and the motives for and the effects of Korea's investment in China.

III. Foreign Direct Investment, Bilateral Trade and Economic Integration

FDI makes a direct contribution to economic integration of home and host countries by leading to the establishment of an affiliate or a subsidiary in a host country and thus transforming a national enterprise into a transnational one. Within this enterprise, as within any internal organization, there is a hierarchical relationship between home office and the affiliate and an up-and-down flow of information and personnel. Such exchange between home office and the affiliate is not readily quantifiable as it bypasses the market, but being an intra-firm relationship it is a closer and more intimate person-to-person relationship than the typical arm's-length relationship between independent agents across the market and thus would have a greater integrative effect on the two economies.[7]

What effect FDI has on the trade relationship between home and host countries is less clear as it can either increase or decrease bilateral trade or may even have no effect at all. It will have no effect on bilateral trade if it simply creates in the host country an "export platform" for third markets and replaces home-country exports to those markets with exports from the affiliate. This kind of investment is most likely to occur when a firm is seeking to reduce the labor cost by relocating its production site from home to a low labor-cost country. Even in this case FDI will still have a positive effect on bilateral trade if the affiliate imports parts and components from the home country.

FDI will have a positive effect on bilateral trade if it leads to "reverse importing"— the home country importing the affiliate's output and replacing what has been produced at home with the imports. This will happen when the home country is losing its comparative advantage in labor-intensive industries and transfers them through FDI to another country that has a latent comparative advantage in the same industries. In this case, seeking to reduce the labor cost is obviously the main motive for overseas investment. This kind of investment took place in Japan in the 1970s (Kojima, 1996; Lee, 1994) and also in Korea since the mid-1980s, as will be discussed below.

FDI will also have a positive effect on bilateral trade if it is for exploiting natural resources that the home country lacks. Its imports of natural resources from the host country may displace its imports of the same from a third country, but this "trade diversion" is likely to be welfare-improving for both countries since for the home country it is from a more costly to a less costly supplier of natural resources and for the host country it expands the market for its natural resources.

There is another reason why FDI may lead to growth in bilateral trade, and that is international fragmentation of production processes or cross-border production sharing that allows previously integrated production processes at one location to be separated into various component parts across national boundaries (Jones, 2001). Such fragmentation may not necessarily be the result of FDI as it can happen with "outsourcing" arrangements between two independent firms, but FDI is certainly a vehicle through which a firm may carry out intra-firm fragmentation of production processes across national boundaries. In such cases FDI will lead to the establishment of production networks, which in turn brings about an increase in bilateral trade in parts and components as the investing firm exports them to its foreign affiliate for further processing or assembling or, conversely, as parts move from the affiliate to the parent companies (Urata, 2004).

FDI will have a negative effect on bilateral trade if it leads to a partial or full displacement of home-country exports to the host country with the goods produced locally by the affiliate. This will occur if the motive for FDI is to serve host-country markets regardless of whether it is to avoid paying tariffs or to reduce the cost of serving the markets such as the cost of transportation. But even in this case FDI will not completely displace bilateral trade if the affiliate imports parts and components from its parent company or other home-country sources.

It is clear from the above discussion on the relationship between FDI and bilateral trade that we can, to some extent, infer the effect of FDI on bilateral trade from the motive of investment. If it is to take advantage of low-cost labor in the host country or exploit its natural resources the FDI is likely to have a positive effect on bilateral trade whereas if the motive is to exploit host-country markets it is likely to have a negative effect (although negligible or even positive if intermediates are supplied from the home country).

The discussion so far of the effect of FDI on bilateral trade is based on the assumption that a trade relationship has existed between two countries before firms in one country start investing in the other. It is, however, quite possible, as happened in China after the Four Modernization reforms in the late 1970s, that FDI precedes trade; that is, foreign investment comes in first to manufacture products, which are then exported. Such investment will have a positive effect on bilateral trade as it generally leads to importing parts and components from the home country and possibly to exporting final products back to it.

The above discussion of the investment-trade nexus relates only to the direct effects of FDI on bilateral trade between home and host countries and do not take into account any indirect effect that FDI may have on bilateral trade through its effect on economic growth. As is well documented in the literature (e.g., Bende-Nabende, 2002; Blomström and Kokko, 1998; Henley, Kirkpatrick, and Wilde, 2002; OECD, 2000, Tseng and Zebregs, 2002), FDI generally has had a positive effect on the economic growth of the host country, and definitely in the case of China, as it brings in capital, advanced technology, and managerial know-how and expands employment while increasing competitive pressure on local enterprises and thus enhancing their efficiency. It is also likely to have a long-run positive effect on the home country by transferring abroad the industries in which it is losing its comparative advantage and thus facilitating structural adjustment. If these indirect positive effects of investment are taken into account FDI motivated by low-cost labor will have a positive effect on bilateral trade. If the motive of investment is, however, to serve the host-country market its effect on bilateral trade will depend on the relative magnitude of direct and indirect effects.

In addition to the investment-trade linkage there is another reason why FDI will have a positive effect on economic integration, and that is the backward linkages or supply chains created by FDI in the host country. To the extent that the affiliate purchases locally produced intermediates the local suppliers become a part of the supply chains and participate in cross-border production networks. This inclusion in production networks will have as strong an effect on economic integration of home and host countries as bilateral trade does. As will be shown below, Korea's investment in China has led to extensive local procurement and thus to the inclusion of local Chinese firms in Korean firms' production networks.[8]

IV. Korean Investment in China: Its Motives and Effects

As noted above, Korea has invested heavily in China with the total sum amounting to $8.9 billion at yearend of 2004. What has motivated Korean firms to invest in China? How has their investment affected bilateral trade and economic integration of the two economies? To answer these questions we examine the results of two surveys on Korea's overseas direct investment—one carried out in 1996 and the other in 2003—by the Korea Institute for Industrial Economics and Trade (KIET). The 1996 survey was done on a sample of 615 Korean companies (216 large firms and 399 small and medium- sized enterprises (SMEs) and their 952 offshore affiliates. The 2003 survey replicated the earlier one with some changes in the sample size and composition—748 companies (89 large firms and 659 SMEs) and their 1,050 offshore affiliates, all in manufacturing. These two surveys provide information on the motives for overseas investment and the patterns of sales and procurement and other activities of offshore affiliates (reported by their parent companies registered officially as overseas investors).

4.1. Motives for investing in China

In the 2003 survey the sample firms were asked to pick the most important motive for investing overseas—natural resource or raw materials, low-cost labor, market access, high technology, and "others." Out of 706 firms with investment in China, 42.6 percent reported low-cost labor and 33.0 percent the market access as the most important reason for investing in China. These motives are quite different from those for investing in North America and Europe, which, according to the survey, are the market access.[9]

Table 7. Motives for Korea's ODI in Manufacturing by Region (2003 KIET Survey)

(Unit: %)

	Natural resource or Raw materials	Low-cost labor	Market Access or Export Expansion	Others	Total (number of sample)
Asia	3.2	43.0	31.7	22.1	100 (945)
China	3.4	42.6	33.0	21.0	100 (706)
North America	0.0	7.1	71.4	21.5	100 (42)
Europe	0.0	3.7	55.6	40.7	100 (27)
Latin America	0.0	46.2	38.5	15.3	100 (26)
All regions	3.1	40.2	34.5	22.2	100 (1,050)

Note: The figures are the percentage of the firms indicating the most important motive for investing abroad in the total number of surveyed firms.

Source: KIET and MOCIE (2004)

According to the 2003 survey, the most important motive for overseas investment in textiles & apparel and footwear & leather industries, which are labor-intensive, was, not surprisingly, the low-cost labor in host countries.[10] The textiles & apparel and footwear & leather industries had been two of Korea's major export industries until the mid-1980s when it began to lose its comparative advantage in labor-intensive industries due in part to rapid increases in labor cost in Korea. Korean firms in those industries had already established international sales networks and thus could capitalize on them in marketing the products from their affiliates in China. In such cases the exports from the Korean affiliates in China would be displacing exports from Korea in third markets and some would even be shipped back to Korea as "reverse imports." Parts imported from Korea would also increase in such cases, leading to expansion in bilateral trade.

Low-cost labor in China was an important factor in Korean firms' decision to invest even in certain capital-intensive, heavy industries such as machinery and equipment, electronics & telecommunications equipment, and fabricated metals (Table 8). This apparent contradiction with the theory of comparative advantage (i.e., to invest in sectors in which China does not have a comparative advantage) can readily be explained, however, if the investment is for labor-intensive parts of production as would happen in international fragmentation of production processes or production sharing.

Table 8. Motives for Korea's FDI in China by Industry (2003)

(Unit: %)

	Natural resource or Raw materials	Low-cost labor	Market Access	Others	Total (number of firms)
Manufacturing	**3.4**	**42.6**	**33.0**	**21.0**	**100 (706)**
Food and Beverage	16.1	12.9	51.6	19.4	100 (31)
Textiles and Apparel	2.5	62.2	16.8	18.5	100 (119)
Footwear and Leather	4.1	63.3	20.4	12.2	100 (49)
Paper and Printing	0.0	37.5	37.5	25.0	100 (8)
Petroleum and Chemical	2.4	25.0	53.6	19.0	100 (84)
Non-metallic minerals	15.4	50.0	19.2	15.4	100 (26)
Basic metals	4.3	43.5	43.5	8.7	100 (23)
Fabricated metals	0.0	46.7	33.3	20.0	100 (30)
Machine and equipment	2.7	27.0	47.3	23.0	100 (74)
Electronics and telecomm equipment	0.6	46.3	23.8	29.3	100 (160)
Motors and Freight	3.7	16.7	46.3	33.3	100 (54)
Other manufacturing	4.2	58.3	33.3	4.2	100 (48)

Note: The figures are the percentage of the firms indicating the most important motive for investing abroad in total number of surveyed firms.
Source: KIET and MOCIE (2004)

Production processes in heavy industries involve, relative to light manufacturing industries, a large number of separable sub-processes with different requirements for technology and factor intensity — some sub-processes requiring high-tech materials and component parts and others requiring an intensive use of low-cost labor. A firm in such an industry can minimize the unit cost of output by producing high-tech components in the home country where there is a high technological capability and assembling them in China where there is an ample supply of low-cost labor. Indeed, many Korean firms in heavy industries have made such production arrangements since the late 1980s by establishing assembly plants in China. International fragmentation thus makes it possible for a labor-abundant developing country to become a site for producing some parts of a previously wholly integrated process in a capital-intensive industry or for assembling parts manufactured in other countries.

The Korean affiliates in heavy industries in China may be serving as export platforms for their parent companies. Even though, in that case, the affiliates' exports from China are displacing exports from Korea, cross-border production sharing has a positive effect on bilateral trade if parts and components are shipped from parent to affiliate firms or conversely.

4.2. Trade patterns of Korean affiliates in China

Here we examine the procurement and sales patterns of affiliates, as reported in the KIET surveys, in order to find out how Korea's FDI in China has affected the bilateral trade. As seen in Table 9, which reports the sources of procurement by Korean affiliates by region, between 1996 and 2003 the share of parts and components imported by the affiliates in China from Korea decreased from 64.7 to 36.9 percent while the share of local procurement increased from 26.5 to 45.6 percent, suggesting an increasing localization of parts supplies. The share of imports from third countries in total procurement also increased from 8.8 to 17.5 percent.

The survey results indicate that Korean investment in China has had a positive effect on their bilateral trade although the share of parts imported from Korea in total procurement by the affiliates in China has declined. They also point to the fact that FDI has created extensive backward local linkages, contributing to the economic integration of the two economies.

Table 9. Sources of Procurement by Korean Offshore Affiliates by Region: all industries

(Unit: % of total procurement)

	Local Procurement		Imports from			
			Korea		Third Countries	
	1996	2003	1996	2003	1996	2003
Asia	37.4	40.9	52.3	41.1	10.3	18.0
China	26.5	45.6	64.7	36.9	8.8	17.5
North America	34.6	13.4	64.8	30.2	0.5	56.4
Europe	19.6	42.1	80.1	23.3	0.3	34.7
Latin America	12.6	20.7	85.9	43.7	1.5	35.6

Note: The figures in the 2003 KIET survey for all regions and those in the 1996 KIET survey for China are for the manufacturing sector only.

Source: Ha and Hong (1998), KIET and MOCIE (2004).

Table 10 reports the procurement patterns of Korean affiliates in China by industries. Between 1996 and 2003 the share of imports from Korea in total procurement decreased for most of industries except for food & beverage, paper & printing, basic metals, and motors & freight. Particularly, electronics and telecommunication equipment decreased from 86.0 percent in 1996 to 36.3 percent in 2003. Except for machine & equipment industry, the industries that experienced a decrease in the share of imports from Korea inversely experienced an increase in the share of local procurement between 1996 and 2003. This indicates strong local backward linkages created by Korean affiliates in China.

Table 10. Sources of Procurement by Korean Affiliates in China by Industry

(Unit: % of total procurement)

	Local Procurement		Imports from			
			Korea		Third Countries	
	1996	2003	1996	2003	1996	2003
Manufacturing	**26.5**	**45.6**	**64.7**	**36.9**	**8.8**	**17.5**
Food and Beverage	78.3	59.6	19.2	21.9	2.6	18.4
Textiles and Apparel	46.0	63.3	53.8	25.7	0.2	11.0
Footwear and Leather	2.6	18.2	94.9	65.6	2.5	16.1
Paper and Printing	91.8	51.5	8.2	31.7	0.0	16.8
Petroleum and Chemical	1.0	37.1	62.9	47.3	36.1	15.6
Non-metallic minerals	49.0	93.0	51.0	3.2	0.0	3.8
Basic metals	88.6	9.0	11.4	90.8	0.0	0.2
Fabricated metals	0.5	41.7	99.5	56.9	0.0	1.4
Machine and equipment	40.9	28.9	49.4	8.9	9.8	62.2
Electronics and telecomm equipment	13.9	56.5	86.0	36.3	0.1	7.2
Motors and Freight	78.8	40.8	21.2	59.2	0.0	0.0

Source: Ha and Hong (1998), KIET and MOCIE (2004).

Table 11 reports the sales and exports of Korean affiliates by region. Between 1996 and 2003, overall local sales in China by the affiliates increased whereas their exports to Korea decreased. Indeed, the share of local sales increased from 22.6 percent to 34.2 percent while the share of exports of the affiliates in China to Korea decreased from 25.8 percent to 17.8 percent.

Table 11. Sales Destination of Korean Offshore Affiliates by Region: all industries

(Unit: % of total sales)

	Local Sales		Exports to			
			Korea		Third Countries	
	1996	2003	1996	2003	1996	2003
Asia	64.5	38.4	14.2	17.4	21.3	44.2
China	22.6	34.2	25.8	17.8	51.6	48.1
North America	93.9	63.6	3.6	3.3	2.5	33.2
Europe	69.9	27.7	1.4	5.3	28.7	67.0
Latin America	58.0	30.1	10.9	8.0	31.1	61.8

Note: The figures in the 2003 KIET survey for all regions and those in the 1996 KIET survey for China are for the manufacturing sector only.
Source: Ha and Hong (1998), KIET and MOCIE (2004).

Sales destinations of the output produced by Korean affiliates in China vary widely from industry to industry (Table 12). According to the 2003 survey, in paper & printing, petroleum & chemical, basic metals, and motors & freight more than a half of the affiliate output was sent to local markets. In contrast, in textiles & apparel, footwear & leather, fabricated metals, machine & equipment, and electronics and telecommunication equipment more than 60 percent of output was exported. Reverse imports—exports back to Korea— accounted for 17.8 percent of the entire manufacturing output and was especially large in footwear & leather and in both non-metallic minerals and basic metals. Exports to third markets were especially large—at least as much as a half of total output—in textiles & apparel, footwear & leather, machine & equipment, and electronics & telecommunication equipment. These are industries that are either labor-intensive or assemblers of parts imported from Korea.

Table 12. Sales Destination of Korean Affiliates in China by Industry

(Unit: % of total sales)

	Local Sales		Exports to			
			Korea		Third Countries	
	1996	2003	1996	2003	1996	2003
Manufacturing	22.6	34.2	25.8	17.8	51.6	48.1
Food and Beverage	51.2	43.4	27.4	35.3	21.5	21.2
Textiles and Apparel	47.5	22.4	8.2	28.4	44.4	49.2
Footwear and Leather	1.2	8.7	29.5	31.5	69.3	59.8
Paper and Printing	13.1	97.3	51.2	0.0	35.7	2.7
Petroleum and Chemical	0.6	78.4	46.6	10.4	52.8	11.3
Non-metallic minerals	40.0	49.6	57.8	46.4	2.2	4.0
Basic metals	51.3	62.8	23.1	35.3	25.6	1.9
Fabricated metals	3.5	36.6	25.7	17.4	70.7	46.0
Machine and equipment	51.6	16.1	47.0	6.4	1.4	77.5
Electronics and telecomm equipment	30.5	32.1	**60.7**	**12.8**	8.9	55.1
Motors and Freight	0.5	93.4	3.7	6.4	95.8	0.3

Source: Ha and Hong (1998), KIET and MOCIE (2004).

Reverse imports resulting from overseas investment clearly add to bilateral trade between home and host countries and reflect a changing comparative advantage between the two. One of the factors that motivated Korean firms to invest in China was a rapidly increasing gap in labor cost between the two countries. Such a gap would have caused a contraction in labor-intensive industries in Korea and an expansion in the same in China even without the transfer of those industries to China through FDI and would have led Korea to import labor-intensive products from China. What Korea's investment in China has done is to bring about a more rapid and a less costly adjustment of the international division of labor to changing comparative advantage and a greater expansion of bilateral trade between Korea and China than would have occurred otherwise (Ogawa and Lee, 1996).[11]

V. Concluding Remarks

Rapid industrialization in China since the late 1970s has had both a positive and a negative effect on the Korean economy. It has made China's export structure increasingly similar to that of Korea, turning it into Korea's major competitor in many of the world markets for manufactured exports. It has at the same time turned China into a major market for Korean exports and an important source of its imports. Now, bilateral trade between the two is highly significant, having increased much more rapidly than their respective trade with the rest of the world. Parts trade between the two, especially parts exported from Korea to China, has increased significantly—a sign of expanding production networks between the two economies.

While losing some of its market shares in labor-intensive, low tech products Korea has managed to increase its world export share from 2.1 percent in 1992 to 2.6 percent in 2003. This is a sign that Korea has successfully been making the necessary structural adjustment in the face of the challenges coming from China's emergence and moving up on the technology ladder. The recent change in manufacturing employment in Korea supports such a conclusion: in both 1992-96 and 2001-03 employment grew at positive rates in the high tech, medium-high tech, and medium-low tech sectors while decreasing by 4.1 and 2.1 percent in those two periods, respectively, in the low tech sector (Table 13).[12]

Table 13. Annual Average Growth Rate in Employment (%) by Industry

		1992-96	2001-03
High Tech	Total	0.8	1.7
	Large firms	0.4	-2.1
	SMEs	1.5	5.5
Medium-high Tech	Total	3.3	2.1
	Large firms	1.3	-2.5
	SMEs	4.7	3.9
Medium-low Tech	Total	2.5	3.4
	Large firms	-1.0	-1.7
	SMEs	4.3	5.0
Low Tech	Total	-4.1	-2.1
	Large firms	-12.3	-7.2
	SMEs	-1.3	-1.3

Source: Korea National Statistical Office, Mining and Manufacturing Survey, various years

If by economic integration we mean increasing cross-border production sharing as well as increasing mobility of the factors of production and goods and services between countries, Korea's investment in China certainly has had a positive effect on the economic integration of the two economies. It probably has had an additional integrative effect by promoting information and personnel exchange between the two countries and by inducing them to abide by contracts and realize the importance of cross-border harmonization of rules and regulations relating to trade and investment. These are the effects of FDI that are rarely quantified or quantifiable and seldom discussed in the literature but perhaps are as important for economic integration as its effect on bilateral trade.

Korea and China are not yet part of a formal regional grouping like the EU and NAFTA, and it may take many years before the two may become members of such a grouping. For various economic, historical and political reasons unique to the region the prospects for such formal regional machinery being established in the near future appear poor (Chung, 2005; Lee, 2003; Schott and Goodrich, 2001; Seliger, 2002). These are not, however, insurmountable barriers to creating organizations such as policy coordinating bodies charged to promote trade and investment and contribute to the creation of a strong regional identity.[13] This paper has demonstrated that the process of economic integration between China and Korea has already begun, paving the way toward building formal regional machinery in Northeast Asia in the foreseeable future.

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Endnotes

[1] Eichengreen, Rhee and Tong (2004) and Eichengreen and Tong (2005) argue that economic growth in China has had a positive effect on high income countries and on countries that produce and export capital goods, components and technology and a negative effect on low-income countries and countries that produce and export consumer goods. In this paper we show that it has had both a positive and a negative effect on the Korean economy.

[2] For this purpose we regroup trade data using the International Standard Industrial Classification (ISIC). The four technology groups are thus comprised of the following ISIC3 groups: 15~22, 36, and 37 for the low technology group; 23, 25~28 and 351for the medium-low technology group; 24 (excluding 2423), 29, 31, 34, and 35 (excluding 351and 353) for the medium-high technology group; and 353, 2423, 30, 32, and 33 for the high technology group. The non-manufacturing group consists of 01~14.

[3] Rodrik (2006) argues that although foreign investment has played a key role in upgrading industries in China the government's industrial policy of fostering domestic capabilities has also contributed to China's rapid increase in high tech exports. Gaulier, Lemoine and Ünal-Kesenci (2005) also make a similar point when they attribute changes in the commodity and geographic pattern of China's trade to its selective trade policy.

[4] This distinction was attributed to C.H. Kwan in Abe (2004).

[5] The export intensity index of country A with respect to country B is the ratio of B's share of A's total exports to B's share of world total imports. If it is greater than 1, B's share of A's exports is bigger than B's share of world imports, suggesting closer economic ties between the two. An increasing value of the index would suggest growing integration of the two economies through trade. The import intensity index is similarly calculated and would have the same implication.

[6] Jones (2001) defines international fragmentation of production processes as an activity that separates previously integrated production processes at one location into various component sub-processes across national boundaries. Obviously, international fragmentation does not have to undertaken only by a multinational corporation, as a firm may "outsource" parts production to an independent firm in another country.

[7] This integrative effect at the level of corporate organizations is well documented in a study of international production networks in Asia by Borrus, Ernst and Haggard (2000).

[8] According to an article published in *The International Herald Tribune* (2/9/06), "Made in China's Labels Don't Tell Whole Story," Samsung Electronics of Korea has established 23 factories in China employing 50,000 workers while closing down its last computer notebook factory in Korea.

[9] Kim and Lee (2003) found that for the large firms the market access is the most important reason for investing in China whereas for SMEs it is the low-cost labor that is the most important reason for investing in China. They also report that Korea's FDI in China in 1993-97 was concentrated in the coastal areas and the areas with a high concentration of ethnic Koreans such as Jilin, Heilongjiang, and Liaoning provinces. These three provinces received a significant amount of investment from SMEs in Korea but a negligible amount from other countries. Kim and Lee attribute this difference to the

importance of a common language and common culture in reducing transactions cost of overseas investment for SMEs.

[10] This survey results are consistent with the result of an econometric study (Fung, Iizaka, and Paker, 2002) that shows that FDI from Hong Kong and Taiwan tend to use China as a platform to manufacture labor-intensive goods and export them to industrialized countries.

[11] Ahn *et al*. (2005) show in an econometric study based on manufacturing micro-data from 1990 to 2003 that Korea's FDI led to a decrease in exports from Korea's low-tech and medium low-tech industries; that an industry with a high growth rate of FDI tends to experience a high growth rate in employment; and that an industry with a high share of FDI in China tends to have a slow rate of growth in employment.

[12] The years 2001-03 are chosen to minimize the negative effect of the Asian financial crisis of 1997-98 on employment and the subsequent rapid recovery in employment in Korea.

[13] Lee (2001) made a proposal for creating a regional economic cooperation body for China, Japan and Korea—the Council for Northeast Asian Economic Cooperation. According to him, such a body would perform useful functions such as strengthening the voice of the three countries in the international arena and pave the way to future formal economic integration in the region.

Comments on "Trade, Investment and Economic Integration of South Korea and China"

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It is my great honor to discuss this nice paper by Dr. Joon-Kyung Kim and his co-authors. I fully agree with the authors in that Korean firms' *vertical FDI* into China is a major driving force of economic integration between the two countries. The literature often classifies FDI as being horizontal or vertical according to firms' motives for affiliate operations abroad. *Vertical FDI* is the case where a firm pursues FDI in order to take advantage of international differences in factor prices, by locating its labor-intensive processing abroad and keeping capital-intensive input production and knowledge-intensive designing and R&D at home. On the other hand, *horizontal FDI* arises when a firm can reduce trade costs by setting up foreign affiliates replicating the parent firm. As the paper underlines properly, increase of parts' trade between Korea and China follows growing vertical outbound FDI from Korea to China.

A recent paper by Dr. Siwook Lee, Dr. Cheonsik Woo, and myself makes a good complement to this position paper by Dr. Kim and others. I would like to report a brief summary of our paper, expecting that readers would realize why I like Dr. Kim's position paper so much.

In our paper, the economic impacts of Korea's outbound FDI were analyzed with a focus on its relation with trade and other industrial performance such as productivity and employment. We used trade, overseas investments and manufacturing survey data, which have been re-aligned consistently at a detailed (3-digit) industry level. We focused on three of Korea's major transaction partners, the US, Japan, and China, and explored how the effects of transactions with these countries could differ across countries.

The main findings of our paper can be summarized as follows:

<u>On the relationship between the outbound FDI and trade</u>

The ultimate concern is whether these two factors are 'substitute' or 'complementary.' The regression results of our paper, which encompasses about 70 groups of industries and covers the period of 1990~2003 showed that no meaningful relationship is found by a simple aggregate OLS analysis lumping all industries together. As for high-tech and medium high-tech industries, outbound FDI turns out to induce an increase in trade, when an OLS analysis is only conducted with respect to these two industrial groups. However, the above results may have been obtained simply because outbound FDI and trade may be positively correlated with each other by the third unspecified factor. In controlling such an endogeneity problem by using an instrumental variable technique, it turns out that outbound FDI leads to a decrease in trade for low-tech and medium low-tech industries

The impact of outbound FDI and trade on employment

According to the regression results on the employment increase effects for individual establishments, (with both establishment and industry level data used as explanatory variables), an increase in the growth rate of outbound FDI in a certain industry leads to an average increase in employment growth of establishments in that industry. However, the higher the share of outward FDI into China in a certain industry, the lower the average employment growth of establishments in that industry. All these patterns are more pronounced among larger firms than SMEs.

The impacts of outbound FDI and trade on TFP

According to the regression results on the TFP growth effects for individual establishments (with both establishment and industry level data used as explanatory variables), An increase in the growth rate of outbound FDI in certain industries leads to an average increase in the TFP growth of establishments in that industry. However, the higher the share of outward FDI into China in a certain industry is, the lower is the average TFP growth of establishments in that industry. In contrast, the greater share of outward FDI into US has the opposite effect. All these patterns are more pronounced among large firms than SMEs. The higher the share of trade with Japan in certain industries, the average TFP growth is lower in establishments in that industry.

The overall effects of outward FDI on domestic activities in Korea

While existing literature is split in the predicted direction of any effects, we find that in general, outward FDI tends to affect employment and TFP positively whereas outward FDI into China exerts a negative effect. On the other hand, in industries trading heavily with Japan, employment and TFP growth of individual establishments tend to be suppressed.

In my view, the true value of a good position paper depends on the quantity and quality of follow-up papers. Internationalization of production in East Asia is still developing, and continued studies would keep on getting benefits from Dr. Kim's pioneering paper.

CHAPTER 1-2

International R&D Spillovers: Trade, FDI, and Information Technology as Spillover Channels

by
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Abstract

Technology has been a major driving force of economic growth. With the rapid pace of economic integration in recent years, the productivity of a country depends not only on domestic R&D, but also on foreign R&D through technology diffusion across countries. The advancement of information technology (IT) has made the international transmission of knowledge faster and more efficient in recent years, providing an important channel for international R&D spillovers. This paper investigates three channels of international R&D spillovers: trade, FDI and information technology. Applying panel cointegration and dynamic OLS analysis to the data for 21 OECD countries plus Israel during the period from 1981 to 1998, we find that bilateral trade remains as an important conduit for international R&D spillovers. Although bilateral FDI is found to be positively related to international R&D spillovers, their impact on productivity growth is relatively small at the national level. We also find that the development of information technology has played a more important role in international R&D spillovers and productivity growth in recent years.

Keywords: International R&D spillovers, FDI, Information technology, Panel cointegration
JEL: F42, F43

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I. Introduction

Technology has been a major driving force for output growth and economic integration in the global economy. Neoclassical economic theory has focused on factor accumulation as the source of output expansion. Technological progress was often treated as exogenous progress. Recent research has provided a new way of dealing with technological change for economic growth (Romer 1990, Grossman and Helpman 1991, Aghion and Howitt 1992, Howitt 2000). The endogenous growth model suggests that innovation relies on knowledge resulting from cumulative R&D experience, and it contributes to the increase in the stock of knowledge as well. R&D activities drive economic growth through the creation of new products according to the horizontally differentiated input model or the improvement in the quality of existing ones according to the vertically differentiated input model.

The non-rival characteristics of technology distinguishes it from other factor inputs in that the marginal costs of applying technology for additional firms are negligible. Technological investments not only benefit the inventors but they also contribute to the knowledge base which is publicly available to them. These externalities are called technology spillovers (Romer, 1990). With the rapid pace of economic integration in recent years, an increase in productivity in a country not only relies on domestic R&D, but also on foreign R&D through the interaction with foreign economies. Recent work has shown that the major sources of productivity growth resulting from technological change in OECD countries are not domestic; instead, they come from abroad (Keller, 2001). International R&D spillovers facilitate domestic inventive activities and hence promote economic growth.

Since technology is a driving force for economic growth, a question of particular interest is: Through which channels does technology diffuse across countries? Although it is widely accepted that trade is an important conduit for technology transfer, it is still not clear whether or not it is the most effective one. With the rapid growth of foreign direct investment (FDI) after the 1980s, there has been an increasing amount of research that considers FDI as an engine for economic growth. Although the theoretical models for FDI and technology transfer are well developed (e.g., Glass and Saggi, 1998 and 1999), empirical studies provided mixed results. Another potential channel for international R&D spillovers is information technology (IT). It is wellknown that information technology has improved the efficiency of production and reduced the cost of communication and monitoring among distant firms (Jeon *et al.* 2005). However, this channel has barely been explored in the literature.

This paper contributes to the literature by investigating three important channels of international R&D spillovers: trade, FDI and information technology. First, we employ FDI stock data to measure the R&D spillover effect based on recently available bilateral FDI statistics published by the OECD. Both inward and outward FDI are considered as R&D spillover channels. Second, the advancement of information technology has made the international transmission of knowledge faster and more efficient in recent years. This paper is one of the first that attempts to investigate IT as a R&D spillover channel. Third, in order to avoid spurious regressions, panel cointegration and dynamic OLS analyses are conducted to test the long-run relationship between total factor productivity and R&D panel data series.

The main findings of this paper are as follows. International trade remains an important channel for R&D spillovers. Although inward FDI plays an important role in the transfer of technology from the source country to the host country, its impact on technology transfer turns out to be much smaller. Outward FDI has a positive impact on international R&D spillovers, but it is only marginally significant. Using teledensity (number of telephone lines per 100 residents) as a proxy for information technology (IT), we found that R&D spillovers through the development of IT have increased more dramatically in the 1990s than in the 1980s.

Understanding the effective channels of technology diffusion across countries is essential to firms and policy makers in the face of increasing globalization for the following reasons. For innovation leader countries, technology diffusion may reduce the incentive for investing in R&D. In the context of long-run economic growth, it is necessary to detect how knowledge is transmitted in order to find ways to protect the interests of innovators. On the other hand, if technology does diffuse from one country to another, it provides an important policy implication for innovation follower countries to integrate with the rest of world. As we know, today's international competitiveness becomes more and more dependent on technology and innovations. Greater openness to trade and FDI, and the advancement in international communication technology will provide a country with a favorable environment for active R&D activities.

This paper is organized in the following way. Section 2 reviews the literature. Section 3 describes the empirical model used to test international R&D spillovers. The data are presented in Section 4. Section 5 reports the empirical findings. Section 6 provides concluding remarks.

II. Literature Review

The endogenous growth model treats commercially oriented innovation efforts as a major engine of technological progress. It stresses that technology diffusion may occur through employing advanced intermediate products that have been invented abroad. As long as the intermediate good costs less than its opportunity costs, there is a benefit from having access to foreign intermediate goods. Previous studies of international R&D spillovers have provided useful information on the relationship between R&D and productivity in a reduced-form framework (Keller 2001).

Coe and Helpman (1995) (henceforth, CH) are the first to examine the R&D spillovers among OECD countries through international trade. Using cumulative R&D expenditures as a proxy for stock of knowledge, they study the effects of the domestic R&D as well as the R&D stocks of a country's trade partners on domestic total factor productivity (TFP). They find that both domestic and foreign R&D capital stocks have significant effects on a country's total factor productivity, and that the greater the effect of the foreign R&D stocks, the more open the economy. Moreover, domestic R&D may be more important in larger countries than in smaller countries. Their paper inspired a number of studies on international R&D spillovers. Coe, Helpman and Hoffmaister (1997) extend their sample and estimate the R&D spillovers from industrialized countries to 77 developing countries. It indicates that a one percent increase in the foreign R&D stocks of industrialized countries raises output of the developing countries by 0.06 percent. Xu and Wang (1999) decompose total imports into capital goods imports and non-capital goods imports and find that R&D spillovers embodied in trade flows are mainly carried by capital goods. They also suggest that the majority of the R&D spillovers in the OECD countries are transmitted through other unknown channels. Lumenga-Neso *et al.* (2001) construct an alternative variable to capture the effect of the previous rounds of imports and confirm that the trade contributes to the technology spillover.

The above studies mainly consider international trade to be the sole channel of R&D spillovers. They are likely to have underestimated the relative magnitude of international spillover effects that pass through other channels. Keller (1998) challenges CH's results by generating simulated and randomly selected trade partners and re-estimating the international R&D spillover effects. These "counterfactual estimation" give rise to larger positive international R&D spillovers and explain more of the variation in productivity across countries. It implies that the R&D spillovers might occur through channels other than international trade.

Over the past two decades, direct investment by multinational firms has grown significantly. The sales by subsidiaries of multinational firms now exceed worldwide exports of goods and services. (UNCTAD 2004) FDI has been a dominant channel for transferring goods and services internationally (Saggi 2002). Since a large share of global R&D is undertaken by multinational corporations (MNCs), FDI by MNCs is considered to be a potential vehicle to access advanced technologies available in the global market place. The knowledge aspect of multinationals is a key feature of Dunning's "OLI" framework, in which a necessary condition for a firm to become a multinational is that it possesses "ownership advantage." Local firms may benefit from the diffusion of new technology through imitation or reverse engineering (Wang & Blomström 1992, Huizinga 1995), labor turnover (Gerschenberg 1987, Song 2000), or the backward and forward production linkages. (Markusen and Venables 1999, Pack and Saggi 2001). Therefore, it is reasonable to believe that FDI creates externalities in the form of technology spillovers.

There is a large number of studies that concentrate on the impact of inward FDI on the productivity growth of a host country. Xu (2000) studies the impact of US outward FDI on 40 host countries and finds that US multinationals contribute to the productivity growth in developed countries but not in developing countries. Baldwin *et al.* (1999) find mixed results in their industry-level study. Other studies using firm-level data yield conflicting results, depending on the country considered (Aitken and Harrison 1999, Kinoshita 2000, Girma and Wakelin 2001). Although it is widely accepted that FDI should play a substantial role in the international technology diffusion, it has rarely been examined econometrically as a specific way of technology transfer in a multi-country framework.

Lichtenberg and van Pottelsberghe (1996) (thereafter, LP) extend CH's analysis by incorporating both inward and outward FDI flows in addition to the trade flow. Due to limited bilateral FDI data, they test only 13 out of 22 countries covered in CH's study. They find that the elasticities of foreign R&D capital stocks with respect to outward FDI flows and imports are both significant. Surprisingly, inward FDI does not contribute to the technology transfer. Hejazi and Safarian (1999) measure international spillovers through trade and FDI outflow from six of the G7 countries to all OECD countries and Israel. They find that the R&D spillovers through FDI are greater than that through trade. The importance of trade as a spillover channel is reduced and the overall spillovers increase significantly with the inclusion of FDI. However, the small number of countries and limited FDI data makes it difficult to compare the results from previous research. A counter-intuitive result emerges when they interact openness to FDI with FDI weighted foreign R&D stock. The result shows that the impact of FDI as a channel for technology diffusion becomes insignificant. In other words, they found that technology transfer through FDI has no correlation to a country's overall openness to FDI.

In the emerging global information economy, knowledge can be transmitted more efficiently over computer networks. However, non-codified or tacit knowledge can only be transferred through "person-to-person" communication. The cost for a person to travel internationally is quite high. By using teleconferencing or the images transmitted through satellites, information technology reduces communication costs and facilitates the distribution of non-codified knowledge all over the world. New information technology stimulates cross-border learning. Keller (2000) argues that communication patterns are crucial for international technology diffusion among OECD countries. Maddan and Savage (2000) use imports of telecommunication and IT equipment to examine international R&D spillover and find a positive relationship between the two. Although these studies provide some evidence for the importance of international communications in the cross-country technology diffusion and productivity improvement, there is still more work that needs to be done in this area.

III. The Empirical Model

The endogenous growth model suggests that the growth in TFP is driven by cumulative domestic R&D stock, $DRD_{i,t}$. CH expanded the model to include foreign R&D stock, represented by $FRD_{j,t}$ and $i \neq j$. They examined how foreign R&D affects a country's productivity growth through the channel of international trade. The model estimated can be written as follows.

$$\log TFP_{i,t} = \alpha_i + \beta_1 \log DRD_{i,t} + \beta_2 [open_{i,t} \times \log(\sum_{j \neq i} \frac{m_{ij,t}}{m_{i,t}} FRD_{j,t})] + \varepsilon_{i,t} \quad (1)$$

where subscripts i and j represent countries and t indexes time periods. TFP is total factor productivity. The first independent variable in equation (1) is a country-specific constant term. The second term measures the impact of domestic R&D stock on TFP while the third term captures the impact of foreign R&D on country i's TFP. The foreign R&D stock is the weighted average of R&D stock from a country's trading partners. The weights are calculated using the ratio of country i's imports from country j, $m_{ij,t}$, relative to the total imports from its trading partners, $m_{i,t}$. In order to take into account the fact that the more open the host country's economy is, the stronger the spillover effect from abroad, CH also multiplied the foreign R&D stock by an openness measure, $open_{i,t}$, which is defined as the fraction of imports in GDP. Thus, the overall impact of foreign R&D stock on a country's TFP is reflected by $\beta_2 * open_{i,t}$ in equation (1). $\beta_2 * open_{i,t}$ measures the elasticity of TFP with respect to foreign R&D stock.

Subject to a Cobb-Douglas production function, the log of TFP is usually defined as

$$\log TFP_{i,t} = \log Y_{i,t} - \beta \log K_{i,t} - (1-\beta) \log L_{i,t} \quad (2)$$

where i represents the i-th country and t is time. Y is the total output or value added, K is capital stock, and L is total employment. The parameter β represents the share of capital income in country i.

Following CH's framework, we extend the empirical model to incorporate FDI and IT as additional channels of international R&D spillover. In addition to test the inward FDI, we take into account outward FDI as well. By establishing production or research facilities in technological leader countries, foreign companies are likely to access the most recent technology. Therefore, outward FDI is a good indicator of technology sourcing. A modified TFP equation is specified as follow.

$$\log TFP_{i,t} = \alpha_i + \beta_1 \log DRD_{i,t} + \beta_2 (G5 \cdot \log DRD_{i,t}) + \beta_3 [M_{trade_{i,t}} \times \log(\sum_{j \neq i} \frac{m_{ij,t}}{m_{i,t}} FRD_{j,t})]$$
$$+ \beta_4 [M_{FDIin_{i,t}} \times \log(\sum_{j \neq i} \frac{FDIin_{ij,t}}{FDIin_{i,t}} FRD_{j,t})] + \beta_5 [M_{FDIout_{i,t}} \times \log(\sum_{j \neq i} \frac{FDIout_{ij,t}}{FDIout_{i,t}} FRD_{j,t})]$$
$$+ \beta_6 [M_{IT_{i,t}} \times \log(\sum_{j \neq i} \frac{IT_{i,t} + IT_{j,t}}{WIT_t} FRD_{j,t})] + \varepsilon_{i,t} \qquad (3)$$

Four weight schemes are proposed to construct different foreign R&D capital stocks in this paper. The first one, also the one used by CH and other studies, is the import weighted foreign R&D, $\log \sum_{j \neq i} \frac{m_{ij,t}}{m_{i,t}} FRD_{j,t}$. The second one is the inward FDI stock weighted foreign R&D, denoted by $\log \sum_{j \neq i} \frac{FDIin_{ij,t}}{FDIin_{i,t}} FRD_{j,t}$, where $FDIin_{ij,t}$ is the inward FDI stock of country *i* from country *j* and $FDIin_{i,t}$ is the total inward FDI stock of country *i* from the rest of countries. Similarly, the foreign R&D embodied in outward FDI stock is computed as $\log \sum_{j \neq i} \frac{FDIout_{ij,t}}{FDIout_{i,t}} FRD_{j,t}$, where $FDIout_{ij,t}$ is the outward FDI stock of country *i* to country *j* and $FDIout_{i,t}$ is the total outward FDI stock of country *i* to the rest of countries. FDI stocks instead of FDI flows (LP 1996) are used here because R&D spillovers through FDI are cumulative and FDI flow data fluctuate over time (sometimes being negative), which makes the estimation biased. The last foreign R&D stock is calculated using teledensity (number of telephone lines per 100 residents) as weight, indicated by IT [1]. It is derived through $\log \sum_{j \neq i} \frac{IT_{i,t} + IT_{j,t}}{WIT_t} FRD_{j,t}$, where $WIT_t = \sum_{j \neq i} (IT_{i,t} + IT_{j,t})$ for any country *i*.

The degree of openness in an economy plays a significant role in making technology transfer possible. More open economies extract larger productivity benefits from foreign R&D than less open economies. Correspondingly, four openness measures are introduced. The openness to trade, M_{trade}, is defined as a country's total imports divided by its GDP. A country's openness to inward or outward FDI is derived as the ratio of a country's inward

[1] Ideally, the bilateral telephone traffic should be used to calculate the weights for IT. However, to the best of knowledge, the multicountry bilateral telephone traffic data are only available after the mid 1990s. Therefore, teledensity is used as an imperfect proxy for international communications. In other words, it is believed that the bilateral telephone traffic should be proportional to the combined teledensity of two countries.

or outward FDI flows to its gross capital formation. They are denoted as M_{FDIin} and M_{FDIout}, respectively. The openness to IT, M_{IT}, is calculated by dividing a country's total outgoing telephone traffic to its GDP (minutes/$100).

G5 is a dummy variable for the five leading research economies: the United States, Untied Kingdom, Japan, Germany and France. As shown in Table 1, domestic R&D stocks in these five countries are much larger than the other 17 countries. By interacting the G5 dummy with the domestic R&D stocks, we can test if domestic R&D stocks play a different role in bigger economies compared with smaller economies.

IV. Data

This paper employs panel data for 21 OECD countries plus Israel for the 1981-1998 period. This time period is selected because the bilateral FDI data are only available from 1980 to 2000. It doesn't go beyond 1998 as the European countries in the sample converted their currencies to the euro in 1999 and it leads to a big jump in the valuation of FDI in US dollars. Definitions of the variables used in this study and data sources are described in Appendix A. Table 2 reports the summary statistics of all independent variables. The mean of different foreign R&D stocks becomes quite similar. However, the standard deviations of FDI weighted foreign R&D stocks are larger than import and IT weighted R&D stocks. Plots of each variable for the period 1981-1998 are provided in Appendix B. It can be seen that almost all the series exhibit a clear trend through time.

V. Empirical Findings

5.1.Panel Cointegration

Coe and Helpman (1995), Keller (1998), Lichtenberg and van Pottelsberghe (1998) and Hejazi and Safarian (1999) derive their estimates using OLS regressions. Estimating the relationship among nonstationary variables using standard OLS techniques may lead to spurious inference. CH emphasize that they try to estimate long-run, cointegrated relationship between TFP and R&D. However, none of their equations are cointegrated based on Levin and Lin (1993). Considerable progress has been made in understanding panel unit root and panel cointegration since then. Combining time series information with that from cross-section data, the panel unit root or panel cointegration test can be more precise, especially when the time series dimension of the data is not very long. Several tests have been proposed to identify unit root in panel data. They can be classified on the basis of whether or not there are restrictions on the autoregressive process across cross-sections. Considering an AR (1) process for panel data:

$$y_{i,t} = \rho_i y_{i,t-1} + \delta_i X_{i,t} + \varepsilon_{i,t} \tag{4}$$

where y represents the dependent variable. X is a vector of independent variables. ρ and δ are coefficients. ε is the disturbance term. The tests proposed by Hadri (1999), Breitung (2000) and Levin, Lin and Chu (2002) assume that there is a common unit root process across cross-sections so that $\rho_i = \rho$ for all *i*. The tests proposed by Maddala and

Wu (1999), Choi (2001) and Im, Pesaran, and Shin (2003) allow for individual unit root processes so that ρ_i may vary freely across cross-sections. The Levin, Lin and Chu (2002) (LLC), Im, Pesaran, and Shin (2003) (IPS) and Maddala and Wu (1999) (MW) test procedures are applied to all series to test for nonstationarity in this study.[2,3]

The results of the panel unit root test are reported in Table 3. All the variables are nonstationary according to the IPS test. The MW test shows that outward FDI weighted foreign R&D stock has evidence of near-stationarity. The LLC test rejects the null hypothesis that the series of inward FDI weighted R&D stock have a unit root. In general, the panel unit root tests confirm that all the panel data used in this study follow integrated processes, more specifically *I(1)*.

Since TFP and R&D series are nonstationary, a cointegration relationship should be established to make sure the estimations are not spurious. Engel and Granger (1987) suggest an error correction model (ECM) to test for cointegration in time series data.[4] The relevant *t*-ratios of the error correction term are shown in Table 4. The LLC, IPS and MW test statistics for all regression residuals are also reported at the bottom of Table 4.

5.2. Empirical Results

Table 4 reports the key estimation results. All the equations include country-specific effects, which are not reported here to save space. The error correction terms are all

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[2] The IPS test is derived from ADF (p_i) equation:

$$\Delta y_{it} = \mu_i + \gamma t + \phi_i y_{i,t-1} + \sum_{j=1}^{p_i} \rho_{ij} \Delta y_{i,t-j} + \varepsilon_{it}$$

where y is the variable under examination and t is a deterministic time trend. The average ADF test statistic for ρ with lags p , $\bar{t}_{NT}$, is calculated as the mean of country-specific ADF statistics, t_{iT} :

$$\bar{t}_{NT}(p,\rho) = \frac{1}{N}\left(\sum_{i=1}^{N} t_{iT}(p_i,\rho_i)\right)$$

The corresponding standardized t-bar statistic is given by

$$\psi_{\bar{t}} = \frac{\sqrt{N}\{\bar{t}_{NT}(p,\rho) - \frac{1}{N}\sum_{i=1}^{N} E[t_{iT}(p_i,0)]\}}{\sqrt{\frac{1}{N}\sum_{i=1}^{N} V[t_{iT}(p_i,0)]}} \rightarrow N(0,1)$$

The values for $E[t_{iT}(p_i,0)]$ and $V[t_{iT}(p_i,0)]$ for different model specifications and lag orders are reported in IPS (2003).

[3] MW test statistics are derived from the p-values of individual unit root tests. Assume π_i is the p-value from any individual unit root test for cross-section i . The MW test demonstrates that $-2\sum_{i=1}^{N} log(\pi_i) \rightarrow \chi^2_{2N}$.

[4] ECMs include lagged residuals from cointegrating equations in the first difference of each equation and test whether the coefficient of the error correction term is negative and significantly different from zero.

significantly negative and suggest that the equations are cointegrated. Both the LLC and MW tests confirm the existence of long-run cointegrating relationships between TFP and R&D stocks, although only equation (2) is cointegrated based on the IPS test.

Column (1) of Table 4 shows the regression results that only consider international trade as the channel for technology diffusion. The estimated elasticity of TFP with respect to the domestic R&D is 0.075, which is consistent with the 0.06 ~ 0.1 range typically found in the literature. The elasticity of domestic R&D stock in G5 countries is significantly higher than other smaller economies. The impact of foreign R&D embodied in trade flows on a country's TFP is positive and significant (0.0997), which is close to LP's result when the levels of R&D stocks rather than the indices are used to avoid the "indexation bias"[5].

The foreign R&D stock weighted by inward FDI stock, outward FDI stock and teledensity are tested separately in columns (2) – (4) in Table 4. All the coefficients on domestic and foreign R&D are positive and significant. The results suggest that both inward and outward FDI yield substantial technology transfers, which is contrary to the findings of LP (1996). The hypotheses of the technology spillover from inward FDI and the technology sourcing from outward FDI are both supported. Since the foreign R&D stocks are interacted with openness measures, it indicates that foreign R&D may have a stronger effect on domestic productivity the more open an economy is. This result is inconsistent with Hejazi and Safarian's argument that R&D is transmitted through FDI and trade, regardless of how open an economy is to trade or FDI. Column (4) shows that IT also contributes to a country's TFP as a potential R&D spillover channel.

All the possible channels of international R&D spillovers are included in regression (5). As shown, the elasticity of TFP with respect to domestic R&D stock decreases dramatically to 0.037. It implies that this elasticity might be overestimated if different channels of technology diffusion are omitted in the regression. The domestic R&D stocks in the G5 countries seem to have a substantially greater impact on TFP growth. The coefficient estimates on import weighted foreign R&D, inward FDI weighted foreign R&D, outward FDI weighted foreign R&D and IT weighted foreign R&D still remain positive and significant, although the magnitudes are smaller. More specifically, when incorporating all four R&D spillover channels together, the spillover effect embodied in imports is significantly weakened. Its impact declines by more than 50%. The R^2 is higher than in the other four regressions.

Kao and Chiang (2000) demonstrated that the OLS estimator in a cointegrated panel is asymptotically normal but with a nonzero mean and proposed to use fully-modified (FMOLS) or dynamic OLS (DOLS) estimators in panel data estimation. We use DOLS method to re-estimate all the equations since it is more promising than OLS or FMOLS in estimating the cointegrated panel regressions (Kao, Chiang and Chen 1999). The DOLS estimator is obtained by including leads and lags of the differenced regressors in the equation:

$$y_{i,t} = \alpha_i + X_{i,t}\beta + \sum_{j=-q_1}^{q_2} \gamma_{ij} \Delta X_{i,t+j} + v_{i,t} \tag{5}$$

Table 5 reports the results of the DOLS estimation. One lead and one lag of differenced

[5] LP suggest that CH's equation might be misspecified due to an "indexation bias". Since TFP is calculated in national currencies and both domestic and foreign R&D capital stocks are in constant 1985 US dollar with PPP adjusted, CH transform all variables into index numbers (1985=1). This procedure would ignore the time varying constant and yield a biased outcome.

independent variables are included in the regression.[6] The results of the DOLS estimations are quite consistent with those of the OLS estimations. The elasticities of domestic R&D stock are all significantly positive. However, the coefficient on the domestic R&D stock with the G5 dummy becomes insignificant for all the cases. When we include all foreign R&D with different weighting schemes together, the foreign R&D stock available from outward FDI does not affect the domestic TFP significantly any more. The R^2 improves for all the equations that reinforce the robustness of the results.

The estimated elasticities of TFP with respect to the foreign R&D capital stocks can be derived by multiplying the different openness measures with the estimated coefficients of the foreign R&D stock reported in column 5 of Table 5. As shown in Table 6, the elasticity of TFP with respect to trade weighted foreign R&D has been relatively stable for all the counties over the sample period and the average is about 1.7~1.8%. Although the elasticities for inward and outward FDI weighted foreign R&D are less than 0.5% until 1998, they have been increasing very rapidly during the past twenty years. Most importantly, the elasticity for IT weighted foreign R&D increased dramatically from 0.7% in 1981 to 2% in 1998.

5.3. Additional Estimation Results: Bilateral Elasticities and G5 Cases

To compare the impacts of domestic R&D and foreign R&D on TFP, we report the estimated elasticities of TFP with respect to domestic and foreign R&D stock in 1981 and 1998 in Table 7. The impact of foreign R&D increased from 1981 to 1998 in all the countries except Japan. Compared with the elasticity of averaged domestic R&D, the foreign R&D plays a more important role in smaller countries, especially in Belgium, Ireland and Switzerland. The productivity growth in G5 countries depends more on domestic R&D.

Based on the DOLS estimation, we can calculate the bilateral TFP elasticities with respect to domestic R&D stocks in G5 countries. For example, a one percent increase of R&D stock in country *i* (DRD_i) will increase country *j*'s TFP through trade flows by $m^j \beta_3 \frac{m_i^j DRD_i}{\sum_{k \neq j} m_k^j DRD_k}$ percent[7], where m^j is country *j*'s import share to GDP and m_i^j is the fraction of *j*'s imports coming from country *i*. We report the bilateral elasticities for the R&D spillovers through trade in 1998 in Table 8. The last row of the table gives the average elasticities. For instance, it shows that a one percent increase in R&D stock in the United States increases the total factor productivity in Japan by 0.005 percent through trade flows and raises the TFP of its trade partners by an average of 0.01 percent. On the other hand, a one percent R&D stock increase in Japan raises the TFP in U.S. by 0.003 percent and on average improves the TFP of its trade partners by 0.001 percent. Table 9 through 11 display the bilateral elasticities of R&D spillovers through inward FDI, outward FDI and IT channels, respectively. In general, the R&D spillovers from the

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[6] The selection of the number of lead and lag terms is based on the statistical significance of coefficients on the lead and lag terms and diagnostic tests on disturbance terms. The signs and relative magnitudes of the estimated coefficients vary little when the number of leads and lags are changed.

[7] $$\frac{\partial \log TFP_j}{\partial \log DRD_i} = \frac{\partial \log TFP_j}{\partial \log FRD_j} \cdot \frac{\partial \log FRD_j}{\partial \log DRD_i} = m^j \beta_3 \frac{\partial FRD_j}{\partial DRD_i} \cdot \frac{DRD_i}{FRD_j} = m^j \beta_3 \frac{m_i^j DRD_i}{\sum_{k \neq j} m_k^j DRD_k}$$

United States are the largest through all the channels, while Germany is a major source of technology spillover through trade and inward FDI channel. The United Kingdom is the second largest country from which other countries seek for technology sourcing. Spillover from Japan is mainly through the IT channel.

Since the United States and Japan are the top two countries in R&D investment, we are interested in examining how the changes in their domestic R&D would affect the TFP in other countries through technology spillovers over the years. Figure 1 shows the average impact of the US domestic R&D on the TFP of the rest of the countries. Trade remains a major channel for technology spillover throughout the whole sample period and its impact is relatively stable. The R&D spillover through the IT channel is shown to have been increasing rapidly in recent years. Similar patterns are observed for R&D spillovers from Japan in Figure 2. However, the R&D spillover through IT from Japan increased about two times more than that from the United states. This may be partly due to the deregulations of the IT industry in Japan since the 1980s.[8] The R&D spillovers through inward and outward FDI from the two countries are relatively small, while they increased significantly from the United States during the 1990s.

VI. Conclusion

This study investigates how international R&D spillovers transmit through different channels and enhance TFP across national borders. It is found that international trade remains an important conduit for technology transfer. Although the importance of FDI as a channel for international R&D spillovers has been increasing, its impact seems to be still limited. IT is found to become a rapidly growing channel of technology diffusion in the 1990s. On average, we find that the elasticity of TFP with respect to bilateral trade is around two percent, less than one percent with respect to FDI, and between 0.7-2 percent with respect to IT. In other words, further liberalization of trade and development of IT should be the top priority for countries who want to benefit from the foreign R&D spillovers, and thus enhancing its total factor productivity.

We have to read the results with some caution due to the limitations of the data. First, the bilateral FDI data, as described in Appendix A, is of limited quality when compared with bilateral trade. Second, our communication weighted foreign R&D is based on teledensity rather than actual bilateral telephone traffic due to the limited data availability. Nonetheless, this paper is one of the first few that attempt to measure the impact of multiple channels for international R&D spillovers – trade, inward FDI and outward FDI, and information technology channels. It sheds some insights regarding how knowledge is spread across countries in recent years.

This paper constitutes only the first step in tackling a rather complicated issue. Although we find that international trade remains a major channel for technology transfer in OECD countries, we cannot make the same conclusion for technology diffusion between developed and developing countries. Secondly, due to the nature of FDI tending to concentrate in certain countries and certain industries, it would be interesting to explore and compare the differing impact of different R&D spillover channels at the industry level.

[8] The "First Info-Communication Reform" took place in 1985 when the Telecommunication Business Law privatized Nippon Telegraph and Telecommunication Corporation and introduced competition to the IT industry in Japan. On January 23, 1996, "Promotion of Deregulations toward the Second Info-Communication Reform" was announced to stimulate the info-communications market.

All these suggest a long agenda for future research.

Table 1. Domestic R&D Stocks (in billions of 1985 U.S. Dollars)

	Domestic R&D	
	1981	1998
United States	718.4	1802.0
United Kingdom	130.8	264.9
France	85.7	207.1
Germany	114.8	311.0
Japan	131.4	485.2
Australia	3.9	34.6
Austria	4.0	15.9
Belgium	10.7	30.1
Canada	17.2	69.5
Denmark	3.3	13.8
Finland	2.7	15.8
Greece	0.2	2.9
Ireland	0.6	4.4
Israel	0.9	1.7
Italy	27.6	117.7
Netherlands	23.6	39.2
New Zealand	0.7	2.8
Norway	3.0	11.9
Portugal	0.4	2.5
Spain	4.0	42.1
Sweden	11.9	65.6
Switzerland	27.0	48.3

Table 2. Summary Statistics of Independent Variables

Variable	Description	Mean	Stand. Dev.	Max.	Min
logDRD	Log of domestic R&D stock	2.735	2.037	7.500	-1.858
limpRD	Log of import weighted foreign R&D stock	5.411	0.577	7.384	4.040
lFDInRD	Log of inward FDI weighted foreign R&D stock	5.380	1.136	7.272	1.951
lFDIoRD	Log of outward FDI weighted foreign R&D stock	4.845	1.660	7.115	-0.121
lITRD	Log of teledensity weighted foreign R&D stock	4.571	0.339	5.175	3.373
M_{trade}×limpRD	Openness to trade with one year lag times limpRD	1.705	0.767	4.093	0.391
M_{FDIn}×lFDInRD	Openness to inward FDI with one year lag times lFDInRD	0.299	0.321	2.188	0
M_{FDIo}×lFDIoRD	Openness to outward FDI with one year lag times lFDIoRD	0.324	0.406	2.339	-0.001
M_{IT}×lITRD	Openness to international technology with one year lag times lITRD	1.244	0.763	4.494	0.035

Table 3. Panel unit root tests (annual data 1981-1998, 396 observations)

	LLC		IPS		MW	
logTFP	-0.18770	(0.4256)	1.43249	(0.9240)	30.1765	(0.9442)
logDRD	0.87952	(0.8104)	5.41983	(1.0000)	7.80948	(1.0000)
M_{trade}×limpRD	3.57638	(0.9998)	4.13581	(1.0000)	13.3994	(1.0000)
M_{FDIn}×lFDInRD	-2.54843	(0.0054)**	-0.31119	(0.3778)	57.4562	(0.0839)
M_{FDIo}×lFDIoRD	-1.27098	(0.1019)	0.60688	(0.7280)	64.2301	(0.0152)*
M_{IT}×lITRD	4.50806	(1.0000)	4.37134	(1.0000)	24.2018	(0.9934)

Note: Numbers in parenthesis are p-values. * Significant at the 5% level, ** Significant at the 1% level.

Table 4. Results of OLS Estimation of International R&D Spillovers

	Sample Period (1981-1998)				
	(1)	(2)	(3)	(4)	(5)
logDRD	0.0752***	0.0725***	0.0790***	0.0450***	0.0371***
	(12.89)	(11.81)	(13.78)	(6.18)	(5.26)
G5logDRD	0.0464***	0.0391**	0.0246	0.0461***	0.0446***
	(2.67)	(2.25)	(1.40)	(2.77)	(2.78)
M_{trade}*limpRD	0.0997***				0.0476***
	(6.87)				(3.26)
M_{FDIn}*lFDInRD		0.0790***			0.0294**
		(6.50)			(2.27)
M_{FDIo}*lFDIoutRD			0.0633***		0.0321***
			(6.29)		(3.07)
M_{IT}*lITRD				0.0656***	0.0451***
				(9.10)	(5.81)
No. of observations	396	396	396	396	396
R-square	0.649	0.645	0.642	0.677	0.710
Adjusted R-square	0.626	0.622	0.619	0.656	0.688
t-statistic on the error correction term	-3.27	-3.87	-3.48	-4.36	-3.49
LLC test	-6.41	-6.89	-6.55	-6.69	-6.84
IPS test	-1.80	-2.51	-1.85	-0.82	0.19
MW test	92.61	112.49	115.63	109.65	116.32

Note: All regressions include unreported country-specific effects. Numbers in parenthesis are *t*-statistics. ***, **, and * represent the statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 5. Dynamic OLS Estimation

	(1)	(2)	(3)	(4)	(5)
logDRD	0.0832***	0.0760***	0.0859***	0.0500***	0.0382***
	(10.42)	(9.26)	(10.65)	(5.35)	(4.24)
G5logDRD	0.0031	0.0031	-0.0124	0.0159	0.0156
	(0.13)	(0.13)	(-0.52)	(0.71)	(0.74)
M_{trade} *limpRD	0.1009***				0.0530***
	(4.94)				(2.71)
M_{FDIn} *lFDInRD		0.1095***			0.0445**
		(6.27)			(2.34)
M_{FDIo} *lFDIoutRD			0.0700***		0.0256
			(4.29)		(1.56)
M_{IT} *lITRD				0.0802***	0.0511***
				(8.99)	(5.24)
No. of observations	330	330	330	330	330
R-square	0.710	0.721	0.700	0.737	0.785
Adjusted R-square	0.677	0.690	0.666	0.708	0.750

Note: All regressions include unreported country-specific effects. Numbers in parenthesis are *t*-statistics. ***, **, and * represent the statistical significance at the 1%, 5%, and 10% levels, respectively. The DOLS regressions include one lead and one lag of the differenced regressors.

Table 6. Elasticities of TFP with respect to Foreign R&D stocks through trade, FDI and IT channels in 1981 and 1998

	Import		Inward FDI		Outward FDI		IT	
	1981	1998	1981	1998	1981	1998	1981	1998
Australia	0.0093	0.0112	0.0018	0.0035	0.0003	0.0017	0.0020	0.0127
Austria	0.0202	0.0230	0.0005	0.0023	0.0001	0.0010	0.0127	0.0265
Belgium	0.0323	0.0372	0.0018	0.0065	0.0000	0.0013	0.0120	0.0279
Canada	0.0140	0.0201	0.0042	0.0039	0.0017	0.0045	0.0127	0.0348
Denmark	0.0177	0.0175	0.0004	0.0035	0.0003	0.0032	0.0099	0.0156
Finland	0.0176	0.0164	0.0001	0.0042	0.0002	0.0060	0.0068	0.0161
France	0.0121	0.0119	0.0009	0.0041	0.0005	0.0036	0.0053	0.0112
Germany	0.0139	0.0141	0.0001	0.0013	0.0005	0.0024	0.0060	0.0116
Greece	0.0147	0.0143	0.0024	0.0018	-	-	0.0094	0.0252
Ireland	0.0319	0.0356	0.0023	0.0071	0.0000	0.0015	0.0041	0.0443
Israel	0.0314	0.0220	0.0005	0.0032	0.0000	0.0011	0.0055	0.0232
Italy	0.0130	0.0118	0.0002	0.0007	0.0002	0.0012	0.0036	0.0096
Japan	0.0076	0.0051	0.0000	0.0001	0.0002	0.0005	0.0004	0.0021
Netherlands	0.0279	0.0292	0.0025	0.0060	0.0037	0.0077	0.0110	0.0208
New Zealand	0.0162	0.0150	0.0017	0.0082	0.0006	0.0000	0.0035	0.0313
Norway	0.0197	0.0177	0.0001	0.0044	0.0004	0.0033	0.0077	0.0158
Portugal	0.0191	0.0202	0.0007	0.0041	0.0000	0.0020	0.0042	0.0189
Spain	0.0091	0.0136	0.0012	0.0023	0.0001	0.0026	0.0030	0.0142
Sweden	0.0164	0.0187	0.0004	0.0123	0.0006	0.0083	0.0085	0.0218
Switzerland	0.0202	0.0187	0.0009	0.0063	0.0004	0.0088	0.0224	0.0390
United Kingdom	0.0132	0.0151	0.0048	0.0073	0.0030	0.0070	0.0070	0.0209
United States	0.0056	0.0068	0.0014	0.0029	0.0009	0.0017	0.0029	0.0140
Average	0.0174	0.0180	0.0013	0.0044	0.0006	0.0032	0.0073	0.0208

Table 7. Elasticity of TFP with respect to foreign and domestic R&D

	Foreign R&D		Domestic R&D
	1981	1998	
United States	0.0108	0.0254	
United Kingdom	0.028	0.0503	
France	0.0188	0.0308	0.0538
Germany	0.0205	0.0294	
Japan	0.0082	0.0078	
Australia	0.0134	0.0291	
Austria	0.0335	0.0528	
Belgium	0.0461	0.0729	
Canada	0.0326	0.0633	
Denmark	0.0283	0.0398	
Finland	0.0247	0.0427	
Greece	0.0265	0.0413	
Ireland	0.0383	0.0885	
Israel	0.0374	0.0495	0.0382
Italy	0.017	0.0233	
Netherlands	0.0451	0.0637	
New Zealand	0.022	0.0545	
Norway	0.0279	0.0412	
Portugal	0.024	0.0452	
Spain	0.0134	0.0327	
Sweden	0.0259	0.0611	
Switzerland	0.0439	0.0728	

Table 8. Bilateral elasticities of TFP with respect to R&D stocks through the trade channel from the G5 countries, 1998

	Import (from)	U.S.	U.K.	France	Germany	Japan
(by)	U.S.	--	0.00102	0.00047	0.00110	0.00296
	U.K.	0.01114	--	0.00090	0.00178	0.00050
	France	0.00678	0.00123	--	0.00246	0.00043
	Germany	0.00989	0.00123	0.00115	--	0.00057
	Japan	0.00477	0.00009	0.00004	0.00016	--
	Australia	0.00621	0.00040	0.00010	0.00024	0.00404
	Austria	0.00819	0.00112	0.00093	0.01041	0.00053
	Belgium	0.01585	0.00439	0.00492	0.00859	0.00076
	Canada	0.01974	0.00007	0.00002	0.00006	0.00023
	Denmark	0.00776	0.00173	0.00086	0.00444	0.00126
	Finland	0.00878	0.00195	0.00092	0.00282	0.00067
	Greece	0.00638	0.00123	0.00073	0.00430	0.00027
	Ireland	0.02230	0.00513	0.00172	0.00368	0.00156
	Israel	0.01997	0.00052	0.00023	0.00052	0.00049
	Italy	0.00699	0.00080	0.00112	0.00211	0.00046
	Netherlands	0.01017	0.00445	0.00229	0.00914	0.00066
	New Zealand	0.00985	0.00079	0.00017	0.00054	0.00314
	Norway	0.00819	0.00251	0.00131	0.00368	0.00079
	Portugal	0.00789	0.00275	0.00233	0.00556	0.00025
	Spain	0.00519	0.00154	0.00259	0.00296	0.00035
	Sweden	0.01206	0.00166	0.00074	0.00247	0.00081
	Switzerland	0.01045	0.00147	0.00098	0.00385	0.00098
	Average	**0.01041**	**0.00172**	**0.00117**	**0.00338**	**0.00103**

Note: Estimated elasticity of total product productivity in the row country with respect to the R&D capital stock in the column country, based on equation (5) in Table 5.

Table 9. Bilateral elasticities of TFP with respect to R&D stocks through the inward FDI channel from the G5 countries, 1998

	Inward FDI (from)	U.S.	U.K.	France	Germany	Japan
(to)	U.S.	--	0.00068	0.00023	0.00054	0.00121
	U.K.	0.00684	--	0.00012	0.00013	0.00014
	France	0.00310	0.00034	--	0.00036	0.00008
	Germany	0.00109	0.00004	0.00004	--	0.00004
	Japan	0.00011	0.00000	0.00000	0.00000	--
	Australia	0.00294	0.00029	0.00003	0.00004	0.00021
	Austria	0.00107	0.00007	0.00008	0.00089	0.00010
	Belgium	0.00459	0.00015	0.00042	0.00081	0.00014
	Canada	0.00371	0.00006	0.00002	0.00002	0.00006
	Denmark	0.00309	0.00018	0.00002	0.00014	0.00002
	Finland	0.00329	0.00014	0.00003	0.00010	0.00010
	Greece	0.00050	0.00012	0.00046	0.00041	0.00000
	Ireland	0.00577	0.00049	0.00005	0.00047	0.00012
	Israel	0.00317	0.00002	0.00000	0.00002	0.00000
	Italy	0.00051	0.00006	0.00006	0.00006	0.00002
	Netherlands	0.00481	0.00044	0.00009	0.00035	0.00016
	New Zealand	0.00719	0.00057	0.00001	0.00002	0.00015
	Norway	0.00374	0.00023	0.00011	0.00008	0.00008
	Portugal	0.00236	0.00046	0.00036	0.00052	0.00007
	Spain	0.00166	0.00010	0.00015	0.00020	0.00003
	Sweden	0.00851	0.00096	0.00035	0.00117	0.00006
	Switzerland	0.00516	0.00005	0.00025	0.00051	0.00010
	Average	**0.00349**	**0.00026**	**0.00014**	**0.00033**	**0.00014**

Note: Estimated elasticity of total product productivity in the row country with respect to the R&D capital stock in the column country, based on equation (5) in Table 5.

Table 10. Bilateral elasticities of TFP with respect to R&D stocks through the outward FDI to the G5 countries, 1998

	Outward FDI (to)	U.S.	U.K.	France	Germany	Japan
(from)	U.S.	--	0.00074	0.00013	0.00023	0.00031
	U.K.	0.00673	--	0.00007	0.00009	0.00003
	France	0.00310	0.00023	--	0.00013	0.00001
	Germany	0.00214	0.00010	0.00007	--	0.00003
	Japan	0.00051	0.00002	0.00000	0.00000	--
	Australia	0.00150	0.00019	0.00000	0.00000	0.00000
	Austria	0.00061	0.00011	0.00004	0.00022	0.00000
	Belgium	0.00109	0.00002	0.00006	0.00006	0.00000
	Canada	0.00427	0.00012	0.00001	0.00002	0.00003
	Denmark	0.00175	0.00096	0.00007	0.00016	0.00007
	Finland	0.00444	0.00025	0.00012	0.00055	0.00002
	Greece	--	--	--	--	--
	Ireland	0.00136	0.00006	0.00001	0.00002	0.00002
	Israel	0.00100	0.00100	0.00000	0.00002	0.00000
	Italy	0.00084	0.00009	0.00008	0.00008	0.00002
	Netherlands	0.00647	0.00040	0.00022	0.00031	0.00006
	New Zealand	0.00105	0.00017	0.00008	0.00002	0.00008
	Norway	0.00275	0.00023	0.00007	0.00009	0.00000
	Portugal	0.00117	0.00021	0.00017	0.00008	0.00000
	Spain	0.00149	0.00005	0.00007	0.00032	0.00000
	Sweden	0.00687	0.00041	0.00021	0.00042	0.00007
	Switzerland	0.00724	0.00060	0.00020	0.00041	0.00013
	Average	**0.00268**	**0.00028**	**0.00008**	**0.00015**	**0.00004**

Note: Estimated elasticity of total product productivity in the row country with respect to the R&D capital stock in the column country, based on equation (5) in Table 5.

Table 11. Bilateral elasticities of TFP with respect to R&D stocks through the IT channel from the G5 countries, 1998

	IT (from)	U.S.	U.K.	France	Germany	Japan
(to)	U.S.	--	0.00205	0.00164	0.00243	0.00369
	U.K.	0.01178	--	0.00126	0.00187	0.00283
	France	0.00621	0.00083	--	0.00099	0.00150
	Germany	0.00663	0.00089	0.00071	--	0.00160
	Japan	0.00125	0.00017	0.00013	0.00020	--
	Australia	0.00673	0.00090	0.00072	0.00106	0.00161
	Austria	0.01395	0.00185	0.00149	0.00220	0.00333
	Belgium	0.01455	0.00201	0.00160	0.00238	0.00364
	Canada	0.01855	0.00249	0.00200	0.00296	0.00449
	Denmark	0.00817	0.00110	0.00088	0.00131	0.00198
	Finland	0.00848	0.00113	0.00091	0.00135	0.00204
	Greece	0.01319	0.00176	0.00141	0.00209	0.00316
	Ireland	0.02332	0.00308	0.00248	0.00367	0.00553
	Israel	0.01217	0.00161	0.00130	0.00192	0.00290
	Italy	0.00521	0.00069	0.00056	0.00082	0.00124
	Netherlands	0.01101	0.00148	0.00118	0.00175	0.00265
	New Zealand	0.01645	0.00219	0.00176	0.00260	0.00393
	Norway	0.00831	0.00111	0.00089	0.00132	0.00200
	Portugal	0.00996	0.00131	0.00106	0.00156	0.00236
	Spain	0.00757	0.00100	0.00080	0.00119	0.00179
	Sweden	0.01157	0.00156	0.00125	0.00185	0.00281
	Switzerland	0.02065	0.00279	0.00223	0.00330	0.00502
	Average	0.01122	0.00152	0.00125	0.00185	0.00286

Note: Estimated elasticity of total product productivity in the row country with respect to the R&D capital stock in the column country, based on equation (5) in Table 5.

Figure 1. Average elasticity of TFP with respect to US R&D stock

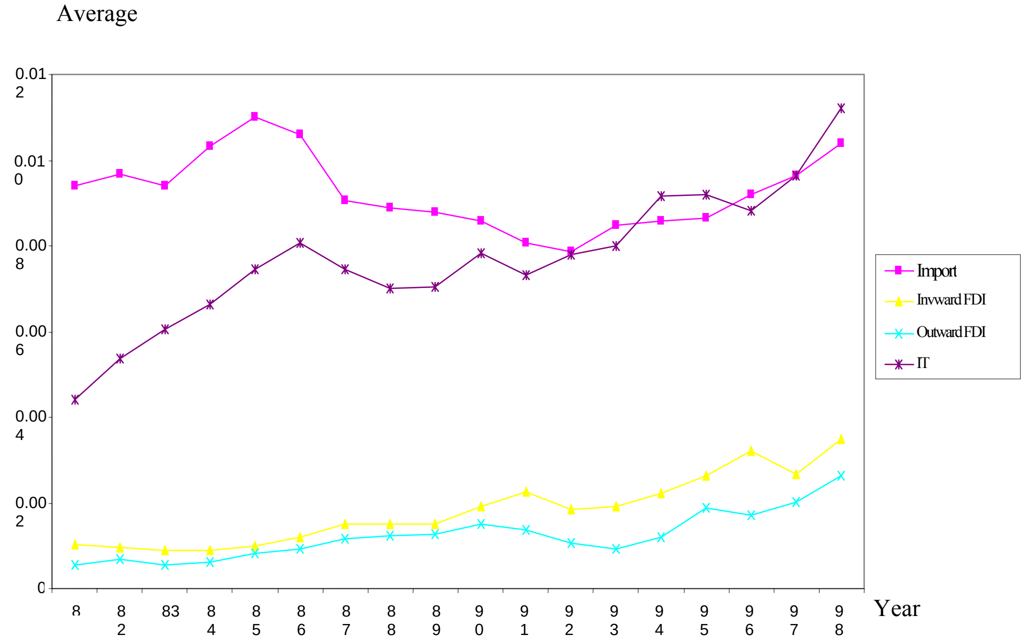
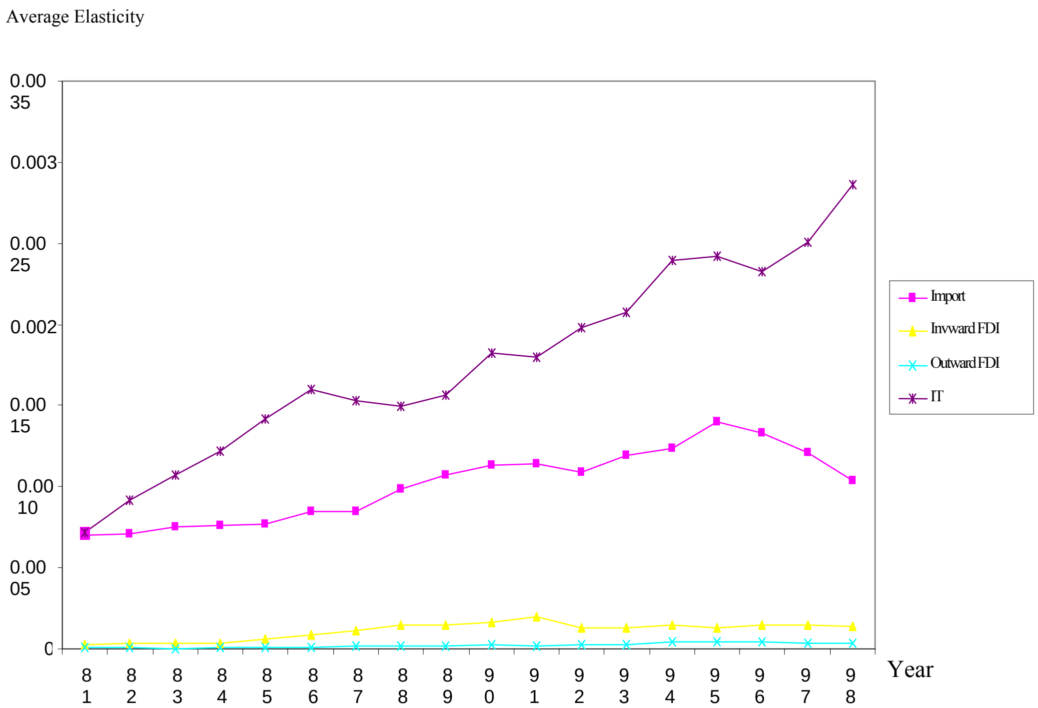


Figure 2. Average elasticity of TFP with respect to Japan R&D stock



Appendix A. Data sources and Definitions

For each country, total factor productivity is calculated as an index with 1985 as the base year. It is defined as $TFP = Y/(K^{\beta}L^{(1-\beta)})$, where Y is the amount of value added in the business sector, K is capital stock in the business sector and L is total employment in the business sector. Y, K, and L are from the OECD *Economic Outlook Database* for all countries except Israel, Portugal and Greece. For those three countries, data in business sectors are not available. So for the three countries, we use data in all sectors to estimate TFP. The data source is World Bank's *World Development Indicators*.

We collect annual research and development expenditure data in business sector from the OECD *Main Science and Technology Indicators*. All are converted into 1985 PPP ajusted US dollars. The research and development capital stocks data from 1981 to 1990 are from CH (1995). We use a perpetual inventory model to calculate R&D stocks (S) from R&D expenditures (R) for the remaining time period as follows. R&D stocks are defined as the beginning of the year.

$$S_t = (1-\delta)S_{t-1} + R_{t-1}$$

where δ is the depreciation rate. To be consistent with CH, 5% depreciation rate is employed for the calculation of R&D stocks.

The bilateral import shares are from OECD *Monthly International Trade*. All openness measures, GDP and gross capital formation data are from the World Bank's *World Development Indicators*. The teledensity data is from *World Telecommunication Indicators 2003* database compiled by International Telecommunication Union (ITU).

The bilateral FDI statistics in this study are from the *International Direct Investment Statistics Yearbook* published annually by OECD since 1993. It covers the time period from 1980 to 2000. The statistics are based mainly on the balance-of-payment data compiled by the central banks or the statistical offices of OECD countries.

Since the FDI statistics between two OECD member countries are reported as FDI inflows by the host country and as outflows by the source country, the inflow and outflow data between the same country pair should be the same in theory. However, due to national differences in FDI definition, currency, and statistical errors, they are different most of the time. Nonetheless, the FDI data reported by the host and source countries are highly correlated, with the correlation coefficient above 90 percent. Therefore, we use FDI data compiled by the host country while the information reported by the source country is employed to make up missing values. Finally, the missing FDI stock data as of the beginning of each year are estimated using FDI flow data that are available in the same database. They are defined as

$$FDIstk(t) = FDIstk(t-1) + FDIflw(t-1)$$

or

$$FDIstk(t) = FDIstk(t+1) - FDIflw(t)$$

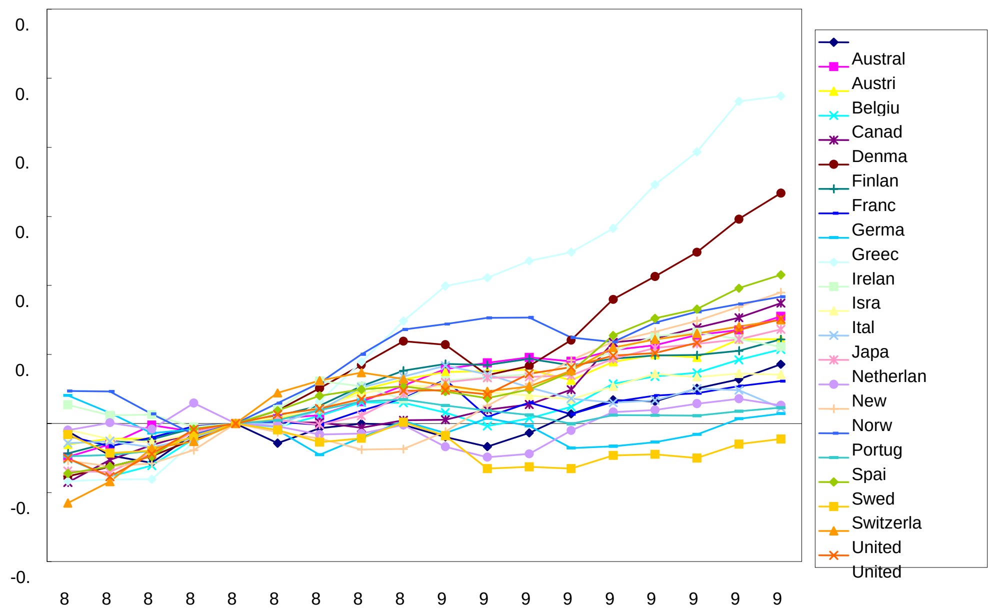
In addition, all negative values are replaced with zero since the FDI stock might not be negative.

Table A.1 Total factor productivity index (1985=1)

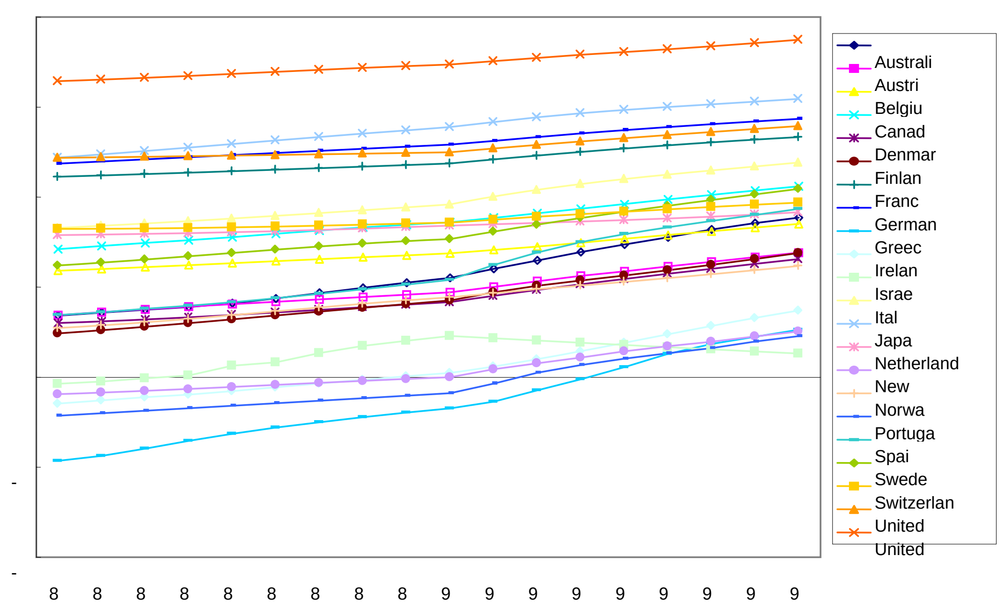
	Aus-tralia	Austria	Belgium	Canada	Denmark	Finland	France	Ger-many	Greece	Ireland	Israel	Italy	Japan	Nether-land	New Zealand	Norway	Portugal	Spain	Sweden	Switzer-land	U.K.	U.S.
1981	0.989	0.953	0.970	0.950	0.918	0.927	0.957	0.982	1.041	0.920	1.027	0.991	0.972	0.933	0.990	0.947	1.048	0.954	0.930	0.984	0.891	0.951
1982	0.955	0.970	0.978	0.926	0.949	0.939	0.973	0.968	1.015	0.922	1.012	0.978	0.975	0.932	1.001	0.940	1.047	0.956	0.940	0.958	0.919	0.926
1983	0.945	0.997	0.978	0.941	0.969	0.954	0.977	0.980	0.986	0.922	1.013	0.973	0.966	0.958	0.992	0.944	1.014	0.961	0.953	0.961	0.964	0.957
1984	0.985	0.988	0.993	0.978	0.986	0.978	0.993	0.996	0.992	0.974	0.995	0.986	0.979	0.988	1.030	0.962	0.984	0.981	0.992	0.982	0.974	0.991
1985	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1986	0.972	1.007	1.006	0.995	1.001	1.019	1.011	1.002	0.990	0.990	1.020	1.009	1.000	1.005	0.996	0.987	1.030	1.005	1.019	0.991	1.045	1.013
1987	0.993	1.012	1.020	1.011	1.001	1.052	1.026	0.998	0.956	1.033	1.063	1.024	1.019	0.998	0.984	0.978	1.061	1.020	1.041	0.973	1.064	1.022
1988	1.000	1.032	1.050	1.031	0.994	1.089	1.055	1.019	0.980	1.093	1.055	1.044	1.054	1.011	0.986	0.963	1.105	1.032	1.051	0.979	1.076	1.036
1989	0.998	1.057	1.066	1.030	1.005	1.126	1.079	1.037	1.003	1.160	1.036	1.057	1.070	1.043	0.998	0.964	1.146	1.035	1.055	1.002	1.067	1.048
1990	0.981	1.082	1.078	1.016	1.005	1.121	1.090	1.065	0.986	1.220	1.064	1.055	1.087	1.061	0.967	0.988	1.155	1.026	1.047	0.982	1.057	1.049
1991	0.967	1.092	1.079	0.996	1.020	1.072	1.088	1.009	1.007	1.235	1.069	1.047	1.074	1.068	0.952	1.026	1.165	1.019	1.037	0.937	1.048	1.043
1992	0.986	1.100	1.081	1.007	1.028	1.087	1.098	1.031	0.996	1.266	1.074	1.041	1.054	1.070	0.957	1.059	1.166	1.012	1.050	0.939	1.055	1.075
1993	1.014	1.094	1.065	1.024	1.050	1.128	1.088	1.013	0.965	1.281	1.085	1.036	1.037	1.072	0.990	1.096	1.133	1.000	1.078	0.937	1.079	1.085
1994	1.035	1.112	1.093	1.059	1.125	1.197	1.098	1.032	0.968	1.326	1.110	1.055	1.031	1.098	1.017	1.126	1.125	1.012	1.136	0.955	1.116	1.103
1995	1.032	1.120	1.105	1.070	1.131	1.237	1.104	1.041	0.973	1.413	1.135	1.075	1.034	1.115	1.020	1.142	1.157	1.012	1.164	0.956	1.129	1.108
1996	1.052	1.137	1.100	1.076	1.149	1.281	1.104	1.045	0.984	1.482	1.141	1.070	1.052	1.122	1.029	1.160	1.176	1.011	1.180	0.951	1.139	1.124
1997	1.066	1.145	1.129	1.096	1.166	1.344	1.111	1.055	1.007	1.594	1.130	1.075	1.049	1.130	1.036	1.184	1.189	1.018	1.216	0.971	1.151	1.145
1998	1.090	1.168	1.130	1.113	1.190	1.396	1.129	1.063	1.014	1.607	1.117	1.073	1.023	1.146	1.026	1.209	1.201	1.023	1.240	0.978	1.162	1.164

Appendix B. Data Plots

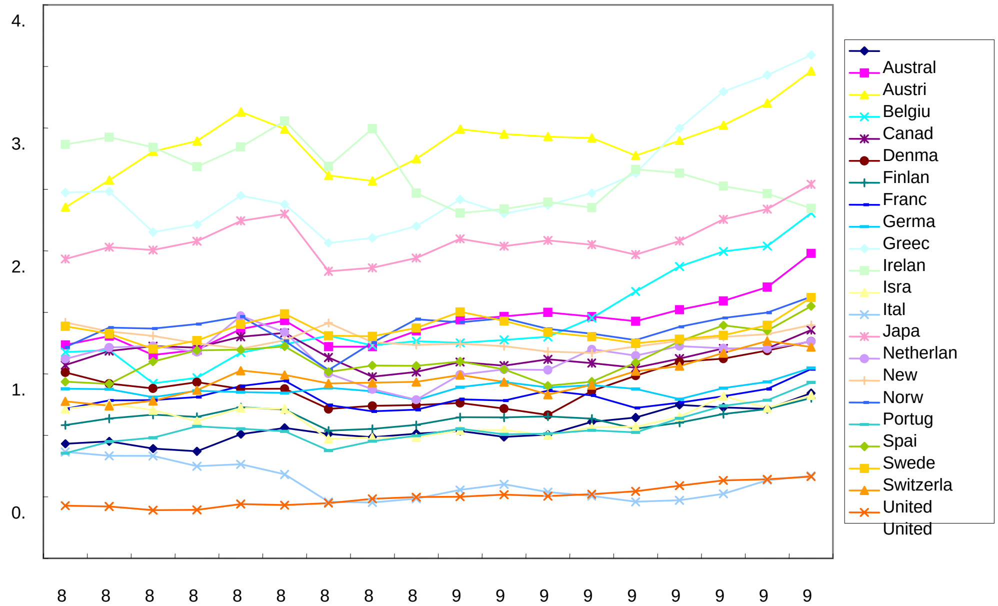
B.1 Total factor productivity (logarithms)



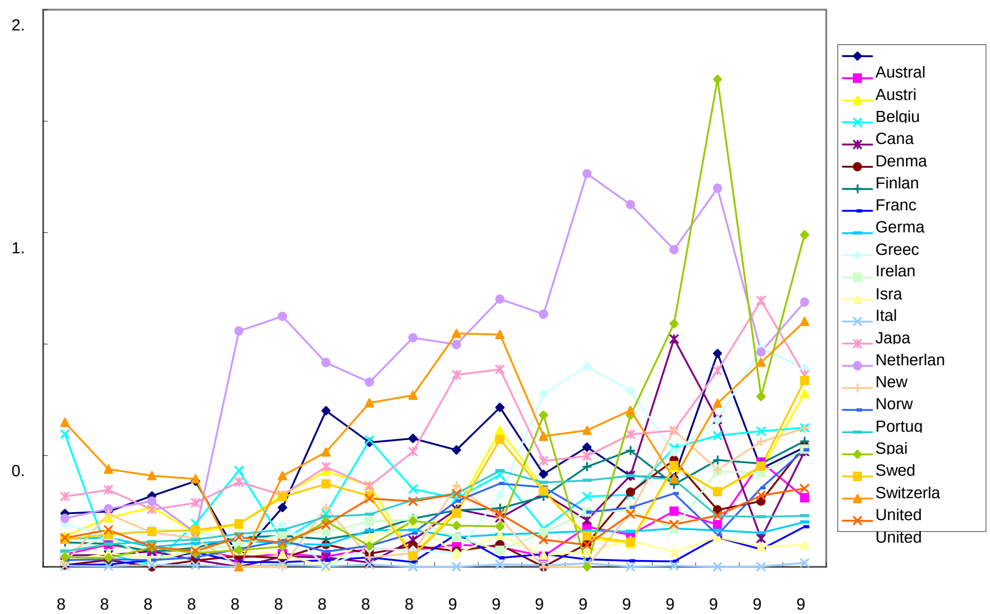
B.2 Domestic R&D capital stock



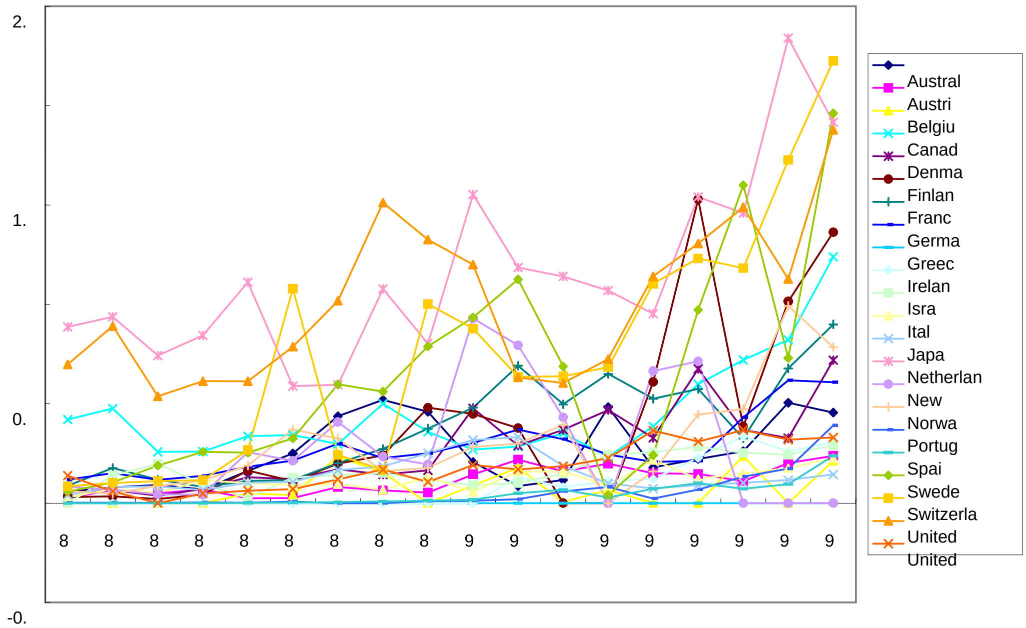
B.3 Import weighted foreign R&D capital stock (with openness)



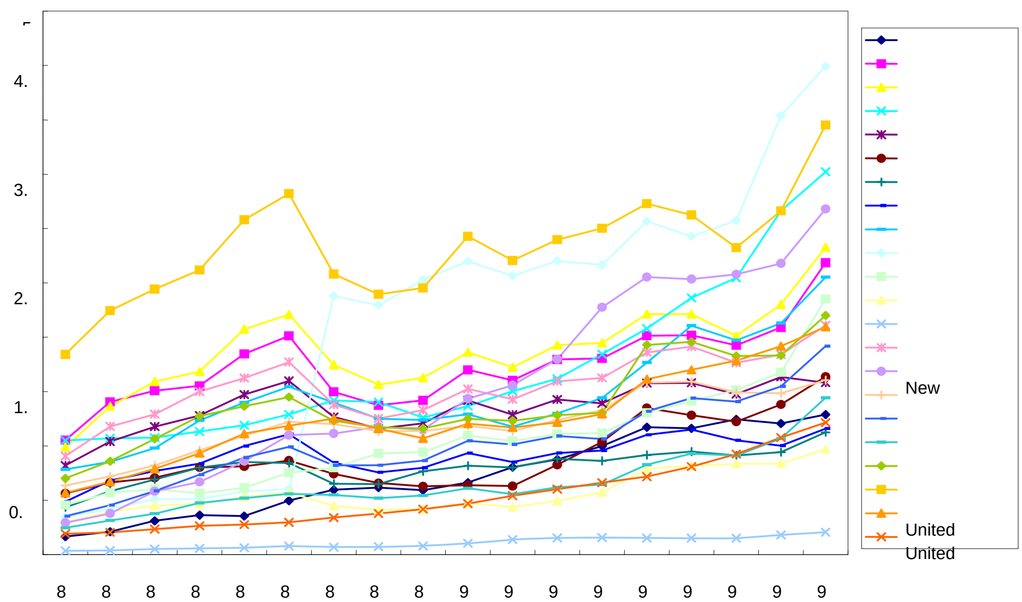
B.4 Inward FDI weighted foreign R&D capital stock (with openness)



B.5 Outward FDI weighted foreign R&D capital stock (with openness)



B.6 IT Weighted foreign R&D capital stock (with openness)



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Comments on "International R&D Spillover Channels"

Byung Woo Kim,
STEPI

The motivation and implication of this paper is very important in Korea, because Korea should lead to productivity, knowledge and innovation - driven economic growth system in the near future. It is urgent and useful to find the mechanism by which integration into the world economy can promote innovation and growth.

First of all, I recommend the authors to use model-based approach.

For example, there are important research results from endogeneous growth theory (e.g. Grossman and Helpman, 1991) about international knowledge flows. They anlaysed mechanism that the foreign contribution to the local knowledge stock increases with the number of commercial interactions between domestic and foreign agents. That is, international trade in tangible commodities facilitates the exchange of intangible ideas.

And, there are increasing amount of theoretical research about FDI and technology transfer(Brecher and Diaz-Alezandro 1977, Krugman 1998, Rodrik 1999, Glass and Saggi 1988, 1999).

I think you had better study to see whether theoretical prediction would accord well with empirical observation and provide statistical evidence that supports the previous theoretical hypothesis.

Second, you applies most advanced econometrical method, panel cointegration. In particular, you used Dynamic OLS(DOLS) to estimate the cointegrated panel regressions. But, I recommend you to also use between-group(BG) fully-modified(FMOLS). Pedroni(2000, 2001) shows that FMOLS has much advantage that it enables us to avoid the problems of endogeneity of the regression variable and autocorrelation of residuals.1 Pedroni(2001) also proposes that BG FMOLS suffers much less from small sample size distortion and allows for a more flexible alternative hypothesis. In addition, the BG FMOLS has an advantage for point estimates in the sense that it can be interpreted as the mean value of the estimators from the individual estimation.

Finally, you used teledensity(number of telephone lines per 100 residents) as a proxy for IT development. I think the development of IT can be found well in increasing use of Internet. So, I recommend that you use the number of personal computers(PCs) that are

[1] We don't know whether or not FDI Granger-causes the TFP.

accessible to Internet or domains that is top-level Internet address as a proxy for internet proliferation.

For all the minor room for improvement, the implication of your paper is very useful for government that performs innovation policy. I think that in Korea, the diffusion of technology has played a central role in the process of innovation and growth. We need to detect the technological spillovers which occur across international borders, because they facilitate subsequent innovation in Korea. So I hope there will be subsequent research that use Korean manufacturing (and service) panel data in industry level.

CHAPTER 1-3

Preference of Cultural Goods: The Case of Korea Film Market

by

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Abstract

There is an ongoing debate on whether cultural goods like movies and music albums should be protected from foreign competitors. One argument frequently used by protectionists is that domestic movies cannot compete against mega-budgeted Hollywood movies and they will disappear if trade protection is lifted. An implicit assumption under the argument is that consumers easily substitute cultural elements for other product characteristics. In this paper we assess how much consumers value cultural elements when other product characteristics are equal. We estimate demand for films in Korea using monthly data on admissions from 2002 to 2004. We include nationality variables in addition to other movie characteristics to measure consumers' willingness to pay for cultural elements. Our result shows that Korean consumers are willing to pay more for home-produced movies compared to imported foreign movies. It suggests that consumers differentiate cultural goods based on nationality and there seems to be a cultural bias in consumption. Our estimate implies that the probability of watching a foreign movie would increase by 87.5 percent if its cultural elements were replaced by Korean.

***Key** words:* Cultural goods; Cultural bias; Nationality; Demand estimation

JEL Classification: F13, F14, L82, Z1, D12

I. Introduction

There is an ongoing debate on whether cultural goods like movies and music albums should be protected from foreign competitors.[1] A country like France, for example, relies on import restriction to protect her domestic film industry. One argument frequently used by protectionists is that domestic movies cannot compete against mega-budgeted Hollywood movies and will disappear if trade protection is lifted. An implicit assumption under this argument is that consumers easily substitute cultural elements for other product characteristics like high quality computer graphics integrated in movies.

On the contrary, one may also argue that preference for cultural goods is *biased* by cultural elements. For example, the utility from watching a Chinese film may diminish if one does not have good understanding of Chinese jokes or Chinese history and tradition. People who share the same ethnic background and social events may appreciate certain topics more than others. Then, cultural goods are naturally protected by cultural elements such as language, history, traditions, ethnic factors, etc.[2]

Movie producers seem to be already aware of the importance of culture. Its evidence is found in movies that are remade in another country even when the original film is available with subtitles. For example, *Shall We Dance?*, directed by Peter Chelsom and featured by Richard Gere, Susan Sarandon, and Jennifer Lopez is a remake of a runaway Japanese hit of the same title. The original Japanese film "contrasts the boldness of social dance with the buttoned-up societal mores of Japan, where people avoid public displays of emotion."[3] The Hollywood remake closely follows the storyline of the original film, but it does not have this contrast. Instead, it focuses on a workaholic lawyer searching for passion.

It is an empirical question how much consumers care about cultural elements. Francois and Ypersele (2002) show that protection may enhance social welfare when preference for domestic culture is heterogeneous and social pressure forces those at the tail of the distribution choose foreign goods under no protection. Their result is based on the assumption that the average consumer does not care about cultural elements.

In this paper we assess how much consumers value cultural elements by estimating demand for films in Korea, which is an ideal place to estimate preference for culture. Korea is an ethnically homogenous country with only 1 percent foreign born in her population.[4] All Koreans speak the same native language, Korean, which is not spoken in any other country (except for North Korea). This gives our study an enormous advantage since we can bypass the concern of controlling consumer heterogeneity in cultural aspects of films.

We use a discrete choice model of differentiated product demand (Berry, 1994). We include nationality variables in addition to other movie characteristics to measure consumers' willingness to pay for cultural elements. We use monthly data on admissions at the individual movie level from 2002 to 2004 with data on movie characteristics. The

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[1] Cultural goods are defined by UNESCO (2005) as "consumer goods which convey ideas, symbols, and ways of life. They inform or entertain, contribute to build collective identity and influence cultural practices. They are the result of individual or collective creativity."

[2] Although it is not confined to cultural goods, Armington home bias is frequently used in the literature to explain preference towards home-produced goods in consumption.

[3] David Horiuchi, editorial reviews at www.amazon.com

[4] Korea National Statistical Office, Resident registration population, Household http://kosis.nso.go.kr

empirical specification is similar to Einav (forthcoming), who estimates demand for films in the US market.

Our result shows that Korean consumers are willing to pay more for home-produced movies compared to imported foreign movies. It suggests that consumers differentiate cultural goods based on nationality and there seems to be a cultural bias in consumption. Our estimate shows that the probability of watching a foreign movie would increase by 87.5 percent if its cultural elements were replaced by Korean.

The paper is organized as follows. Section 2 briefly describes the film market of Korea. Section 3 describes data. Model and estimation strategies are discussed in section 4. Estimation results are in Section 5. Section 6 concludes.

II. Korea Film Market

Recently, demand in the Korean film market has expanded significantly. This is reflected by an increase in total admissions and attendance per movie. This trend is summarized in Table 1. In 2004, 268 movies were shown in Seoul, the capital city of Korea, and they drew 47 million admissions with about 175,000 admissions per movie. Total admissions as well as the attendance per movie have more than doubled in about six years while the number of movies shown per year has remained almost the same; in 1998, total admissions were 22 million for 287 movies with 78,000 admissions per movie.

Table 1. Recent Trend of Korean Film Market (Seoul only)

Year	Number of Movies	Admissions	Attendance per Movie
2004	268	47,037,793	175,514
2003	240	43,948,082	183,117
2002	274	40,767,729	148,787
2001	280	34,983,217	124,940
2000	339	27,463,315	81,013
1999	275	24,083,750	87,577
1998	287	22,396,593	78,037
Average	280	34,382,926	125,569

More than seventy percent of movies shown in Korea have been either Korean or Hollywood movies. They have combined more than ninety percent of total admissions. As shown in Table 2, Korean movies have advanced rapidly during the six year span. Their market share increased from 21 percent of the total admissions in 1998 to 54 percent in 2004 with the attendance per movie almost tripled. Meanwhile, US movies have lost the attendance share from 72 percent to 41 percent with a moderate increase in the attendance per movie.

Table 2. Film Market Shares in Korea (Seoul only)

	Movies Share		Admissions Share		Attendance per Movie	
Year	Korea	USA	Korea	USA	Korea	USA
2004	0.28	0.44	0.54	0.41	306,509	304,903
2003	0.27	0.47	0.50	0.43	317,109	311,855
2002	0.30	0.48	0.45	0.49	217,719	261,383
2001	0.19	0.49	0.46	0.46	283,016	230,444
2000	0.18	0.51	0.32	0.55	148,509	180,207
1999	0.15	0.60	0.36	0.56	205,010	182,922
1998	0.15	0.60	0.21	0.72	111,152	216,599

While the stellar performance of Korean movies is eye-catching, this is only a recent phenomenon. Not long ago, there were periods during which they had to rely heavily on screen quota to exhibit a minimum number of movies. In 1966, a screen quota system was created based on the Movie Promotion Law in Korea. The screen quota system initially required theaters to exhibit at least six Korean movies for 90 days or more per year. After rounds of modifications, the screen quota system now requires at least 146 days of Korean movie exhibition, which is equivalent to 2/5 of exhibit days per year.

The current screen quota requirement, however, is *effectively* 106 days due to special reduction allowances for summer peak exhibition days counted as one and 2/3 days for each day of exhibition up to 20 days and an additional 20 day reduction for the theaters participating in the integrated electronic network. The screen quota system, however, has had no significant effect until more recently due to strong import restrictions.

In 1988, Korea lifted import restrictions on foreign films and allowed Hollywood film distributors to open a branch in Korea for direct-distribution of Hollywood movies; the first such case is UIP. Since then, Korean movies' admissions share had continuously declined and recorded the lowest mark of 15 percent in 1993.

Theaters were blamed for having contributed to this result by violating screen quota. Since there was virtually no monitoring, theaters often reported false data on the number of Korean movie exhibition days to the government. Then a citizen's group, mostly consisting of Korean movie industry workers, created *Screen Quota Watchers* to enforce theaters to abide by the screen quota system. Some people argue that the screen quota system, although not fully complied by all theaters partly due to the light penalty for violating the screen quota, may have prevented a total collapse of the Korean films industry at that time.

The situation has drastically turned around in more recent years. Since 2001, the exhibition days of Korean films have remained above the requirement about 38 percent or more and the Korean films admissions share has skyrocketed to more than 50 percent. While screen quota may have contributed to the renaissance of Korean films in the development process, it has not been binding in recent years.

The recent surge of the Korean movies can be explained in part by a big increase in production and advertising budget, which is related with the entry of big conglomerates, so-called *Chaebol*. Samsung marked the first of conglomerates entering into the film industry in 1992. In time these conglomerates transformed the structure of the business, introducing a vertically integrated system whereby the finance, production, exhibition, distribution, and video release of films was all controlled by a single company.

Although many *Chaebol* including Samsung dropped out of the industry after the 1997 financial crisis, major conglomerates such as CJ, Lotte and the Orion Group remain the industry's most powerful players. In 2004, movies distributed by the big three led total attendance at about 60 percent of all movies of the year and they captured more than 80 percent of Korean movie admissions. Table 3 shows the average production and advertising budget of Korean films in recent years. The average production budget has doubled from 1998 to 2004 and the advertising budget has more than quadrupled.[5]

Table 3. Average Production Budget for Korean Movies

(unit: in 100 million Korean won)

Year	Average Total Budget	Average Production budget	Average Advertising budget	Number of Movies	Total Budget for the Year
2004	42	28	14	82	3,411
2003	42	28	13	80	3,328
2002	37	25	13	78	2,902
2001	26	16	9	65	1,658
2000	22	15	7	59	1,269
1999	19	14	5	49	931
1998	15	12	3	43	645
1997	13	11	2	59	767
1996	10	9	1	65	650

Aided by the budget increase in production and advertising, Korean films began to produce a string of box office hits. *Shiri* in 1999, which recorded then all-time high 6.2 million admissions, is considered to be the first Korean blockbuster movie. Following *Shiri* and a few other record-breaking movies, *Taegukki* (2004) and *Silmido* (2003) both recorded more than 11 million admissions. Before *Shiri*, the previous record was set by *Supyunje* (English title: The sorrow of Korean singer) that broke one million admissions mark (Seoul only) in 1993 for the first time ever in Korean film history. Table 4 reports top six Korean blockbusters of all-time as of December, 2004.

[5] They are in nominal value. The annual inflation rate for the six year span was about 4 percent.

Table 4. Top Six Korean Blockbusters (All-time Record as of December, 2004)

Film	Year	Admissions (in million)
Taegukki	2004	11.15
Silmido	2003	11.07
Chingu (Friend)	2002	8.18
Shiri	1999	6.21
JSA	2000	5.83
My wife is a Gangster	2001	5.25

III. Data

Data availability limits our study to the most recent years. Monthly admissions data for 764 films from 2002 to 2004 are provided by the Korean Film Commission. Other characteristics for the films include opening date, nationality, distributor, producer/importer, movie rating, and number of screens. A market in our study is defined on a month and total number of observation is 1294. The geographic area is confined to Seoul, the capital city of South Korea, which accounts for more than one-third of the Korean film market.

Summary statistics for the entire sample period are provided in Table 5-1. Age variable is constructed by calculating the number of days a film has been shown since the opening date to the end of the month. Five observations are missing for the age variable. Some movies appear with a long lag between exhibitions and the age becomes extremely large. Some movies have with an error on their opening dates (opening date later than the exhibition month).

Table 5-1. Summary Statistics for the Entire Sample Period

Variable	Obs.	Mean	Std. Dev.	Min	Max
Age	1289	28.2	21.6	1	145
Budget[a]	870	23,600	36,900	59	200,000
Share	1294	0.017	.035	1.73e-07	0.414

Note: [a] in thousand US dollars

There are only 524 movies (870 observations) with budget information. Production budget information for Korean movies is taken from each year's edition of *Korean Cinema* published by Korean Film Commission (KOFIC). For US and other country films, we use various internet sources to find the information. For US movies, production budgets do not include prints and advertising budgets. For Korean movies, it is not specified whether the amount includes prints and advertising budgets. Appendix provides the internet sources and opening dates of the US movies in the United States.

Table 5-2 and Table 5-3 provide information on the distribution of movie exhibitions by rating and by month, respectively. Note that the monthly pattern of movies shown in each month is distinguished from the pattern of the United States.[6] Smaller number of movies is shown in January, July, and December, although admission shares are highest in these months and August (Table 5-4.) This particular monthly pattern is less evident with Korean movies or US movies alone from Table 5-3. One possible explanation is that potential blockbusters of Korean movies and US movies are more likely set to target a release date in peak seasons. Small budget movies and other foreign movies may want to avoid the head-to-head competition with the potential blockbusters.

Table 5-2. Number of Movie Exhibitions by Rating

Rating	Obs.	Percent
All	199	15.38
PG-12	312	24.11
PG-15	496	38.33
R	287	22.18
Total	1,294	100

Historical admissions data for the films market of Korea are in Table A1 in Appendix. Descriptive statistics of movie shares and attendance shares by nationality/region are reported for each sample period in Table A2.

Table 5-3. Number of Movie Exhibitions and Shares by Month

	Total		Korea		USA	
Month	Obs.	Share (%)	Obs.	Share (%)	Obs.	Share (%)
1	82	6.34	27	6.15	19	8.09
2	104	8.04	32	7.29	23	9.79
3	105	8.11	29	6.61	25	10.64
4	126	9.74	37	8.43	19	8.09
5	102	7.88	38	8.66	12	5.11
6	123	9.51	43	9.79	16	6.81
7	90	6.96	40	9.11	15	6.38
8	105	8.11	38	8.66	20	8.51
9	128	9.89	44	10.02	23	9.79
10	122	9.43	37	8.43	22	9.36
11	129	9.97	43	9.79	26	11.06
12	78	6.03	31	7.06	15	6.38
Total	1,294	100	439	100	235	100

Table 5-4. Admissions Share Statistics by Month

[6] See Einav (forthcoming).

Month	Obs	Mean	Std. Dev.	Min	Max
1	82	0.0266	0.0487	5.20e-06	0.3057
2	104	0.0195	0.0516	5.20e-07	0.4149
3	105	0.0128	0.0217	5.20e-06	0.1508
4	126	0.0114	0.0263	1.78e-05	0.1555
5	102	0.0186	0.0393	1.39e-06	0.2262
6	123	0.0148	0.0299	1.73e-07	0.1500
7	90	0.0269	0.0361	5.72e-06	0.1394
8	105	0.0228	0.0300	1.04e-06	0.1598
9	128	0.0135	0.0284	2.42e-06	0.1649
10	122	0.0132	0.0291	8.66e-07	0.2106
11	129	0.0126	0.0256	1.73e-06	0.1584
12	78	0.0260	0.0516	1.73e-06	0.2116

IV. Model and Estimation Strategy

We use a discrete choice model of differentiated product demand to estimate consumer demand for watching movies in theaters. A market is defined as the capital city of South Korea in a given month. An underlying assumption in this model is that consumers consume at most one unit of goods or choose the outside option in each period.7 Thus, we assume that consumers watch at most one movie in each month and define the outside option as not watching any movies.

The indirect utility function for consumer *i* and product *j* is

$$u_{ij} = X_j\beta + \xi_j + \varepsilon_{ij} \tag{1}$$

Where X_j is a set of observed movie characteristics, β is marginal utility with respect to observed characteristics, ξ_j is the mean value of unobserved characteristics, and ε_{ij} is *i.i.d.* Type I extreme value error. We assume that consumers pay the same admission fee for any movies they watch. There is a little variation in the admission fee among theaters, but

[7] It seems to be a strong assumption since each period corresponds to one month in our data. However, the assumption turns out to be practical for the Korea market when we investigate the data. The all time high admissions recorded by Taegukki is 11 million and this number must be very close to the movie-goer population in Korea, which is about a quarter of the whole population. During our data period of 2002-2004, the average admissions (in Seoul only) per year were 44 million, that is, 3.67 million per month. Population in Seoul is about 10 million. If we apply the movie-goer population estimation, each movie-goer in Seoul must go to 1.5 movies per month. If we apply one-third, it is 1.1 movies per month.

it is largely uniform. It is the same for all movies shown in a given theater. Therefore, we drop a price variable from the indirect utility function.

Observable characteristics include the rating, the age of movies in the market, the producer/importer, the distributor, the nationality, and the seasonable dummy variables. Einav (forthcoming) provides a discussion on the role of the age as characteristics. We also use a budget variable in some specifications. However, we have 240 out of 764 movies without information on the budget.

Although it is not straightforward to interpret the producer/importer and the distributor as characteristics of movies, these variables capture important elements that may affect success/failure of movies. For example, a producer with a considerable market power often casts popular actors and actress, invests more money in making movies, and advertises more aggressively.

In a market with J movies on screen the probability of movie j being watched is

$$s_j = \frac{\exp\left(X_j \beta + \xi_j\right)}{1 + \sum_{m=1}^{J} \exp\left(X_m \beta + \xi_m\right)} \tag{2}$$

The model is estimated by assuming that unobserved characteristics of movies are not correlated with observed characteristics. Since we do not estimate a price coefficient, we are not concerned about price endogeneity.

However, current characteristics may not be sufficient to control for quality that consumers care about such as directors, casting, genre, and so forth. One way to control for the unobservable quality is to estimate the mean quality by using the fixed effect without characteristics which do not vary over time, and then to regress the mean quality on characteristics (Nevo, 2001). Einav (forthcoming) uses this method to control unobservable movie quality. However, one needs to observe the same movie over a reasonably long period of time to consistently estimate the mean quality. As we have monthly data, the average duration of movie in the market is less than 2 periods.

As an alternative we attempt to control as much of unobservable quality as possible with producer/importer and distributor dummy variables. There are 28 producers/importers and 25 distributors we control for. In addition to these we use the random effect at a movie level.

Our main focus is on nationality variables. Is nationality a characteristic which consumers care about when they choose which movie to watch? In a more hypothetical setting, if a movie made in Hong Kong had been made in Korea with Korean speaking actors/actresses, would the same number of Koreans have watched this movie?

An important characteristic of the Korean movie market is that almost all consumers are Korean. Therefore, the coefficient on the dummy variables for nationality in the indirect utility function captures how much people from one culture value their own culture compared with other cultures.

V. Estimation Results

Tables 6-1 and 6-2 show demand estimates. In Table 6-2 we control the producer/importer and distributor effects. *Age* variable measures the number of days a movie is shown from the opening date to the end of a given period. *USA*, *Korea*, and *Europe* are nationality dummy variables. Their coefficients capture consumers' marginal utility from origins of movies relative to *Asia* and *Others*. There are four ratings; *All*, *PG-12*, *PG-15*, and *R*, and we drop *All*. *Month* dummy variables capture the seasonal effect in movie watching.

Table 6-1 Demand Estimates in the Logit Model

	Specification 1		Specification 2		Specification 3	
	Coefficient	s.e.	Coefficient	s.e.	Coefficient	s.e.
Age	-0.015**	0.003	-0.033**	0.003	-0.037**	0.003
Budget	—		—		0.052**	0.008
Budget Squared	—		—		-0.00017**	0.00005
USA	0.838**	0.240	0.956**	0.268	-0.937	0.521
Korea	1.215**	0.251	1.325**	0.282	1.949**	0.513
Europe	-0.979**	0.310	-0.956**	0.345	-1.261*	0.602
PG-12	0.730**	0.235	0.806**	0.274	0.377	0.270
PG-15	0.341	0.218	0.303	0.252	0.417	0.253
R	-0.145	0.240	-0.161	0.277	0.214	0.282
February	-1.209**	0.375	-0.992**	0.311	-1.109**	0.342
March	-1.408**	0.375	-1.154**	0.334	-1.282**	0.358
April	-1.778**	0.361	-1.661**	0.334	-1.499**	0.355
May	-1.283**	0.376	-0.932**	0.350	-0.503	0.380
June	-1.713**	0.363	-1.348**	0.342	-1.078**	0.366
July	0.331	0.390	0.432	0.362	0.372	0.384
August	0.206	0.374	0.689*	0.350	0.600	0.370
September	-1.747**	0.360	-1.298**	0.338	-1.576**	0.353
October	-1.668**	0.363	-1.540**	0.339	-1.635**	0.363
November	-1.507**	0.359	-1.293**	0.332	-1.286**	0.360
December	-0.739	0.403	-0.602	0.339	-0.554	0.375
Constant	-4.522**	0.373	-4.544**	0.380	-4.359**	0.576
Random Effect	No		Yes		Yes	
Producer/Importer	No		No		No	
Distributor	No		No		No	
R^2	0.150		0.145		0.297	
Obs.	1289		1289		933	

Note: *significant at the 5% level
**significant at the 1% level

Table 6-2 Demand Estimates in the Logit Model, continued

	Specification 4		Specification 5		Specification 6	
	Coefficient	s.e.	Coefficient	s.e.	Coefficient	s.e.
Age	-0.032**	0.003	-0.033**	0.003	-0.039**	0.003
Budget	—		—		0.041**	0.008
Budget Squared	—		—		-0.000*	0.000
USA	0.407	0.302	0.094	0.285	-0.811	0.634
Korea	1.499**	0.297	0.882**	0.296	1.779**	0.655
Europe	-0.454	0.333	-0.224	0.312	-0.097	0.706
PG-12	0.824**	0.250	0.667**	0.233	0.324	0.265
PG-15	0.295	0.232	0.193	0.215	0.449	0.251
R	-0.252	0.256	-0.258	0.238	0.170	0.281
February	-1.054**	0.303	-1.016**	0.294	-1.018**	0.336
March	-1.194**	0.319	-1.090**	0.307	-1.202**	0.349
April	-1.674**	0.316	-1.605**	0.301	-1.431**	0.348
May	-0.907**	0.331	-0.906**	0.315	-0.532	0.371
June	-1.027**	0.328	-0.918**	0.311	-0.758*	0.360
July	0.572	0.342	0.603	0.327	0.518	0.375
August	0.805*	0.329	0.854**	0.314	0.755*	0.361
September	-1.240**	0.318	-1.238**	0.302	-1.455**	0.344
October	-1.419**	0.318	-1.398**	0.304	-1.543**	0.353
November	-1.202**	0.312	-1.180**	0.298	-1.149**	0.349
December	-0.408	0.329	-0.376	0.319	-0.403	0.368
Constant	-5.394**	0.537	-5.346**	1.810	-5.558**	1.764
Random Effect	Yes		Yes		Yes	
Producer/Importer	Yes		Yes		Yes	
Distributor	No		Yes		Yes	
R^2	0.314		0.427		0.426	
Obs.	1289		1289		933	

Note: *significant at the 5% leve
**significant at the 1% level

Except for *Specification 1* we use the random effect at the movie level in all other specifications. As the first two columns of Table 6-1 show, the coefficients of the age variable and the dummy variable for August increase and become significant with the random effect. Other estimates do not change much.

The coefficient of *Age* variable is significant and negative in all specifications, showing a time decaying effect. With the coefficient -0.033 the probability of watching a movie decreases by 3.24 percent on average as the movie becomes one day "older".[8]

[8] The semi-elasticity of the share with respect to characteristics evaluated at the average share.

Demand for *PG-12* movies is the highest, followed by *PG-15* and *All*, although the coefficients of *PG-15* and *All* are not significant in any specifications. It shows that the largest consumer group is teenagers.

Demand for movies is the highest in January, July, August, and December, and it is the lowest in April, September, and October. This seasonal demand is different from the US movie market where a high demand season starts on Memorial Day and ends on Labor Day. The difference is mainly due to school schedule. Schools in Korea have the winter break over two months from the middle of December and one month summer break from the mid-July, whereas US schools have almost four months summer break starting around Memorial Day.

In the first two specifications the coefficients of the nationality dummy variables are all significant. They imply that demand for Korean movies is the highest, followed by USA and Asian movies, and European movies are the least popular, controlling the decay effect, the seasonal effect, and the ratings. In particular, if a movie had been made with Korean cultural elements, instead of other Asian cultures, the probability of watching that movie increases by 131.5 percent on average. On the other hand, if the same movie had been made with American cultural elements the probability goes up by 94.9 percent on average.

The third column in Table 6-1 shows demand estimates with *Budget* and *Budget squared* included. 240 movies without budget information are dropped in the estimation. Most of them are Asian and European movies. The budget variables are significant, and show that movie quality increases at a decreasing rate with a higher budget. In particular, when an extra million dollar is spent, the probability of watching a movie increases by 4 percent on average.

Interestingly, the coefficient of USA variable becomes negative, although not significant, while the coefficients of Korea and Europe variables increase in an absolute term. It suggests that preference for US movies is mainly explained by preference for high budget movies, and that Korean consumers do not prefer US movies more than Asian movies for other reasons.

One may argue that characteristics of movies are not sufficiently controlled with the current variables, and that our results may reflect the aggregate market share with respect to nationality. Thus, we use all information available like producers/importers and distributors to control characteristics as much as possible.

Table 6-2 shows demand estimates with 28 major producers/importers and/or 25 major distributors included. There are some producers/importers or distributors with a small number of movies. Producers/importers that have less than 10 observations are treated as the same producer/distributor. The same treatment is applied to distributors.

With the producer/importer effect controlled the coefficient of USA variable decreases from 0.956 to 0.407 and becomes insignificant (in the first column.) The coefficient of Europe increases from -0.956 to -0.454 and becomes insignificant. The Korea variable increases from 1.325 to 1.499 and is still significant. The overall R squared increases to 0.314.

With the distributor effect added, difference among foreign movies becomes more negligible. The coefficient of USA decreases from 0.407 to 0.099 and that of Europe increases from -0.454 to -0.224. The coefficient of Korea decreases from 1.499 to 0.882 but is still significant (in the second column.) This means that if cultural elements in a foreign movie were switched to Korean, the probability of watching that movie increases by 87.5 percent on average.

We repeat this exercise with the budget variable in the third column. The coefficient of USA does not change with more variables included. It is negative but not significant. The coefficient of Europe increases from -1.261 to -0.097 and becomes insignificant. The coefficient of Korea decreases to 1.779 but is still significant.

VI. Conclusion

In this paper we assess how much consumers value cultural elements by estimating demand for films in Korea. We use a discrete choice model of differentiated product demand and include nationality variables in addition to other movie characteristics to measure consumers' willingness to pay for cultural elements.

Our result shows that Korean consumers are willing to pay more for home-produced movies compared to imported foreign movies. Our estimate shows that the probability of watching a foreign movie would increase by 87.5 percent if its cultural elements were replaced by Korean. According to our findings, there seems to be a cultural bias in consumption.

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Appendix. Data Sources for Budget and Opening Dates of US Movies in the United States

For Budget of U.S. movies:

* Internet Sources

1. http://www.the-numbers.com/movies
2. http://www.imdb.com

For Budget of Korean movies:

* Source: Korean Film Commission (2001-2004), *Korean Cinema: Feature Films.*

Note 1) All budgets are estimated values.
Note 2) Production Budget only for the U.S. movies. Prints and Advertising budgets are not included.
Note 3) Budget of Korean movies is not specified whether it includes Prints and Advertising budgets.

For Opening Dates of U.S. movies in the United States:

* Internet Sources

1. http://www.imdb.com
2. http://movies.yahoo.com/
3. http://www.the-numbers.com/movies

Table A1. Historical Admissions Data: Korea Film Market (Unit for Admissions: 10,000 persons)

	Korean Movies			Foreign Movies			Total	
Year	Admissions	Share (%)	Movies per Person	Admissions	Share (%)	Movies per Person	Admissions	Movies per Person
2004	8,019	59.3	1.65	5,498	40.7	1.13	13,517	2.78
2003	6,391	53.5	1.32	5,556	46.5	1.15	11,947	2.47
2002	5,082	48.3	1.07	5,431	51.7	1.13	10,513	2.2
2001	4,481	50.1	0.96	4,455	49.9	0.93	8,936	1.9
2000	2,271	35.1	0.42	4,191	64.9	0.89	6,462	1.3
1999	2,172	39.7	0.50	3,300	60.3	0.71	5,472	1.2
1998	1,259	25.1	0.29	3,759	74.9	0.81	5,018	1.1
1997	1,212	25.5	0.23	3,540	74.5	0.77	4,752	1
1996	976	23.1	0.19	3,244	76.9	0.71	4,220	0.9
1995	944	20.9	0.21	3,569	79.1	0.79	4,513	1
1994	993	22.0	0.24	3,842	79.5	0.86	4,835	1.1
1993	769	15.9	0.18	4,054	84.1	0.92	4,823	1.1
1992	872	18.5	0.22	3,839	82.0	0.88	4,711	1.1
1991	1,106	21.2	0.25	4,114	78.8	0.94	5,220	1.2
1990	1,081	20.2	0.25	4,265	79.7	0.99	5,350	1.2
1989	1,115	20.2	0.26	4,415	79.8	1.04	5,530	1.3
1988	1,216	23.3	0.29	4,007	76.8	0.96	5,220	1.2
1987	1,311	27.0	0.31	3,549	73.0	0.85	4,860	1.2
1986	1,562	33.0	0.38	3,166	66.9	0.77	4,730	0.9
1985	1,644	34.2	0.40	3,166	65.8	0.78	4,810	1.2
1984	1,689	38.5	0.42	2,703	61.6	0.67	4,390	1.1

1983	1,755	39.8	0.43	2,648	60.1	0.66	4,404	1.1
1982	0	0	0	0	0	0	4,274	1.1
1981	0	0	0	0	0	0	4,444	1.2
1980	0	0	0	0	0	0	5,377	1.41
1979	0	0	0	0	0	0	6,552	1.7
1978	0	0	0	0	0	0	7,399	2
1977	0	0	0	0	0	0	6,493	1.8
1976	0	0	0	0	0	0	6,570	1.8
1975	0	0	0	0	0	0	7,560	2.1
1974	0	0	0	0	0	0	9,738	2.81
1973	0	0	0	0	0	0	11,462	3.4
1972	0	0	0	0	0	0	11,872	3.5
1971	0	0	0	0	0	0	14,630	4.4
1970	0	0	0	0	0	0	16,635	5.2
1969	0	0	0	0	0	0	17,304	5.5
1968	0	0	0	0	0	0	17,134	5.61
1967	0	0	0	0	0	0	16,408	5.4
1966	0	0	0	0	0	0	15,634	5.3
1965	0	0	0	0	0	0	12,170	4.2
1964	0	0	0	0	0	0	10,458	3.7
1963	0	0	0	0	0	0	9,606	3.5
1962	0	0	0	0	0	0	7,905	3
1961	0	0	0	0	0	0	5,861	2.32

Table A2. Movie Shares and Attendance Shares by Nationality/Region for Each Sample Period

	Korea		USA		Asia		Europe		Other		Total (number)	
Period	Movies	Attendance	Movies	Attendance	Movies	Attendance	Movies	Attendance	Movies	Attendance	Movies	Attendance
2002.1	0.353	0.268	0.412	0.705	0.088	0.009	0.147	0.018	0	0	34	3974028
2	0.314	0.561	0.600	0.438	0.029	0.000	0.029	0.001	0.029	0.000	35	3006557
3	0.244	0.312	0.585	0.672	0.122	0.008	0.049	0.008	0	0	41	2514334
4	0.256	0.669	0.564	0.294	0.051	0.021	0.103	0.003	0.026	0.014	39	2565929
5	0.425	0.525	0.450	0.411	0.025	0.061	0.075	0.002	0.025	0.000	40	3323447
6	0.339	0.559	0.339	0.361	0.051	0.070	0.271	0.010	0	0	59	2443993
7	0.400	0.276	0.486	0.548	0.057	0.173	0.057	0.004	0	0	35	4138175
8	0.311	0.292	0.467	0.589	0.089	0.083	0.133	0.036	0	0	45	4522808
9	0.395	0.697	0.372	0.245	0.116	0.038	0.093	0.020	0.023	0.001	43	3193764
10	0.441	0.553	0.412	0.389	0.059	0.055	0.059	0.000	0.029	0.003	34	2983687
11	0.390	0.537	0.537	0.428	0.049	0.007	0.024	0.029	0	0	41	3191356
12	0.425	0.403	0.400	0.581	0.125	0.003	0.050	0.013	0	0	40	4539241
2003.1	0.296	0.326	0.556	0.508	0.074	0.129	0.074	0.037	0	0	27	3378124
2	0.300	0.551	0.500	0.317	0.133	0.126	0.067	0.006	0	0	30	4172805
3	0.219	0.397	0.594	0.548	0.125	0.055	0.063	0.000	0	0	32	2543359
4	0.317	0.545	0.463	0.404	0.073	0.021	0.146	0.030	0	0	41	2495317
5	0.343	0.500	0.343	0.466	0.086	0.011	0.171	0.013	0.057	0.010	35	4006261
6	0.375	0.499	0.375	0.443	0.094	0.037	0.125	0.021	0.031	0.001	32	4039375
7	0.482	0.459	0.407	0.475	0.037	0.054	0.074	0.012	0	0	27	4742770
8	0.385	0.418	0.423	0.505	0.039	0.059	0.154	0.018	0	0	26	4136191
9	0.333	0.590	0.515	0.354	0.091	0.054	0.061	0.002	0	0	33	3282474
10	0.255	0.705	0.471	0.236	0.177	0.046	0.098	0.013	0	0	51	3391656
11	0.333	0.495	0.400	0.461	0.156	0.030	0.111	0.015	0	0	45	3451629
12	0.393	0.437	0.393	0.531	0.179	0.031	0	0	0.036	0.001	28	4069073
2004.1	0.360	0.625	0.400	0.370	0.120	0.002	0.080	0.001	0.040	0.002	24	5248745
2	0.279	0.823	0.535	0.161	0.047	0.013	0.140	0.003	0	0	43	4551057
3	0.375	0.758	0.563	0.231	0	0	0.063	0.011	0	0	32	2731211
4	0.304	0.572	0.457	0.401	0.174	0.025	0.065	0.002	0	0	46	3260573
5	0.333	0.613	0.370	0.343	0.185	0.042	0.111	0.002	0	0	27	3630545
6	0.344	0.328	0.375	0.649	0.219	0.019	0.031	0.000	0.031	0.004	32	4007589
7	0.464	0.434	0.357	0.533	0.143	0.032	0	0	0.036	0.001	28	5092378
8	0.412	0.559	0.382	0.436	0.088	0.001	0.118	0.004	0	0	34	5172062
9	0.308	0.553	0.442	0.284	0.077	0.145	0.173	0.019	0	0	52	3467086
10	0.243	0.619	0.378	0.269	0.216	0.103	0.135	0.004	0.027	0.005	37	2909380
11	0.286	0.528	0.381	0.399	0.095	0.030	0.167	0.012	0.071	0.031	42	2760949
Average	0.339	0.508	0.448	0.434	0.099	0.045	0.101	0.010	0.012	0.002	37	3626798

Comments on "Preference for Cultural Goods; The Case of Korea Film Market"

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This paper is interested in the notion that preference for cultural goods is biased by cultural elements, specifically in Korean movie market. Therefore this paper analyzes empirically how much consumers value cultural elements in Korean movie market. By applying a discrete choice model of differentiated product demand to a monthly admissions data set with 764 films in the period of 2002-2004, authors found that there seems to be a cultural bias in consumption. Specifically, the probability of watching a foreign movie would increases by 87.5 percent if its cultural elements were replaced by Korean.

This research topic is timely and the empirical results would draw important policy implications. I would like to recommend this paper for the publication with minor revision. However, there are some comments on the econometric model and specification as follows;

1. This paper mentions that it uses a discrete choice model of differentiated product demand, but does not explain why this model is useful for this empirical analysis. This is critical because we have to use a Logit model. Since we have admission data, I do not see a particular reason not to use ordinary linear regression model. I am not against the use of this discrete choice model. More explanation of the model would help readers to understand this better.

2. Moreover, this model assume that consumers at most one unit goods or choose the outside option in each period. This is not what happens in a real world. Young teens, major consumers in Korean movie market usually go to mega-box several times during vacation. That is, the number of consumption is not limited to one. Again, the explanation how this model to work with the assumption would be helpful.

3. Table 6-1 and 6-2 is the main results of this paper and there are six different specifications. Which specification is the final choice as your empirical results? Some estimates are variable depending on specification. Some hypothesis tests are necessary.

4. Other than age and budget variables, all regressors are dummy variables.. Jwa and Lee (2006) argue that the spread of mega-box has a strong relationship with admission increase. I think a number of screens of each movie at opening day could be an important variable to explain variations in admission, since it can represent the effect of distributor.

5. About specification:. The monthly dummies add 11 more parameters and production and distribution dummies also add about 55 more parameters. Using vacation dummy instead of the monthly dummies would decrease a number of parameter without losing explanatory power.

6. I think that the estimate of Korea dummy overstates the effect of cultural elements even though I agree with your results of a positive and significant estimate of the variable, since the demand function does not control for all factors. For instance, it does not control for the effect of P2P. Korean young people not only go to theater to enjoy a movie, but also get free download. And free download is usually available for Holywood movies but not for domestic movies until they are off screen. This implies Holywood movie in front of a computer is a strong substitute to Holywood movie in a theater, but a domestic movie in a theater enjoys monopoly power. Therefore, the Korea dummy also includes the effect of P2P and does not represent only the effects of cultural elements.

CHAPTER 2-1

R&D Activities, Imperfect Competition and Economic Growth

by

ByungWoo Kim, STEPI

Abstract

Ideas do not become exhausted, and there are no diminishing returns in the creation of knowledge. Nonetheless, growth ultimately ceases in this simplest model of endogeneous innovation. But, if we treat knowledge capital as a public capital considering of its non-appropriable benefits, economic growth can be sustained in the economy.

We showed that considering goodness of fit of regression model, we can see that the empirical evidence is strongly in favor of the character of knowledge as the public knowledge capital. So, we can expect that by product innovation, economic growth can be sustained in the Korean economy.

Key Word: R&D investment, product differentiation, knowledge capital, public capital, sustained growth, monopolistic competition

I. Introduction

In the 1920s and 1930s considerable progress was made in the analysis of economic equilibrium, "monopolistic competition revolution".

Monopolistic competition was introduced by Chamberlin(1933). His concern was to deal with market structures characterized by advertising and product differentiation. If a firm is making a profit selling a product in an industry, and other firms are not allowed to perfectly reproduce that product, they still may find it profitable to enter that industry and produce a similar but distinctive product. Economists refer to this phenomenon as product differentiation. Each product has its following of consumers, and so has some degree of market power.

Since Harrod(1939) and Domar(1946), economists have looked to captital formation for their explanation of rising standards of living. It was Solow(1956) who formalized the idea that capital deepening could cause labor productivity to rise in a dynamic process of investment and growth. The model's critical assumption concerning the product function is that it has CRS(constant returns to scale) in its two arguments, capital and labor. In addition, intangibles such as human capital and knowledge capital have pecular economic properties that may not be well represented by the standard formulations.

The starting point for discussions of the pure theory of trade and productivity is Ricardo's *Principles*. A country will choose to obtain goods through trade when a unit of labor applied to exports will produce more goods for home use than will result from the application of labor to produce these goods domestically. This will be the case whenever the relative labor costs involved in the production of different commodities differ from one country to another. This difference comes mainly from the difference of productivity. If one country invests in R&D activities, then that country can lower labor costs relatively and exports more commodities. An alternative approach to the pure theory of trade and productivity originated in the work of Heckhsher(1919) and Ohlin(1933). Hecksher's purpose was to analyse the effects of trade on the income distribution between factors of production.

Although Linder(1961) stressed increasing returns to scale(IRS) in trade theory, it was not until much later (Krugman, 1979) that a more formal treatment of trade and productivity under IRS was provided. One of the problems with incorporating IRS into a theory of trade and productivity is the need to deal with imperfect competition. Krugman uses a model of monopolistic competition to show that trade can be viewed as a means of exploiting economies of scale in the presence of a less than completely elastic home market.

Grossman and Helpman(1991) developed coherent theoretical framework that previous discussions of trade, growth, development, industrial organization(IO) and innovation have lacked. They attempted to integrate the theory of IO with the theory of growth. As growth theory, they focused on the economic determinants of technological progress. As IO theory, they applied tools from the theory of IO to develop aggregate models of ongoing investemnts in new technologies. Their premise was that new technologies stem from the intentional actions of economic agents responding to market incentives.

In this paper, we review new models of intentional industiral innovation. We deal with innovation that serves to expand the range of goods avaliable on the market. Firms devote resources to R&D in order to invent new goods that substitute imperfectly for existing brands. Producers of unique products earn monopoly rents, which serve as the reward for their prior R&D investments. In addition, we adapt new growth theory to real Korean economy data by empirical analysis.

II. Economic model and empirical analysis

2.1. Imperfect competition and new growth theory

It was Solow(1956) who formalized the idea that capital deepening could cause labor productivity to rise in a dynamic process of investment and growth.

Many of the early models treated technological progress as an exogeneous process driven only by time. The view that innovation is driven by basic research, which is implicit in the models with exogeneous technology, was made explicit in a paper by Shell(1967).

Arrow(1962) was the first to view technological progress as an outgrowth of activities in the economic realm. Romer(1986), who discussed the possibility that learning-by-doing might be a source of growth, maintained this treatment of technological progress as wholly the outgrowth of an external economy.

Now we let the productivity of labor depend upon the economywide cumulative experience in the investment activity, that is, on the aggregate stock of capital. Then aggregate output of Z will be given by

$$Z = F[K,\ A(K)L]$$

The first argument in F( ) represents the private input of capital by all firms in the economy. The second argument reflects their aggregate employment of effective labor, which depends in part upon the state of technology, as represented by the term A(K).

Romer(1986) provides an alternative interpretation of this specification. He views K itself as knowledge. Knowledge is created via an R&D process. Firms invest in private knowledge, but at the same time they contribute inadvertently to a public pool of knowledge, which is represented here by A(K).

Shell(1967) makes knowledge the intended output of those who create it. The production function $F[K_Z,\ AL_Z]$ describes the relationship between inputs and output of the final good. We assume that the same production function applies to the generation of knowledge as applies to the production of tangible commodities:

$$\Delta A = F[K_A,\ AL_A]$$

where K_A and L_A are the inputs of capital and labor, respectively, into the research activity.

Grossman and Helpman(1991) developed endogenous growth based on intentional innovation. Industrial research may be aimed at inventing entirely new commodities(product innovation). They incorporated tools from the theory of industrial organization(IO), and their extensions in trade theory to general equilibrium settings to develop aggregate models of ongoing investments in new technologies. They represent the set of brands available on the market by the interval [0, n]. With this convention n is the measure of products invented. They referred to n as the "number" of available varieties.

Monopolistic competition was introduced by Chamberlin(1933). It is probably the most prevalent form of industry structure. If a firm is making a profit selling a product in an industry, and other firms are not allowed to perfectly reproduce that product, they still may find it profitable to enter that industry and produce a similar but distinctive product. Economists refer to this phenomenon as product differentiation. Each product has its following of consumers, and so has some degree of market power.

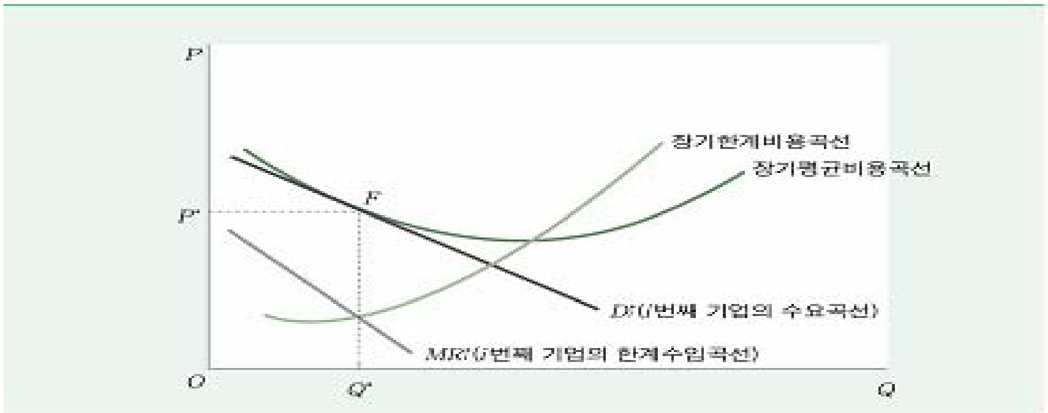
We can describe the (long-run) equilibrium of the industry in the following way:

(i) Each firm faces a downward-sloping demand.

(ii) Each firm makes no profit.

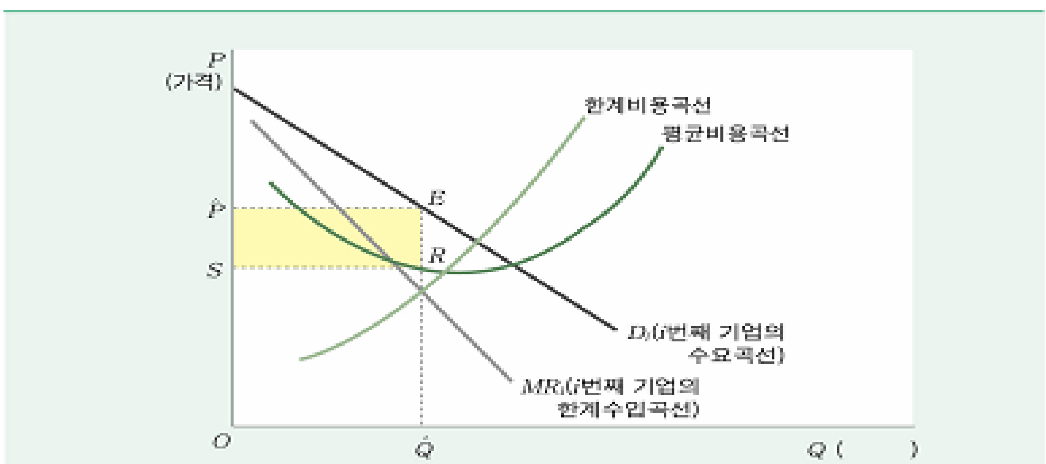
(iii) A price change by one firm has negligible effect.

Figure 1. Long-run equilibrium in Monopolistic competition



If we treat commercial research as an ordinary economic activity, returns to R&D come in the form of monopoly rents in (short-run) imperfectly competitive product markets.

Figure 2. Short-run equilibrium in Monopolistic competition



The representative household maximizes utility over an infinite horizon.

$$U(t) = \int_t^\infty e^{-p(\tau - t)} \log D(\tau) d\tau$$

Here $\log D(\tau)$ represents an index of consumption at time τ, and p is the subjective discount rate.

We adopt for D a specification that imposes a constant elasticity of substitution between every pair of goods. It is straightforward to show that, with these preferences, the elasticity of substitution between any two products is $\varepsilon = 1/(1-\alpha)\ (>1)$.

$$D = [\int_0^n x(j)^\alpha dj]^{(1/\alpha)} \quad (2.1)$$

where x(j) denotes consumption of brand j.

It is useful to develop an interpretation of the consumption index D. We may think of households as consuming a single homogeneous consumption good in quantity D. We suppose that the final good is assembled from differentiated intermediate inputs or producer services.

In equilibrium manufacturers of consumer goods would employ equal quantities $x(j) = x$ of each. Then (2.1) implies that $D = n^{(1/\alpha)} X$.

Then final output per unit of primary input(TFP) is given by $D / X = n^{(1-\alpha)/\alpha}$.[1]

Firms may enter freely into R&D. An entrepreneur who devotes 1 units of labor to R&D for a time interval of length dt acquires the ability to produce $dn = (1/a)dt$ new products. The efoort creates value for the entrepreneur of $v(1/a)dt$, since each blueprint has a market value of v.

$$\Delta n = F[L_N]$$

It is known that when the initial number of brands exceeds n, there always exists a perfect foresight equilibrium with no product development.(<Appendix>)

Ideas do not become exhausted, and there are no diminishing returns in the creation of knowledge. Nonetheless, growth ultimately ceases in this simplest model of endogeneous innovation.

As yet, we treated knowledge capital as a private good. But, the originators of many new ideas often cannot appropriate all of the potential benefits from their creations.

So in this point, we modify formulation of knowledge creation to allow for the existence of non-appropriable benefits from industrial research.

Romer(1990) argued that each research project also contributes to a stock of general knowledge capital $K_N(t)$.

In place of technology for product innovation $\Delta n = F[L_N]$, we assume that

[1] We can use X=nx to measure the resources embodied in final goods.

$$\Delta n = F[K_N, \ L_N] = (1/\text{a})(K_N L_N)$$

where K_N and L_N are stock of general knowledge capital and aggregate employment in R&D, respectively. Of course the previous formulation is a special case of this equation with $K_N(t) \equiv 1$.

We take the knowledge capital stock to be proportional to the economy's cumulative experience at R&D.

$$K_N = n$$

Let's ask what the equilibrium implies about the rate of growth of final output and the rate of growth of GDP. When the differentiated products are interpreted to be intermediate goods, clearly faster innovation implies faster output growth.

It is apparent that the economy innovates faster the larger is its resource base(large L), the more productive are its resources in the industrial research lab(small a), the more patient are its households(small p), and the greater is the perceived differentiation of products(small α).

If we treat knowledge capital as a public capital considering of its non-appropriable benefits, economic growth can be sustained in the economy.(<Appendix>)

IO economists have long tried to summarize the distribution of market shares among firms in a single index to be used in econometric and antitrust analysis. Such an aggregate index is called a concentration index.

The 3-firm concentration ratio(CR3), which adds up the 3 highest shares in the economy has been changed as in <Fig. 3> From this, we can infer that oligopolistic market structure like monopolistic competition is probably the most prevalent form of Korean industry structure.

Figure 3. 3-firm concentration ratio of Korea(CR3)

2.2. Data and Empirical Analysis

The term "panel data" refers to data sets where we have data on the same individual(industry; i) over several periods of time(t). The main advantage is that it allows us to test and relax the assumptions that are implicit in cross-sectional analysis.

The data set consists of 5 industries in manufacturing sector observed yearly for 15 years(1990-2004), a "balanced panel". Because of no missing data on some of the variables, we obtained 75 observations.

We examined a simple model for the technology for product innovation of 5 industries in manufacturing sector:[2]

$$n_{it} = \alpha_i + \beta' x_{it} + \varepsilon_{it}$$

n: the number of firms in each industry[3]

x: R&D investment, R&D stock, R&D personnel

The fixed effects approach takes α_i to be a group(industry) specific constant term in the regression model. The random effects approach specifies that takes α_i is a group(industry) specific disturbance in the regression model.

Fixed and random effects regression produces the following results. Estimated standard errors are given together. <Table> also contains the estimated technology for product innovation equations with individual industry effects.

Table 1. Panel data by industry classification

Industy variable (1990-2004)	R&D(OECD, KOSIS) Value Added, Number of firms(KOSIS)
FOOD	Food products, beverages and tobacco
CLOTH	Textiles, textile products, leather and footwear
CHEMICAL	Chemical, rubber, plastics and fuel products
METAL	Basic metals
MACHINE	Machinery and equipment, instruments and transport equipment

[2] In this point, we need to consider Schumpeter's(1943) thesis about the link between market structure and R&D. Schumpeter's basic point – that monopoly situations and R&D are intimately related – is articulated in the following clearly distinct argument; that if one wants to induce firms to undertake R&D one must accept the creation of monopolies as a necessary evil. While all firms stand prepared to use useful information created by other firms, no one firm is willing to pay the sums of money necessary to produce it without compensation. In practice, such compensation often comes through the granting of a patent that provides the innovating firm with a temporary monopoly. Previous empirical studies on Schumpeter hypothesis show that the prediction of Schumpeter does not accord well with empirical observation of Korean economy.(Lee and Cheong 1985, Kim and Cho 1989, Kim 2005, Sung 2005)

[3] Strictly speaking, n(t) is the measure of products invented before time t. Grossman and Helpman(1991) referred to n as the "number" of available varieties. In this paper, we use the number of firms for n due to limitation of getting data for the number of products by industry. This may be the limit of the paper.

<Table 2> contains the estimated production function for blueprints(knowledge) with individual industry disturbances. Considering chi-squared statistic for testing for the fixed and random effects, we can see that the evidence is strongly in favor of the random effects model.

We examined the following model for the technology for product innovation of 5 industries in manufacturing sector:[4]

$$n_{it} = \alpha_i + \beta' x_{it} + vGDP_t + \varepsilon_{it} \quad (2.2)$$

x: R&D investment

Significantly estimated elasticity of R&D to the number of firms in each industry is 0.14. It means that if firms increase R&D by 1%, then the number of blueprint is increased by 0.14%. GDP variable is used to control confounding factors(eg. business cycle).

Table 2. Random-effects model estimation for panel data[5]

Dependent Variable: LOG(N?)				
Method: Pooled EGLS (Cross-section random effects)				
Sample (adjusted): 1991 2004				
Included observations: 14 after adjustments				
Cross-sections included: 5				
Total pool (balanced) observations: 70				
Swamy and Arora estimator of component variances				
Period SUR (PCSE) standard errors & covariance (d.f. corrected)				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.464819	1.136276	2.169208	0.0336*
LOG(RD?(0))	0.137833	0.044106	3.125044	0.0026*
LOG(GDP(-1))	0.38548	0.09349	4.123231	0.0001*
Random Effects (Cross)				
_FOOD--C	-0.37473			
_CLOTH--C	0.851245			
_CHEMICAL--C	0.425791			
_METAL--C	-1.46356			
_MACHINE--C	0.561251			
	Effects Specification			

[4] In this specification of regression model, we again need to consider Schumpeter's thesis that imperfect competition situations like monopoly and R&D are intimately related because there may be the endogeneity problem. A fundamental assumption of regression analysis is that the explanatory variable(R&D) and the disturbance are uncorrelated in the market structure equation. In this situation, Ordinary Least Squares(OLS) estimates of the structural parameters are inconsistent, because the endogeneous variables(R&D and market structure) can be determined simultaneously. So, it is necessary to analyze the causalty between the two panel variables.(Canning and Pedroni, 2001) In this paper, we omit causality analysis and this may be the limit of the paper.

[5] If estimated coefficient is statistically significant, we denote *, or **, by 5% or 10% confidence level, respectively.

Cross-section random S.D. / Rho		1.013221	0.9933
Idiosyncratic random S.D. / Rho		0.083326	0.0067
	Weighted Statistics		
R-squared	0.729983	Mean dependent var	0.203608
Adjusted R-squared	0.721923	S.D. dependent var	0.157329
S.E. of regression	0.082965	Sum squared resid	0.461168
F-statistic	90.5662	Durbin-Watson stat	0.874371
Prob(F-statistic)	0.00		

Next, we examined the following model for the economic growth by product differentiation of 5 industries in manufacturing sector:

<Table 3> contains the estimated grow rate function in each industry byproduct differentiation with individual industry effects. Considering F statistic for testing the joint significance of the industry effects, we can see that the evidence is strongly in favor of a industry specific effect in the data.

$$(\Delta V / V)_{it} = \alpha_i + \beta' n_{it} + vGDP_{t-1} + \varepsilon_{it}$$

V: Value added by industry

Significantly estimated elasticity of product differentiation to the economic growth in each industry is 0.18. It means that if firms increase product differentiation by 1%, then the grow rate of industry is increased by 0.18%. Lagged GDP variable is used to control confounding factors(eg. business cycle).

Table 3. Fixed-effects model estimation for panel data

Dependent Variable: LOG(V?)-LOG(V?(-1))				
Method: Pooled Least Squares				
Sample (adjusted): 1992 2003				
Included observations: 12 after adjustments				
Cross-sections included: 5				
Total pool (balanced) observations: 60				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.126298	0.662803	3.208037	0.0023*
LOG(N?(0))	0.178434	0.102772	1.736217	0.0883**
LOG(GDP(-1))	-0.282846	0.071846	-3.936838	0.0002
Fixed Effects (Cross)				
_FOOD--C	0.074848			
_CLOTH--C	-0.151938			
_CHEMICAL--C	-0.083044			
_METAL--C	0.288039			
_MACHINE--C	-0.127905			
	Effects Specification			
Cross-section fixed (dummy variables)				
R-squared	0.345753	Mean dependent var		0.079265
Adjusted R-squared	0.271688	S.D. dependent var		0.078827
S.E. of regression	0.067272	Akaike info criterion		-2.450877

Sum squared resid	0.239850	Schwarz criterion	-2.206537
Log likelihood	80.52631	F-statistic	4.668201
Durbin-Watson stat	2.252562	Prob(F-statistic)	0.000704

Next, we examined the following model for the production function for blueprints(knowledge). We analysed the model to see whether the knowledge is a private good or public capital.

Considering goodness of fit, we can see that the evidence is strongly in favor of the character as the public knowledge capital.

We examined the following five models for the technology for product innovation of 5 industries in manufacturing sector:

$$\Delta n_{it} = \alpha_i + \beta' n_{it} + \varepsilon_{it} \qquad (2.2)$$

n: the number of firms in each industry

Significantly estimated regression coefficient of product differentiation to the production of knowledge in each industry is 0.04.(<Table 4>)

Table 4. Pooles LS estimation for panel data

Dependent Variable: (N?(0)-N?(-1))				
Method: Pooled Least Squares				
Sample (adjusted): 1992 2004				
Included observations: 13 after adjustments				
Cross-sections included: 5				
Total pool (balanced) observations: 65				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-92.21473	289.6156	-0.318404	0.7512
N?	0.040503	0.016040	2.525210	0.0141*
R-squared	0.091914	Mean dependent var		522.0462
Adjusted R-squared	0.077500	S.D. dependent var		1319.392
S.E. of regression	1267.235	Akaike info criterion		17.15735
Sum squared resid	1.01E+08	Schwarz criterion		17.22425
Log likelihood	-555.6138	F-statistic		6.376684
Durbin-Watson stat	1.652972	Prob(F-statistic)		0.014092

$$\Delta n_{it} = \alpha_i + \beta' RL_{it} + Vn_{it} + \varepsilon_{it} \qquad (2.3)$$

RL: R&D personnel

Significantly estimated regression coefficient of product differentiation to the production of knowledge in each industry is 0.04 and 0.24 in pooled LS and fixed-effects estimation model, respectively.(<Table 5>)

Table 5. Pooles LS and fixed-effects estimation for panel data

Dependent Variable: (N?(0)-N?(-1))				
Method: Pooled Least Squares				
Sample (adjusted): 1992 2004				
Included observations: 13 after adjustments				
Cross-sections included: 5				
Total pool (balanced) observations: 65				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	628.0331	744.4468	0.843624	0.4021
N?	0.043692	0.016312	2.678584	0.0095*
RDL	-0.003432	0.003268	-1.050075	0.2978
R-squared	0.107782	Mean dependent var		522.0462
Adjusted R-squared	0.079001	S.D. dependent var		1319.392
S.E. of regression	1266.204	Akaike info criterion		17.17049
Sum squared resid	99402839	Schwarz criterion		17.27085
Log likelihood	-555.0409	F-statistic		3.744867
Durbin-Watson stat	1.666312	Prob(F-statistic)		0.029148

Dependent Variable: (N?(0)-N?(-1))				
Method: Pooled Least Squares				
Sample (adjusted): 1992 2004				
Included observations: 13 after adjustments				
Cross-sections included: 5				
Total pool (balanced) observations: 65				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-692.1023	889.4651	-0.778111	0.4397
N?	0.237517	0.080123	2.964384	0.0044*
RDL	-0.010663	0.004281	-2.490987	0.0156*
Fixed Effects (Cross)				
_FOOD--C	1786.621			
_CLOTH--C	-1579.342			
_CHEMICAL--C	-460.6286			
_METAL--C	2638.287			
_MACHINE--C	-2384.937			
Cross-section fixed (dummy variables)				
R-squared	0.240083	Mean dependent var		522.0462
Adjusted R-squared	0.161471	S.D. dependent var		1319.392
S.E. of regression	1208.183	Akaike info criterion		17.13306
Sum squared resid	84663021	Schwarz criterion		17.36723
Log likelihood	-549.8246	F-statistic		3.054025
Durbin-Watson stat	1.597917	Prob(F-statistic)		0.011513

$$In(\Delta n_{it}) = \alpha_i + \beta' \ln(RL_{it}) + v \ln(n_{it}) + \varepsilon_{it} \quad (2.4)$$

The above equation is derived by taking logs of the following production function for blueprints(knowledge):

$$\Delta n = F[K_N, \ L_N] = (1/\text{a})(K_N L_N) = (1/\text{a})(nL_N)$$

Significantly estimated elasticity of product differentiation to the production of knowledge in each industry is 1.18.(<Table 6>)

Table 6. Pooles LS estimation for panel data

Dependent Variable: LOG(N?(0)-N?(-1))				
Method: Pooled Least Squares				
Sample (adjusted): 1992 2004				
Included observations: 11 after adjustments				
Cross-sections included: 5				
Total pool (unbalanced) observations: 48				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.148216	7.467068	0.555535	0.5813
LOG(N?)	1.175704	0.147096	7.992748	0.0000*
LOG(RDL)	-0.719558	0.606875	-1.185677	0.2420
R-squared	0.587487	Mean dependent var		6.217950
Adjusted R-squared	0.569153	S.D. dependent var		1.487177
S.E. of regression	0.976167	Akaike info criterion		2.850095
Sum squared resid	42.88058	Schwarz criterion		2.967045
Log likelihood	-65.40228	F-statistic		32.04375
Durbin-Watson stat	2.173729	Prob(F-statistic)		0.000000

$$In(\Delta n_{it}) = \alpha_i + \beta' \ln(RK_{it}) + v \ln(n_{it}) + \varepsilon_{it} \quad (2.5)$$

RK: R&D capital(stock)

Significantly estimated elasticity of product differentiation to the production of knowledge in each industry is 1.17.(<Table 7>)

Table 7. Pooles LS estimation for panel data

Dependent Variable: LOG(N?(0)-N?(-1))				
Method: Pooled Least Squares				
Sample (adjusted): 1992 2004				
Included observations: 11 after adjustments				
Cross-sections included: 5				
Total pool (unbalanced) observations: 48				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1.727818	4.746207	-0.364042	0.7175
LOG(N?)	1.167162	0.148597	7.854574	0.0000*
LOG(RDSTOCK)	-0.167249	0.268541	-0.622808	0.5366
R-squared	0.578235	Mean dependent var		6.21795
AdjustedR-squared	0.55949	S.D. dependent var		1.487177
S.E. of regression	0.987053	Akaike info criterion		2.872275
Sum squared resid	43.84228	Schwarz criterion		2.989225
Log likelihood	-65.9346	F-statistic		30.8473
Durbin-Watson	2.195918	Prob(F-statistic)		0.00

$$\ln(\Delta n_{it}) = \alpha_i + \beta' \ln(RL_{it}) + v \ln(RK_{it}) + \delta \ln(n_{it}) + \varepsilon_{it} \quad (2.6)$$

Significantly estimated elasticity of product differentiation to the production of knowledge in each industry is 1.19.(<Table 8>)

Table 8. Pooles LS estimation for panel data

Dependent Variable: LOG(N?(0)-N?(-1))				
Method: Pooled Least Squares				
Sample (adjusted): 1992 2004				
Included observations: 11 after adjustments				
Cross-sections included: 5				
Total pool (unbalanced) observations: 48				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	30.91205	13.14028	2.352464	0.0232*
LOG(N?)	1.188201	0.139846	8.496496	0.0000*
LOG(RDL)	-6.671516	2.526445	-2.640674	0.0114*
LOG(RDSTOCK)	2.675276	1.105616	2.419717	0.0197*
R-squared	0.635933	Mean dependent var		6.217950
Adjusted R-squared	0.611110	S.D. dependent var		1.487177
S.E. of regression	0.927419	Akaike info criterion		2.766832
Sum squared resid	37.84464	Schwarz criterion		2.922765
Log likelihood	-62.40397	F-statistic		25.61896
Durbin-Watson stat	1.916236	Prob(F-statistic)		0.000000

Considering goodness of fit of regression model, we can see that the empirical evidence is strongly in favor of the character of knowledge as the public (knowledge) capital. In all cases, individual coefficient for n is statistically significant at 5% confidence level.[6]

That result gives the implication that by product differentiation, economic growth can be sustained in the Korean economy.

III. Summary and Conclusion

Grossman and Helpman(1991) presented the models of endogeneous growth based on intentional industrial innovation. Innovations serve to expand the range of available products. They find that if the creation of knowledge generates nonappropriable benefits that allow later generations of researchers to proceed at lower resource cost than their predecessors, then the process of endogeneous innovation and growth may be sustained.

But, in the endogeneous growth model which treats knowledge capital as a private good, it is known that when the initial number of brands exceeds some number(eg. n), there always exists a perfect foresight equilibrium with no product development.

Ideas do not become exhausted, and there are no diminishing returns in the creation of knowledge. Nonetheless, growth ultimately ceases in this simplest model of endogeneous innovation.

If we treat knowledge capital as a public capital considering of its non-appropriable benefits, economic growth, however, can be sustained in the economy.

We showed that considering goodness of fit of regression model, we can see that the empirical evidence is strongly in favor of the character of knowledge as the public knowledge capital.

So, we can expect that by product innovation, economic growth can be sustained in the Korean economy.

Table 9. Panel analysis summary

Causal relationship	Innovation	(Elasticity)¡¡	Industry structure	(Elasticity)	Growth
Monopolistic Competition	R&D investment(X)	¢¡(0.14)	Product differentiation (n)	¢¡(0.18)	Economic growth in industry(¥ÄV/V)

[6] In particular, in the three log-linear model cases, estimated regression coefficients are all lager than 1. This gives the implication that the process of knowledge accumulation may be characterized by increasing returns. This can be explained by the fact, for example, if there exist important complementarities between different ideas. Actually Romer(1986) assumed increasing returns in the production of output from labor and total (public and private) knowledge. His condition for the sustainability of long-run growth amounts to an assumption that the accumulation of knowledge is not subject to diminishing returns.

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Appendix

In the momentary equilibrium all varieties are priced equally at p, where

$$p = w/a$$

(The specified technology makes marginal manufacturing costs equal to the wage rate w.)

With symmetric demands and E(aggregate spending)=1, this pricing strategy yields per brand operating profits of

$$\pi = (1\text{-}a)/n$$

This inverse relationship between the number of available varieties and profits per brand suggests that product development may never get underway if an economy inherits a sufficiently diverse set of differentiated commodities. In other words, in the endogeneous growth model which treats knowledge capital as a private good, when the initial number of brands exceeds some number(eg. n_0), there always exists a perfect foresight equilibrium with no product development. We can see that with these initial conditions, the dynamic equilibrium without any R&D is unique.

But, if we treat knowledge capital as a public capital considering of its non-appropriable benefits, economic growth can be sustained in the economy. In this case, the higher is the rate of innovation, the greater is employment in R&D. In the steady-state equilibrium, product development continues indefinitely, always at a constant rate. We may calculate the steady-state rate of innovation as follows:

$$g = (1\text{-}a)/(L/a)\text{-}ap$$

L: labor supply

Sustained innovation is possible in this case because the cost of product development falls with the accumulation of knowledge capital, even as the return to the marginal innovation declines. The nonappopriable benefits from R&D keep the state of knowledge moving forward, and so the private incentives for further research are maintained.

Comments on "R&D Activities, Imperfect Competition and Economic Growth"

Dual Kim,
Korea Development Institute

This paper deals with an interesting topic, but it does not have any new significant contribution.

1. Modeling:
   - It is incomplete. Author's idea is not clearly presented.

2. His discussion on market structure
   - He just shows three firm concentrations ratio for asserting that the industries he considers satisfy the condition of the monopolistic competition. However, this does not make sense.
   - He uses not number of commodities but number of firms for showing the relationship between R&D investment and product differentiation. However, this identification requires very strong (even unrealistic) assumptions.

3. His regression:
   - He only uses 75 observations (5 industry * 15 year panel). However, this small number of industry is not suitable for testing his argument. More disaggregate data or firm level data should be available at hand.
   - He should also worry about the endogeneity problem.

In conclusion, this paper is **not up to** the standard of this journal.

CHAPTER 2-2

Investment –Specific Multifactor Productivity in Multi-sector Open Economies: Data and Analysis

by

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Abstract

In the last half of the 1990s, labor productivity growth rose in the U.S. and fell almost everywhere in Europe. We document changes in both capital deepening and multifactor productivity (MFP) growth in both the information and communication technology (ICT) and non-ICT sectors. We view MFP growth in the ICT sector as investment-specific productivity (ISP) growth. We perform simulations suggested by the data using a two-country DGE model with traded and nontraded goods. For ISP, we consider level increases and persistent growth rate increases that are symmetric across countries and allow for costs of adjusting capital-labor ratios that are higher in one country because of structural differences. ISP increases generate investment booms unless adjustment costs are too high. For MFP, we consider persistent growth rate shocks that are asymmetric. When such MFP shocks affect only traded goods (as often assumed), movements in 'international' variables are qualitatively similar to those in the data. However, when they also affect nontraded goods (as suggested by the data), movements in some of the variables are not. To obtain plausible results for the growth rate shocks, it is necessary to assume slow recognition.

JEL Classifications: D83, F43, O41

Keywords: Technology Shocks, Technical Change, Dynamic General Equilibrium, Learning, Harrod-Balassa-Samuelson Effect, Nontraded Goods

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I. Introduction

Changes in labor productivity growth in the U.S. and Europe are among the major economic events of the last fifteen years. There now seems to be general agreement that in the last half of the 1990s, labor productivity growth rose in the U.S. and fell almost everywhere in Europe. In the first half of the 1990s, U.S. growth was significantly below that in European countries, but in the second half the situation was reversed in almost every case. Recently, several analysts have provided breakdowns of changes in labor productivity growth by country, by component, and by sector.[1]

Some generalizations are suggested by the data. In both the U.S. and Europe there were increases in multifactor productivity (MFP) growth in the information and communication technology (ICT) sector. It came as a surprise to us that these increases were the same or even greater in Europe. As a consequence, there were sharp reductions in the relative prices of ICT goods.[2] At least partly for this reason, capital deepening through investment in information and communication technology (ICT) goods increased in both the U.S. and Europe, but the increase was about twice as great in the U.S. We treat MFP growth in the ICT sector as investment-specific productivity (ISP) growth, a convention adopted by several others.[3]

MFP growth in the non-ICT-producing sector rose by a significant amount in the U.S. and by comparable amounts in some European countries but fell by more than double these amounts in other European countries. Capital deepening through investment in non-ICT goods increased markedly in the U.S. but decreased in Europe. Increases in both labor productivity growth and MFP growth have been higher in the U.S. in important sectors that produce mostly nontraded goods.

The changes in relative productivity growth rates in the last half of the 1990s were accompanied by some dramatic changes in other variables. In the U.S., there was an investment boom, a deterioration in the trade account, a temporary improvement in the terms of trade, and a significant real appreciation of the dollar.

In an attempt to provide perspective on the data, we perform simulations using a DGE model with two countries (Home and Foreign).[4] Each country produces a traded good and a nontraded good, and the two traded goods are imperfect substitutes for each other.[5] In each country, consumption and investment goods are aggregates assembled

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[1] Most of our data come from three sources: the Groningen Growth and Development Center, Dale Jorgenson and his associates, and the Organization for Economic Co-operation and Development.

[2] To be more precise, what happened in the last half of the 1990s was an increase in the rate of decline of the relative price of investment goods.

[3] See, for example, Greenwood, Hercowitz, and Krusell(1997).

[4] Pioneering contributions to the analysis of productivity shocks in open-economy DGE models include Backus, Kehoe, and Kydland (1994b), Backus, Kehoe, and Kydland (1994a), Stockman and Tesar(1995), Baxter and Crucini (1995), and Kollmann (1998). Recent contributions include Erceg, Guerrieri, and Gust(2002), Laxton and Pesenti (2003), and Hunt and Rebucci (2003). Closed economy contributions include Edge, Laubach, and Williams (2003, 2004).

[5] Nontraded goods are clearly a large fraction of output in the U.S. (and Europe). The (increasingly unsatisfactory) convention of indentifying goods as traded and services as nontraded leads to the conclusion that 75% or so of output is nontraded. Taking account of the familiar argument that some services are traded, we assume that nontraded goods constitute 63% of consumption and 52% investment. These figures are in the middle of the (admittedly large) range of assumptions in the literature.

using the two traded goods and the local nontraded good. The baskets of traded goods used in both consumption and investment are biased toward the locally-produced good, but the 'local bias' in consumption is greater. The model nests most two-country DGE models used over the past fifteen years to analyze productivity changes.

Our reading of the disparate productivity-growth experiences of the U.S. and Europe has determined our choice of simulation experiments. We focus primarily on two persistent productivity growth shocks. The first is a symmetric ISP growth shock. This shock has different effects on the two countries because one of them has less structural rigidity reflected in lower costs of adjusting capital-labor ($K-L$) ratios. The second is an MFP growth shock that is (perfectly) asymmetric across countries. Departing from much previous analysis, we emphasize the case in which the shock affects both the traded and nontraded sectors. To take account of slow adjustment of consumption and slow recognition of persistent growth shocks, we incorporate habit in consumption and learning about shocks. To fix ideas, we consider symmetric ISP level shocks before discussing the two growth shocks.

We calibrate the symmetric ISP growth shock so that it causes an increase in the rate of decline of the relative price of investment that closely matches the one in U.S. data. In the country with low $K-L$ adjustment costs, the investment incentive of the shock is large relative to the wealth effect. As a result, there is an investment boom, an actual reduction in consumption for several periods, and a modest trade deficit. In contrast, in the country with high $K-L$ adjustment costs, the wealth effect dominates: investment increases very little, but consumption rises significantly. The movements in the TOT and the RER are qualitatively quite different from those in the data.

We calibrate the asymmetric MFP growth shock so that for the country receiving the increase, the initial rise in labor productivity growth is the same as for the symmetric ISP shock. With MFP shocks, the wealth effect is large relative to the investment incentive. For positive shocks, both consumption and investment rise, and there is a sizeable trade deficit. The large wealth effect combined with local-good bias keeps the TOT from deteriorating for a while since demand for the local traded good increases by as much as supply.

In succeeding sections, we present data relevant for analyzing productivity shocks in the U.S. and Europe, our model, our simulations, and our conclusions.

II. Data

2.1. Accounting for Changes in Labor Productivity Growth

Much progress has been made in accounting for changes in labor productivity growth in the U.S. and Europe during the 1990s.[6] It is no easy task to separate out the contributions of capital deepening and multi-factor productivity growth for the economy as a whole and for individual sectors.[7] Data revisions and improvements in methodology continue to have significant effects on conclusions.

[6] In this paper we do not attempt to explain why labor productivity growth was higher in Europe for many years before 1995 or to compare the levels of labor productivity in the U.S. and Europe.

[7] Some analysts also separate out a contribution of changes in labor quality, but in this paper we abstract from such changes.

Here we focus primarily on data from three sources: the Groningen Growth and Development Center (GGDC), Dale Jorgenson and his associates, and the Organization for Economic Co-operation and Development (OECD) STandard ANalysis data base.[8] Data from all three sources have at least three desirable features: they (1) are reported on a standardized basis across several countries, (2) include estimates of hours instead of only the number of employees for all countries, and (3) include estimates of real investment that are quality adjusted using the same methodology.

Table 1 contains a comparison of GGDC and Jorgenson data for the U.S., France, Germany, and the U.K.[9] In addition, for the GGDC there are data for the Netherlands and an aggregate called the 'EU-4' (France, Germany, the U.K., and the Netherlands). For Jorgenson there are data for Italy but there is no aggregate of European countries. In our comparisons we use average annual growth rates for the periods 1990-1995 and 1996-2001. We focus our attention on changes in average growth rates between the two periods in the U.S. and European countries. Unless stated otherwise, growth rate differences are presented in percentage point (pp) form.

Changes in U.S. growth rates are essentially the same in the data from the GGDC and Jorgenson, and we will treat them as if they were the same in what follows.[10] Most of the major qualitative features that we choose to emphasize can be illustrated by comparisons between the U.S. and the EU-4 aggregate in the GGDC data.[11] In the last half of the 1990s, labor productivity growth rose in the U.S. and fell in Europe resulting in a difference between changes in growth rates of 1.5 pp. In the first half of the 1990s, U.S. labor productivity growth was significantly below that in the EU-4, but in the second half it was slightly above.

Using the same data, the changes in labor productivity can be broken down into changes in components. Overall capital deepening increased in the U.S.: there were increases for both ICT capital (0.4 pp) and non-ICT capital (0.2 pp). In contrast, overall capital deepening fell in the EU-4 because the increase in ICT capital deepening (0.2 pp) was only half as much as in the U.S. and was more than offset by the decrease in non-ICT capital deepening (-0.6 pp). The contribution of MFP growth increased in both the U.S. and the EU-4 but the U.S. increase was more than twice as high (0.7 pp versus 0.3 pp).

The Jorgenson data include a breakdown of the contributions of MFP growth into those from ICT-producing sectors and those from all other sectors. These data confirm earlier findings that there has been a significant increase in the contribution of MFP growth in ICT producing sector in the U.S. (0.3 pp).[12] However, it came as a surprise to us that they also imply that the contribution of this sector has been just as high in the European countries. In the non-ICT sectors, MFP growth increased by 0.4 pp in the U.S. and by slightly more in France and the U.K. but fell by 1.2 pp in Italy and by even more in Germany.

There has been much interest in the sectoral breakdown of the changes in labor productivity growth. Using OECD data on *value added by sector* in the U.S. (a

[8] Two GGDC sources are GGDC (2004) and Inklaar, O'Mahony, Robinson, and Timmer (2003). The work of Jorgenson and his associates is summarized in Jorgenson (2004). For the OECD STAN data base source, see Organization for Economic Co-operation and Development (2004).

[9] The GGDC data come from GGDC (2004) and the Jorgenson data come from Jorgenson (2004).

[10] The possible exceptions to this statement are the growth rates for labor quality which are not considered in this paper.

[11] In the GGDC data, France is the only country where the qualitative pattern is different from that in the EU-4 aggregate.

[12] See, for example, Oliner and Sichel (2000).

rearrangement of BEA data) we constructed a sectoral breakdown of labor productivity growth for the U.S. which is shown in the leftmost three columns of Table 2.[13] It appears that most of the pickup in aggregate growth was accounted for by three sectors: Manufacturing (0.2 pp); Wholesale and Retail Trade; Restaurants and Hotels (0.4 pp); and Finance, Insurance, Real Estate, and Business Services (0.2 pp).

Conceptually, sectoral contributions to changes in aggregate labor productivity growth can be broken down into changes in capital deepening and changes in MFP growth. As it turns out, it is difficult to reach definitive conclusions about the relative importance of these contributions. There is evidence that sectoral changes in ICT capital deepening have been important. As an example, the data in Table 2 provide some support for the view that the sectors that have made the largest sectoral contributions are the ones with the biggest increases in investment in ICT goods. Sectoral data for the ratio of nominal gross investment in ICT goods to nominal value added are shown in the rightmost three columns of Table 2. The increases in this ratio for Wholesale and Retail Trade as well as Finance, Insurance, Real Estate & Business Sector Services are significantly larger than for all of the other sectors (except Transportation, Storage, and Communication). These are two of the three sectors that made the largest contributions. However, even though Manufacturing is the third, the increase in its ratio is on the low end. Furthermore, by far the largest increase in the ratio occurred in the Transportation, Storage, and Communication sector, where there was a negative contribution.

There is also evidence that sectoral changes in MFP growth have been important. [?] show that some of the sectors that have made the largest contributions to the increase in the difference between aggregate U.S. and EU-4 labor productivity growth are sectors in which increases in the difference between MFP growth rates have also been high.[14] According to their data, for some of these sectors the increases in MFP growth were considerably more important than the increases in ICT capital deepening.[15] Three sectors which exhibit both of these phenomena are (1) Electrical and Electronic Equipment; Instruments, (2) Repairs and Wholesale Trade, and (3) Retail Trade.

We believe that the data clearly suggest at least three generalizations regarding the breakdown of the increase in the difference between U.S. and European labor productivity growth rates. First, although MFP growth in the ICT sector was roughly the same in the U.S. and Europe, there have been important increases in differences between ICT capital deepening in both ICT -producing and non- ICT -producing sectors. Second, MFP growth in the non- ICT -producing sectors increased in the U.S. but fell on balance in Europe. Third, in contrast to what some might have expected, there have been significant increases in differentials in MFP growth rates nontraded goods as well as for traded goods. We have taken these generalizations into account in constructing the model that we use to shed light on recent experience.

2.2. More on the U.S. Economy in the 1990s

Some additional data for the U.S. economy relevant for analyzing the effects of productivity shocks are shown in Figure 1. In discussing figures, we use the convention that, for example, 'panel 4 of Figure 1' is referred to simply as 'F1.4'.

In the second half of the 1990s, the decline in prices of investment goods became more rapid. In particular, the rate of decline in the price of aggregate investment relative to

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[13] The contributions in Table 2 are calculated using the standard methodology summarized in equation A.43 on p. 145 of Schreyer (2001).

[14] See their Figure III.3.c. The analysis in Fernald and Ramnath (2004) also supports this conclusion.

[15] See their Appendix Tables III.C.1 through III.C.6.

GDP (F1.1) increased by 0.69 pp. A greater increase for consumer durables and a smaller increase for private investment (by businesses) more than offset the small decline for government investment. For the subcategory of investment in equipment and software, the increase was 1.28 pp.

At least partly in response to this more rapid rate of price decline, there was an investment boom. The share of investment in GDP (broken line F1.4) rose throughout this period from about 0.19 to about 0.22. In contrast, the saving rate, the solid line, climbed by 2 pp between 1995 and 1998 but fell back to slightly below its 1994 level by the end of 2000. Since the fraction of GDP devoted to government spending was fairly constant in the late 1990s, the continued increase in investment accompanied by the reduction in savings implied a deterioration in the overall U.S. trade balance (F1.5).

The increase in the nominal investment share does not fully capture the magnitude of the investment boom because of the decline in prices of investment goods. To better capture the relative magnitude of the changes in quality-adjusted real investment, we plot the difference between the growth rates of chain-weighted real investment and chain-weighted real GDP (F1.2). The difference between these two growth rates got at least as high in the last half of the 1990s as in earlier booms and remained high much longer. Furthermore, the drop in the difference in the recession of the early 2000s was significantly less than in earlier recessions.

What is not shown in Figure 1 is that an overwhelming portion of growth in investment can be attributed to outlays for ICT investment (information-processing equipment and computer software); nominal outlays on these item were 9% of total nominal investment in 1990 and 22% in 1999. Real outlays grew faster because computer prices fell. The increase in ICT investment growth accounts for 60% of the increase in all investment.[16]

There was an abrupt increase in U.S. labor productivity growth (F1.3) in the second half of the 1990s.[17]

The overall U.S. trade balance as a ratio of GDP (F1.5, dotted line) deteriorated rapidly in the last half of the 1990s. We are especially interested in a comparison of the U.S. with Europe. The U.S. bilateral trade balance with the European Union (solid line) worsened slightly. After improving for a while, the overall trade balance for Europe (dashed line) fell below its initial level.

The U.S. terms of trade with the rest of the world (F1.6, dotted line) improved by as much as 5% before giving back much of its gain by the end of the decade.[18] The dollar appreciated dramatically in real terms against the 'rest of the world' (dashed line) and even more dramatically against the Euro (solid line).

It apparently took some time for government and private analysts to become convinced that the increase in productivity growth was going to be persistent. Both the Congressional Budget Office and the consensus of Blue Chip forecasters produce five-year-ahead forecasts of real GDP growth. As reported by Erceg, Guerrieri and Gust (2002), these forecasts were virtually unchanged until the late 1990s and then increased gradually.

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[16] See, for example, Bosworth and Triplett (2000).

[17] The quarterly data shown come from the productivity release of the Bureau of Labor Statistics. It differs from the data presented in Table 1 in that it excludes the government and farm sectors.

[18] The US/ROW terms of trade is the ratio of the U.S. import deflator to the U.S. export deflator. We have not calculated a US/EURO terms of trade because there are no bilateral data for some countries in the Euro Area. The U.S./ROW real exchange rate is the ratio of the U.S. CPI to the trade-weighted sum of exchange-rate-adjusted CPIs for 25 major trading partners of the U.S.

III. Model

In our analysis of the effects of different productivity shocks, we use a DGE model with two countries designated Home and Foreign which are mirror images of one another. We describe the behavior of the representative Home agent.

3.1. Tastes

In period t, the agent maximizes the intertemporal utility function

$$\sum_{s=t}^{\infty} \beta^{s-t} \frac{V_s^{1-\gamma} - 1}{1-\gamma} \tag{1}$$

Period utility is a constant elasticity function of V_s which, in turn, depends on the current consumption of the agent (C_s), lagged total consumption (C_{s-1}), and leisure which is given by one minus labor (L_s):

$$V_s = V(C_s, C_{s-1}, L_s) = \left(\frac{C_s - \eta C_{s-1}}{1-\eta}\right) \exp\left\{\chi_0 \left[\frac{(1-Ls)^{1-\chi} - 1}{1-\chi}\right]\right\} \tag{2}$$

That is, there is external habit in consumption. The agent also chooses holdings of a single bond (B) denominated in the Home traded good (the numeraire good for the model) and traded internationally.

3.2. Technology

Home technology comprises six sectors. First, there are two sectors in which traded (T) goods and nontraded (N) goods are produced using identical Cobb-Douglas production functions scaled by adjustment costs:

$$Y_{is} = K_{is}^{\alpha} L_{is}^{1-\alpha} X_{is}^{1-\alpha} \left[1 - \frac{\psi_{KL}}{2} \left(\frac{K_{is}}{L_{is}} / \frac{K_{is-1}}{L_{is-1}}\right)^2\right] = F(\underline{K}_{is}, \underline{L}_{is}) X_{is}^{1-\alpha}, \tag{3}$$

where $\underline{K}_{is}$ and $\underline{L}_{is}$ are vectors containing current and lagged values and $i = T, N$. For sector i, output (Y_{is}) is produced using sector-specific capital (K_{is}) and labor (L_{is}). The T and N sectors use all the labor that is supplied:

$$L_s = L_{Ts} + L_{Ns.}. \tag{4}$$

There are MFP shocks (X_{is}) that may differ between the two sectors. For sector i, there are quadratic adjustment costs (governed by ψ_{KL}) associated with changing capital-labor ratios. Examples of such adjustment costs are training costs and costs of satisfying regulations.

Next, there are two sectors in which capital stocks are accumulated. In each of these sectors, yesterday's sector-specific capital stock (K_{is-1}) and some of yesterday's investment good (J_{is-1}) are used to generate today's sector-specific capital stock :

$$K_{is} = \left[\delta\left(\frac{J_{is-1}}{\delta}\right)^{1-\phi} + (1-\delta)(K_{is-1})^{1-\phi}\right]^{\frac{1}{1-\phi}}, i = T, N \text{ ,}$$

where ϕ governs the costs of adjusting capital stocks.

Finally, there are two sectors in which goods are assembled into a consumption good (C_s) and an investment good (J_s). C_s is a constant elasticity of substitution (CES) function of consumption inputs of traded goods (C_{Ts}) and of the local nontraded good (C_{Ns}):

$$C_s = \left[(1-v_C)\left(\frac{C_{Ts}}{1-v}\right)^{1-\theta_{CN}} + v_C\left(\frac{C_{Ns}}{v}\right)^{1-\theta_{CN}}\right]^{\frac{1}{1-\theta_{CN}}}, \tag{5}$$

and J_s is a CES function of 'quality-adjusted' investment inputs of traded goods (τ_{Ts}) and of the local nontraded good (I_{Ns}):

$$J_s = \left[(1-\nu_I)\left(\frac{\mathcal{I}_{Ts}}{1-\nu}\right)^{1-\theta_{IN}} + \nu_I\left(\frac{I_{Ns}}{\nu}\right)^{1-\theta_{IN}}\right]^{\frac{1}{1-\theta_{IN}}}, \tag{6}$$

where (τ_{Ts}) is the 'quality-adjusted' input of traded goods defined below. In assembly sector i where $i = I, C$, the parameters v_i and $1/\theta_{iN}$ are, respectively, the weight given to nontraded goods in production and the elasticity of substitution between traded and nontraded goods.

In turn, the consumption input of traded goods is a CES function of consumption inputs of Home traded goods (C_{Hs}) and of Foreign traded goods (C_{Fs}):

$$C_{Ts} = \left[\ell_C \left(\frac{C_{Hs}}{\ell_C} \right)^{1-\theta_{CT}} + (1-\ell_C) \left(\frac{C_{Fs}}{1-\ell_C} \right)^{1-\theta_{CT}} \right]^{\frac{1}{1-\theta_{CT}}}, \ell_C = n + k_C. \quad (7)$$

By analogy, the investment input of quality-adjusted traded goods is a CES function of quality-adjusted inputs of Home traded goods ($\mathcal{I}_{Hs}$) and of Foreign traded goods ($\mathcal{I}_{Fs}$):

$$\mathcal{I}_{Ts} = \left[\ell_I \left(\frac{\mathcal{I}_{Hs}}{\ell_I} \right)^{1-\theta_{IT}} + (1-\ell_I) \left(\frac{\mathcal{I}_{Fs}}{1-\ell_I} \right)^{1-\theta_{IT}} \right]^{\frac{1}{1-\theta_{IT}}}, \qquad \ell_I = n + \kappa_I. \quad (8)$$

$0 < \ell_C, \ell_I < 1$ are, respectively, the weights on the Home traded good in traded-good inputs into consumption and investment. n is the proportion of the world's population living in the Home country. In this paper, we make the simplifying assumption that the two countries are of equal size ($n = \frac{1}{2}$). The parameters k_C and $k_1 (0 < k_C, k_I < 1-n)$ determine the amount of local-good bias in the composition of traded goods inputs into consumption and investment, respectively. (For example, there is no local-good bias when $k_C = k_I = 0$). We incorporate the empirically-based assumption that the local-good bias is greater in consumption than in investment.

Traded investment inputs are referred to as 'quality-adjusted', because there are investment-specific productivity (ISP) increases:

$$\begin{aligned} \mathcal{I}_{Hs} &= Q_{Hs}^{\frac{1-\alpha}{\alpha}} I_{Hs}, \qquad \mathcal{I}_{Fs} = Q_{Fs}^{\frac{1-\alpha}{\alpha}} I_{Fs}, \\ \mathcal{P}_{Hs} &= \frac{1}{Q_{Hs}^{\frac{1-\alpha}{\alpha}}}, \qquad \mathcal{P}_{Fs} = \frac{P_{Fs}}{Q_{Fs}^{\frac{1-\alpha}{\alpha}}}, \end{aligned} \quad (9)$$

where the $Q_{js}, j = H, F$ are ISP shocks that can be different.[19] If a Q_{js} increases, a given physical unit of output of good j can contribute more to investment good output (J_s) than the same unit did before. I_{Hs} and I_{Fs} are measured in units of Home and Foreign traded goods, respectively, whereas $\mathcal{I}_{Hs}$ and $\mathcal{I}_{Fs}$ are measured in performance units. For example, I_{Hs} and I_{Fs} might be measured in numbers of computers in which

[19] The qualtity shocks are entered with the exponent $\frac{1-\alpha}{\alpha}$ so that if the Q_{js} are equal, doubling all of them doubles steady-state outputs. More precisely, if $Q_{js} = Q_s$, $j = H, F, N,$, then $\frac{Y_{is}}{Q_s}$, $i = T, N$ is constant in the nonstochastic steady state. In this paper we assume that Q_{Ns} remains constant at unity.

case $\mathcal{I}_{Hs}$ and $\mathcal{I}_{Fs}$ might be measured in terms of computing power. Given that the Home traded good is the numeraire, the price of a unit of I_{Hs} is unity. P_{Fs} is the price of the Foreign traded good in terms of the Home traded good, and ρ_{Hs} and ρ_{Fs} are prices of Home and Foreign performance units in terms of the Home traded good.

Our ISP shocks are designed to generate effects similar to those of an increase in multifactor productivity in a separate ICT sector. The traded-goods sector can be thought of as being divided into two sub-sectors—one producing investment inputs that are subject to quality improvements and the other producing consumption inputs that are not—with perfect mobility of capital and labor between the two subsectors. Note that all of the ISP shocks affect output of the investment good, which can be used to increase the capital stock in both the traded and nontraded goods sectors.

Q shocks are reflected in the relative prices of investment goods. Using the model results for sectoral prices and quantities, we can construct aggregate prices and quantities. In order to generate model results that are comparable to the data, we construct chain-weighted aggregates. For example, for the relative price of investment, we use the ratio of Fisher indices for the investment (J_s) deflator and the GDP deflator, where the deflator for J_s is calculated using the prices of $\mathcal{I}_{Hs}$, $\mathcal{I}_{Fs}$, and I_{ws} and the deflator for GDP is calculated using the prices of C_{Hs}, C^*_{Hs}, C_{Ns}, $\mathcal{I}_{Hs}$, $\mathcal{I}^*_{Hs}$, and I_{Ns}.

3.3. The Budget Constraint

The agent must also take into account a budget constraint. Income from production of traded and nontraded goods plus interest from claims on Foreign last period must be at least enough to cover purchases of both traded goods and the home nontraded good for use in assembling consumption and investment plus claims on Foreign this period and "portfolio management costs" associated with claims on or liabilities to Foreign:[20]

$$F(\underline{K}_{Ts}, \underline{L}_{Ts})X_{Ts}^{1-\alpha} + F(\underline{K}_{Ns}, \underline{L}_{Ns})X_{Ns}^{1-\alpha} + R_{s-1}B_{s-1} \geq$$

$$\left[C_{Hs} + P_{Fs}C_{Fs} + P_{Ns}C_{Ns} + \frac{\mathcal{I}_{Hs}}{Q_{Hs}^{\frac{1-\alpha}{\alpha}}} + \frac{P_{Fs}\mathcal{I}_{Fs}}{Q_{Fs}^{\frac{1-\alpha}{\alpha}}} + P_{Ns}I_{Ns} + B_s + \frac{\zeta}{2}\frac{B_s^2}{Z_{Ts}}\right]. \quad (10)$$

P_{Ns} is the price of Home nontraded goods in term of Home traded goods. R_s is the gross return on bonds denominated in the Home traded good. A positive value of B_s indicates claims of Home on Foreign.

[20] Portfolio management costs are included to insure that the model has a well-defined steady state. Including these costs is the easiest among several roughly equivalent ways of guaranteeing stationarity as explained by Schmitt-Grohe and Uribe (2003).

3.4. Relative Prices

In this paper, we focus on four relative prices. Two of them are the relative prices of the two countries' nontraded goods in terms of their traded goods represented by P_{Ns} and P^*_{Ns}, respectively. An asterisk on a variable indicates that it relates to Foreign. The terms of trade (TOT) and real exchange rate (RER) are given by

$$TOT_s = \frac{1}{P_{Fs}} \quad , \qquad RER_S = \frac{P_{Cs}}{P_{Fs}P^*_{Cs}} \tag{11}$$

where P^*_{Ns} is the price of the Foreign consumption bundle in terms of the Foreign traded good. The TOT is defined as the number of Foreign traded goods it takes to buy a unit of Home traded goods, so an increase is an improvement. The RER is the CPI-adjusted exchange rate defined as the number of Foreign consumption bundles it takes to buy a Home consumption bundle, so an increase is an appreciation of the Home currency in real terms. Improvements in the TOT and increases in P_{Ns} cause the Home currency to appreciate in real terms but increases in P^*_{Ns} cause it to depreciate. In the neighborhood of the steady state

$$\widehat{RER}_s = \nu\left(\widehat{P}_{Ns} - \widehat{P}^*_{Ns}\right) + (1-\nu)\left(\kappa_C + \kappa^*_C\right)\widehat{TOT}_s, \tag{12}$$

where a hat over a variable indicates a percentage deviation from its steady-state value. $0 < k^*_C < n$ is the degree of local-good bias in consumption in Foreign, and we assume $k^*_C < k_C$.

IV. Simulations

In this section we report the results of our simulations. To fix ideas, we first discuss symmetric increases in the levels of ISP in Home and Foreign. Then, we analyze two types of persistent productivity growth shocks suggested by the data: symmetric increases in ISP growth and (perfectly) asymmetric changes in MFP growth. The values of the parameters used in the simulations are in Table A1 in the Appendix. Unless stated otherwise, we assume that Home and Foreign parameters are identical.

In explaining our simulations, we use the terms 'wealth effect' and 'investment incentive'. For us, a shock has a positive wealth effect if it gives rise to an increase in the excess of income over the spending needed to support the initial steady-state path (both measured in Home traded goods). In calculating this excess, we hold constant relative prices of *physical* units, consumption allocations, effective investment input allocations

($\mathcal{I}_{Hs}$ and $\mathcal{I}_{Fs}$), and bond holdings.[21] With MFP shocks, income goes up. Agents receive the value of production of traded and nontraded goods through either wages or capital income, and MFP shocks increase the amounts produced. With ISP shocks, spending goes down. There is a fall in the relative price of *effective* traded-good investment inputs. When there are positive wealth effects, agents can consume more, increase the capital stock by more, or work less. What they choose to do depends on the incentives they face.

A positive investment incentive can arise either because of a fall in the consumption price of (quality-adjusted) investment or because of a rise in the marginal product of capital.[22] Changes in the consumption price of investment are associated with changes in the GDP price of investment in the same direction. We use the latter variable and call it simply the 'relative price of investment'. U.S. data for this relative price are in F1.1.

4.1. Symmetric ISP Level Increases

In our first experiment, there are symmetric permanent increases in the levels of ISP . We compare results for two cases: (1) the identical (adjustment) costs case in which adjusting capital-labor ($K-L$) ratios is costless in both countries ($\psi_{KL}=0$), and (2) the higher Foreign (adjustment) costs case in which adjusting $K-L$ ratios is very costly in Foreign ($\psi^*_{KL}=5000$). In both cases, there are positive costs of adjusting capital stocks that are the same in both countries.

In F2A and F2B, we show the effects of 1% increases in the productivities of Home and Foreign traded goods that are used as inputs in the assembly of investment goods (Q_{Hs} and Q_{Fs} respectively). Since these increases in the ISP of tradable investment inputs are symmetric, they have the same positive wealth effects in both countries in both cases. In each country, it takes fewer resources to support the initial steady-state path.

We use the case with identical costs (dashed lines) as a benchmark. In this case, the two countries are completely symmetric, so all the effects are the same in the two countries. These results are similar to those for a closed economy in many respects.

It comes as no surprise that the shocks create positive investment incentives. Before adjustment of consumption and investment, there are decreases in the relative prices of investment. With optimal adjustment, the relative prices of investment (F2A.1) fall by roughly 0.45%. The magnitudes of these declines reflect the fact that tradables account for roughly half of investment inputs. After their initial drop, the relative prices of investment remain roughly constant.

In our calibration, the costs of adjusting capital stocks are low enough that (gross) investment shares (F2A.3) increase because quantity increases outweigh price declines. The increases in investment shares by 0.09 pp must be matched by equal decreases in consumption shares (F2A.4). The investment incentive is large enough relative to the

[21] Since the initial excess is zero, the wealth effect is given by the first line of equation (10) minus the second where X_{Ts}, X_{Ns}, $Q_{Hs}^{\frac{1-\alpha}{\alpha}}$, and $Q_{Fs}^{\frac{1-\alpha}{\alpha}}$ are at their post shock values and all other variables are at their initial steady state values. Our definition of the term 'wealth effect' is quite different from the one in Baxter (1995).

[22] For further discussion of the investment incentive see the Appendix.

wealth effect that there are decreases not only in the shares of consumption but also in the chain-weighted levels (F2B.1). Although the shares of consumption remain below baseline for twenty five years, the levels rise above baseline after four years. The hump-shaped responses of consumption shares are due to the effects of habit in consumption. In each country, there are the same spikes in the excess of (quality-adjusted) investment growth over GDP growth (F2A.2), labor productivity growth (F2A.5), and GDP growth (F2A.7) as well as persistent increases in capital deepening (F2A.6) and hours worked (F2A.8).

Now we turn to the case with higher Foreign costs (solid and dotted lines). Once again, there are positive investment incentives in both countries. Before adjustment of consumption and investment, the declines in the relative prices of investment are the same. However, the positive investment incentive is larger in Home. The marginal product of capital is higher there because there are no $K-L$ adjustment costs. The initial increase in the Home investment share is about twice as great as in the identical-costs case. About one third of this change is financed by an additional reduction in the Home consumption share and the remaining two thirds by borrowing from Foreign. As in the identical-costs case, the investment incentive effect is large enough relative to the wealth effects that there are reductions not only in the share of Home consumption but also in its the level. There is a major deterrent to increasing investment further by borrowing more. Nontraded goods constitute a large share of Home investment-assembly inputs and are complements to the other inputs, so either the fall in consumption or the rise in work effort would have to be relatively large.[23]

In contrast, in Foreign the investment incentive is small enough relative to the wealth effect that the investment share is reduced rather than increased. Given that investment inputs are now much cheaper, Foreign residents can maintain their capital stocks and even increase them a little, even though they drastically reduce their investment share. They choose to devote the lion's share of the freed resources to increasing their consumption share because there is a relatively small increase in the incentive to lend to Home.

In Home, there is some magnification of the effects on the excess of investment growth over GDP growth, labor productivity growth, GDP growth, capital deepening, and hours worked.[24] However, in Foreign, there are significant effects on only three of these variables: GDP growth, labor productivity growth, and hours. The initial spike in labor productivity growth is larger in Foreign (0.14 pp) than in Home (0.1 pp). Output growth increases somewhat less in Foreign, but hours remain virtually unchanged there while they increase significantly in Home. At first, hours in Foreign remain virtually unchanged because of the large cost of changing the capital-labor ratio. Over time, total hours increase as a gradual increase in nontraded hours (not shown) offsets an even more gradual decrease in traded hours (not shown). Two observations help in understanding why: (1) steady-state capital stocks increase in Foreign as much as they do in Home and (2) nontraded investment inputs are complements to traded inputs but do not benefit from an improvement in ISP .

[23] We find it natural to assume that nontraded goods are complements in the assembly of investment (and consumption) goods. In our simulations the elasticity of substitution between nontraded and traded goods is one-half. Raising it to one has very small quantitative effects. Raising it to four (the value of the elasticity of substitution between the two traded goods) has large effects at the sectoral level and significant but considerably smaller effects at the aggregate level. It is more attractive to use traded goods in both investment and consumption, so investment can be higher without having consumption be any lower. At its peak the trade deficit is 0.10 pp instead of 0.07 pp.

[24] Note that the initial decrease in capital deepening occurs because hours can increase in the period of the shock, but the capital stock cannot.

Home runs a trade balance deficit (F2B.3) for about 5 years and a trade surplus for many years thereafter. The higher level of investment in Home increases demand for both tradable investment inputs. The increase in the trade deficit as a share of GDP is at its maximum (-.05 pp) initially when it is about a fourth of the total increase in the Home investment share.

The Home TOT (F2B.4) remains roughly unchanged initially and then deteriorates slowly over time. At first, the supply of and demand for traded goods (not shown) are cut back by roughly equal amounts in Home and in Foreign. In Home, a significant amount of labor (not shown) is shifted from the traded to the nontraded sector. However, almost immediately the supply of traded goods begins to increase faster in Home because the Home traded-good capital stock increases much more rapidly and because Home traded-good hours rebound rapidly. In each country, the relative price of the nontraded goods (F2B.6), P_N or P_N^*, rises by roughly the same amount initially. It continues to rise in Foreign but begins to fall in Home because of the divergent movements in consumption assembly, which is relatively intensive in nontraded goods. Initially, the Home currency appreciates in real terms (F2B.5), and equation (12) helps in understanding why. The RER rises a little initially because the TOT improves, and the movements in the relative prices of nontraded goods offset each other. However, it begins to fall almost immediately because the effects of the divergent movements in the relative prices of nontraded goods reinforce those of the deterioration in the TOT.

4.2. Symmetric ISP Growth Rate Increases

The data indicate that there was a persistent increase in MFP growth in the ICT sector in the last half of the 1990s in both the U.S. and Europe. For this reason, it is interesting to analyze persistent symmetric increases in the growth rates of ISP. For simplicity, we restrict our attention to the more relevant case of asymmetric adjustment costs. Like other analysts of persistent growth-rate shocks, we find it necessary to assume that agents must learn the process governing the growth rate shocks in order to obtain results that bear some resemblance to the data.[25] We focus on the learning case and show results for the full-information case primarily for purposes of exposition.

We assume that the Home ISP growth rate follows an $AR(1)$ process:

$$\widetilde{Q}_{Hs} = 0.95\widetilde{Q}_{Hs-1} + \varepsilon_{Hs} \tag{13}$$

where a tilde over a variable indicates a growth rate. We set the coefficient on the lagged growth rate equal to 0.95 so that the relative price of investment (F3a.1) decreases by one percent per year during the first six years of the simulation (1996-2001). This rate of decrease closely matches the one in the U.S. data. The process for the Foreign ISP growth rate is analogous.

[25] Learning has been used in the analysis of productivity shocks by Erceg, Guerrieri, and Gust (2002) and Edge, Laubach, and Williams (2004).

In the case with learning, agents hypothesize that $\widetilde{Q}_{Hs}$ is the sum of a persistent shock (S_{Ps}) and a temporary shock (S_{Ts}) and that it evolves according to

$$\widetilde{Q}_{Hs} = S_{Ps} + S_{Ts}, \quad S_{Ps} = 0.95 S_{Ps-1} + e_{Ps}, \quad S_{Ts} = e_{Ts}, \tag{14}$$

where e_{Ps} and e_{Ts} are normally distributed innovations. Having observed $\widetilde{Q}_{Hs}$, the agent infers S_{Ps} and S_{Ts} using a Kalman filter. We assume that agents set the autoregressive coefficient for their hypothesized persistent process equal to the true coefficient.[26] The ratio of the variances of e_{Ps} and e_{Ts} perceived by agents determines how long it takes them to learn. We choose this ratio so that the part of the observed shock attributed to the persistent component is 75% after five years and virtually 100% after ten years. The learning process for the Foreign ISP growth rate is analogous.

We choose the ISP growth rate innovations (ε_{Hs} for Home) so that they raise the level of ISP by 1% in the first period. That is, the first-period effects of the ISP growth rate shocks on the levels of ISP are the same as those of the ISP level shock considered in subsection 1. Scaling the shocks in this way makes it easy to compare the initial effects in the learning and full information cases. However, it has the implication that the effects of persistent growth rate shocks are an order of magnitude larger because the ISP shocks asymptotically approach levels that are 13% higher than their preshock levels.

Just as in the case of increases in the levels of ISP, the wealth effects are the same in both countries because the shocks are symmetric. However, the wealth effects are smaller in the benchmark case with learning than with full information because agents are not sure that the shock is truly a persistent growth rate shock.

There are positive investment incentives in both countries, but the incentive in Home is greater. The initial decreases in the relative prices of investment are the same in both countries, but the marginal product of capital is higher in Home because there are no $K-L$ adjustment costs. With optimal adjustment, the paths for the relative prices of investment (F3A.1) in Home and Foreign are slightly different because investment demand increases by more in Home, limiting the price decline to some extent. The increase in Home investment demand is reflected both in the increase in the investment share (F3A.3) over time and in the rise in the excess of investment growth over output growth (F3A.2) by about 0.5 pp for the first 5 years. As in the level shocks case, investment is attractive enough that there are decreases in both the share (F3A.4) and the level (F3B.1) of consumption. Also, Home is induced to borrow from Foreign. In contrast, Foreign residents reduce the share of investment but increase the level of investment very gradually because of the high costs of adjusting $K-L$ ratios. They increase the consumption share by somewhat less than they decrease the investment share, and lend to Home.

In order to better understand the adjustment process in the learning case, it is useful to consider the full information case. We show only the results for Home. With full information, the wealth effect is greater. Agents know full well that the relative price of

[26] If agents must also learn the coefficient of the autoregressive process, they figure out the true shock process much more slowly.

investment will be much lower in the future. For Home residents, investment is unattractive enough initially that they cut the investment share (F3A.3) by roughly 2 pp and the level of investment (F3B.2) by roughly 8%. The growth rate of investment is temporarily below that of output (F3A.2). A little more than half of the decrease in the investment share is used to raise the consumption share, and the rest is lent to Foreign. We do not discuss the full information case any further, except to note that in the early periods the paths for all the variables depart from those in the learning case in the manner implied by a larger perceived wealth effect.

With learning, the response of the Home investment share in the first period is a weighted average of what the response would be for a persistent growth shock with full information (-1.77 pp from F3A.2) and what it would be with a level shock (0.17 pp from F2A.2). Agents initially attribute only 6% of the observed movement in *ISP* to the persistent component and the other 94% to a level shock. When these percentages are used to weight the effects of the two possible kinds of shocks, the average effect is 0.05 pp (F3A.3). Since the U.S. investment share did not fall in the data when the rate of decline in the relative price of investment became larger, the results with learning seem more plausible to us than those with full information.

Home labor productivity growth (F3A.5) increases on impact by 0.14 pp, roughly the amount of the initial increase in ISP times the share in GDP of traded investment inputs (Home and Foreign). As the large increase in investment raises the contribution of capital deepening (F4A.6), labor productivity growth rises above its initial level. In contrast, in Foreign there is essentially no contribution of capital deepening, so the evolution of labor productivity growth closely matches that of the *ISP* shock.

In Home, hours (F4A.8) rise relatively rapidly and then fall back toward their initial level. In Foreign, hours increase more slowly and reach a higher level.

The Home trade balance (F3B.3) is in deficit for a time but then moves into surplus. The Home TOT (F3B.4) deteriorate over time, making Home traded goods relatively more attractive. The relative price of the nontraded good rises in Foreign because consumption is intensive in nontraded goods. This rise reinforces the deterioration in the Home TOT both of which cause the Home currency to depreciate in real terms (F3B.4).

4.3. Asymmetric MFP Growth Rate Shocks

According to the data we report above, in the late 90s the U.S. experienced an increase in the rate of growth of MFP in the non-ICT sector, and taken together European countries experienced a reduction. In both regions, there were changes in several sectors, some of which clearly produce nontraded goods. We perform simulations designed to isolate the effects of persistent changes in MFP growth rates.

For clarity, we make two simplifying assumptions. First, we assume that the shocks are (perfectly) asymmetric by which we mean that the increase in Home and the decrease in Foreign are equal in absolute value. Second, we assume that there are no costs of adjusting $K-L$ ratios in either Home or Foreign.[27] We report responses only for Home since with symmetric economic structures and asymmetric shocks, Foreign responses are the exact opposites of Home responses.

As a benchmark, we take the case in which there are MFP shocks of equal magnitude in the traded and nontraded sectors as suggested by the data. For comparison, we also consider the more familiar case in which there are MFP shocks only in the traded goods sector. This is the case used in discussions of the well-known Harrod-Balassa-Samuelson

[27] Allowing for costs of adjusting $K-L$ ratios in Foreign would make less difference in the case of MFP growth shocks since capital deepening makes a smaller contribution to labor productivity growth in this case.

effect. In both cases, we assume that agents face a learning problem with the same structure as the one described in Subsection 2. We also discuss some of the differences between the results for MFP shocks and those for ISP shocks.

In the benchmark case the MFP growth rate increases initially by 0.33 pp in both the traded and nontraded sectors in Home (and declines by 0.33 pp in Foreign).[28] We have picked the size of the shocks so that the initial rise in Home labor productivity growth matches the one in the simulation for a 1% ISP growth shock.[29]

There is a positive wealth effect since the outputs of both traded and nontraded goods increase. Before quantities adjust, there is no change in the relative price of investment goods because MFP rises by the same proportion in the traded and nontraded sectors. Nonetheless, there is still a positive investment incentive in Home because the marginal products of capital rise in both sectors.

The positive investment incentive leads to increases in the Home investment share (F4A.3) and in the excess of investment growth over GDP growth (F4A.2). At the point at which it is the largest (0.8 pp), about half of the increase in the investment share is financed by a reduction in the consumption share (F4A.4), and the remainder is financed by borrowing from Foreign. Although the consumption share falls, the wealth effect is strong enough relative to the investment incentive that the level of consumption rises steadily.

In the benchmark MFP case, the initial rise in Home labor productivity growth (F4B.1, solid line) of roughly 0.2 pp reflects both the 0.33 pp increase in MFP growth across the economy and labor's share of income (0.7 pp). As MFP growth subsides, labor productivity growth declines, and the contribution of capital deepening (F4A.6)—as opposed to the shock itself—accounts for a larger and larger share of labor productivity growth.

For the first several years, Home continues to borrow and run a trade-balance deficit (F4B.3). Since Home and Foreign traded goods are good substitutes, the deterioration is substantial, as much as 0.5% of GDP in our baseline case. Since there is local-good bias in both consumption and investment, the big initial increase in home absorption results in a slight improvement in the terms of trade. However, as Home production continues to expand, the Home terms of trade (F4B.4) deteriorate.

Now we turn to the more familiar case in which the MFP shock is concentrated in the traded sector. We call this case the 'traded-sector-only' case and double the magnitude of the shock since it affects only one sector. The traded-sector-only case is similar to the benchmark case in several ways. In Home there are a positive wealth effect and a positive investment incentive because the output of traded goods and the marginal product of capital in the traded goods sector both rise.

However, there are some differences between the two cases. In the traded-sector-only case, the path for the relative price of investment (F4A.1) is lower everywhere. The reason is that investment assembly is more intensive in traded goods than consumption assembly.[30] As a result, the investment share of GDP goes up by more. Since the reduction in the consumption share (F4A.4) is about the same in both cases, the higher investment share is reflected in more borrowing from Foreign accompanied by more deterioration in the trade balance (F4B.3).

[28] As before, the $AR(1)$ process governing the evolution of MFP growth has a coefficient of 0.95.

[29] It is not surprising that with MFP shocks of the type we consider, we cannot match the entire path of labor productivity growth.

[30] In our calibration, the traded shares for investment and consumption are 0.48 and 0.37, respectively.

The most significant differences from the benchmark case lie in the results for some relative prices. The deterioration of the Home TOT (F4B.4) in the first few years is not very different from that in the benchmark case. In sharp contrast, the relative price of the nontraded good (F4B.6) increases rapidly in Home (and falls rapidly in Foreign) instead of remaining constant and is about 7% higher in the long run. The large and divergent movements in the relative prices of nontraded goods dominate movements in the TOT, so the RER (F4B.5) rises in accordance with equation (12). That is, in contrast to the benchmark case, the Home currency appreciates dramatically in real terms, exemplifying the familiar Harrod-Balassa-Samuelson effect.

A comparison of the effects of growth rate shocks for MFP with those of ISP reveals some important differences. The MFP and ISP shocks we have chosen are the ones suggested by our reading of the data, not those best suited for a head- to-head comparison of the two kinds of shocks. Nonetheless, our simulations reveal some salient differences between them.

The relative importances of the wealth effect and the investment incentive are opposite in the two cases. With MFP shocks, the relative strength of the wealth effect is great enough that the level of consumption rises from the outset. In contrast, with ISP shocks, the wealth effect is relatively weak, so the level of consumption falls for some time.

The increase in labor productivity can be divided into the contribution of capital deepening and the contribution of the shocks themselves.[31] Capital deepening is relatively less important with MFP shocks; that is, it accounts for a smaller fraction of labor productivity growth. For instance, in year 2000 (4 years after the start of the simulation) capital deepening accounts for one fourth of labor productivity growth with MFP shocks (F4A.5 and F4A.6) as opposed to one half with ISP shocks (F3A.5 and F3A.6).

As stated above, we calibrate the shocks so that the initial change in labor productivity growth is the same for MFP and for ISP shocks. Given this normalization and our calibration of the parameters, for example, the trade balance deteriorates more with the MFP shocks.

V. Conclusions

Our analysis highlights the major difference between positive ISP and MFP shocks. Both shocks lead to marked increases in labor productivity growth. However, with ISP shocks, raising labor productivity growth requires much more investment. Increases in labor productivity are accounted for more by increases in capital deepening than by the shock itself. This finding supports the view that ISP shocks played a relatively more important role than MFP shocks in generating the persistent excess of investment growth over GDP growth in the U.S. in the late 1990s.

Lags in recognition are key in explaining our results for persistent growth shocks. Under full information, with positive ISP shocks investment falls initially and remains below its initial level for a few years. Agents postpone investment because they realize that the price of investment goods will be even lower in the future. With learning, our simulation results are closer to the observed outcomes: investment remains constant initially but rises immediately thereafter.

[31] See the Appendix.

We confirm that the treatment of nontraded goods can make a big difference.[32] In the case of ISP shocks, changing the degree of substitutability between traded and nontraded goods has large effects at the sectoral level. In the case of MFP shocks, we can reproduce the conventional Harrod-Balassa-Samuelson result: when a country experiences a positive shock that affects only traded goods, its currency appreciates in real terms and its trade balance deteriorates, changes like those that occurred in the U.S. in the late 1990s. However, the data suggest that real-life MFP shocks also affected nontraded goods. Our model implies that such shocks should have virtually no effect on the RER and that they should generate a smaller trade balance deterioration.

Our simulations provide some insights regarding the effects of observed productivity shocks. However, it is not surprising that they leave some features of the data unaccounted for. We use a two-country model. But it seems clear that a model with more regions, almost certainly including a separate East Asia bloc, is required to analyze some of the developments of the 1990s, such as the big increase in the U.S. trade account deficit—accompanied by little increase in the bilateral trade surplus of Europe with the U.S.—and the large real appreciation of the dollar. We consider only productivity shocks. But other important shocks influenced economic outcomes in the 1990s. A prime example is the Asian crisis.

[32] Like many others, we assume that the dividing line between traded and nontraded goods is exogenous. There is a clear need for more research on endogenous tradability. An early contribution is Dornbusch, Fischer, and Samuelson (1977), and recent contributions include Bergin and Glick (2003) and Ghironi and Melitz (2004). The outsourcing abroad of record keeping and customer service functions is a familiar concrete example.

Appendix

Lagrangian Expression for Home Agent

The Lagrangian expression for the home agent is

$$\sum_{s=t}^{\infty} \beta^{s-t} \left\{ \frac{[V(C_s, \mathcal{C}_{s-1}, L_s)]^{1-\gamma} - 1}{1-\gamma} + \Lambda_{Ts} \left[K\left(J_{Ts-1}, K_{Ts-1}\right) - K_{Ts} \right] \right.$$

$$+ \Lambda_{Ns} \left[K\left(J_{Ns-1}, K_{Ns-1}\right) - K_{Ns} \right] + \Lambda_{Js} \left[J\left(Q_{Hs}^{\frac{1-\alpha}{\alpha}} \mathcal{I}_{Hs}, Q_{Fs}^{\frac{1-\alpha}{\alpha}} \mathcal{I}_{Fs}, , I_{Ns} \right) - J_{Ts} - J_{Ns} \right]$$

$$+ \Lambda_{Cs} \left[R_{s-1} B_{s-1} + F(\underline{K}_{Ts}, \underline{L}_{Ts}) X_{Ts}^{1-\alpha} + P_{Ns} F(\underline{K}_{Ns}, \underline{L}_{Ns}) X_{Ns}^{1-\alpha} - \frac{\zeta}{2} \frac{B_s^2}{Z_{Ts}} \right.$$

$$\left. - C_{Hs} - P_{Fs} C_{Fs} - P_{Ns} C_{Ns} - \frac{\mathcal{I}_{Hs}}{Q_{Hs}^{\frac{1-\alpha}{\alpha}}} - \frac{P_{Fs} \mathcal{I}_{Fs}}{Q_{Fs}^{\frac{1-\alpha}{\alpha}}} - P_{Ns} I_{Ns} - B_s \right]$$

where Λ_{Ts}, Λ_{Ns}, Λ_{Js}, and Λ_{Cs} are the shadow prices of K_{Ts}, K_{Ns}, $J = J_{Ts} + J_{Ns}$ and income.

Parameter Values

The parameter values used in the simulations are given in Table A1. In the initial steady state P_F, P_N, P_N^*, Q_T, Q_T^*, X_T, X_N, X_T^* and X_N^* are all unity.

Table A1. Parameter Values

β	discount factor	0.98
γ	elasticity of marginal utility w.r.t. V	1.0
α	share of capital in production	0.35
δ	depreciation rate	0.025
ϕ	governs capital adjustment costs	0.2
v_C & v_I	share of nontraded goods in C & I	0.63 & 0.52
$1/\theta_{CN}$	elasticity of substitution - T & N & goods in C	0.5
$1/\theta_{IN}$	elasticity of substitution - T & N goods in J	0.5
n	relative size of home country	0.5
k_C	local-good bias in C_T	0.32
k_I	local-good bias in I_T	0.08
$1/\theta_{CT}$	elasticity of substitution - H & F goods in C_T	4.0
$1/\theta_{IT}$	elasticity of substitution - H & F goods in I_T	4.0
ψ_{KL} & ψ^*_{KL}	governs capital-labor ratio adjustment costs	0 & 5000
ζ	governs portfolio management costs	0.0001
$2/x$	Frisch elasticity of labor supply	0.4
x_0	set so steady-state share of time worked is 0.33	0.719

Decomposing Labor Productivity Growth

In this section, we show that the usual decomposition of labor productivity growth into a contribution from capital deepening and a contribution from a productivity shock is as relevant for ISP shocks as it is for MFP shocks. For simplicity, we focus on a special case in which all goods are traded, but the argument generalizes.

The Törnqvist index for quality-adjusted, chain-weighted output growth, which approximates the Fisher index, is given by

$$\hat{Y}_t^{CW} = S_{CHt}\tilde{C}_{Ht} + S^*_{CHt}\tilde{C}^*_{Ht} + S_{IHt}\left(\tilde{I}_{Ht} + \frac{1-\alpha}{\alpha}\tilde{Q}_{Ht}\right) + S^*_{IHt}\left(\tilde{I}^*_{Ht} + \frac{1-\alpha}{\alpha}\tilde{Q}_{Ht}\right), \quad (15)$$

where Y_t^{CW}, C_{Ht}^*, and I_{Ht}^* are chain-weighted output, consumption exports, and investment exports, respectively, and, for example S_{CHt} is the average of the shares of the consumption of the Home good in total output in periods t and $t-1$.[33]

Quality-adjusted output at constant prices (Y_t^{CP}) and its growth rate ($\widetilde{Y}_t^{CP}$) are

$$Y_t^{CP} = C_H + C_{Ht}^* + Q_{Ht}^{\frac{1-\alpha}{\alpha}} \left(I_{Ht} + I_{Ht}^*\right), \tag{16}$$

$$\widetilde{Y}_t^{CP} = S_{CH}\widetilde{C}_{Ht} + S_{CH}^*\widetilde{C}_{Ht}^* + S_{IH}\left(\widetilde{I}_{HT} + \frac{1-\alpha}{\alpha}\widetilde{Q}_{Ht}\right) + S_{IH}^*\left(\widetilde{I}_{Ht}^* + \frac{1-\alpha}{\alpha}\widetilde{Q}_{Ht}\right) \tag{17}$$

where in the initial steady state $Q_t = 1$, and, for example, $S_{CHt} = S_{CH}$. From equations (15) and (17), it is clear that growth of GDP at constant prices can be viewed as the first-order approximation of the Törnqvist index with no trend growth since $\widetilde{C}_{Ht} = \widetilde{C}_{Ht}^* = \widetilde{I}_{Ht} + \frac{1-\alpha}{\alpha}\widetilde{Q}_{Ht} = \widetilde{I}_{Ht}^* + \frac{1-\alpha}{\alpha}\widetilde{Q}_{Ht} = 0$ in the steady state.

Log-linearizing and combining equation (16) and the technology constraint

$$C_H + C_{Ht}^* + I_{Ht} + I_{Ht}^* = K_t^{\alpha} L_t^{1-\alpha} X_t^{1-\alpha}, \tag{18}$$

yield the usual decomposition in terms of percent deviations from the steady state:

$$\hat{Y}_t^{CP} - \hat{L}_t = \alpha\left(\hat{K}_t - \hat{L}_t\right) + (1-\alpha)\hat{X}_{Ht} + \left(Sh_{IH} + Sh_{IH^*}\right)\frac{1-\alpha}{\alpha}\hat{Q}_{Ht\bullet}. \tag{19}$$

From equation (19), it is clear that the ISP shock ($\hat{Q}_t$) can be interpreted as an MFP shock that affects only the investment-producing sector of the economy.

Defining the Investment Incentive

For us, a positive investment incentive arises for one of two reasons. The first reason is a decrease in the relative price of investment. Under perfect competition, prices equal

[33] Dumagan (2002) shows the relationship between the Törnqvist index and the Fisher ideal index used in computing chain-weighted GDP by the U.S. Bureau of Economic Analysis.

marginal costs, so this relative price equals the ratio of marginal costs, $\frac{MC_{It}}{MC_{Ct}}$,, where MC_{It} and MC_{Ct} are obtained from the cost minimization problems

$$\min_{I_{Ht}, I_{Nt}, I_{Ft}} I_{Ht+} P_{Nt} I_{Nt} + P_{Ft} I_{Ft} + MC_{It}\left[J\left(Q_{Ht} I_{Ht}, Q_{Ft} I_{Ft}, I_{Nt},\right) - J_0\right], \tag{20}$$

$$\min_{C_{Ht}, C_{Nt}, C_{Ft}} C_{Ht+} P_{Nt} C_{Nt} + P_{Ft} C_{Ft} + MC_{Ct}\left[C\left(C_{Ht}, C_{Nt}, C_{Ft}\right) - C_0\right] \;. \tag{21}$$

$J(\cdot)$ and $C(\cdot)$ are the CES aggregators (6) and (5), and J_0 and C_0 are the pre-shock levels of quality-adjusted investment and consumption. Positive ISP shocks lower the relative price of investment. The second reason is an increase in the marginal product of capital. Positive MFP shocks raise the marginal product of capital.

Table 1. Output Growth for the U.S. and Some European Countries

	U.S.		EU-4*	France		German		Italy	Netherlands	U.K.	
	Groningen	Jorgenson	Groningen	Groningen	Jorgenson	Groningen	Jorgenson	Jorgenson	Groningen	Groningen	Jorgenson
Output											
1990-1995	2.1	2.5	1.8	1.0	1.3	2.5	2.3	1.5	2.1	1.6	1.6
1996-2001	3.8	4.2	2.8	2.6	2.3	2.0	1.2	1.9	3.2	3.7	2.7
Hours											
1990-1995	1.1	1.0	-0.5	-0.4	-0.4	-0.1	-0.7	-0.6	0.8	-1.3	-1.2
1996-2001	1.6	1.5	0.8	1.0	0.9	0.0	-0.1	1.0	2.1	1.1	1.0
Labor Productivity											
1990-1995	1.0	1.5	2.3	1.4	1.7	2.6	3.1	2.1	1.4	3.3	2.8
1996-2001	2.2	2.7	2.0	1.5	1.4	2.0	1.3	0.9	1.1	2.6	1.7
Capital Deepening											
Contribution from ICT Capital											
1990-1995	0.4	0.4	0.3	0.1	0.2	0.4	0.3	0.3	0.3	0.4	0.3
1996-2001	0.8	0.9	0.5	0.3	0.4	0.5	0.5	0.5	0.6	0.7	0.7
Contribution from non-ICT Capital											
1990-1995	0.2	0.4	0.8	0.5	1.2	1.0	1.3	1.1	0.4	0.8	2.1
1996-2001	0.4	0.6	0.2	-0.2	0.3	0.5	0.7	0.6	0.1	0.2	-0.2
1990-1995	0.6	0.8	1.2	0.6	1.4	1.4	1.6	1.3	0.7		2.4
1996-2001	1.2	1.5	0.7	0.0	0.6	1.1	1.2	1.1	0.7		0.5
Multifactor Productivity											
Contribution from ICT											
1990-1995		0.2			0.3		0.4	0.4			0.3
1996-2001		0.5			0.6		0.7	0.7			0.8
Contribution from non-ICT											
1990-1995		0.1			-0.6		0.7	0.0			-0.4
1996-2001		0.5			0.0		-0.8	-1.2			0.1
1990-1995	0.1	0.4	0.8	0.5	-0.3	1.1	1.1	0.4	0.5	1.5	-0.1
1996-2001	0.8	1.0	1.1	1.0	0.6	0.9	-0.1	-0.5	0.4	1.3	0.9
Labor Quality											
1990-1995	0.2	0.4	0.4	0.3	0.6	0.1	0.3	0.4	0.2	0.6	0.5
1996-2001	0.2	0.2	0.2	0.5	0.2	0.0	0.2	0.4	0.1	0.3	0.3

* Aggregate for France, Germany, the U.K., and the Netherlands.

Table 2. Labor Productivity Growth and Investment in ICT by Sector (averages)

	Contribution to Labor Productivity Growth			U.S. Nominal Gross Investment in ICT (percent of value added)**		
	1990-1995	1996-2001	Increase	1990-1995	1996-2001	Increase
Agriculture, hunting, forestry & fishing	0.0%	0.0%	0.0%	0.7	1.0	0.3
Mining and quarrying	0.0%	0.0%	0.0%	3.0	3.1	0.1
Manufacturing	0.4%	0.6%	0.2%	3.2	3.5	0.3
Electricity, gas and water	0.1%	0.0%	-0.1%	5.2	4.8	-0.4
Construction	-0.1%	-0.1%	0.0%	0.6	0.7	0.2
Wholesale & retail	0.3%	0.7%	0.4%	3.3	4.3	1.0
Tansportation, storage & communication	0.3%	0.2%	-0.1%	10.0	13.6	3.6
Finance, insurance, real estate & business-sector services	0.3%	0.5%	0.2%	3.8	5.0	1.2
Community, social & personal services ***	-0.2%	-0.3%	-0.1%	1.6	2.2	0.6
Total	1.1%	1.7%	0.6%			

* Source: OECD Stan Database.
** Includes other automation equipment. Source: Bureau of Economic Analysis.
*** Excludes government services for nominal gross investment shares

Figure 1. U.S. Stylized Facts

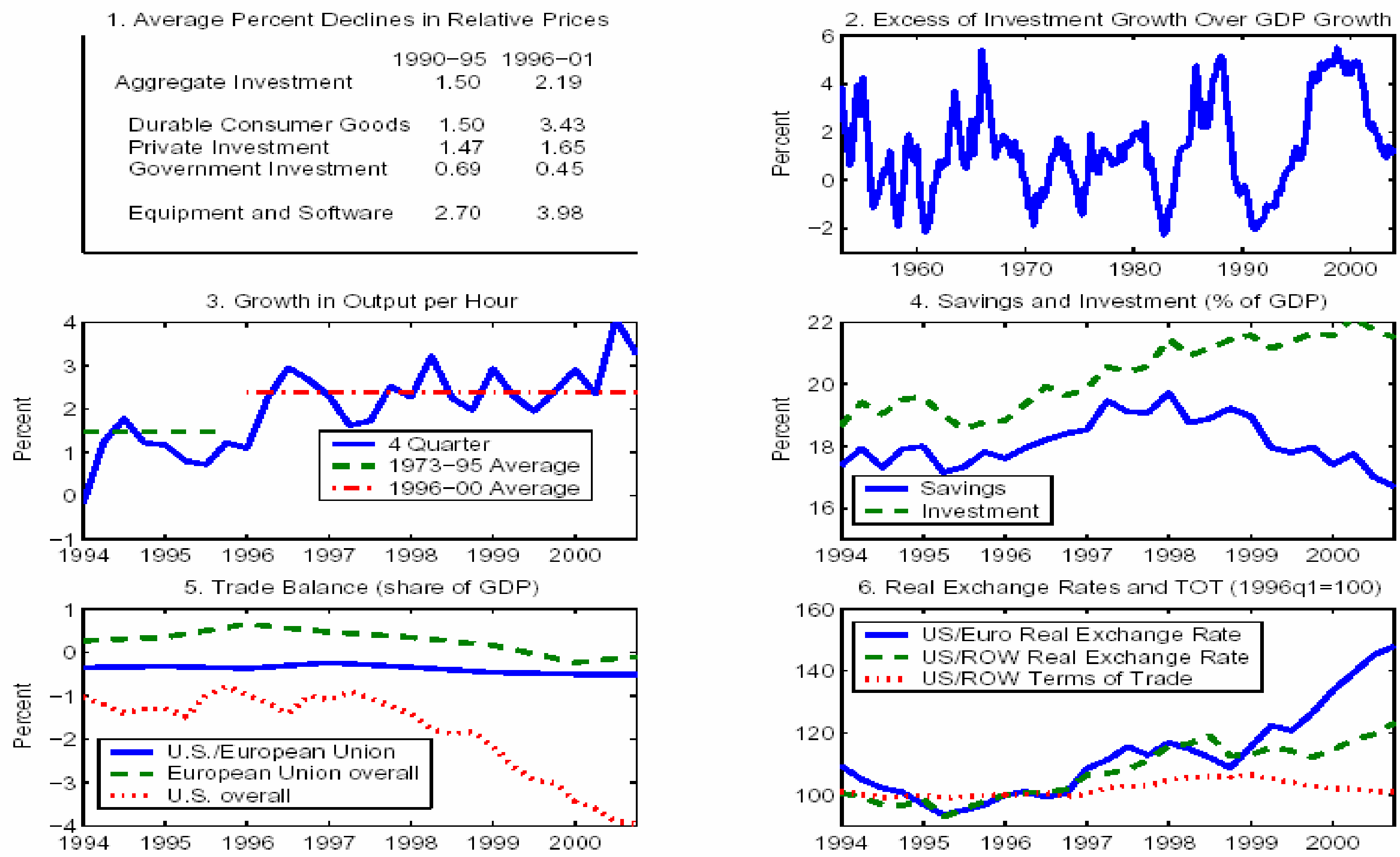


Figure 2A. ISP Level Shocks

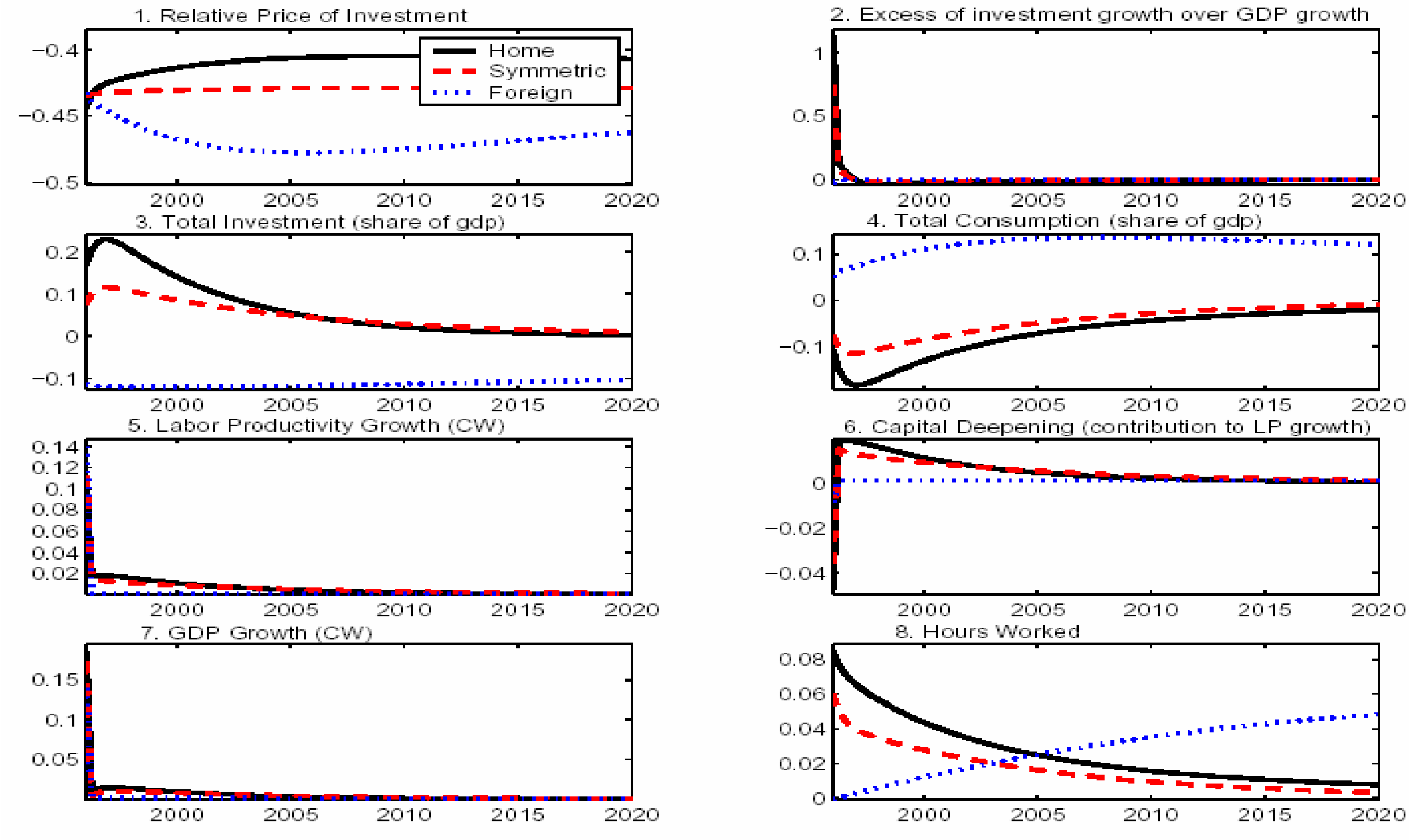


Figure 2B. ISP Level Shocks

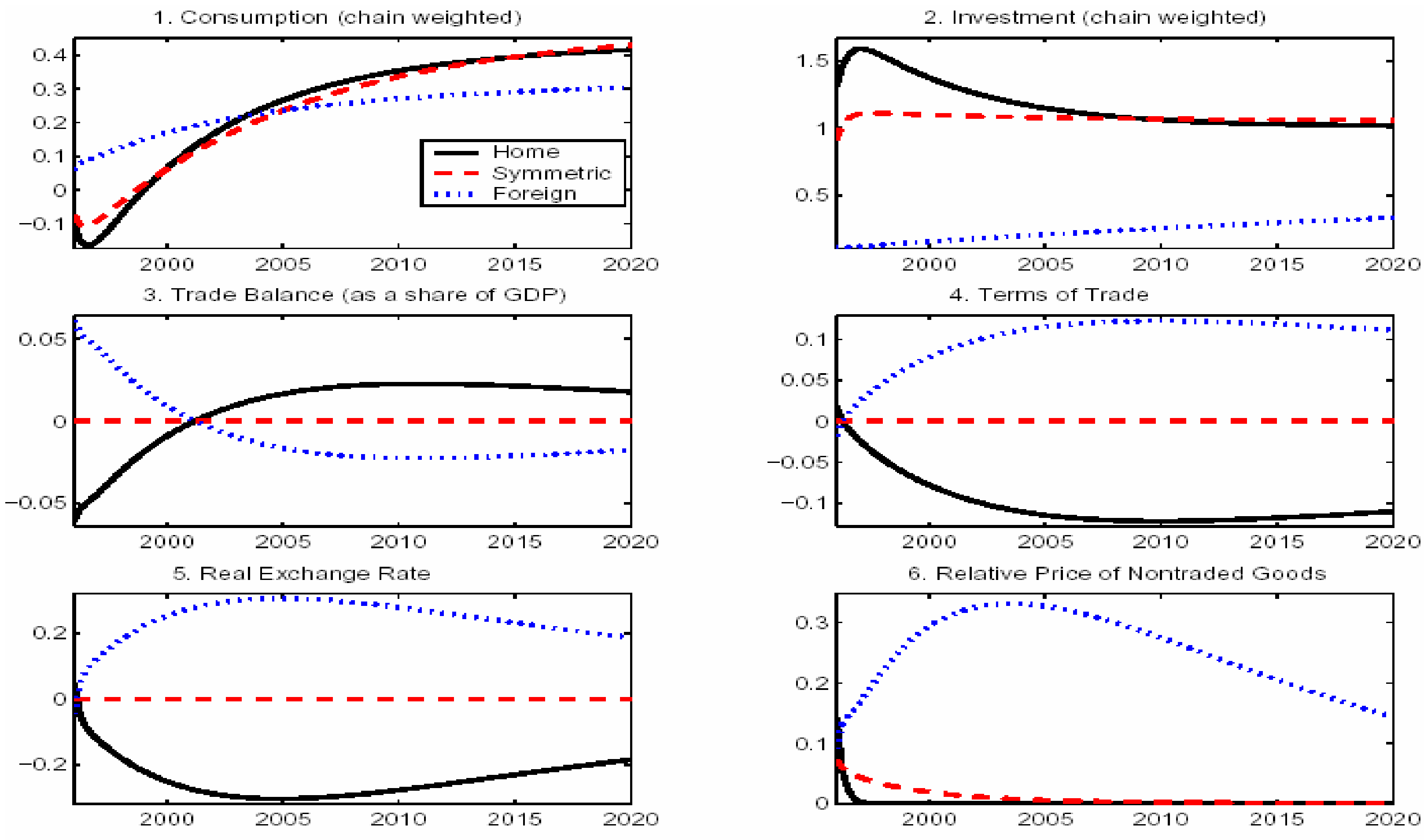


Figure 3A. ISP Growth Shocks

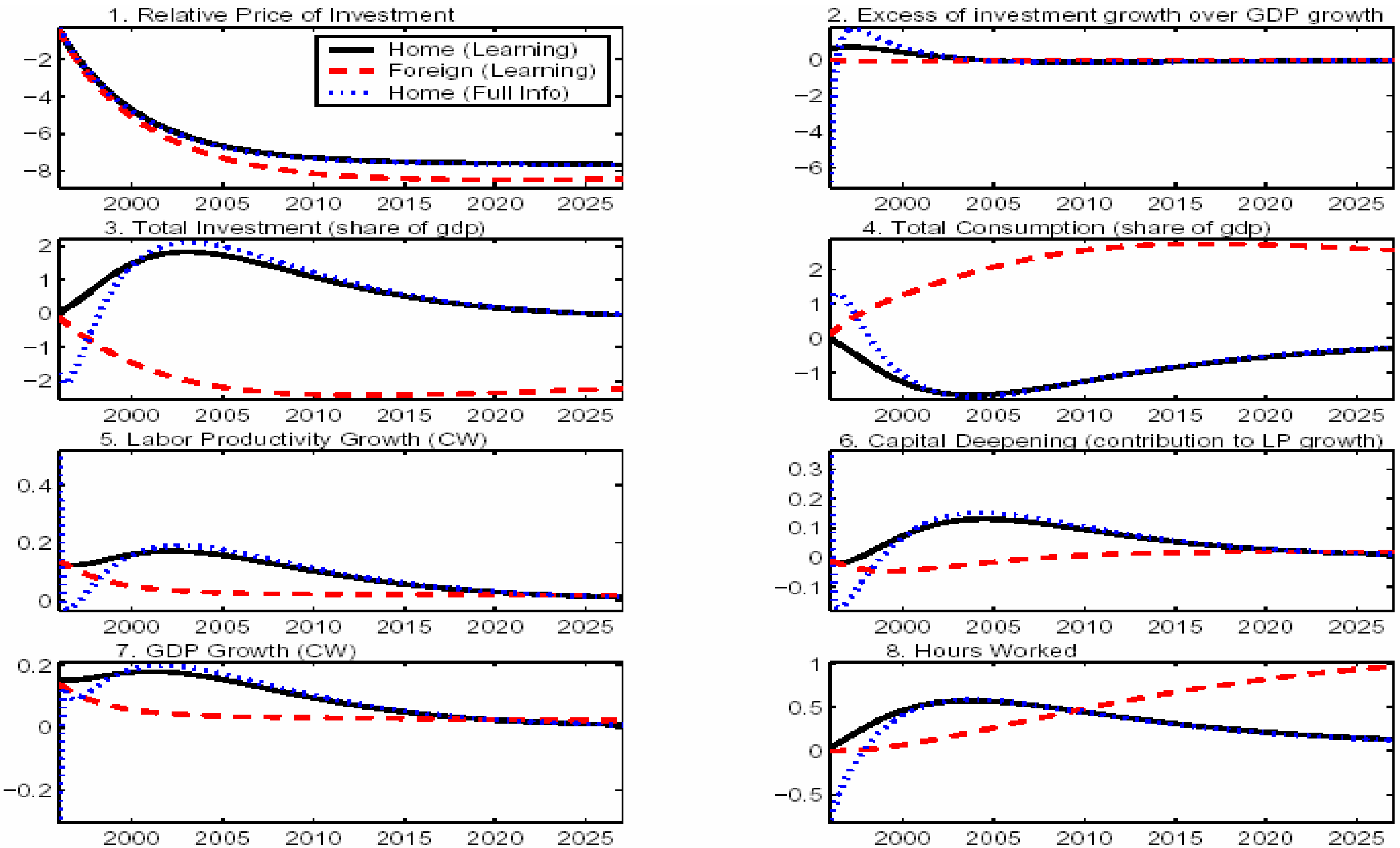


Figure 3B. ISP Growth Shocks

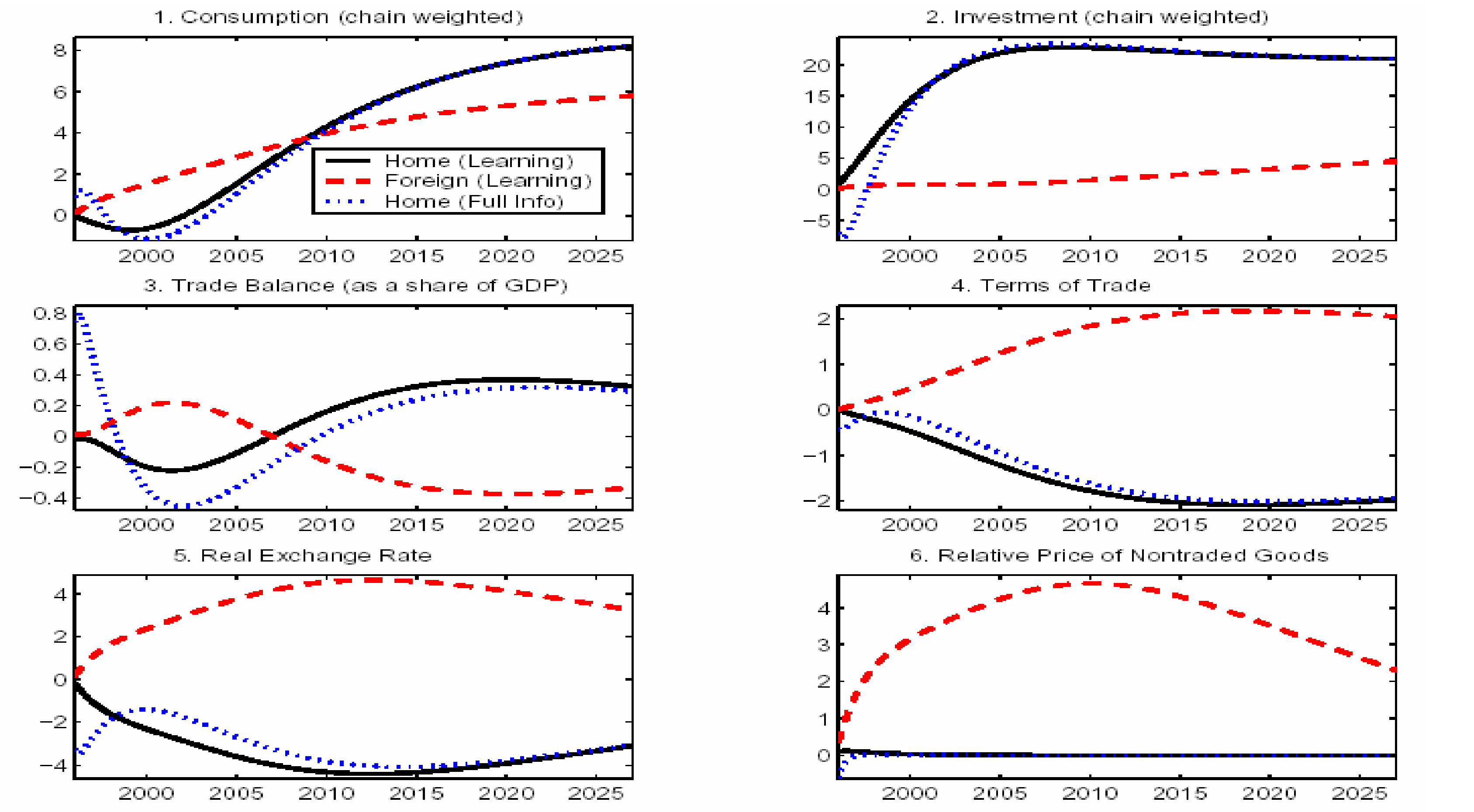


Figure 4A. Home Response to MFP Growth Shocks

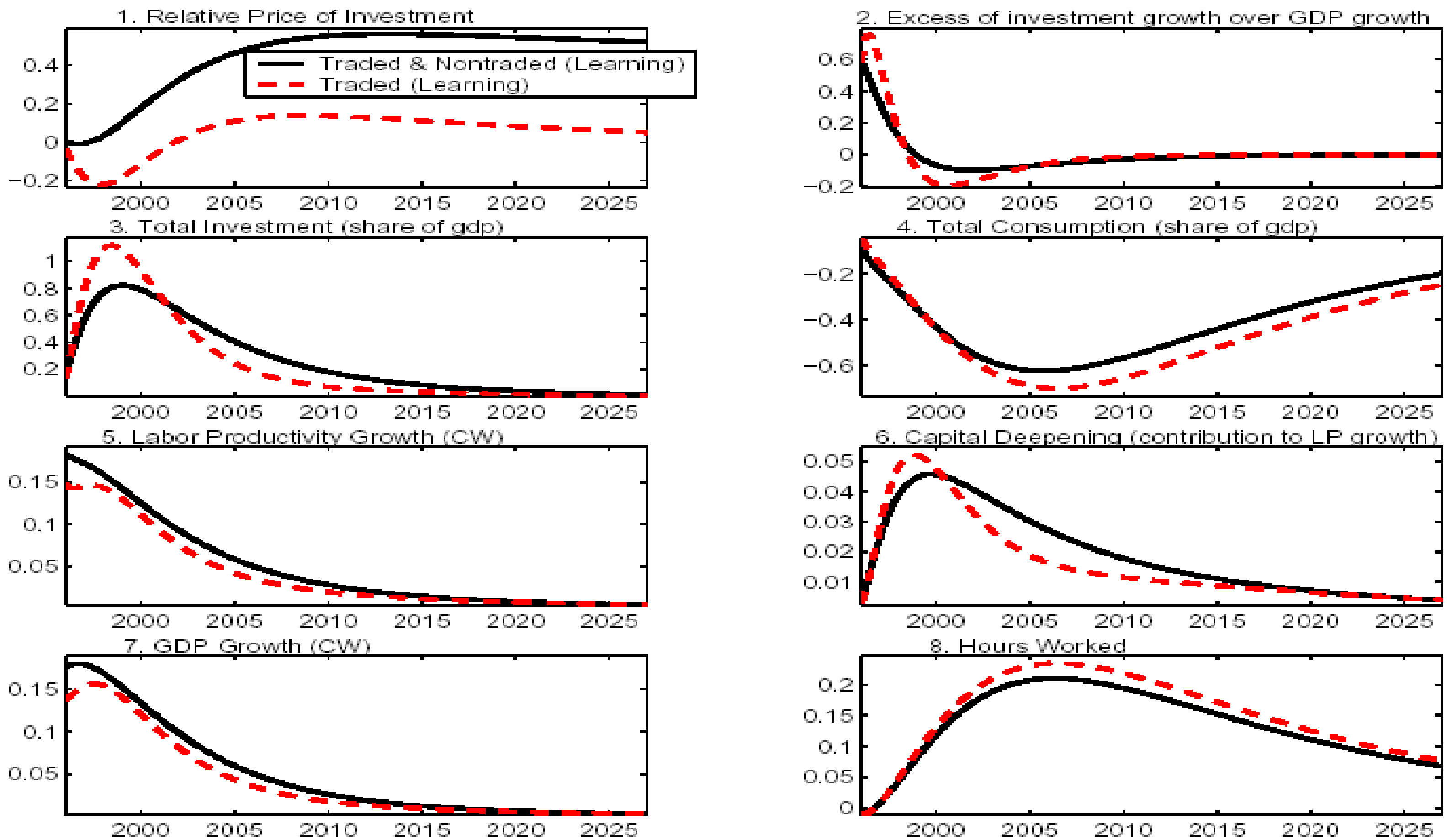
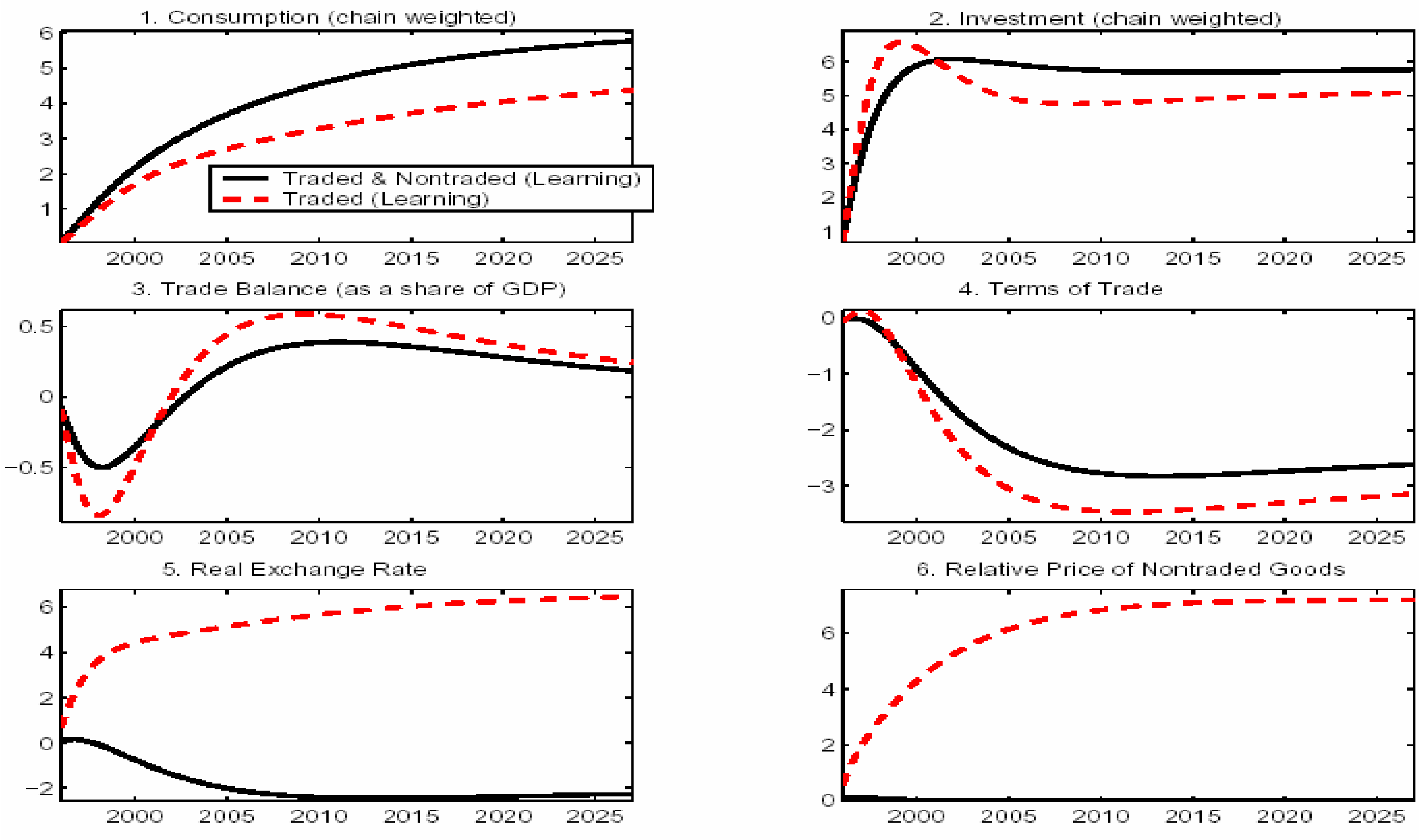


Figure 4B. Home Response to MFP Growth Shocks



Comments on "Investment-Specific and Multifactor Productivity in Multi-Sector Open Economies: Data and Analysis"

Keun Hee Rhee,
Korea Productivity Center

[1] ISP/MFP shocks

'...ISP shocks played a relatively more important role than MFP shocks in the U.S. in the late 1990s...' (p18)

Which tool is more better or important in Korean industrial policy (Productivity innovation policy) between ISP and MFP shock?

[2] With FTA between Korea and U.S.(Chile or Singapore)

If FTA is setup the weight of trade goods will be risen. So Harrod-Balassa-Samuelson effect will be stronger than before. Then the trade balance will be more deteriorated even if there is MFP's effect on non trade goods as you say. As a result we can infer that the productivity gain(or the positive effect of productivity shock) from FTA in Korea will be reduced in open economy. What can you expect on the issue in view of Korean industrial policy?

[3] The role of ICT's productivity

You view MFP growth in the ICT sectors as investment specific productivity(ISP) growth (in abstract). Also you mentioned capital deepening and MFP of both ICT and non ICT sectors (in introduction).

But there are not enough explanations on the MFP growth in the ICT sectors in conclusion. So ICT issues does not fully emerged in conclusion.

Table 2. Weight of GDP between ICT and Non ICT sector (Bank of Korea)

(unit: billion won, %)

	GDP			Weight ICT sector (B/A*100)	Weight Non ICT Sector (C/A*100)
	Total (A=B+C)	ICT sector (B)	Non ICT sector (C)		
95	359,582	21,685	337,897	6.0	94.0
96	402,230	22,388	379,843	5.6	94.4
97	438,597	23,567	415,029	5.4	94.6
98	438,638	29,840	408,798	6.8	93.2
99	472,742	35,337	437,405	7.5	92.5
00	514,054	42,554	471,500	8.3	91.7
01	550,008	42,549	507,459	7.7	92.3
02	602,092	47,260	554,832	7.8	92.2
03	639,762	50,510	589,252	7.9	92.1
04	694,317	59,645	634,673	8.6	91.4
05	718,032	58,776	659,256	8.2	91.8

CHAPTER 3-1

Corporate Entrepreneurship and Innovation in Business Practices

by

Hong Y. Park, Saginaw Valley State University

Abstract

The essence of corporate entrepreneurship is innovation, risk taking and proactiveness. This paper investigates the relationship between theories of the firm and innovations in business practices. Stylized facts of the business survey results appear to support that the theories of the firm provide the basis on what to innovate and how to innovate for corporate entrepreneurs. The paper proposes that it is worth considering an establishment of business practice engineering to develop better business practices.

I. Introduction

Corporate entrepreneurship is known for fostering organizational and economic growth. Entrepreneurial firms perform better than non-entrepreneurial firms. However, the economic analysis ignored the entrepreneur and Baumol (1968, 1993, 1995) has urged economists to include entrepreneurs in the economic model. The nation's economic growth stems from the growth of firms, and entrepreneurs play a key role in their growth. Entrepreneurial decisions, such as the timing of when to introduce an innovation, a new product from the R&D and a new business practice make a firm profitable. Economists acknowledge the importance of the entrepreneurial role, but do not incorporate the entrepreneur's role into the mainstream models of the theory of the firm (Baumol, 1993).

In recent years, entrepreneurship has, however, been recognized as an important factor in firm success and economic growth, studied by scholars in corporate strategy, sociology and psychology. Baumol (1993) indicates that there are two uses for the term "entrepreneur."

> One uses the term to refer to someone who creates and then, perhaps, organizes and operates a new business firm, whether or not there is anything innovative in those acts. The second takes the entrepreneur as the innovator—as the one who transforms invention and ideas into economically

> viable entities, whether or not, in the course of doing so, they create or operate a firm (Baumol, 1993 p. 198).

Baumol refers to the former as the firm-organizing entrepreneur, and the latter as the innovating entrepreneur. Our study will focus on innovating entrepreneurship, which is mainly concerned with entrepreneurship within existing organizations, referred to as corporate entrepreneurship or intrapreneurship.

The essence of corporate entrepreneurship is innovation, risk taking and proactiveness (Fitzsimmons et al., 2005; Miller & Friesen, 1982) and research on corporate entrepreneurship has lately been growing. Research on intrapreneurship focuses on a relationship between corporate entrepreneurship and firm performance (Zahra 1991; Zahra & Covin 1995; Wiklund 1999) and antecedents of corporate entrepreneurship (Chung & Gibbons, 1997; Covin & Slevin, 1989; Miller, 1983; Kurako et al., 2001; Zahra, 1996). However, there is a paucity of studies on how the innovating entrepreneur can derive the innovation better. This paper attempts to offer a theoretical framework which innovating entrepreneurs can use to identify what to innovate along with guiding principles for how to innovate.

II. Corporate Entrepreneurship and Growth

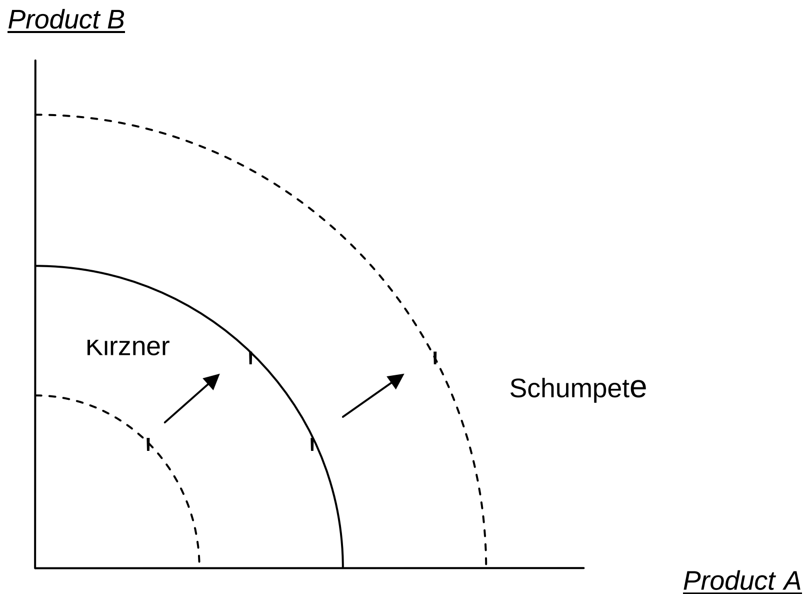
Economists have identified the function of entrepreneurs in the market in slightly different ways, Lanstr⊕m (2005) indicates that these differences were reflected in Schumpeter (1934) and Kirzner's (1973) views on entrepreneurship.

> According to Schumpeter, the entrepreneur creates imperfection in the market by introducing new innovations. Kirzner, on the other hand, saw the entrepreneur as a seeker of imbalances which she/he aims to remove by means of her/his entrepreneurial activity. The entrepreneurial function includes the coordination of information obtained for the purpose of identifying gaps between supply and demand, and acting as a broker, in order to make money on the difference. (Lanstr⊕m, p. 14).

Lanstr⊕m also illustrates differences between Schumpeter and Kirzner's views on entrepreneurship with the production possibility curve (see Figure 1).

> Schumpeter's view is that society is on the edge of the curve and that the entrepreneur pushes the curve outwards by the introduction of innovations. This differs from the view taken by Kirzner, who argues that society is within the curve and reaches the edge with the aid of the entrepreneur, i.e. the entrepreneur is the person who pushes the economy toward the edge of the production possibility curve (Lanstr⊕m, p. 14).

Figure 1. The Production possibility curve in relation to Schumpeter's and Kirzner's view on entrepreneurship



However, Kirzner moderated his view on entrepreneurs' creative ability (Kirzner, 1985). Schumpeter and Kirzner tend to complement each other in that Schumpeter's entrepreneur creates disequilibrium in the market while Kirzner's entrepreneur identifies and acts on it (Lanstr⊕m, 2005). Kirzner's view on entrepreneurs is similar to Leibenstein (1968), who defines the entrepreneur as an individual or group of individuals with four major characteristics: he/she connects different markets, he is capable of making up for market deficiencies (gap-fillings), he/she is an "input-completer," and he/she creates or expands time-binding input-transforming entities (i.e., firms). Leibenstein (1968) also argued that under some circumstances the level of direct effort of the human inputs may be low and, as a consequence, some firms operate under a considerable degree of slack. He pointed out that the persistent slack implies the existence of entrepreneurial opportunities (Leibenstein, 1968, p. 66).

We can see that managers and employees introduce innovations of different types, and these innovations contribute to firm profitability and growth, main sources of economic growth. Although there is no unified widely accepted definition of corporate entrepreneurship (CE), most researchers on corporate entrepreneurship accept Miller's definition (1983) that the CE has three dimensions: innovativeness, proactiveness, and risk taking. Zahra (2005) explains the three dimensions as follows:

> Innovativeness refers to a firm's investment in and commitment to product, process and organizational innovation. Not only does innovation transform a company (Quinn, 1985), but it also creates new market places in which new competencies provide avenues for growth (Kim and Mauborgne, 1999; Markides, 1997, 1998). Proactiveness denotes a firm's disposition and actual commitment to beating competition by being first to the market with new products, system or processes. Risk taking signals a firm's willingness to

assume the various risks associated with new venture creation even when the payoff is uncertain (Zahra, p. XV).

This paper offers a unified theoretical framework which connects Schumpeter's innovation and Kirzner's creative ability as aspects of entrepreneurship. Corporate entrepreneurial opportunities can be derived from theories of the firm. We will explore this in the following section.

III. Theories of the Firm and Corporate Innovation

Several theories of the firm have emerged in economics: the classical theory, the agency theory, the property rights theory, the transaction cost theory, the resource-based theory and the evolutionary theory. Each of these theories contains some elements that define the nature of the firm and offers differing vantage points of the firm. Acs and Gerlowski (1996) summarize various perspectives of the firm into three dimensions: unit of analysis, availability of information and the operational environment assumed. Acs and Gerlowski point out that the unit of analysis in the neoclassical theory, the principal agent theory, the transaction cost theory and the evolutionary theory of the firm is exchange, the firm in relation to itself, the individual transaction between parties and the firm, and its productive processes, respectively. The unit of analysis in the property rights theory is the assignment of ownership.

The availability of information assumed differs among theories. The neoclassical theory assumes that the economic agent has perfect information. The principal-agent theory introduces asymmetric information into the analysis, and asymmetric information leads to the moral hazard and adverse selection problems which result in less than optimal outcomes of the organization. The transaction cost theory assumes that economic agents act with the bounded rationality ("intended rationally, only limitedly so," Simon, 1961, p. xxiv) and opportunism ("self-interest seeking with guile," Williamson, 1985, p. 47). The transaction cost theory is concerned with the hold up problems of incomplete contracts. The property rights theory recognizes the problems associated with the ownership of assets and post-contractual investment in plants and assets. The evolutionary theory of the firm regards firms as complex adaptive systems. Information regarding market and technology changes is important to organizational changes, which are critical for firms to survive.

A summary of the definition of each theory of the firm, the unit of analysis, assumptions on information and behavior and the principle that each theory is offering for profit maximizing and a stitching link of all theories is presented in Figure 2 (Park and Shin, 2004, 2005).

Figure 2. A Summary of the Theories of the Firm

Theory of the Firm	Definition of the Firm	Unit of Analysis and Major Issues for Explanation	Assumptions on Information and Behavioral Principles	Action Principles of Profit Maximizing and Stitching Links
Neoclassical theory	A device for resource allocation	-exchange -technical efficiency	-perfect information -symmetric information -rational behavior	-set the ratio or factor price over marginal productivity -production cost minimizing
Agency theory	A nexus of contracts	-the contractual relationship between agent and principal -work incentives	-imperfect information -asymmetric information -bounded rationality	-design of contract to deal with risk sharing, work incentives, shirking -economize agency cost
Property rights theory	A team of property owners	-assignment of property rights -ownership of the firm	-incomplete information -information asymmetry -bounded rationality -opportunistic behavior	-capital owners are owners of the firm -economizing costs of assigning property rights
Transaction cost theory	A collection of transaction	-transaction/contract -holdup costs problem -make or buy	-imperfect information -information asymmetry -bounded rationality -opportunistic behavior	-aligning governance structure with transaction characteristics -economize transaction costs
Resource-based theory	A collection of resources and capabilities	-resources -continue to create excess profit	-imperfect information -bounded rationality	-develop strategic assets and efficient resource deployment -economize resource development cost
Evolutionary theory	-a collection of routines -complex adaptive system	-routine -product and process innovation	Bounded rationality	-adapt to changes in selection environment -economize innovation cost and adaptation cost

The firm involves all aspects of the extant theories: the scale and scope of the economy, technical efficiency, agency efficiency, transaction cost economization, ownership structure and assignment, selection, development and deployment of corporate resources and adaptation to changing input and output markets, and product and process innovation. If the firm operates below the production possibility curve, there will be slack and the slack presents an opportunity for entrepreneurs to innovate. The evolutionary theory of the firm offers a theoretical framework which innovating entrepreneurs can use in their innovation.

Theories of the firm explain the technical efficiency, the work incentive, the efficient ownership of the firm, the make-or-buy, the Ricardian rent and the Schumpeterian rent, and provide guiding principles on how to achieve them. If the firm does not achieve them, there will be slack in the firm.

Leibenstein (1968) stated that some firms operate under a considerable degree of slack and persistent slack offers entrepreneurial opportunities. The existence of slack implies that the firm is operating below the production possibilities curve. Kirzner's entrepreneur (1973) reaches the edge of the production possibility curve by making better use of existing resources. We contend that the neoclassical theory, the principal-agent theory, the property rights theory, the transaction cost theory and the resource-based theory are sources of innovation in Kirznerian entrepreneurship and the evolutionary theory of the firm provides sources of innovation in Schumpeterian entrepreneurship.

IV. The Neoclassical Theory

The firm in the neoclassical theory is a device for resource allocation. Neoclassical price theory models of firms are production functions that transform inputs into outputs (Boudreaux and Holcombe, 1989). Entrepreneurs direct resources to their best uses and maximize profit by accomplishing technical efficiency of inputs. As input prices such as wages change, entrepreneurs need to redirect resources. When wages increase, managers need to reduce labor input and increase capital input. If managers fail to redirect resources, the firm's costs will rise and profits will decline. An entrepreneur recognizes the problem and becomes an innovator by recombining resources.

Theories of the firm provide the innovating corporate entrepreneur what she/he can innovate and how she/he can do it better. Current corporate restructuring changes the capital/labor ratio as the wages in certain countries such as the U.S. and Korea are rising rapidly. The neoclassical theory of the firm offers a theoretical framework on what the entrepreneur should innovate and how she/he should do it.

V. The Principal-agent Theory

Whenever one individual acts on behalf of another, a principal-agent relationship develops. A firm is multi-layers of principal-agent, stock owners (principals) hire managers (agents) and managers (principals) hire employees (agents). In the principal-agent approach, the firm is defined as a nexus of contracts (Alchian and Demsetz, 1972; Jensen and Meckling, 1976; Fama, 1980, Cheung, 1983) and the unit of analysis is the contractual relationship between a principal and agents. Alchian and Demsetz (1972) provide the rationale for team production.

> "The output is yielded by a team, by definition, and is not a sum of separable outputs of each member. There exist production techniques in which the Z obtained is greater than if X_i and X_j had produced Z separately. Team Production will be used if it yields an output enough larger than sum of separable production of Z to cover the costs of organizing and disciplining team members (p. 779)".

The costs of metering or ascertaining the marginal products of the team's members cause the team members to shirk and result in inefficient production. If a method could be devised to monitor effectively and efficiently the behavior of each team member, the problem would be solved, because the shirkers would be required to bear the full cost of their shirking. Boudreaux and Holcomb (1989), therefore, characterize the entrepreneur in Achian and Demsetz model as the monitor.

Incentive devices such as pay for performance, employee stock ownership (ESOP), bonuses and stock options reduce monitoring cost and raise voluntary levels of employee efforts (productivity). Less efficient monitoring creates slack in the firm. The entrepreneur in the principal-agent theory is to make innovations in incentive devices. The principal agent theory presents a theoretical framework for entrepreneurs to search for improvement in work incentives.

The firm in the principal-agent theory is a nexus of contract. Asymmetric information between the principal and agent in a contract results in adverse selection and moral hazard problems. In the case of a multi-agents team, there will be a free ride problem. The entrepreneur in the principal-agent theory of the firm needs to find tools to solve adverse selection, moral hazard and free ride problems. The pay-for-performance system, increasing transparency in purchasing and management, and improvement in trust between the principal and agent are business practices dealing with problems associated with information asymmetry. One of the well-known problems in information asymmetry is the lemon-car problem (Ackerlof, 1970). One solution to this problem is dealers' certification and warranty on used cars, common practices in today's used car market. Dealers examine the used car, certify the quality of the car, and offer a dealer's warranty if it is a good quality car. This business practice moderates the lemon car problem.

VI. The Property Rights Theory

Alchian and Woodward (1988) describe the firm as a team of resource owners. The value of the firm exceeds the sum of the market values of individual resources separately. The source of the firm value stems partly from the mutually owned specialized knowledge in the firm. The desire to maintain the value of the firm causes it to form contractual relationships among input owners. The property rights of the firm tend to be assigned to the resource owner who ended up to lose most if the team is dissolved, because he is willing to pay the highest price for the ownership. The residual claims of the firm naturally belong to the owners of the firm.

The assignment of property rights is the unit of analysis in the property rights approach to the firm. Main issues in property rights are exercise of property and problems in wrong assignment of property and rights (Coase, 1960) and the separation of ownership and control (Berle and Means, 1932).

The separation of ownership and control has become the focal point of corporate governance in recent years. Managers of the firm use firm resources, but they are not owners of the firm. Managers may use the resources for their own interest rather than the interests of the owners of the firm. The moral hazard problem associated with corporate managers (Jensen and Meckling 1976) and the free ride problem of widely spread small stock owners lead to an over expansion in size of the firm and an under investment to the inefficiency of capital resources. Grossman and Hart (1986) and Hart and Moore (1990) clearly identify the costs and benefits of ownership assignment and vertical integration without relying on the presence of an impersonal market.

A firm in the property rights theory is a team of resource owners. The capital owners in a capitalist economy are normally owners (principals) of the firm. Separation of ownership and control in capitalist economy creates principal-agent problems, a divergence of interests between the principal and the agent. If one can align the interests between the principal and agent, the costs of monitoring will be reduced or the need for monitoring will diminish. In order to forge a confluence of interests between the employer and workers, a joint ownership such as employee stock ownership is created. However, this may create the problem of a free ride which can be seen in partnerships. Holmstr⊕m and Tirole (1989) argue that power sharing or politics becomes a problem with employee stock ownership. In ownership the capitalistic form of organization is preferred because there is a separation between the employer and labor (Holmstr⊕m, 1982). The employer can monitor the efforts of employees in a corporate type of organization by creating a hierarchy. A partnership type of organization tends to face the free rider problem because of the lack of monitoring. Workers' involvement in the process of decision-making, profit sharing and gain sharing are to build common interests between the employer and workers. Samsung, for example, has been working to make employees feel that they are owners of the firm.

Workers' involvement in the process of decision-making reduces a need for monitoring because it enhances communications and the workers become partial owners of the process. It may also improve the quality of decisions, since decisions are made where information is superior. As workers' involvement increases, some levels of hierarchies can be eliminated, since it will reduce the need for monitoring. Rooney (1989) found that workers' participation is associated with diminished costs of vertical monitoring of shirking. The Coca-Cola Company announced an innovative plan for paying outside directors: if earnings per share do not rise fast enough over a three-year period, directors will receive nothing. But they will get a significant raise if earnings perform as expected (*The New York Times*, Coke's Board to Get Bonus or Nothing, Floyd Norris, April 6, 2006, p. C1). This innovative plan aligns directors' interests with shareholders' to encourage board members to think of long-term interests. Samsung made similar changes in 2005.

VII. The Transaction Cost Theory

The transaction cost approach to the nature of the firm originates from Coase (1937). The transaction cost approach lays foundations on the decision to make or buy. The decision to make or to buy, an important strategic issue, was first examined by Coase (1937), who raised two questions in the paper, "The Nature of the Firm": (1) Why, if by organizing, one can eliminate certain costs and in fact reduce the cost of production, are there any market transactions at all? (2) Why is not all production carried on by one big firm? Coase stated that "a firm will tend to expand until the costs of organizing an extra transaction within the firm become equal to the cost of carrying out the same transaction by means of an exchange on the open market or the costs of organizing in another firm" (p. 396).

Coase's seminal work (1937) has been further advanced by Williamson (1975, 1985), Demsetz (1988), and Klein, et al. (1978). Williamson (1975, 1985) assumes that parties involved in an exchange behave opportunistically and economize transaction costs on bounded rationality. Transactions between buyers and suppliers are carried out in incomplete contracts because the parties involved in the transaction cannot foresee all future contingencies. Thus drawing up a complete contract is too costly or next to impossible. Incomplete contracts, however, lead to the hazards of opportunism that cause suppliers to underinvest in the production of supplies. Remedies for this underinvestment problem are to organize the production within the organization or establish a long-term relationship (contract) with suppliers. But internal production lacks high-powered market incentives (Williamson 1975, 1985) and is subject to increasing management and input costs.

The transaction cost theory of the firm offers entrepreneurs an opportunity to economize transaction cost. Entrepreneurs search for new innovative ways of economizing transaction costs by matching governance structure with transaction characteristics.

Transaction costs are a major problem in outsourcing and financial markets. Innovation in outsourcing and financial markets has been directed toward economizing transaction costs. The outsourcing (buy) strategy seeks to solve the underinvestment problem by strategic alliances; major automobile manufacturers such as Toyota and GM reduce the hazards of outsourcing by a long-term contract, joint venture (hybrid mode), modular systems and tier system (Park et al., 1996, 2001). Mishkin (2006) indicates mutual funds are a similar device for economizing transaction costs in financial markets.

> By bundling investors' funds together transaction costs for each individual investor are far smaller. Economies of scale exist because the total cost of carrying out a transaction in financial markets increase only a little as the size of transaction grows (Mishkin, 2006, p. 173).

VIII. The Resource-Based Theory

The resource-based theory of the firm attempts to incorporate the dynamic aspects of corporate changes in the theoretical framework. The firm in the resource-based approach is a collection of resources or a bundle of resources (Penrose, 1959; Wernerfelt, 1984). The unit of analysis is resources (Penrose, 1959; Grant, 1991; Foss et al., 1995). Resources in the classical production function are labor, capital, land and raw materials, entrepreneurship and technology, and business firms purchase services of resources. Services of these resources are the contributions of these resources to the production of outputs (Penrose, 1959). Caves (1980) defined resources as tangible and intangible assets such as the brand name, technical knowledge, hiring of skilled labor, machine and trading partners. Barney (1991) included all assets, capabilities, organizational processes, special characteristics of business firms, information and knowledge in business firms' resources.

Business firms use these resources to produce outputs for profits. Resources by themselves are not productive and the production of output requires cooperation and control of many teams of resources. The capability of a team of resources is the team's ability to perform and take activities in producing outputs. Resources are the source of the capability, and the capability of resources is a source of the firm's competitive advantage (Grant, 1991, p. 1991).

Firm resources play an important role in firm growth and rent creation (Penrose, 1959; Schoenecker and Cooper, 1998; Chartterjee and Wernerfelt, 1991; Rubin, 1973; Madadok, 2001, 2002). Two distinctive mechanisms have been proposed in understanding how managers create economic rents for their firm: resource picking and capability building, Makadok (2001) explained the two mechanisms as follows:

> The former mechanism [resource picking] asserts that firms create economic rent by being more effective than their rivals at selecting resources. The latter mechanism [capability-building] asserts that firms create economic rent by being more effective than their rivals at developing resources (Makadok, 2001).

The entrepreneur in the resource-based theory of the firm searches for new resource selection skills and resource developing methods.

Resource picking creates Ricardian rents (Ricardo, 1917) by applying superior resource picking skill. Firms acquire resources with heterogeneous productivity; since resource markets are imperfect, firms appropriate Ricardian rents for profits. A firm's Ricardian rents should contribute to the performance of the firm. Chatterjee and Wenerfelt (1991) considered three classes of firm resources: (a) physical resources, (b) intangible assets, and (c) financial resources. Physical resources, such as plants and equipments, are fixed capacity. Intangible assets include brand names or innovative capability. Financial resources are the most liquid and flexible. We expect that if firms have superior selection skills and dynamic capabilities (resource deployment), the firm's assets will create better sales and profits.

IX. The Evolutionary Theory

The firm in the evolutionary approach is a bundle of routine (Nelson and Winter, 1982; Williamson, 1999) and the unit of analysis is a routine (Foss et al., 1995). Nelson and Winter (1982) compare changes in the business firm with natural selection in biology. We can find the same line of thought from Alchian's paper (1950); Alchian asserted that an analogy of the imitation, innovation and profit in economics can be found in biology: the gene, mutation and natural selection. Nelson and Winter (1982) base their evolutionary approach to the firm on Schumpeter's innovation and creative destruction (1934). Nelson and Winter proposed three concepts in their evolutionary theory of the firm: (1) routines, (2) search routine and (3) selection environment. The ways to perform everyday tasks and to make decisions on what to do are routines. Activities and tasks performed by everyday routines do not imply that they are not changing, but their scopes of activities are limited. The business firm attempts to modify its routines as the firm faces the changing environment. The attempt to change the firm's routines can be risky and endanger the survival of the firm. The employees' accumulated work experience and knowledge are intangible capital which can reduce the risk of dealing with the changing environment.

Search routines include the assessment, modification and substitution of all activities that the firm is currently performing. Search routines create probabilistically a mutation and the innovation in economics is equivalent to mutation in biology. The innovation can result in desirable outcomes as well as adverse outcomes, just as mutations in biology. Some mutations (innovations) are healthy and help the firm survive better, but they can be cancer-causing mutations and risky as the firm faces a new selection environment. Search routines help a firm to succeed in new technology development, product and process innovation. Search routines in the firm that are research and development have a high degree of path dependency. Research and development can lead to product and process innovation, but they do not necessarily contribute to the profits of the firm.

The selection environment of a business organization includes all factors affecting the expansion and contraction of the business organization. For example, the supply of production factors, the demand for the product, and the nature and activities of competing firms in the same industry comprise the selection environment. Selection means that the inefficient firms exit from the competition and the industry (Teece, et al., 1994) and are weeded out (Alchian, 1950). Selection in the firm occurs through the entry and exit of the market process. Teece, Rumelt, Dosi and Winter (1994) observed that the market process of the firm's expansion and decline does not operate instantaneously, and firms with various capacities try to satisfy the needs for the same consumers. Inefficient firms may survive for a longer time span in a weak selection environment. However, they exit more quickly in a strong selection environment. Korean firms faced the changing selection environment from weak to strong in the '90s and experienced the discipline of the capital market, inefficient and highly indebted firms quickly exited from the market.

The evolutionary theory of the firm is not interested in the convergence of the static equilibrium, but places emphasis on the process of adapting to the dynamic changes in factor and product markets, and technologies. Firms are complex, adaptive systems and the evolutionary theory of the firm focuses on organization's core competency, structure and strategy. Firms are able to survive and prosper if they change in response to changing input and output markets and technologies. Firms must find new productive and valuable outlets for their core competency (Nelson and Winter, 1982).

Firms deploy resources to foster process and product innovations. New processes and products can create temporary monopoly and monopoly profits (Schumpeter, 1950). This Schumpeterian perspective has been codified into a dynamic capability view of resources (Nelson and Winter, 1982; Amit and Schoemaker, 1993; Dierickx and Cool, 1989; Teece, Pisano and Shuen, 1997). Capabilities refer to a firm's capacity to deploy resources, usually in combination, using organizational processes, to effect a desired end (Amit and Schoemaker, 1993, 35). The evolutionary theory of the firm places emphasis on the firm's innovation and adaptability.

Teece and Pisano (1994) offer the dynamic capabilities perspective as an emerging paradigm of the modern business. This perspective is an eclectic paradigm, combining ideas from evolutionary economics with the resource-based perspective. Teece, Pisano, and Shuen (1997) made efforts to identify the dimensions of firm-specific capabilities as sources of competitive advantage and explain how combinations of competence and resources can be developed, deployed and protected. They refer to this as the "dynamic capabilities" approach to stress, exploiting existing internal and external firm-specific competence to address changing environments (p. 510). Firm-specific competences are firm resources, and Prahalad and Hamel (1990) argue that the firm's central asset is its core competence. Dynamic capabilities are the organizational and strategic processes by which managers manipulate resources into new productive assets in the context of changing markets (Galunic and Eisenhardt, 2001).

Evolutionary economics emphasizes firms' adaptability to changing environments. Foss, Knudsen and Montgomery (1995) believe that the evolutionary approach has a great deal to offer as a component of the still-developing resource-based approach in the field of strategic management. The knowledge-based approach of the firm identifies knowledge as an important asset in firms' innovation and change (Nonaka, and Takeuchi, 1994, 1995; Kogut and Zender, 1992; Spender, 1996; Grant 1996; Winter, 1987; Teece, 1992; Liebeskind, 1996). The dynamic capabilities perspective, therefore, integrates evolutionary economics and the resource-based perspective as well as the knowledge-based perspective of the firm. This combination provides a good analytical framework to study Korean firms' changes in response to the Korean economic environment shock in 1997.

The entrepreneur in the evolutionary theory of the firm is a Schumpeterian entrepreneur who creates process and product innovation.

Hypothesis: In the light of the relationship between corporate business practices and theories of the firm analyzed above, we hypothesize that theories of the firm provide innovating corporate entrepreneurs a framework on what they can innovate and guidelines for how they can do it better.

X. Innovation in Korean Firms after the 1997 Economic Crisis

Corporate entrepreneurship creates a new organization or instigates renewal or innovation within the organization (Colins and Moore, 1970; Sharma and Chrisman, 1999). The mode of innovation can be continual (first order) or revolutionary (second order). Many firms tend to make radical innovation when they face a crisis. The 1997 Korean economic crisis forced Korean firms to make radical innovation or changes. Schumpeter (1947) also recognized two different kinds of reaction to changes in condition.

> Whenever an economy or a sector of an economy adapts itself to a change in its data in the way that traditional theory describes, ----within its existing practice, we may speak of the development as adaptive response. And whenever the economy or an industry or some firms in an industry do something else, something that is outside of the range of existing practice, we may speak of creative response (Schumpeter, 1947, p. 150).

Schumpeter (1947) stated that "a study of creative response in business becomes coterminous with a study of entrepreneurship, and the mechanisms of economic change in capitalist society pivot on entrepreneurial activity" (p. 150). Therefore, the creative response to the 1997 Korean economic crisis was entrepreneurial activities.

Nelson (2002) suggested that the concept of institutions as social technologies fits into evolutionary theories and economic growth theory. Nelson pointed out that evolutionary theorists put special weight on technological advance, as do almost all scholars studying economic growth. He classified technologies into two categories: physical technologies and social technologies. Nelson believes that the conception of institutions (rules of the game) as defining or shaping social technologies is coherent and he argues that physical and social technologies coevolve.

In my view at least, the advance of physical technologies continues to play the leading role in the process of economic growth. In the example of the rise of mass production, social technologies enter the story in terms of how they enable the implementation of physical technologies. In the case of the rise of the industrial R&D laboratory, new social technologies are needed to support activities that create new physical technologies. Perhaps a useful way of looking at this obvious interdependence is to posit or recognize, that physical and social technologies coevolve. And this coevolutionary process is the driving force behind economic growth (Nelson, 2002, pp. 26-27).

North and Wallis (1994) have made a similar distinction between physical and social technologies. Korean firms' responses to the economic crisis and innovations after the 1997 crisis can be viewed as entrepreneurial activities as well as an adaptation of new social technologies. We conducted a survey of Korean business firms in 2003 to examine Korean firms' entrepreneurial activities and adaptation of new social technologies. The survey questionnaire included many questions regarding causes of the 1997 economic crisis, changes made after the economic crisis, learning from the crisis, advantages and disadvantages of Chaebol and business practices implemented (Park and Shin, 2004, 2005).

We created a website for the questionnaire and asked managers to answer questions. Two-hundred-four managers, representing all large business groups in Korea and many other firms, responded to our survey. One part of this survey asked respondents to list the top three successful business practices and top three unsuccessful business practices among business practices which their firm has implemented since 1997. Table 1 is a summary of responses for the question.

Table 1. Successful and Unsuccessful Business Practices

Successful Business Practices	Frequency	Identified as Unsuccessful Business Practices and Frequency
Structural change: Sales of business, labor and business structure change	30	Excessive structural change 9
Quality improvement by adopting sigma management	30	1
Concentration in core business	20	2
Cost reduction by outsourcing in non-core business	16	Low quality because of outsourcing 2
Productivity increase by adopting the pay-for-performance system	16	Reduction of cooperation, excessive competition, lack of harmony among workers 10
Increase in sense of ownership and responsibility by adopting team system, empowering employees	16	Endangering management rights 5
Cooperation of labor and management, labor flexibility and declaration of no job action	15	Inefficient human resource management, conflict between labor and management 5
Production process innovation	15	1
Globalization of market and development and maintenance of new markets	15	Lack of prediction and response to market changes, environment, and technology changes; heavy dependency on one customer 15
Reduction in debt and increasing importance in cash-flow management	15	Inefficient allocation of financial resources and high debt 6
Securing, developing and maintaining superior human resources, recognizing importance of human resources	15	Influx of core employees from outside caused failure in organizational adaptation. Need for internal human resource development 4
Top manager's prescient forecasting of the future and prompt proactive response to environment changes	10	Authoritative decision and order 6
Success in R&D and new product innovation	10	Difficulties in obtaining the state of the art technologies, problem in leaking new technology to outside and reduction in R&D 4
Increasing problem-solving capability by adopting knowledge management and learning	13	2
Increasing transparency in purchasing and management	12	Lack of transparency 2
Ethical and trustful management	7	Excessive competition and lack of trust 2

Table 1. Successful and Unsuccessful Business Practices (continued)

Successful Business Practices	Frequency	Identification as Unsuccessful Business Practices and Frequency
Enterprise resource planning (ERP)	6	4
Value enhancing management	5	Too much short-term performance orientation 2
Task force team (TFT)	5	
Active M&A	3	Government induced M&A 2
Benchmarking	3	1
Customer relation management	3	
Diversification with no expertise		11
Lack of long-run vision and strategy		4
Frequent changes in management culture and conflict in management culture		4

When these responses are mapped with theories of the firm, the relationships between theories and business practices are evident.

Figure 3. Relationship between Business Practices and Theories of the Firm

The classical theory →	• Structural changes in labor and business structure, and downsizing (30) • Reduction in debt (15) 45
The principal-agent →	• Pay for performance (16) • Transparency in purchasing and management (12) • Cooperation of labor and management, labor flexibility (15) • Ethical and trustful management (7) 50
The property rights →	• Increase in sense of ownership and responsibility by adopting team system and empowering employees (16) • Task force team (TFT) (5) 21
The transaction cost →	• Reduction in costs by outsourcing of non-core business (16) • Concentration in core competence (20) • Customer relation management (3) • Active M&A (3) 42
The resource-based →	human resources, recognizing the importance of human resources (15) • Increasing problem-solving capability by adopting knowledge management and learning (13) 28
The evolutionary theory →	• Production process innovation (15) • Successes in R&D and new product innovation (10) • Quality improvement by employing 6 sigma (∪) management (30) • Globalization of market, developing and maintaining new markets (15) • Top management's president forecasting of the future and prompt proactive response to environment changes (10) 80

The numbers at the bottom of each box are the total number of responses of items listed in each theory and the numbers in the parentheses are the frequency of each item.

XI. Discussion

Figure 2 showed that definitions of the firm from six theoretical perspectives, major issues that each theory addresses, and action principles to address issues. Figure 3, a summary of our survey results, appears to support our contention that what to innovate and how to innovate can be deduced from the theories of the firm.

Baumol (1990) proposed a theory that "the productive contribution of the society's entrepreneurial activities varies much more because of their allocation between productive activities such as innovation and largely unproductive activities such as rent seeking or organized crime" (p. 893). He also pointed out that allocation is heavily influenced by the relative payoffs society offers such activities. The Korean government pursued economic growth and relied on large chaebols. The financial resource allocation was led by the government and the government-led financial resource allocation resulted in rent seeking entrepreneurs (Park, 1981). The government-led financial resource allocation favoring large business groups and corporate governance was not well designed to monitor performances of these financial resources (Joh, 2001, 2003). Large business groups expanded their businesses with borrowing from financial institutions and they ended up carrying high financial debt.

Because the majority of entrepreneurs in Korea are owners and managers of the firm, they have strong debt financing incentives (Park and Shin, 2002). Active labor unions in the late '80s and early '90s raised large firms' wages significantly. These wages reduced corporate profits while lower profits caused speculative attacks on Korean currency (Joh 2003; Park and Shin 2002). High debts, low profits and speculative attacks are major causes of the 1997 economic crisis. After the economic crisis, Korean firms needed to make adjustments in capital structure and labor. Corporate entrepreneurs in Korea found slack in over-expanded businesses and labor, and unsustainable high debts. Therefore, they reduced labor force, slimmed the businesses and reduced debts. These measures were also partly driven by the Korean government.

Slack in labor productivity and asymmetrical information between managers and employees resulted in low productivity and undesirable activities in purchasing. These provided entrepreneurial opportunities for corporate entrepreneurs to improve productivity and to reduce undesirable activities. Corporate entrepreneurs adopted the pay-for-performance system to increase productivity and developed transparency in purchasing and management to reduce undesirable business activities. Entrepreneurs reduced slack stemming from the conflict between labor and management by increasing cooperation between labor and management and initiating ethical and trustful management.

The property rights theory and the principal-agent theory deal with issues associated with the principal and the agent and ownership assignment. Slack caused by the ownership problems are addressed by increasing a sense of ownership with a team system and the empowering of employees.

Entrepreneurs start new firms, innovate and foster growth (Baumol, 1968, 1990; Murphy, Shleifer and Vishny, 1991). Murphy et al. (1991) found that in most countries, rent seeking rewards talent more than entrepreneurship does, leading to stagnation. They also argued that "growth and entrepreneurial endeavor are particularly vulnerable and precarious in countries where property rights are poorly enforced" (p. 27). Findings in Baumol (1990) and Muphy et al. (1991) offered a good policy guide to Korean economic policy makers and Korean people. Policy makers were often tempted to intervene in the market and placed restrictions on the property rights without making a careful analysis about the eventual consequences.

The mismatch of governance structure (make, varying degree of hybrid, buy) creates slack. As wages in large Korean firms rose faster than in small firms in the early '90s, making parts within the firm became more expensive than buying from the outside. This presented an opportunity for corporate entrepreneurs to cut costs by outsourcing, and they acted to eliminate slack stemming from making the parts within the firm. Large firms in the U.S. and Japan had experienced the same pattern of outsourcing as they faced rising wages (Park et al., 1996; Sako, 1992).

Resource picking and capability building are crucial in creating economic rent. The human resource has become more important than ever before as the world economy is becoming a knowledge-based economy. Responses on the survey reflect the importance of human resources and knowledge.

Entrepreneurs in the evolutionary theory of the firm make product and process innovations and find markets for new products to create Schumpeterian rent (Nelson and Winter, 1982). The evolutionary theory of the firm helps explain the development of physical technologies and the firm growth. Responses on the survey appear to illustrate these aspects of the theory well. Respondents report that they made product and process innovations, and improved quality by employing 6 sigma (∪) management. They globalized market and developed and maintained new markets. Entrepreneurs' prescient forecasting the future and proactive response to anticipated environmental changes are key to the firm's success. Samsung's memory chip development illustrates this point well (Chang Kyu Hwang's presentation to Korea Trade Association: *Central Daily News*, reported by Chang Hee Yun on November 11, 2005). Samsung decided to develop memory chips with the CEO's prescient forecasting of memory chips' future, currently its market share is 50%.

It should be noted that even successful business practices are accompanied by downsides. For example, excessive structural change was cited as unsuccessful business practice by nine survey respondents. The pay-for-performance system had a downside in reduction of cooperation, excessive competition and lack of harmony among workers. The lack of prediction and response to market, environment and technology changes were regarded as the largest unsuccessful business practices. Eleven respondents indicated that diversifications with no expertise were unsuccessful business practices. Efforts to mitigate these negative side effects may continue to generate new business practices.

XII. Business Practice Engineering

Innovations in business practices contribute to firm performances. Total quality management (TQM) is known as a significant contribution factor of quality improvement and just-in-time inventory control has reduced inventory costs. Survey respondents in Table 1 indicated that the labor productivity has been increased by changing the seniority-based pay system to the pay-for-performance system. In the late 80s large U.S. firms such as GM, Ford and Chrysler began to certify their suppliers and monitor them on prices, quality and on-time delivery. These practices have significantly improved the quality, on-time delivery and price of supplies and U.S. firms have become more competitive in the 90s (Park et al., 1996). These examples illustrate that innovations in business practices reduce costs, improve productivity and quality of products.

We use the term, innovation, in a loose way. When a business firm changes a business practice or introduces a new business practice to the organization, we regard it as an innovation in business practice. Lately the dealer certification is employed by used car dealers. The dealer certification is a business practice which addresses the information asymmetry problem known as the lemon car problem in the used car markets (Ackerlof, 1970). When a used car dealer certifies a used car and offers a warranty, the dealer conveys the information to the buyer that the used car is not a lemon car. The used car dealer's certification is a new business practice that mitigates the lemon car problem. The lemon car problem depresses the used car market, but the new business practice improves the efficiency of the used car market and helps foster the new car market as well. However, this business practice emerged long after the lemon car problem initially raised by Ackerlof (1970).

We propose business practice engineering which identifies what to innovate and studies guiding principles on how to innovate better in a timely and systematic way. The entrepreneur in the principal-agent theory of the firm is a monitor of agents. The entrepreneur designs a work incentive to economize or optimize monitoring costs. The pay-for-performance system is a business practice and various pay-for-performance methods have emerged over the years. As reported in Table 1, the pay-for-performance system accompanies hazards of the lack of cooperation, excessive competition and lack of harmony among workers. Therefore, business firms adopting the pay-for-performance system need to mitigate these hazards. A good mix of individual and group incentives may mitigate these hazards. As physical technologies and market conditions for inputs and outputs continue to change, business organizations need to innovate social technologies as well as business practices for improvement in performances. Business practice engineering can make the business practice innovation more efficient and timely.

Figure 4. Roles of Entrepreneurs and Innovations

Theory of the Firm	Entrepreneur's Role	What to innovate	How to innovate
Neoclassical Theory	Direct resources to their best uses	Combination of resources or structure of resources	Accomplish technical efficiency
Principal-Agent Theory	Monitor	Work incentives	Economize agency costs
Property Rights Theory	Residual claimer	Ownership structure	Economizing costs of property rights assignment
Transaction Cost Theory	Transaction cost economizer	Governance structure and firm boundaries	Economize transaction costs
Resource-based Theory	Resource picker, deployer and developer	Resource picking, deploying and developing	Create Ricardian rent
Evolutionary Theory	Innovator	Product, process and organization	Create Schumpeterian rent (monopoly profits)

Figure 4 shows entrepreneurs' role in various theories of the firm, the identification of what to innovate and guiding principles of how to innovate. An entrepreneur in the evolutionary theory of the firm is an innovator who innovates products, processes and the organization to create monopoly profits (Schumpeterian profits). Today's popular business practice, Kaizen or continuing improvements, originates from Schumpeter's continuous creative destruction (Schumpeter, 1934). Japanese business firms put Schumpeter's creative destruction into a business practice and they are competitive in the global economy. The business practice engineering can facilitate new business practices which will lead to firm and economic growth.

XIII. Summary and Conclusion

Our contention was that the theories of the firm provide the basis on what to innovate and how to innovate for corporate entrepreneurs. Stylized facts of the survey results appear to support our contention. Corporate entrepreneurs can find sources of slack from the factor combination, work intensity, ownership and governance structures, and firms' routines. These sources provide information on what to innovate, and action principles of each theory offer a guideline on how to innovate. Principles of economizing agency cost, property rights assignment cost, transaction cost, resource picking and development cost, and innovation and adaptation appeared to be applied in innovating the firm. In other words, innovations appear to be cost-economizing.

Corporate entrepreneurs play a key role in corporate innovation and firm growth. A nation's economic growth depends heavily on the firm growth. As noted by Baumol (1968, 1990) and Murph et al. (1991), the productive contribution of a society's entrepreneurial activities vary depending on the relative payoffs on the types of entrepreneurial activities. To foster economic growth society and policy makers should, therefore, provide an environment conducive for productive entrepreneurial activities.

Policy makers and society should not continue to find faults of non-productive and rent seeking activities which were the product of the past society and environment. Limiting new venturing of large chaebols should also be lifted. On the role of government policy matters, Langlois and Robertson (2002) persuasively argued that the government's role ought to be facilitating rather than narrow and prescriptive, allowing scope for firms to develop organizational forms that are best adapted to their particular environments. Enforcements of property rights are conducive to the corporate entrepreneurship which facilitates innovation in product processes and new products, and fosters economic growth.

It is worth considering an establishment of business practice engineering, to study the development of social technologies as well as physical technologies and the relationship between them. The Kirznerian entrepreneur deals with social technologies, and the Schumpeterian entrepreneur focuses on physical technologies. As Nelson (2002) stated, new social technologies are needed to support activities that create new physical technologies. For example, as the computer and internet technologies emerged, the nature of the outsourcing system changed to better use the physical technologies. Business practices such as just-in-time inventory control, total quality control, and outsourcing have contributed immensely to firm performances and growth. Business practice engineering may help generate better business practices and contribute to firm growth, and thus to economic growth.

Global sourcing and global vertical integration have become common business practices with the help of internet technology. Society needs to create beliefs, culture and corporate entrepreneurial mindsets which were urged by entrepreneurial scholars and institutionalists (Nelson, 2002; North, 2005; Parker, 2006; Zahra 2005) to engender productive entrepreneurs.

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Comments on "Corporate Entrepreneurship and Innovation in Business Practices"

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This paper deals with the relationship between the entrepreneurship and the theories of the firm.

It first introduces the concept of entrepreneurship; in Schumpeter's view and Kirzner's view. After that, several theories of the firm are surveyed. Then it is argued that these theories of the firm can be used as a theory or guideline for corporate entrepreneurs as to what to innovate and how to innovate it.

Of course, in each theory of the firm, there must be some perspective what the successful (or productive) firm is. The purpose of these theories is to understand the organization or behavior of the existing firms, whose existence is automatically the evidence of their successes. Therefore, these theories naturally explain the factors that make the firm successful in various aspects. It is obvious that the knowledge of theories can be helpful to understand the successful entrepreneurship.

However, it is not sure whether this link can be called "the unified theoretical framework" as the authors insist. It is not that these theories precede the successful innovations as a guideline. Rather, these theories are trials to understand the preceding successful innovations and the resulting organizations of the firm. This paper's argument is just a renaming the existing theories with their motivations and results exchanged.

Survey results about the successful business practices are reported to support this somewhat obvious link between the corporate entrepreneurship and the theories of the firm. However, it is just labeling, where we just classify some business practices as related to some theories of the firm. This very basic survey does not seem to be enough evidence to support this link.

There can be many details requiring comments[1]. Besides that, the logical line of the paper is quite ambiguous on the whole, and it was quite difficult for readers to understand what will be the main assertion and purpose of the paper is.

[1] For example, while lemon market is a seminal example of asymmetric information and market inefficiency, it does not have anything to do with principal-agent theory of the firm organization.

CHAPTER 3-2

Entrepreneurship and Mobility

by

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Abstract

The politics of equalization that has come to dominate Korean politics is largely based on the perception that there is a pronounced tendency for *bu-ik-bu-bin-ik-bin*, (or "the rich getting richer and the poor getting poorer"). Though the issue of RGR involves the subject matter of economics, it has scarcely been examined. The reason for the neglect is primarily that most people find it rather obviously true.

This paper examines the validity of the thesis of RGR and finds it wanting based on the US data. For example, an implication of RGR, viz., increasing polarization of income and wealth distribution, or *yang-keuk-wah*, is not borne out by observation. Also, there is too much mobility across income strata to be consistent with RGR. RGR is at best a short term observation; it is a mistake to regard it as a long term tendency. The idea of RGR rests on a faulty understanding of the way the market economy works. The fault lies in taking a static view of a dynamic economy and ignoring its dynamo—entrepreneurship, which generates significant countervailing forces against RGR. What has been overlooked by traditional economics is that entrepreneurship is not the ownership of capital, but the discovery of opportunities.

Attempts to redress the perceived tendency of RGR through various redistributive schemes and regulations will merely handicap entrepreneurship and reduce mobility, creating more stratified society. The misperception of RGR, as expressed in the politics of equalization, will, ironically, result in a more permanent distinction between the rich and the poor.

JEL Classification: D39, J69, M13

I. Introduction

The politics of equalization has come to the fore in Korea. In recent years, it has driven most of government's programs to reduce inequality—through progressive taxation, regulations to protect the have-not, and dispensation of various entitlements, (creating vast unfunded, or under-funded liabilities), and various attempts to redress regional differences in economic development by government decree, including the re-location of the nation's capital, etc.—to the possible detriment of long term viability of the Korean economy.

The politics of equalization is driven by four kinds of beliefs: (1) that the observed degree of inequality in income and wealth distribution is too high, (2) that much of the income and wealth of the rich is undeserving, (3) that one's gain is necessarily at the expense of another, and (4) that there is a tendency for the rich to get richer and the poor to get poorer. Of course, these are not unique to the current Korean politics of equalization. Rather, these are the some of the most deeply held beliefs of humanity that flare up now and then to drive the politics of equalization, leading often to a destructive ending. To the extent that these beliefs pertain to the subject matter of economics, economists should be able to contribute. Let us briefly consider each in turn before we set out to the main task of the paper.

(1) It is often asserted that there is too much inequality. Though economists often contribute to the debate, on the account that they are more familiar with the data, there is not much an economist *qua* economist can say about the issue, other than clarifying the use of data.[1] It is because to judge whether or not the existing distribution is too unequal, there must be a criterion. No critic of excessive inequality, however, has proposed what the acceptable degree of inequality should be. In the absence of a criterion that can be supported by economic science, any expression of approval or disapproval of existing degree of inequality is an expression of one's own preference, pure and simple. According to the widely accepted notion of the trade-off between efficiency and equity, in which the former is in the realm of economics, and the latter in preference.[2]

(2) It is sometimes asserted in intellectual circles that much of the income and wealth of the rich (as well as the plight of the poor) is undeserving. There are two flavors of this sort of argument, one is a variant of the labor theory of value and other philosophical. Economists can and should confront mistakes of the labor theory of value, such as "only labor creates value", or "the rich get income only from non-labor sources", etc. As economists have done a good job in this regard, I believe, there is no need to dwell further on it in this paper.

The philosophical proposition that the rich do not deserve what they have on their own merit, nor do the poor through any fault of their own, is based on the belief that differences in income and wealth stem ultimately from differences in natural endowment (such as intelligence, physical abilities, family background, determination and drive), which are not one's own doing, but a matter of luck. The proponents further argue that no

[1] There is a great misuse of data in the literature on inequality even by economists, however. See Choi (2002).

[2] A small but growing literature in economics denying the trade-off deserves a critical examination, but it is not directly relevant for the purpose of the paper.

one deserves to be luckier, or unluckier, than others. Though I believe the argument leads to absurdities, the argument is in the realm of justice, not in the realm of economics.[3]

(3) There is a widely held belief that one's gain is necessarily at the expense of another known as the *Montaigne's Dogma*. The fallacy of this belief has been fully exposed by economists through the logic of mutual gains from voluntary exchanges. (It is, however, worth repeating and educating each generation on the perennial fallacy.)

(4) Widely perceived to be valid is yet another belief that there is a tendency for "the rich to get richer and the poor to get poorer", (RGR, hereafter.) As the belief in RGR pertains to the subject matter of economics—the process of income and wealth generation and distribution—yet it remains least examined.

In the Korean media, we see ubiquitous denunciations of the evil of RGR and the announcements of various government policies to combat it. That a large and growing proportion of the population has come to believe that the system is rigged against them, and therefore it is unfair, is not to be overlooked. They are bound to feel compelled and justified to advocate measures to counter the systemic tendency for greater polarization.[4] Of course, what the advocates of equalization policies to counter the evil of RGR often forget, (or are ignorant of, or don't care about), is the fact that even the most draconian, and repulsive, measures, (viz., the socialist experiments), have not in the past succeeded in equalizing income or wealth. The advocates of greater equalization further ignore that the consequence of attempting to equalize by force had adverse impacts on the lives of people—lessening individual liberty, a less dynamic economy, and reduced social mobility across social strata. They simply react to what they believe to be unfair. The prevailing sentiment of increasing polarization of income and wealth is not unique to contemporary Korea. It tends to flare up now and then, in many different countries whenever statistics suggest that there is a growing inequality[5]. For example, only a short while ago, in the late 1980s and early 1990s, there was a great outcry against the perceived tendency for RGR in the US, demanding governmental actions to counter it.

[3] See Choi (2002).

[4] Yoo (2006). It should be noted that, despite all the talk of polarization of income in Korea, income inequality in Korea, as measured by Gini coefficient in Korea compares favorably against other countries. According to the World Bank (2006), Gini coefficient, was 0.316 (in 1998, in the aftermath of the financial crisis. It has subsequently decreased to 0.31 range.) Only few countries in the world—such as Japan, Sweden, Norway, Finland, and Germany—had lower Gini coefficient, meaning a more equal distribution of income. Many other countries had higher Gini coefficients—e.g., Netherlands (0.326), Italy and UK (0.360), US (0.408), Singapore (0.425), Mainland China (0.447), Hong Kong (0.525), etc. The proponents of polarization of income in Korea focus on the one-time jump in Gini coefficient in 1998, in the aftermath of the financial crisis. But there is no more indication of Gini coefficient increasing since. See Lee (2006). Given the nature of statistics, one should examine changes in measurements (i.e., definition of income, changes in taxes, welfare benefits, the size of household, etc.), before jumping to a conclusion that Gini coefficient truly increase. Since the paper analyzes a similar episode in the US, using the US data, I will leave my comments at this.

[5] In a market economy, inequality tends to increase when there is a major restructuring of the economy, that is, when entrepreneurs take advantage of profitable opportunities. The process of increasing inequality is mitigated or even reversed as entrepreneurial profits are dissipated through imitation.

Yet, this widely held belief of RGR is seldom examined, perhaps because so many people are already convinced of its truth. For example, Paul Krugman was so sure of the idea that he suspects anyone who proposes to critically evaluate the validity of the common inference of RGR from the statistics as "hired guns of the right."[6] But in reality, the process of income and wealth generation is far from well understood.

The aim of the paper is to fill this lacuna by evaluating the validity of the idea of RGR, as it pertains to the processes of wealth and income creation and distribution. As I shall argue subsequently that entrepreneurship is the most important countervailing force against RGR and account for much of economic mobility, the paper is a contribution to a theory of entrepreneurship, as well.

The outline of the paper is as follows: In the next section, I will briefly review the arguments supporting the idea of RGR. It will be followed by a section in which I will argue that there is much contrary evidence, viz., the implications of the idea of RGR are not borne out by evidence. (In the paper, I rely on the US data, leaving a similar evaluation using the Korean data for a future study.) I end the section by concluding that the notion of RGR is based on a deficient understanding of entrepreneurship, the most dynamic force in the processes of income and wealth generation. The following section spells out how the entrepreneur creates and destroys wealth. The main thesis of the section is that as entrepreneurship is not based on ownership of currently valued assets, (or capital), but on the discovery of profitable opportunities and that, therefore, the rich do not have an advantage. Furthermore, what advantage the rich may have by the ownership of greater capital, can be more than off-set by their tendency to adhere to the proven way of doing business. I end the paper with a consideration on the policy implication of the argument in the preceding sections.

II. Arguments for RGR

The idea of RGR reflects a popular view of the processes of income and wealth generation and distribution, in which the rich have inherent advantages over the poor. Surely, one can easily think of many advantages of the rich over the poor.[7] Let us briefly consider a few arguments commonly advanced in support of the popular belief.

It must be noted at the outset that, traditionally, economists have not had much to say directly about the *processes* of wealth and income generation.[8] It is because the economic theory is primarily concerned with static equilibrium and the bulk of economic research in the relevant area is devoted to the analysis of the functional division of social output among the factors of production and statistical explanations of the patterns of existing income distribution.[9]

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[6] Krugman (1996, 47). See also Krugman (1995, 8-12).

[7] RGR is perceived to be universally valid principle for distributional tendencies when the word "the rich" is interpreted as the above average possession of valued attributes, (e.g., strength, size, beauty, family connections, intelligence, etc.) As such, the popular perception is often applied not only to personal income and wealth, but to the fortunes of firms, regions, nations, etc., as well.

[8] I am aware of two exceptions: Schumpeter in connection with the tendency for industrial concentration and Frank and Cook in connection with the characterization of the market as winner-take-all process. We discuss both below.

[9] See Sahota (1978) for a survey of literature.

Yet, the standard economics does not appear to contradict the idea of RGR. The reason is that economic theory has a stylized view of income distribution as a by-product of economic activities of transforming *given resources* into goods through *known* methods of production or trade. In this view, it is not possible to imagine a case where the poor with less resources ever doing better than the rich with more resources. The poor may attempt to improve his lot by acquiring skills or education; but the rich can do better, given his better ability to finance! Only luck could bring about a change in one's relative standing on the income ladder. Therefore, the majority of economists does not object to, and even appear to agree with the idea of RGR when they admit that there is a trade-off between prosperity and equality.

Even so, there have been some explicit arguments in support of the thesis of RGR. One commonly advanced argument in support of RGR is based on two considerations—differential savings rate across different income strata, and the "law of compounding interest". The argument runs as follows: The rich have a higher savings rate than the poor, the poorest saving virtually nothing. Given this, it is inevitable that the wealth of the rich will grow at a higher rate, even if everyone earned the same rate of return on their savings. Accordingly, wealth will increasingly concentrate in the hand of the rich, and the gap between the rich and the poor will grow.[10]

Earlier, Schumpeter argued similarly, in the context of industrial studies, that large firms have advantages in technological innovation and there would be an increasing concentration of wealth. His argument is something like this: As an economy develops through increasing specialization, R&D necessary for modern industrial innovations becomes a specialization as well. Large firms, especially those that attained the dominant positions in their respective industry and enjoy above average profit, will be able to invest more in R&D and therefore innovate better. Using their wealth, large firms can nip the bud of what challenges small or medium-sized firms might pose. In the end, wealth will become concentrated in a "small number of bureaucratized corporations."[11] Schumpeter's idea of increasing concentration of industries is a consistent with the idea of RGR.

Recently, Frank and Cook have advanced an argument that in the modern economy there is a pronounced tendency of RGR. Their argument is based on the perceived tendency of even small differences in ability (and resources) to be translated into large differences in income (and wealth) in modern economics.[12] They portray the process of income and wealth distribution in modern society as the *winner-take-all*. By extension they claim that there is widespread tendency of *those-near-the-top-get-a-disproportionate-share* and those who are only slightly inferior in ability fail miserably. They see the tendency not only in art and entertainment (actors, singers, fashion models, sport players, books, etc.), but also in law, business, technology, investment, academia, and even in lowly entry level white color jobs. In short, they see the real source of rising inequality (noted in the late 1980s and the early 1990s) is in the spread of the winner-take-all-markets. Here we have a rare case of two economists providing an explicit support for the thesis of RGR.[13]

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[10] Inhaber and Carroll (1992)

[11] Schumpeter (1975, 219)

[12] Frank and Cook (1995)

[13] Frank and Cook (1995) further argue that the winner-take-all means not only growing inequality, but inefficiency, as well. They reason that as more and more people compete to acquire the desired attributes, people end up over-investing in them. The market, they claim, has become inequitable and inefficient. As they see no trade-off between efficiency and equity, they propose certain reforms such as taxing the rich and regulating the

III. Evidence against RGR

Surely, one can easily think of many advantages of the rich over the poor. To many it is a common sense. However, not all common sense can stand scrutiny. I believe RGR is one of them. Can RGR be truly the dominant feature of the process of generating income and wealth in a market economy? I do not think so. Surely, the advantage of the rich is more pronounced in the short run. After all, in the extremely short run, it is definitional—the rich have and the poor don't.

In a longer run, however, the putative advantage of the rich and disadvantages of the poor becomes less clear. I shall argue subsequently, that there is a more important factor than the ownership of currently valued assets in determining the future income and wealth. There, I shall argue how entrepreneurship provides a countervailing force against RGR. In this section, we will examine whether the implications of the popular perception of RGR is borne out by experience. I present some contrary evidences.

In the context of assessing the validity of RGR, the process of income distribution has two possibilities: (A) The income of the rich and the poor grow at the same rate; or (B) The income of the rich grows, on the average, at a higher rate than the income of the poor.

When people observe that there is a tendency for RGR, they probably do not mean A. For in this case, though the absolute amount gained by the rich is greater than that by the poor, the relative position of the rich and the poor is not altered. Besides, to characterize this as RGR is to commit a conceptual confusion. For then, one employs the distinction of the rich and poor, which is a relative concept, and at the same time the income gap over time is measured using an absolute scale. Only B is unambiguously consistent with the popular notion of RGR.

B has two possible versions: (B-1) As the rich get richer, the poor become absolutely pooper[14]; or (B-2) Even as the poor get richer, the richer get richer at a much faster rate.[15] It is difficult to judge which version of RGR is referred to when a social critic denounces the evil of RGR. Many social critics, have argued that B-1 is the case.[16] B-1 implies growing immiserization of the poor. In light of the phenomenal increase in the standard of living, especially among the poor in the recent centuries, however, B-1 does not stand against evidence.[17] Judged by the context in which the thesis of RGR became popular in the US in the late 1980s and the early 1990s when an increase in the Gini-coefficient was noted and decried, probably others have in mind B-2, instead. Now let's scrutinize B-2.

Now, if RGR in the sense of B-2 were true, we should observe little income mobility and increasing polarization of income and wealth distribution over time.[18] But neither is consistent with evidence. [19] For we observe the contrary: (1) In the long run, the pattern of

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market to reduce the wasteful competition. The result they anticipate is more equitable distribution and greater efficiency!

[14] [W/W]rich > 0 > [W/W]poor

[15] [W/W]rich > [W/W]poor > 0

[16] Frank (2000, 255). Also Krugman (1992, 1996) Freeman (1999)

[17] Cox and Alm (1995). See also Choi (2004).

[18] This is what Koreans mean by yang-geuk-wha.

[19] Here, I am relying on the US data.

income and wealth distribution is rather stable, (especially if changes in demography, institutions, industrial structure, etc., are allowed); (2) There is a great deal of income mobility, both intra-generational and inter-generational. Let me explain them in turn.

3.1. Relative Stability of The patterns of Income Distribution

In the 1990s, Krugman was a forefront proponent of RGR: "…it does not take much imagination to envision what our society will be like if this process [of RGR] continues for another 15 or 20 years…. [It will be a state]... in which a few people live in luxury while the majority grovel in Third World living standards."[20] However, his projection of increasing polarization of wealth distribution has not been borne out. Even as Krugman complaint about increasing polarization in the mid 1990s, the measured degree of inequality stopped growing by 1993.[21]

Increase in inequality in the late 1980s and early 1990s, in fact, was not out of norm from a long term perspective. The pattern of American male earnings distribution in the last 150 years is "marked by long periods of relative stability and shorter periods of substantial change, [not all in one direction]."[22] The pattern of income distribution in the period between the end of the Civil War and World War I was stable. Inequality declined sharply during and immediately after World War I, but gradually increased to the pre-World War I level by 1929. From the beginning of the Great Depression to 1949, inequality declined sharply but from 1950 it remained stable for nearly 30 years. Despite the recent increase in inequality, the current inequality in distribution is not out of ordinary from the historical perspective: "Wages were no more unequally distributed in 1990 than in 1940. They were even more unequally distributed during the Depression and in earlier periods of economic stress."[23] From a historical perspective we should conclude that the degree of inequality has, through periods of relatively rapid increase or decrease, remained within a bound. Moreover, the pattern of income distribution does not vary much across ages and across different economic systems.[24]

What caused the increasing inequality in the 1980s that led so many into believing RGR? The increase in inequality in the 1980s and the early 1990s had much to do with changes in demography, labor market conditions, and industrial structure. Levy and

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[20] Krugman (1996, 49).

[21] The US Census Bureau economists Jones and Weinberg (2000, 8) conclude that "Data collected since 1993 indicate that the trend of increasing income inequality, which characterized the 1980s, has slowed or disappeared." Interestingly, the story is similar to that in Korea. All the recent talk of increasing polarization of income and wealth in Korea refers, basically, to one-time jump in Gini coefficient in 1998, in the aftermath of the financial crisis. There is no evidence of Gini coefficient increasing afterward. If anything, it has declined from the high of 1998 to a level prevailed in the 1970s and the early 1980s. See Lee (2006).

[22] Levy and Murnane (1992, 1340).

[23] James Heckman (1999, 62).

[24] International (as well as intertemporal) comparison of income dispersion is difficult because of data incompatibility. Nevertheless, Lydall (1968) found that that "within the group of industrialized countries the degree of dispersion is broadly the same," despite differences in economic structures. Atkinson (1975, 27) Inhaber and Carroll (1992, 2) speak of the "natural laws" of income distribution in the sense that all income distribution is lognormal with a Pareto tail.

Murnane observe that "the growing inequality" between groups is largely attributable to "the plight of young, less educated workers" which reflect the shifts in the demand and supply of labor.[25] The supply of young and less educated males increased (relative to the more educated), reflecting a low premium on education during the preceding decades. At the same time, the demand for the less educated male labor declined in the 1980s when the strengthening of the dollar accelerated restructuring of industries and increased industrial migration to high tech/ service industries and the relocation of manufacturing to overseas.[26] Ergo, the plight of young and less educated males showed up as growing inequality. Greenwood observes that the observed growing inequality is but a reflection of radical shifts in technology, as in the Industrial Revolution.[27]

Whatever the cause, it has turned out to be premature to argue, based on a few years of observation, that RGR was real and to project increasing polarization. Indeed, even as some leading academics continued to denounce growing inequality through the 1990s and well into the early 2000 (and went on to establish a dedicated academic journal and Ph.D. programs in income distribution at Harvard, Princeton, Yale, Cornell, and the like), increasing inequality had already stopped by 1993.

3.2. Income Mobility

The implied lack of mobility is also contrary to the evidence. Relatively few remain chronically poor, within his or her lifetime or across generations.[28]

Intra-generational mobility: Intra-generational mobility deals with the degree to which the income status of an individual at a moment in time is determined by his or her economic status at another moment in time. Much of intra-generational mobility has to do with life-cycle of the individual. Another source of intra-generational mobility is changes in one's career path.

A study, based on the University of Michigan's Panel Survey of Income Dynamics (PSID), shows much intra-generational mobility. (Table 1)

Table 1. Income Mobility Percent in Each Quintile in 1991

1974 Quintile	1st	2nd	3rd	4th	5th	Total
1st	42.1	22.8	14.3	13.0	7.8	100%
2nd	28.7	36.5	19.3	9.2	6.7	100%
3rd	14.7	20.6	32.1	20.5	12.0	100%
4th	9.7	12.0	24.2	32.4	21.7	100%
5th	3.1	7.3	10.2	25.4	53.9	100%

Source: Gottschalk (1997, 37).

The chance of those in the poorest quintile in 1974 improving their situation in 1991 is 58% and their chance of finding themselves in the top two quintiles is 21%. Their chance of finding themselves in the same quintile after 17 years (42%) is much higher than the

[25] Levy and Murnane (1992, 1340-1341)

[26] Another factor is the increased competition in the labor market brought about by women, who had marked gains during the period under consideration.

[27] Greenwood (1997)

[28] Greg Duncan (1984, 41-3, 91) finds substantial mobility and observed that only about 2.6% of the population appeared to be chronically poor.

chance of finding themselves in the top quintile (8%). Given that we are considering *intra*-generational mobility, (mobility during a period in which one's ability, education, training, attitude, etc., are largely given), mobility is substantial. Noting that there is a good deal of mobility in the US, Alan Blinder observes: "While ghetto dwellers rarely trade places with Rockefellers, ours is not a stratified society."[29]

Inter-generational mobility: Inter-generational mobility, which is perhaps of greater interest to many concerned with the advantages of the rich, deals with the degree to which income status is transmitted from one generation to another. Many economists have found evidence for high inter-generational mobility, or little correlation between fathers' income and sons' income.[30] Gary Becker observes that in rich countries, including the US, "low earnings as well as high earnings are not strongly transmitted from fathers to sons."[31]

Solon, however, argues that the impression of highly mobile America is based on flawed studies, overestimating inter-generational mobility. According to Solon, in a study based on PSID, the correlation is 0.4 or higher "indicating dramatically less mobility than suggested by earlier research."[32] Solon's estimate certainly implies a higher degree of transmission of earnings status across generations than earlier estimates.[33]

But what does it mean? Does the father-son earnings correlation of 0.4 represent lack of mobility? Hardly. Given the father-son earnings correlation of 0.4, the expected differences in earnings among sons will be only 40% of the differences among their fathers. The expected differences among grandsons will be only 16% of the differences among their grandfathers. [34] The degree of mobility in the US is rather striking. Some people might argue that anything short of equality between the probability of the poor becoming rich and the probability of the rich becoming poor is insufficient. Millions of prospective immigrants wish to vote to the contrary with their feet. If there is less inter-generational mobility in a certain country, then the cause is to be sought not in the nature of the market economy, but in various institutions in place, including government regulations.

Mobility among the richest: What about mobility among the richest? Since one of the major difficulties of large-scale data is under-representation of the highest level of income or wealth, it would be of great interest to get a glimpse of the degree of mobility at the very top of the wealth scale. Mobility among the richest is of added interest in the context of our discussion; if the alleged advantage of the rich is true, it should be even more pronounced among the richest. First, let us consider the ten richest people in 1983 and their subsequent standing in 1989, 1995 and 2005.

[29] Blinder (1980, 454).

[30] Sewell and Hauser (1975, 72).

[31] Becker (1988, 10).

[32] Solon (1992).

[33] Sewell and Hauser (1975, 72) estimate the correlation at 0.18.

[34] This may be an underestimate of inter-generational mobility as Solon admits that his model ignores the possibility of differential intergenerational transmission across income strata. The possibility is not idle. Solon (1992, 404) admits the possibility that the correlation is higher for the highest quintile (0.48) and lower for the lowest quintile (0.34). That is, "'riches to rags' may occur less frequently than 'rags to riches'."

Table 2.

	1983 Rank	1989	1995	2005
G. P. Getty	1	46	39	116
S. M. Walton	2	17	8*	6-10+
D. K. Ludwig	3	119	N/A	N/A
D. Packard	4	14	11	N/A
A. Wang	5	N/A	N/A	N/A
N.B. Hunt	6	N/A	N/A	N/A
C. R. Hunt	7	69	202	N/A
H.R. Perot	8	8	22	50
M. Hunt Hill	9	47	57	N/A
George Mitchell	10	110	190	93

Source: Forbes, various years. N/A means that the person is not listed among the 400 richest. It could be death or it could a drastic diminution of fortune. * The ranking is based the combined inheritances of Walton fortune among 5 heirs. +Five heirs of Walton rank from 6 through 10, each worth about 15.6 billion dollars.

We see that only one of the ten richest in 1983 stayed that way in 1995 and 2005, (ignoring a setback in 1989); it is the Wal-Mart fortune. The rest either faced death or much diminution of wealth. The An Wang fortune sank from 5th in 1983 to outside the richest 400 in 1989 even before his death.

Now, let us consider the ten richest people in 1995 and their prior and subsequent rankings.35 It should be noted that all, save the Waltons, are self-made. In 1983, only twelve years before, five out of the ten were not even ranked among the richest 400. By 2005, ten years later, some of them were already elbowed out by newcomers. Mobility among the richest is high, indeed.

Table 3. The Ten Richest in 1995 and Their Prior and Subsequent Rankings

Name	Source of Wealth	1983	1989	1995	2005
W. H. Gates III	Microsoft	N/A	43	1	1
W. E Buffett	Investment	31	2	2	2
J. W. Kluge	Metromedia	100	1	3	23
P. G. Allen	Microsoft	N/A	86	4	3
S. M. Redstone	Viacom	N/A	3	5	25
R. M. DeVos and J. Van Andel	Amway	102	268	6	65
S. I. and D. E Newhouse	Media	19	6	7	26*
Waltons	Wal Mart (Inheritance)	2	17	8	6-10
R. O. Perelman	Investment	N/A	5	9	34
L. J. Ellison	Oracle	N/A	98	10	5

Source: Forbes, various years. *DeVos and Van Andel are listed separately in 2005, each ranking 26.

Of course, there are Rockefellers, Du Ponts, and Mellons who have more carefully husbanded their inheritances and remain among the richest. However, their fortunes pale compared to the newly found fortunes of Bill Gates (Microsoft), Larry Ellison (Oracle), Warren Buffett (Berkshire Hathaway), Michael Dell (Dell Computer), and the like.

[35] In 1995, the five heirs of Wal-Mart fortune did not individually rank in the top ten richest Americans.

Moreover, few heirs of great fortunes from the Roaring 20s are still counted among the richest.[36] Obviously, the rich do not always stay on top.

Also, the popular notion that people with better academic credentials have insurmountable advantage over those with lesser credentials in earning income, underlined by Frank and Cook, is of dubious validity.[37] Contrary to the popular view, graduates of elite universities do not earn the most, nor do they monopolize the top posts. Of the 1,981 present and former CEOs of Fortune 500 and Service 500 companies surveyed by *Fortune* magazine, 156 graduated from the Ivy League schools. That is a little over 8%.[38] All the graduates of the schools that produced more than three CEOs, which include not only Harvard and Yale, but also Xavier, University of Oklahoma, University of Detroit and the like, add up to 495. That is about 26%! From this, one must conclude that the great majority of CEOs of Fortune 500 companies graduated from less well known colleges and universities. In all probability, the academic credentials will be even less impressive if we survey smaller firms, many of which grow much faster than the Fortune 500 firms. Hacker concurs: "…anyone who has attended reunion of Ivy League college graduates cannot help but be struck by how many of these alumni end up with middle class incomes and quite commonplace careers. What is instructive is that so many man and woman from quite modest backgrounds ascend to higher echelons, moving ahead of people who started with more auspicious credentials."[39] Yet, the popular perception is that acquiring the right credentials is crucial because RGR.[40]

In connection with Schumpeter's thesis of growing concentration, consider the list of Fortune 500 companies. We do not see one firm monopolizing the whole economy, not even an industry. The would-be monopolist is constantly challenged or by-passed. Daily, we see dominant firms are challenged and supplanted by more nimble rivals, many of which are start-up firms, even in industries that are characterized by intense R&D. For example, IBM, after spending multi-billion dollars on R&D year after year, hiring people with some of the best credentials has been challenged by rag-tag armies many of whose leaders include college drop-outs. Many great firms have sunk into obscurity (or even gone bankrupt), while others have risen to dominance from obscurity (or out of nowhere.) From a study of the assets of the 500 largest American industrial firms from 1961 to 1980, Kirchhoff finds that these firms did not increase their share of assets and, more interestingly, that "at least 16 percent of the firms in the Fortune 500 largest category

[36] Some may remain skeptical, believing that old fortunes skillfully hide their fortune from the probing eyes of *Forbes* researchers, (and more importantly from the probing eyes of the IRS.) Of course, there are limitations to "Forbes 400", as most data are. But the suspicion is an unfalsifiable speculation. For what evidence (that can stick in court) is there, when solid evidence would enable an ambitious politico to build an outstanding career?

[37] Frank and Cook (1995).

[38] Caminiti (1990, 120). This is the very same source Frank and Cook (1995) meant to support their thesis!

[39] Hacker (1997, 217). Bauer (2000, 125-138) notes a high degree of mobility in the supposedly stratified Great Britain.

[40] People in academic establishment would have vested interest in perpetuating the misconception.

change every two years. Some of the additions to the 500 were firms that formed and grew into the 500 within ten years."[41]

Evidence considered thus far contradict critics' claim that the rich have inherent advantage over the poor and, as a consequence, the distribution will become increasingly unequal. Instead of increasing polarization of income distribution and little or no mobility, we see both long-term stability in the pattern of income distribution and much mobility.

Based on this evidence, one cannot but wonder why the idea of RGR, which so many find self-evident is not borne out by facts. There must be some countervailing forces that counter the perceived tendency of RGR, allowing some of the poor, with all their disadvantages in resources, (e.g., poor manpower, difficulty of raising capital, lack of connections, etc.), somehow to supplant the rich, while many rich, with all their putative advantages, fall from their dominance. If so, to emphasize the idea of RGR (at the neglect of the countervailing tendencies that contribute to much mobility) and to project growing polarization (when we readily observe a skewed but stable income and wealth distribution over time) is not only to misrepresent the facts, but to display a profound misunderstanding of the way the economy operates. Let us now examine how this may be the case.

IV. Entrepreneurship: Process of Income and Wealth Generation

The perception of RGR pertains to a short term trend, beyond which it is not valid to generalize. There are some obvious factors that may close off the endless accumulation of rich: (1) As the founder of a fortune passes away his fortune is divided among a growing number of offspring, making the shares of each offspring smaller and smaller as generations pass[42]; (2) The wealthy, and especially their heirs, tend to be profligate and concerned with many finer pursuits than making money[43]; (3) The wealthy are likely to be the target of fortune hunters, whose main weapon is charm; and (4) Across generations, fortunes may be reduced by inheritance taxes—directly through the taxes and indirectly through the effort to evade them.[44] One may be able to think about a few more.

None of these is as significant as entrepreneurship in creating and destroying wealth, however. Entrepreneurship is the most important force that puts a limit to the process of cumulative advantage of the rich, and generates much of social mobility. The entrepreneur creates wealth by discovering and exploiting profitable opportunities for

[41] Kirchhoff (1994, 46)

[42] Primogeniture may, in principle, slow the process of wealth dissipation somewhat. But primogeniture is hardly practiced nowadays. Assortive mating, together with small number of offspring, may also slow the process of wealth dissipation. Aside from anecdotal evidence, it is difficult to determine how widely practiced assortive mating is.

[43] In doing so, one should note, they sometimes perform a valuable social function of financing "outrageous" experiments, willy-nilly paying for innovations.

[44] Considering the fact that a rather small amount of inheritance taxes is collected, the major impact of inheritance taxes is rather channeling resources to uses that are less valued than the ones that would have been undertaken without taxes. Also notable is the fact that the patterns of income distribution across countries with varying degrees of progressive taxation are not dissimilar.

placing resources at higher valued uses than hitherto thought possible by others. It can also destroy the wealth of those whose fortune is built on the assumption that tomorrow will be like today and that the competition posed by the entrepreneur is unlikely.

The nature of entrepreneurship, however, is not well understood, even by the majority of economists.[45] After looking into the issue, for example, Baumol concludes that entrepreneurship is not subject to systematic principles.[46] A few find it elusive.[47] Demsetz goes so far as to wonder whether it is meaningful to talk about entrepreneurship at all.48 The reason for the neglect of entrepreneurship is that modern economics adopts the perspective of the economy as allocating given resources to known ends and distributing goods among resource owners according to the productive contribution of the resources they own. The basic theory of modern economics, perfect competition, takes elaborate steps to establish that there is no profit in competitive markets. (Obviously, there can be no economic profit in doing what everyone else know about.)

Within the standard economic theory, the process of income and wealth generation may be likened to a race along an established track, as it were. From this perspective, it is obvious that people with more capital, or more currently valued resources for the purpose at hand, will have an advantage over others with less. Other than a string of bad luck, or some personal shortcomings such as sloth and debauchery (as in the fable of tortoise and hare), it is difficult to imagine how the rich might ever be outdone by their poor brethren.

However, it would be a mistake to think that this—running a race along a known path—is all there is to the processes of wealth and income generation. This perspective ignores the fact that human beings have to act in the face of uncertainty, that the availability and the value of resources are yet to be explored and determined, and that the prospect of profit induces vigorous exploration and experimentation of all manners. People who hold the idea of RGR as valid apparently forget that the way to riches is not only running faster than others along the proven path (where 'the rich' would have an advantage), but also (and often more importantly) in discovering a short-cut (or even a new destination) that others somehow ignore, perhaps because their heart is so set on running as fast as they can along the proven paths. In the later case, in the case of entrepreneurship, the rich do not have an advantage because the road to riches rests not on the ownership of currently valued resources, but on the discovery of profitable opportunities.[49]

The entrepreneur, in the process of creating wealth for himself and his allies, may also destroy other people's wealth to the extent that the entrepreneurial action exposes their mistakes. The way the entrepreneur creates and destroys is as follows: The entrepreneur discovers a profitable opportunity where he can round up resources needed to produce a product at a price lower than the prevailing price of the product, or to produce a product or service for which consumers are willing to pay more. He captures the price difference

[45] Kirzner (1973).

[46] Baumol (1982, 30). Baumol (1993) has changed his mind and began to write about entrepreneurship in connection with innovation. For Baumol, however, entrepreneurship remains a scarce resource that needs to be efficiently allocated.

[47] Schultz (1990, 31) and Kilby (1971, 1).

[48] Demsetz (1982, 275).

[49] In England under primogeniture the first sons inherited his father's estate. The younger sons sought their fortune elsewhere in military, seafaring, or other commercial adventures, etc., and ended up doing much better than the eldest sons.

as profit. If the price difference is expected to last into the future, the present value of the expected future incomes becomes his wealth. This is how big fortunes are created. The resource owners involved in the creation of the fortune, to a greater or lesser extent, share in the fortune. When the entrepreneur successfully creates a fortune in the process of better satisfying the consumer demand, he may destroy others' fortune along the way to the extent that the entrepreneurial innovation raises the costs of (resource) rivals—others things being equal it would reduce the expected profit stream and lower its present value estimate—or lower the price of (product) rivals. The fortunes of the rivals, (including those of many erstwhile rich), are diminished.

In fact, all business enterprises face the threat of competition at all time: Somewhere and somehow, successful rivals who can better serve the consumer will appear in the resource markets, or in the product markets, and diminish the value of the firms. The current rich face constant threats of being greatly diminished, if not wiped out. It does not matter whether the current rich are the original entrepreneur, or the investor who bought the going concern from the original entrepreneur (with the funds from other entrepreneurial successes, or from inheritance, or, much less likely, out of savings.) Firms face constant threats of diminution from other entrepreneur.

If an entrepreneurial fortune is cashed in, the entrepreneur himself or his heirs would be less subject to the challenge from the next entrepreneurs. But as coupon clippers they are not likely to do better than the average rate of return in the market as a whole. Therefore, one cannot maintain for this class of people that the rich get richer. This class of people, largely exempting themselves from the entrepreneurial challenge, have many reasons to spend down the fortune—the pursuit of finer things in life, the need to maintain the appearances corresponding to their standing in society, and all the attentions from the gorgeous people and the people with ingenious schemes, who would love to show the rich how to use their wealth, (as well as being subject to the inevitable fact of having to divide the fortune among the increasing number of heirs as generation passes, among other things.)

V. Do the Rich Have Advantage in Entrepreneurship?

One may contend that, if entrepreneurship consists of discovering profitable opportunities, it may be possible that the rich are still in a better position to discover them, since they can devote more resources to the search for profitable opportunities. If so, the idea that RGR would be still valid.

The trouble with the above argument is that the process of discovering profitable opportunities is portrayed as something similar to combing the beach with metal detectors. The wider area you cover devoting more resources, the more likely you will come up with discoveries. In this metaphor, you are presumed to know the general area to be searched. The metaphor is misleading because the general area of potential profit itself is yet to be decided.

A consideration of how small or medium-sized firms can and do often successfully enter industries dominated by firms that spend large resources on R&D, however, render such a presumption questionable. Just think about challenges such dominant firms as IBM, Microsoft and Kodak are facing. The history of business is a history of once dominant firms sinking into oblivion (Westinghouse, UNIVAC, Wang Lab, DEC, etc.) even as newly found firms rise to dominance (Dell, Microsoft, Google, Yahoo, etc.) And also think about all the inventions in the research labs of IBM, Kodak, Xerox, AT&T, etc., cast aside as unworthy, only to regret that others create fortunes for themselves from the inventions![50] On the problem of forecasting future technology, Nathan Rosenberg observes: "We frequently simply do not know what new findings may turn out to be relevant or to what particular realm of human activity that relevance may eventually apply."[51] Entrepreneurship consists, precisely, of discovering the neglected and unexploited opportunities, not on the ownership of currently valued resources.

Still, how is it possible that profitable opportunities are left unexploited when they are available for grabbing, so to speak? Aren't there enough people in the world intent on getting rich, doing everything they can to realize their dreams? In the traditional economic theory, it is not possible.[52] To make sense of how profitable opportunities can be left unexploited by some, but exploited by others, an examination of certain aspects of human decision making under uncertainty is necessary.[53]

Human beings have to make decisions in the face of uncertainty, meaning that human action is a very much mediated response to stimuli. This fact reflects the human constitution: Like all animate beings we are driven by the will to live. Through evolution, human beings have acquired a highly developed capacity to make tools, especially mental tools, (e.g., perception, categories, theories, rules, etc.). In the course of living, each of us develops an elaborate and intricate set of mental tools serviceable in our familiar surroundings.

When we are faced with an unfamiliar situation, we have to decide what the situation we are faced with is and how to best bring about results that we can live with. The processes by which we resolve uncertainty, by which we decide what to do, are open to speculation. But this much can be said: (1) The processes must involve the existing set of mental tools; (2) In the processes of resolving uncertainty, the existing mental tool set is modified to handle the novelty--either by fashioning new tools, or by learning to use existing tools in a new way; and (3) the process of modification is conjectural and experimental, and not at all guaranteed to succeed. The process of decision making in the face of uncertainty--in many ways similar to the way scientists study his subject and hypothesize or the way jurists examine cases and render verdicts--enable us to learn about the situation we are faced with and learn to live with it.[54]

If our action is less successful, we will place little confidence in the appropriateness of our approaches or methods, (and the implicit understanding of the situation), and would be more willing to look for some other approaches, through mental experimentation or through the imitation of the successful. If our actions are successful, however, our confidence in the appropriateness (if not the verity) of our approaches in the kind of situation will increase. If our actions are met with repeated successes, we are increasingly likely to take our customary approaches as the only possible ones, becoming less inclined to entertain the possibility of doing better by adopting an alternative way of looking at the situation.

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[50] Audretsch and Acs (1994, 174).

[51] Rosenberg (1995, 20).

[52] Arrow (1974, 7-8).

[53] What follows is different in focus from the growing literature on economic psychology, following the lead of Daniel Kahneman.

[54] For a more detailed account of what follows, see Choi (1993b). The view espoused here is largely consistent with the central themes of Hayek (1952). Others have expressed somewhat similar views, e.g., Loasby (1991 and 1999). See also Denzau and North (1993).

In other words, if we have met success in the past with certain ways of doing business and become rich, we are less likely to deviate from them (unless it is something almost guaranteed.) Conversely, we are more likely to explore different possibilities, if we have not had much success with our approach, (unless of course we have not already lost ambition and come to learn to live in a meager station.)

To avoid a misunderstanding, let me add a few words about the greater willingness of the successful to adhere to the accustomed and proven ways of doing business. It is not so much that the successful will do exactly what they did in the past, but that the successful tend to adhere to the general perspective and approache that brought them success in the past. My argument is not so much the successful becoming lazy, as their getting confident about proven ways of doing business and therefore becoming less inclined to explore alternatives representing a radical departure from the customary. [55]

The complicating factor for the successful is that there is always room for improvement, however marginal, within the adopted approach. The impulse of those who have grown comfortable and proficient with certain approaches is to make improvements within the chosen framework, rather than trying some radically different approach which may not be fully developed, or with which one is not proficient, (so that the prospect of improvement over the old ways is not at all clear.)[56]

The tendency of human beings, especially the successful, to adhere to their proven ways of doing business creates the possibility of neglecting profitable opportunities that could be had, only if one were willing to consider them. The less successful, (provided that they have not yet given up the thought of doing better and adjusted to be content in their meager stations[57] or given to criminal paths), are more likely to explore and experiment with different approaches and may discover that some profitable opportunities are there to be grasped, as it were. That is why among the ranks of entrepreneurs, we find a disproportionate representation of people who cannot be said to be privileged—immigrants, minorities, school drop-outs, the young, and so on.

Based on these considerations, I argue that the rich do not have an advantage in entrepreneurship. In fact, I am even inclined to argue the opposite—*as far as entrepreneurship is concerned, the rich may be disadvantaged*. This, I believe, is the most important of the countervailing forces that limit the cumulative advantages of the rich.

VI. Concluding Remarks

I have argued in this paper that the idea of RGR as a characterization of the process of wealth generation is valid locally and in the short run, but in a wider context, and over time, it is limited, (and even negated), by countervailing forces, the most important of which is entrepreneurship. To the extent that entrepreneurship consists of the discovery of opportunities, not of the ownership of currently valued resources, the rich has no advantage over the poor in this regard. I further argued that, given the way the human

[55] Klein (1998, 67) observes: "The biggest danger of using mental simulation is that we can imagine any contradictory evidence away." See Perrow (1984) and Hirt and Sherman (1985) for documented evidences in real life and in lab experimentation. See Schoenberger (1997) for discussion of the tendency of industrial firms to adhere to the established ways.

[56] Herbert Simon's distinction between "hill-jumping" vs. "hill-climbing" is useful here.

[57] A state of such acquiescence and resignation is called accidia.

mind works the rich (or the successful) are less likely than the poor to venture off the proven and beaten track, the pursuit of which comprises entrepreneurship.

The popular perception of RGR, fanned by politically-motivated intellectuals whenever there is an increase in inequality in income statistics, leads to the belief that the masses are doomed to fail and a system so unfair must be somehow be brought down, and/or amended substantially. The idea of RGR drives the politics of equalization. Implications are enormous; the politics of equalization will entail severe restrictions on what individuals can or cannot do, beyond the general rules of conduct, as economic processes must be fitted to conform to some acceptable (but never defined) level of equality. Consequently, if redistributive measures are at all successful, it will mean: (1) a stagnant economy through the restriction of entrepreneurship, and (2) a society with more rigid class distinctions through a diminution of mobility. The end-result will be a poorer society where the rich and the poor stay as they are. It would be most tragic that the pessimism about one's life prospect and the ill-feeling toward the market system, (based largely on the perception of RGR, a mistaken view of the way the market economy works), becomes self-fulfilling.

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Comments on "Entrepreneurship and Mobility"

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This paper deals with an interesting topic, but it does not have any new contribution on the subject.

1. This paper does not provide any new empirical findings. The evidence the author discusses is all from other studies, or just anecdotal.

2. Even as a survey paper, it is incomplete. He does not discuss many important recent findings on inequality and social mobility of the United States, which are all against his conclusion on patterns of inequality, or intragenerational wealth transfer and so on.

3. He suggests that entrepreneurship ameliorates inequality. It contradicts recent U.S. economy. The major source of increase of inequality is executive compensation and capital gains given to CEOs.

4. The logic emphasizing the nature of entrepreneurship is hardly novel.

In conclusion, this paper is **not up to** the standard of this journal.

CHAPTER 4-1

Structure of Corporate Borrowing and Economic Crisis in Korea: A Micro-evidence

by

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I. Introduction

Using the firm-level data set[1], this paper attempts to examine the dynamic patterns in the allocation of credit across firms in Korea. Supposedly, in Korea, the economic crisis in 1997 had a significant impact on the pattern in the allocation of credit across firms, in particular, across large and small firms.

Corporate financing issues are intimately related to the cause of the Korean crisis. For instance, the chaebols' indebtedness to banks is viewed as having contributed much to the crisis.[2] Among others, Krueger and Yoo (2001) demonstrate that the chaebols' indebtedness is indeed the chief culprit of the crisis. In this regard, since the outbreak of the financial crisis in 1997, the government has undertaken various reform measures to restructure the financial and corporate sectors[3]. The new regulatory system is now underway to induce the financial institutions to change their imprudent lending practices, and the capital market began to force the chaebols to correct their incentive structure. Supposedly, these post-crisis developments in Korea have caused the chaebols and financial institutions to change their previously imprudent (borrowing and lending) practices.

The paper suggests that large firms, to some extent, are leaving banks and going to the capital market for their financing after the crisis.[4] The paper also suggests that small firms are gaining better access to credit by financial institutions after the crisis. There has been a shift in the allocation of bank credit from large firms to small firms. The paper suggests

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[1] The data set covers most of the Korean firms except for extra-small ones.

[2] The failure of chaebols' corporate governance exacerbated the situation. For the failure of chaebols' corporate governance before the crisis, see Joh (2003).

[3] Bankruptcy policy reform was one of the essential elements in these structural reforms. Lim (2002) studies empirically the post-crisis bankruptcy policy reform in Korea.

[4] Shortly after the crisis, the corporate bond market took off with the weak regulatory infrastructure. This immature expansion led to liquidity crises in 1999 and 2001. See Lim (2002) as well as Oh and Rhee (2002).

that the improved lending practices of financial institutions, at least partially, contributed to this shift of corporate loans from large firms to small firms.[5] The paper also suggests the improved practices of the corporate bond market after the economic crisis. For this purpose, the paper attempted to empirically investigate the determinants of corporate loans and bonds.

The firms' affiliation with chaebols was an important (positive) determinant of corporate loans before the crisis whereas it turned out to be the opposite after the crisis. Furthermore, before the economic crisis, given the firms are affiliated with chaebols, the less profitable firms borrowed more from financial institutions. But, after the economic crisis, given the firms are affiliated with chaebols, the more profitable firms borrowed more from financial institutions. The paper also suggests that profitability became an important determinant of corporate loans for large and small firms after the economic crisis (whether they are affiliated with chaebols or not).

Comparing the periods before and after the economic crisis suggests that some important changes occurred to the corporate bond market. Before the crisis, the less profitable and larger firms borrowed more from the corporate bond market. On the other hand, after the crisis, the more profitable firms borrowed more from the corporate bond market and the firm size turned out to be an insignificant factor.

This paper is organized as follows. In Section 2, we provide the aggregate data on the corporate financing sources in recent Korea. Section 3 explains the firm-level data set. In Section 4, we examine the dynamic patterns in the allocation of credit across firms. Section 5 concludes the paper with agenda for future research.

II. Aggregate Patterns in the Corporate Financing Sources

In <table 1> we show the aggregate data for the sources of corporate financing before and after the economic crisis. We calculated the numbers in <Table 1> from the information given in the various publications by the Bank of Korea.[6]

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[5] Borensztein and Lee (2002) examine the micro data on Korean listed firms in 1996-1998. They suggest that chaebol-affiliated firms lost the preferential access to credit and that credit was reallocated in favor of more efficient firms.

[6] Economic Statistics Yearbook, Flow of Funds, Monthly Bulletin, and www.bok.or.kr

Table 1. Sources of Corporate Financing (Flows) for all the Firms in the Korean Economy 1992 - 2000

(Unit; %)

	1992	1993	1994	1995	1996	1997	1998	1999	2000
Total Finance	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	_
Retained Earnings	28.7	30.0	27.3	27.9	22.6	27.1	50.0	49.4	_
External Finance	71.3	70.0	72.7	72.1	77.4	72.9	50.0	50.6	_
External Finance	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Indirect Finance	36.3	31.4	44.5	31.8	28.0	36.8	-57.3	4.1	17.1
Commercial Banks	15.1	13.1	20.7	14.9	14.0	12.9	2.5	29.2	35.2
Insurance Companies	3.9	3.1	2.4	2.7	2.8	2.3	-20.8	0.5	3.1
Short-term Finance Companies (e.g., Merchant Banks)	-0.4	2.4	4.3	0.5	-0.4	1.8	-22.4	-2.6	-6.8
Other Non-bank Financial Intermediaries	17.7	12.8	17.1	13.7	11.5	19.8	-16.7	-22.9	-14.4
Direct Finance	38.9	49.1	36.5	48.1	47.2	37.4	178.9	46.8	28.6
Government Bonds	3.3	3.4	0.4	-0.9	0.3	0.5	2.0	0.0	-2.2
Commercial Paper	7.6	13.9	4.9	16.1	17.5	3.7	-42.2	-30.4	-1.7
Corporate Bonds	12.1	14.5	14.2	15.3	17.9	23.3	165.9	-5.3	-3.2
Equity	15.9	17.3	17.0	17.6	11.6	9.9	53.2	82.6	35.6
Foreign Borrowing	7.1	1.5	6.6	8.4	10.4	5.6	-35.5	24.1	23.7
Borrowing from Government	1.0	-0.2	0.2	0.2	-0.2	1.4	5.8	3.6	7.4
Inter-firm Credit	8.9	9.0	6.9	5.0	6.8	10.6	-27.2	10.2	6.8
Etc.	7.9	9.2	5.3	6.5	7.8	8.4	35.3	11.1	16.5

Source: Author's own calculation from the information in each issue of the Flow of Funds.

The main reason we present this table is that it decomposes indirect finance further into the detailed sources (commercial banks, insurance companies (including pension funds), short-term finance companies (e.g., merchant banks), and other non-bank financial intermediaries). Another point in the table is that it has been constructed by aggregating all the financial transactions for all the firms in the Korean economy. Hence, we could use this table to check the consistency in the firm-level data, for example, whether there is any systematic bias in the firm-level data due to the exclusion of extra-small firms.

After the crisis, in 1998-9, the share of external finance in the total finance sharply declines to 50% from about 70%, throughout the 90's until 1997[7].

In 1998, as expected, the crisis completely changes the table for corporate financing sources. However, in 2000 when the crisis phases out, the table for corporate financing sources takes a somewhat different composition compared to before the crisis.

First of all, the share of indirect finance does not recover the level before the crisis. A look into the components of indirect finance is necessary. The non-bank financial intermediaries, except for insurance companies, lose their share significantly, compared with before the crisis. On the other hand, the share of commercial banks increases to almost double the average level before the crisis. Second, in 2000, the composition of direct finance changes compared to before the crisis. Equity takes away the share of the borrowing from financial markets (commercial paper, bonds, etc). Lastly, foreign borrowing increases its share significantly.

III. The Firm-level Data

This study uses detailed financial information on the firms that have external audit reports. According to the Act on External Audit of Joint-Stock Corporations, a firm with assets of 7 billion won or more must issue audited financial statements. The data thus include all the firms with assets of 7 billion won or more. The total number of firms in the data is about 11,000.

The Financial Supervisory Commission is responsible for establishing accounting and auditing standards and the Securities and Futures Commission is then responsible for the review of the audited financial statements issued by firms. Finally, the National Information and Credit Evaluation, Inc. (NICE) coded this public information into their database after checking the consistency of the reported financial statements.

From the NICE data, we can estimate only the borrowing from all the financial intermediaries, not the borrowings from the detailed components of indirect finance. However, <Table 1> in Section 2 shows that after the crisis, most of the new lending by financial intermediaries is, in fact, from commercial banks, not from non-bank financial institutions.

<Table 2-1> presents summary statistics (mean, median, minimum, maximum, standard deviation) for the key variables in the empirical analysis. It divides the sample period into the four sub-period around the crisis: 1992-1996 (before the crisis), 1997-1998 (during the crisis), 1999-2001 (after the crisis I), and 2002-2005 (after the crisis II). During the period of 1999-2001, liquidity crises continued to afflict the financial market: the collapse of Daewoo Group in 1999 and the financial distress of Hyundai Group in 2000-2001. Hence we divided the post-crisis period into two sub-periods.

Profitability is measured by the EBIT (Earnings before Interest and Tax Payment) divided by total assets. After the crisis, the share of loans in asset increases compared with the pre-crisis period; on the other hand, the weight of bond financing decreases.

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[7] Although not shown in the Table, the share of external finance in the total finance declined steadily throughout the 1970's and 1980's, and until 1988. During this period, except for the period of oil shocks, overseas export markets, together with emerging domestic markets, helped Korean firms to realize large profits. The ratio of internal finance to total finance was less than 20 percent in 1975, but it continued to grow to a level of more than 40 percent in 1988.

Table 2-1. Summary Statistics of Firm-level Data

(million won)

		1992~1996	1997~1998	1999~2001	2002~2005
	N	28,189	15 ,069	32,349	52,159
ASSET	MEAN	61,832.3	98,940.1	88,817.9	100,983.8
	MEDIAN	8,474.3	11,460.4	11,573.9	17,586.2
	STD	473,180.1	866,687.8	882,797.3	976,202.6
	MIN	2.8360	2.6550	0.0840	0.0415
	MAX	32,026,789.1	49,083,094.2	64,529,738.4	68,898,808.3
FIXED ASSET	MEAN	35,257.7	60,041.5	57,829.7	62,547.2
	MEDIAN	3,937.9	5,144.9	4,844.8	7,208.5
	STD	359,035.2	669,577.0	742,819.1	769,501.2
	MIN	0.0000	0.0000	0.0149	-465.9013
	MAX	30,023,935.3	46,474,112.6	61,721,821.7	65,627,908.0
LIABILITIES	MEAN	45,441.5	75,652.0	59,588.3	59,641.4
	MEDIAN	6,232.6	8,131.7	7,030.7	10,978.5
	STD	307,985.1	621,355.7	563,712.1	490,884.5
	MIN	0.0036	0.0000	-9.0810	-25.9839
	MAX	16,935,173.4	31,223,840.0	33,582,612.1	24,591,864.2
LOAN	MEAN	23,451.4	39,033.8	23,766.1	22,164.3
	MEDIAN	3,216.2	4,588.9	3,338.8	5,794.9
	STD	135,646.2	266,406.6	196,967.6	172,837.2
	MIN	0.0000	-4,531.3135	-340.0000	-99.6915
	MAX	5,490,033.4	8,859,246.3	15,110,408.4	12,116,021.7
BOND	MEAN	32,943.6	97,724.4	121,553.8	97,010.3
	MEDIAN	3,562.6	4,970.0	6,204.5	4,355.0
	STD	167,293.2	559,397.5	634,613.5	540,736.3
	MIN	-93.0659	0.0000	0.0000	-7.3016
	MAX	5,822,790.6	15,640,749.4	17,593,664.3	10,860,654.8
EBIT	MEAN	4,368.6	4,415.4	4,625.5	8,622.3
	MEDIAN	556.8	673.5	884.5	1,021.4
	STD	37,243.6	74,808.7	166,128.4	156,567.1
	MIN	-247,334.6	-5,885,988.2	-17,239,034.1	-4,466,470.9
	MAX	2,882,958.7	2,400,227.7	8,443,815.7	18,657,308.0

The financing pattern varies according to the size of firms. For example, the empirical distribution of the loans' share in total asset has a different shape according to the size of firms. For this reason, we divide all individual firms into ten groups based on the distribution of asset size, and select three representative size cohorts for presenting the empirical results. The results are robust to minor changes in the thresholds. We employ the following three size cohorts: (1) the largest firms (top 10% in asset size)[8], (2) the medium-sized firms (middle 10% in asset size), and (3) the smallest firms (bottom 10% in asset size).

[8] For the case of large firms, we present the results using this particular cohort, but defining the largest firms differently such as the top 1%, or the top 5%, does not change the qualitative results of the paper.

For the three size cohorts, <Table 2-2-1> to <Table 2-2-6> provides summary statistics (mean, median, minimum, maximum, standard deviation) for the key variables in the empirical analysis. It also divides the sample period into the four sub-periods around the crisis.

Table 2-2-1. Summary Statistics for the Three size Cohorts in Firm-level Data: Asset

(million won)

	Large Firms (Top 10% in asset size)				Medium-sized Firms (Middle 10% in asset size)				Small Firms (Bottom 10% in asset size)			
	1992~1996	1997~1998	1999~2001	2002~2005	1992~1996	1997~1998	1999~2001	2002~2005	1992~1996	1997~1998	1999~2001	2002~2005
N	2,817	1,506	3,234	5,214	2,820	1,507	3,234	5,216	2,823	1,507	3,237	5,218
MEAN	506,549.0	839,832.6	742,003.8	798,033.1	10,058.6	13,338.7	13,379.5	20,175.9	1,139.0	1,244.6	1,538.0	4,847.3
MEDIAN	154,008.3	216,359.5	189,134.4	213,897.2	10,159.7	13,242.1	13,340.9	19,953.5	1,117.8	1,219.6	1,490.0	5,042.5
STD	1,421,158.3	2,628,164.0	2,705,726.7	2,998,483.6	2,062.4	1,275.0	1,499.5	3,189.7	618.4	758.8	924.8	2,479.5
MIN	53,389.7	89,887.7	82,017.8	90,827.9	6,386.0	11,089.2	10,382.8	14,576.5	2.8360	2.6550	0.0840	0.0415
MAX	32,026,789.1	49,083,094.2	64,529,738.4	68,898,808.3	14,312.4	16,164.5	16,759.1	27,425.5	2,582.3	2,657.0	3,652.6	8,823.1

Table 2-2-2. Summary Statistics for the Three size Cohorts in Firm-level Data: FIXED ASSET

(million won)

	Large Firms (Top 10% in asset size)				Medium-sized Firms (Middle 10% in asset size)				Small Firms (Bottom 10% in asset size)			
	1992~1996	1997~1998	1999~2001	2002~2005	1992~1996	1997~1998	1999~2001	2002~2005	1992~1996	1997~1998	1999~2001	2002~2005
N	2,817	1,506	3,234	5,212	2,820	1,507	3,234	5,211	2,818	1,501	3,229	5,189
MEAN	297,092.8	524,583.7	507,872.7	528,619.1	5,012.7	6,443.1	6,242.1	8,853.8	472.0	486.4	588.1	2,061.6
MEDIAN	78,565.2	114,766.7	104,039.8	117,635.7	4,750.1	6,300.9	6,110.8	8,517.2	350.3	310.0	397.5	1,517.2
STD	1,101,505.3	2,060,534.0	2,300,441.7	2,382,458.3	2,568.3	3,310.0	3,575.1	5,806.5	416.0	469.6	570.0	1,914.6
MIN	937.2	1,345.0	15.9	0.7	0.0	0.0	0.2	0.2	0.4130	0.0000	0.0149	0.0124
MAX	30,023,935.3	46,474,112.6	61,721,821.7	65,627,908.0	13,882.9	15,512.7	16,392.9	27,398.2	4,804.6	2,556.6	3,384.5	8,789.4

Table 2-2-3. Summary Statistics for the Three size Cohorts in Firm-level Data: LIABILITIES

(million won)

	Large Firms (Top 10% in asset size)				Medium-sized Firms (Middle 10% in asset size)				Small Firms (Bottom 10% in asset size)			
	1992~1996	1997~1998	1999~2001	2002~2005	1992~1996	1997~1998	1999~2001	2002~2005	1992~1996	1997~1998	1999~2001	2002~2005
N	2,817	1,506	3,234	5,214	2,820	1,507	3,234	5,216	2,808	1,486	3,185	5,192
MEAN	369,153.2	642,315.8	498,828.7	447,958.4	7,572.2	9,845.0	8,784.2	13,178.0	831.1	911.2	915.9	3,852.8
MEDIAN	118,273.7	165,475.3	118,619.5	123,829.7	7,263.1	9,757.0	8,589.6	12,846.8	756.1	825.8	783.1	2,981.6
STD	911,710.4	1,870,792.5	1,719,506.1	1,448,569.0	2,833.9	4,431.7	4,863.1	7,242.4	581.8	694.6	776.3	7,989.1
MIN	191.2	1,024.1	122.1	13.3	21.5	0.8	0.5	2.4	0.0036	0.0000	-9.0810	-25.9839
MAX	16,935,173.4	31,223,840.0	33,582,612.1	24,591,864.2	33,705.5	81,445.4	109,964.8	129,198.9	6,274.4	10,135.4	7,469.7	512,622.0

Table 2-2-4. Summary Statistics for the Three size Cohorts in Firm-level Data: LOAN

(million won)

	Large Firms (Top 10% in asset size)				Medium-sized Firms (Middle 10% in asset size)				Small Firms (Bottom 10% in asset size)			
	1992~1996	1997~1998	1999~2001	2002~2005	1992~1996	1997~1998	1999~2001	2002~2005	1992~1996	1997~1998	1999~2001	2002~2005
N	2,745	1,463	2,955	4,346	2,497	1,328	2,815	4,393	1,181	615	1,819	3,791
MEAN	152,616.4	254,940.9	165,858.1	136,596.6	3,200.4	4,425.7	4,213.2	7,228.5	403.6	484.4	533.8	2,348.2
MEDIAN	49,326.3	69,601.7	43,530.0	47,682.2	2,932.2	4,042.1	3,728.2	6,396.0	286.0	349.3	393.3	1,535.2
STD	354,273.1	702,208.2	561,235.3	479,591.8	2,125.0	3,801.0	3,874.1	5,937.0	402.0	538.0	508.8	2,750.0
MIN	7.4	114.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0043	0.1446	-340.0000	0.0470
MAX	5,490,033.4	8,859,246.3	15,110,408.4	12,116,021.7	24,135.6	74,452.9	106,349.4	126,063.5	5,501.6	8,560.9	5,495.4	35,294.6

Table 2-2-5. Summary Statistics for the Three size Cohorts in Firm-level Data: BOND

(million won)

	Large Firms (Top 10% in asset size)				Medium-sized Firms (Middle 10% in asset size)				Small Firms (Bottom 10% in asset size)			
	1992~1996	1997~1998	1999~2001	2002~2005	1992~1996	1997~1998	1999~2001	2002~2005	1992~1996	1997~1998	1999~2001	2002~2005
N	2,028	1,070	1,573	1,856	476	205	153	403	22	10	75	339
MEAN	91,669.7	245,841.3	264,694.0	278,372.1	981.0	1,545.2	1,853.7	3,114.8	253.5	293.3	563.1	1,586.5
MEDIAN	23,697.9	39,311.0	38,589.9	39,242.5	782.5	939.0	990.7	2,285.7	82.5	154.1	512.3	1,114.5
STD	278,681.0	879,497.2	925,603.4	882,445.0	775.7	1,652.8	2,029.8	2,758.5	411.1	369.6	417.3	2,923.3
MIN	42.7	73.7	0.0	-7.3	0.0	0.0	0.0	0.8	18.2850	0.8376	0.0000	7.0524
MAX	5,822,790.6	15,640,749.4	17,593,664.3	10,860,654.8	4,397.5	9,141.5	10,544.7	24,144.5	1,708.0	1,192.8	1,966.5	49,071.9

Table 2-2-6. Summary Statistics for the Three size Cohorts in Firm-level Data: EBIT

(million won)

	Large Firms (Top 10% in asset size)				Medium-sized Firms (Middle 10% in asset size)				Small Firms (Bottom 10% in asset size)			
	1992~1996	1997~1998	1999~2001	2002~2005	1992~1996	1997~1998	1999~2001	2002~2005	1992~1996	1997~1998	1999~2001	2002~2005
N	2,817	1,505	3,193	5,209	2,819	1,504	3,112	5,203	2,601	1,270	2,287	4,828
MEAN	34,395.4	33,960.8	29,822.7	71,755.7	772.1	961.8	1,046.9	1,243.0	80.5	71.5	8.2	-207.3
MEDIAN	10,931.0	11,091.4	11,725.2	15,048.3	710.6	926.8	940.8	1,164.1	66.0	58.7	30.9	125.7
STD	111,413.2	228,388.7	488,327.8	485,980.2	913.2	1,502.1	1,726.8	3,229.6	148.9	283.3	413.8	3,148.0
MIN	-247,334.6	-5,885,988.2	-17,239,034.1	-4,466,470.9	-9,209.1	-11,066.6	-20,796.2	-43,435.9	-1,519.0	-5,473.8	-6,244.9	-61,929.9
MAX	2,882,958.7	2,400,227.7	8,443,815.7	18,657,308.0	12,149.4	14,766.3	21,296.8	71,472.5	1,587.3	1,779.4	3,152.9	122,033.7

The statistics in <Table 2-2> present a different picture compared to the one in <Table 2-1>. The aggregate numbers in <Table 2-1> do not fully capture the changes in the financing pattern experienced by heterogeneous firms during this period. Profitability evolves differently according to size groups. During the period of 1992-2001, profitability worsens for large and small firms whereas it rebounds for medium-sized firms. On the other hand, during the period of 2002-2005, profitability worsens only for small firms whereas it rebounds for large firms. While the share of loans in asset decreases for large firms, the opposite is the case for the other groups.

IV. Corporate Borrowing Pattern and the Crisis: Micro Evidence

In Section 3.1, the summary statistics of key variables hint that the heterogeneity of firms is important in understanding the evolution of corporate borrowing patterns after the crisis. The sample means of key variables also hint the following pattern around the crisis: the largest firms are leaving financial institutions and switching directly to the financial markets for their financing, whereas the small- and medium-sized firms are increasing their dependency on financial institutions for financing. The empirical distributions of key variables show this point clearly. The empirical distributions have different shapes according to the size of firms and evolve differently after the crisis. In this section, we present the result from comparing the empirical distributions of key variables.

4.1. Empirical Distribution of Corporate Loans for Different Cohorts

<Figure 1-1-1> and <Figure 1-1-2> show the distribution of the loan-borrowing ratio for the largest cohort (top 1% firms in asset size) before and after the crisis. After the crisis (in 1998-2000), the loan-borrowing ratio distribution for the largest firms shifts leftwards clearly, as seen in <Figure 1-1-2>. This leftward shift starts partly in 1997 during the crisis.

Figure 1-1-1. Largest Firms - Top 1 %; Before the Crisis

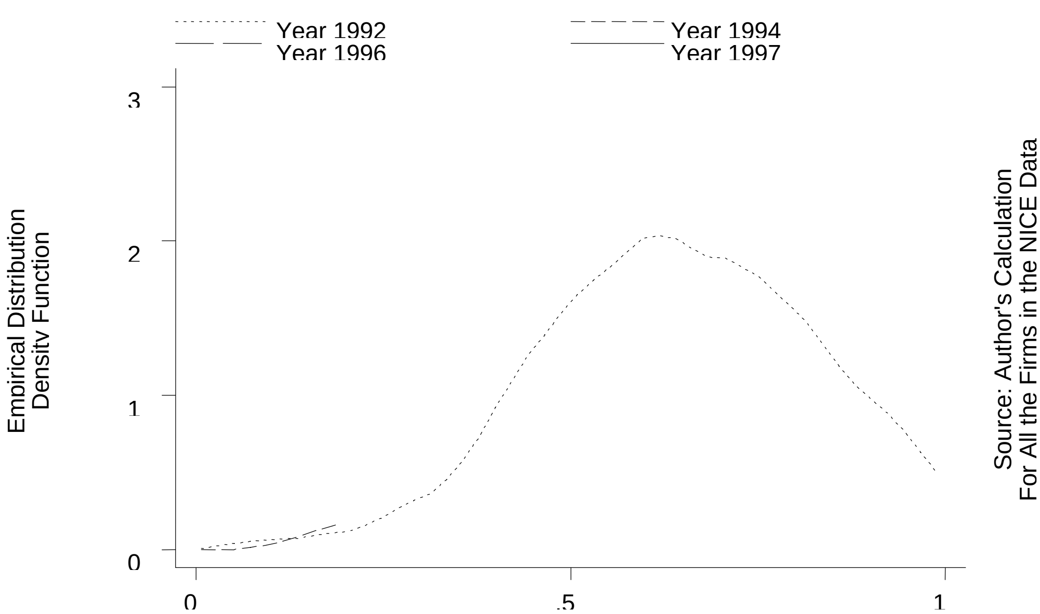
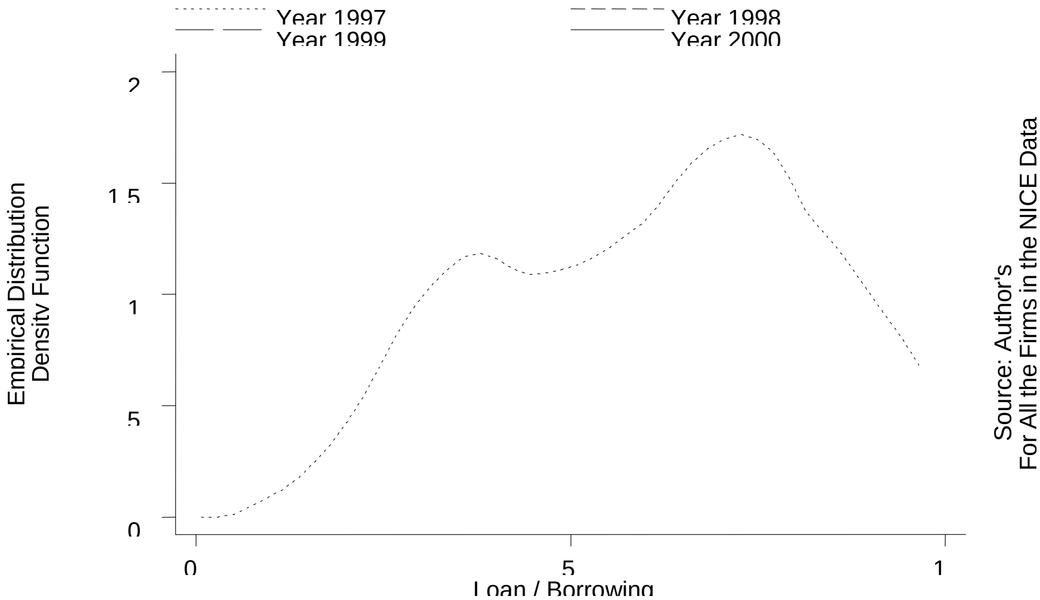


Figure 1-1-2. Largest Firms - Top 1 %; After the Crisis



For the small-sized firms (bottom 10% firms in asset size) the distribution of the loan-borrowing ratio shifts to the right markedly in 1996 (actually in 1995, although not shown in the paper) and maintains more or less this pattern even after the crisis (<Figure 1-2-1> and <Figure 1-2-2>).

Figure 1-2-1. Small-sized Firms - Bottom 10%; Before the Crisis

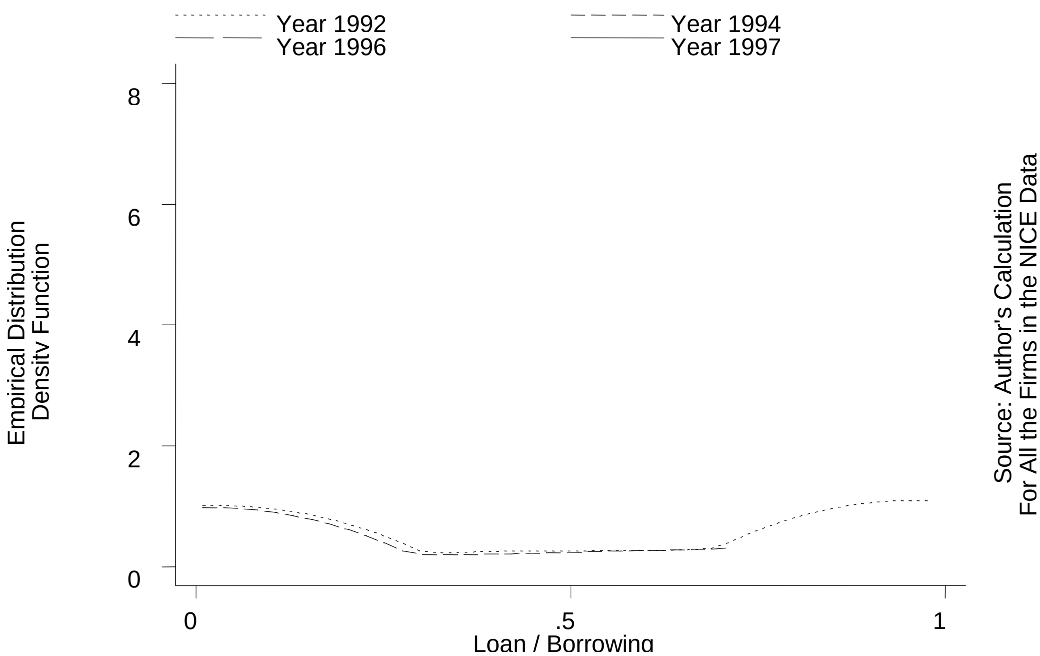
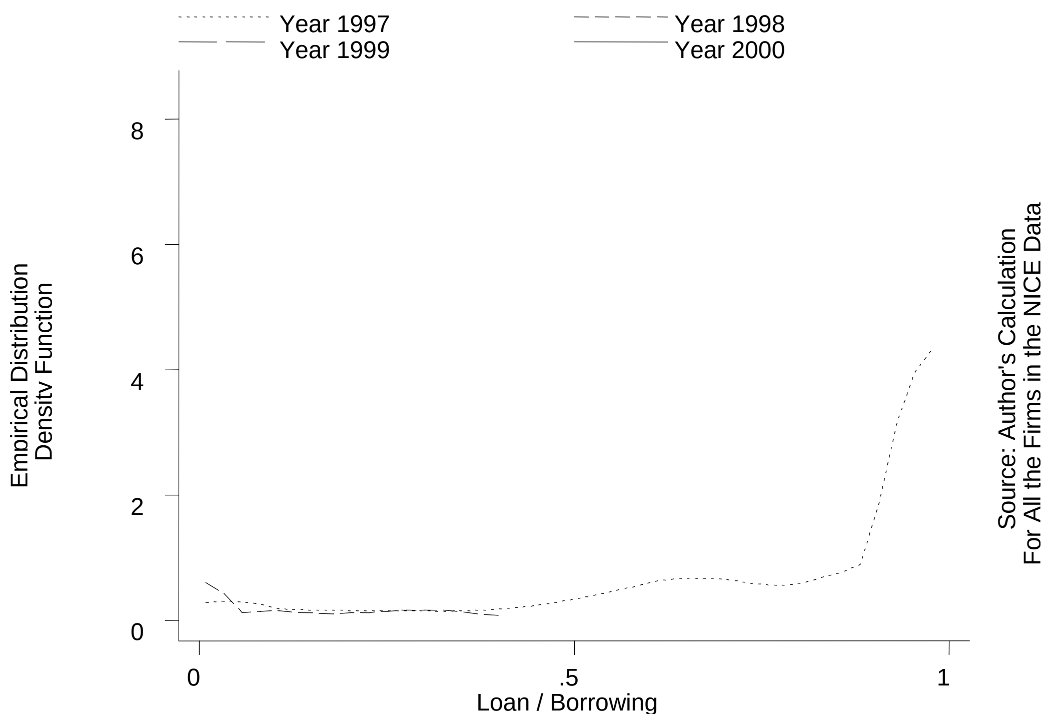


Figure 1-2-2. Small-sized Firms - Bottom 10%; After the Crisis



In <Figure 1-2-1>, we note that, until 1994, a certain portion of the firms in our database does not have access to financial intermediaries for their corporate financing. One could see a certain dense around zero. However, after 1994, this pattern changes: the dense around zero continue to disappear until 1997, and, after the crisis, a dense around zero appears again, but to a much smaller scale than before 1995. <Figure 1-2-1> and <Figure 1-2-2> make another interesting point. After 1994, we continue to see a peak at one and a certain mass around one, which indicates that these firms depend (or do not depend) completely on the loans from financial intermediaries for their borrowing.

For the medium-sized firms, the share of loans in total borrowing does not show any marked changes before and after the crisis, except that, after the crisis, we could see a more cluster around one (<Figure 1-3-1> and <Figure 1-3-2>).

Figure 1-3-1. Medium-sized Firms - Middle 10%; Before the Crisis

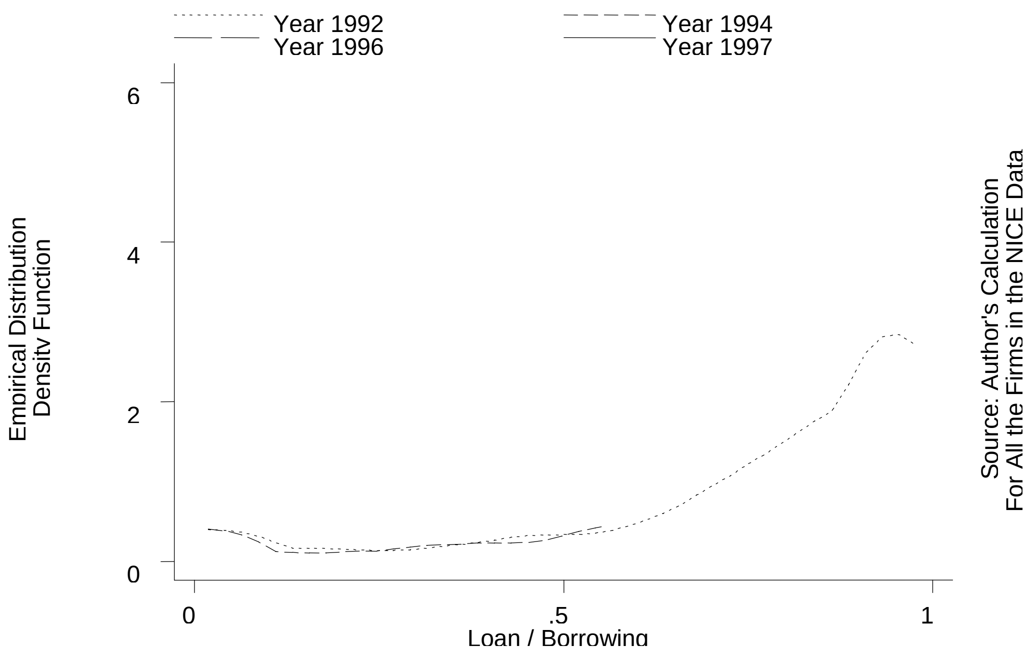
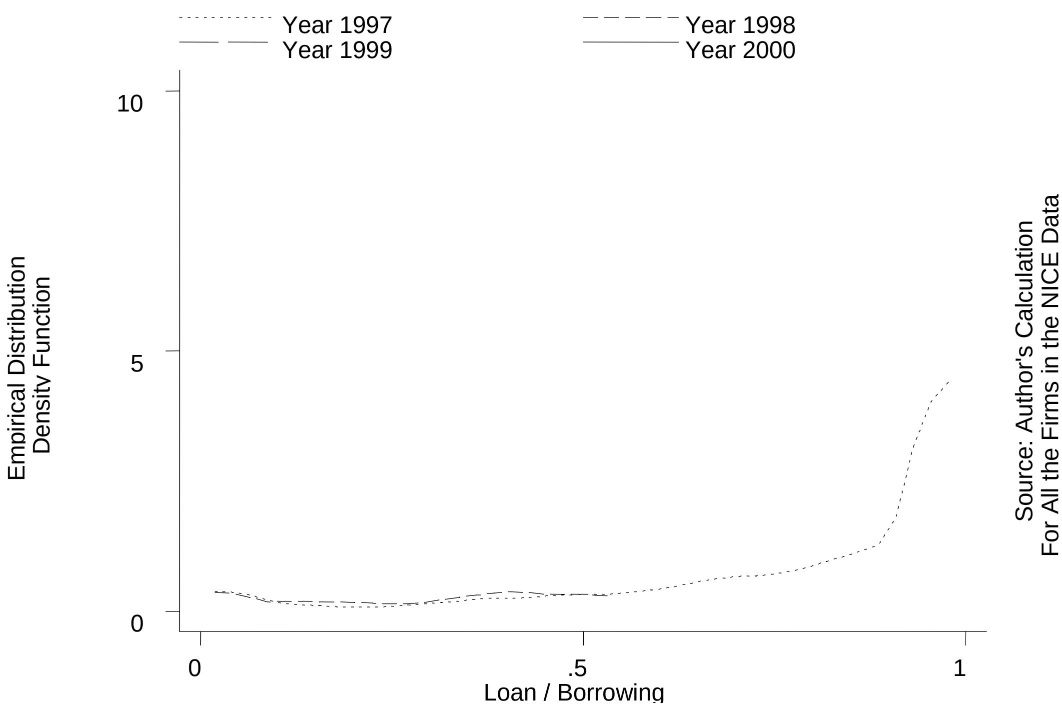


Figure 1-3-2. Medium-sized Firms - Middle 10%; After the Crisis



4.2. Empirical Distribution of Corporate Bond Financing for Different Cohorts

The result in the above implies that the large firms moves to some other sources of financing after the crisis. This section will show that the large firms go to the bond market to compensate the decrease in loans by financial institutions. This was hinted in Section 2.1.

<Figure 2-1-1> and <Figure 2-1-2> show the bond-borrowing ratio distributions before and after the crisis for the largest cohort. After the crisis (in 1998-2000), the bond-borrowing ratio distribution for the largest firms shifts clearly to the right (<Figure 2-1-2>).

Figure 2-1-1. Large-sized Firms - Top 1 %; Before the Crisis

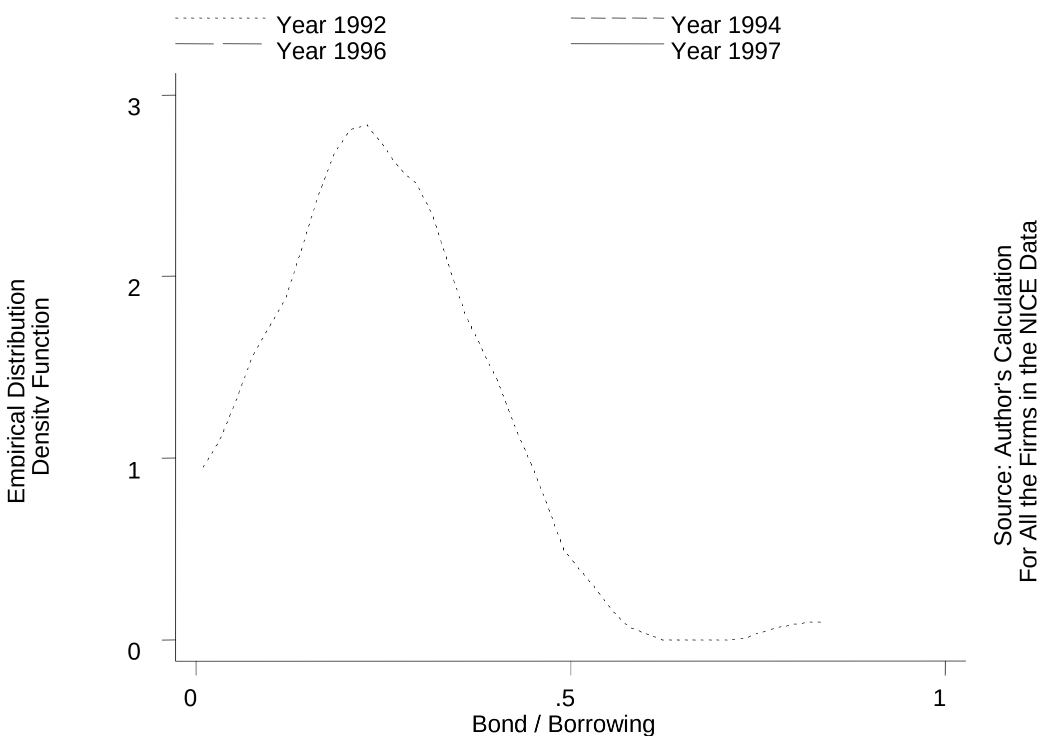
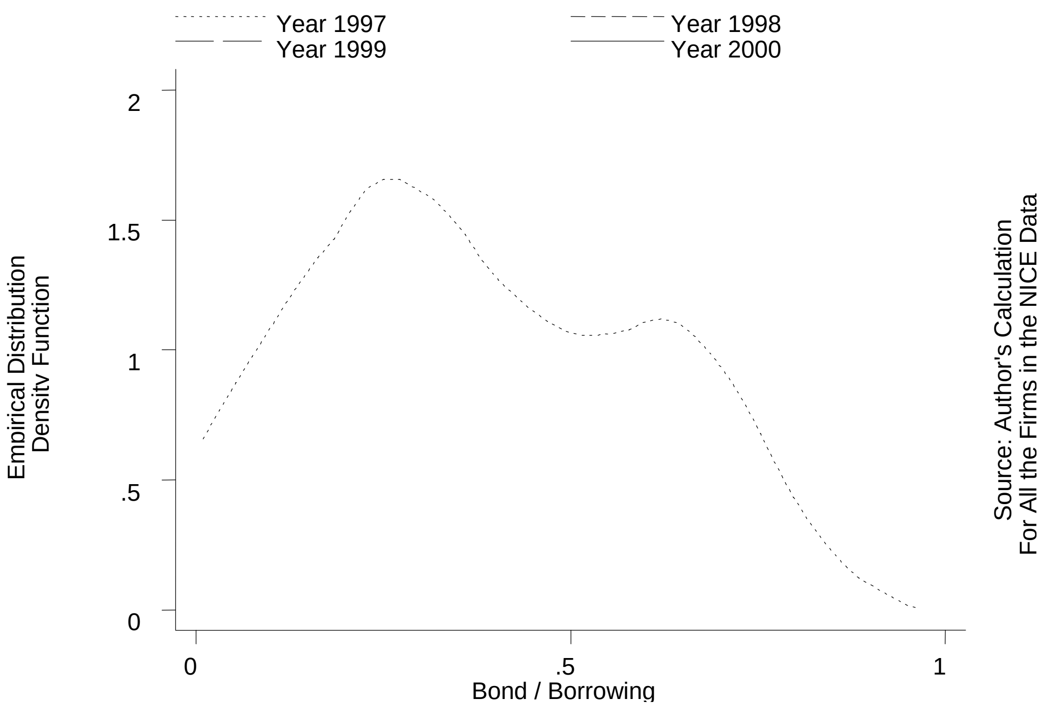


Figure 2-1-2. Large-sized Firms - Top 1 %; After the Crisis



In <Figure 2-2-1> and <Figure 2-2-2>, we show the similar figures for another size cohort (top 11% - top 20% firms in asset size). This cohort is, in fact, the smallest firms to have any access to the bond market at all in the sample period. For this cohort, the loan-borrowing ratio distribution shifts to the right marginally before the crisis. After the crisis, however, the distribution shifts back to the left. There is a large peak around zero in 1999 and the distribution becomes degenerate in 2000 (i.e., this cohort does not have any access to bond market). A large proportion of the bonds that has been issued during the crisis, were under the risk of default, especially after the demise of the Daewoo group (one of the top four chaebols at that time in Korea) in 1999. This, in turn, put the whole market for corporate bonds into a state of malfunction in 1999 and in 2000.

Figure 2-2-1. Top 11% - Top 20% in Asset Size; Before the Crisis

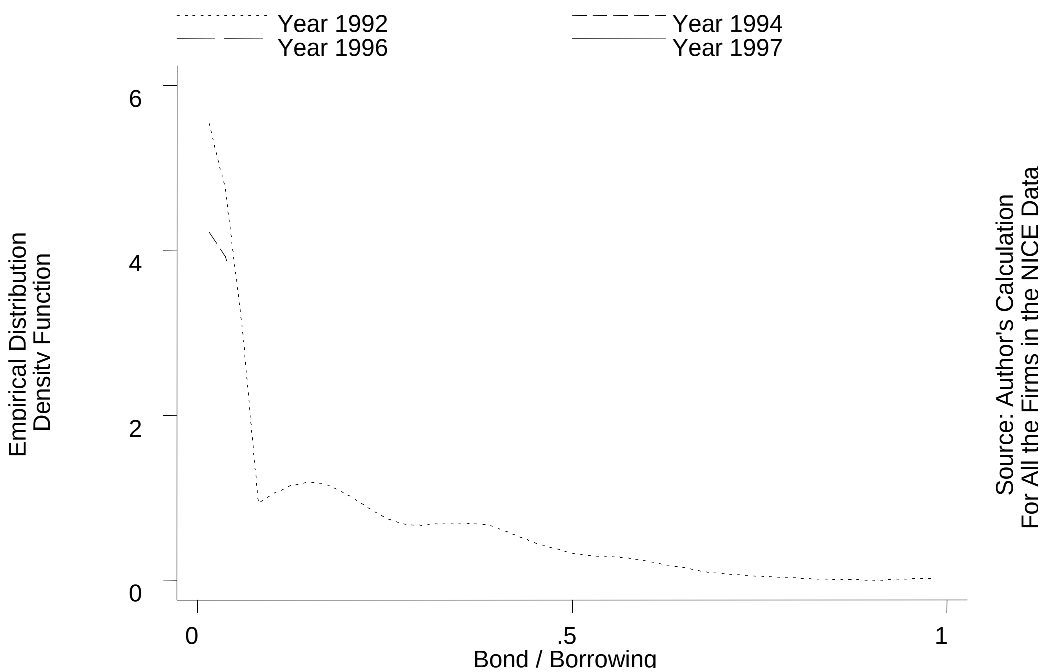
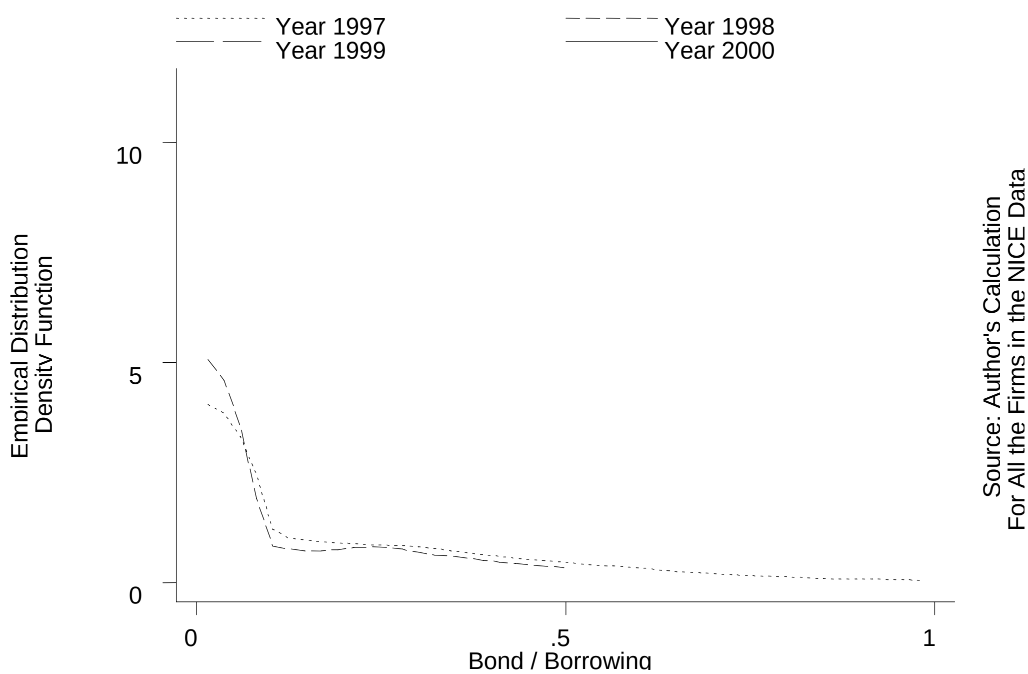


Figure 2-2-2. Top 11% - Top 20% in Asset Size; After the Crisis



4.3. Determinants of Loans (Borrowing from Financial Institutions)

In this subsection, we regress the loan-asset ratio (defined as the borrowing from financial institutions divided by total asset) on various independent variables (determinants of loans).

First, as determinants of loans, we include firm size, profitability, collateral ability, and industry dummy. Both theoretical and empirical literatures suggest that firm size, profitability, and collateral ability could be important determinants of corporate borrowing. The log of total asset is used to measure firm size, whereas we use the ratio of fixed asset to total asset as a proxy variable for collateral ability. As mentioned in section 3.1, profitability is measured by the ratio of EBIT (Earnings before Interest and Tax Payment) to total asset.

Next, we include several dummy variables to control for the effect of going public, chaebol effect, economic crisis effect, business cycle effect. List dummy measures the effect of public companies as opposed to private companies. Chaebol dummy identifies the sample firm's belonging to chaebols. The Korean Fair Trade Commission (KFTC) identifies the 30 largest business groups and announces them every year. We use the definition of chaebols by the KFTC. The dummy for economic crisis assigns 1 to the period of 1997-98, 0 otherwise. Year dummy variable is introduced to control for the effect of business cycle. Lastly, we include an interaction dummy variable, chaebol dummy multiplied by (EBIT/Asset).

<Table 3-1>, <Table 3-2>, and <Table 3-3> summarize the regression results. <Table 3-1> reports the regression results for the all samples, listed companies, and unlisted companies. The hypothesis here is that public companies might behave differently as compared to private companies since they have other sources of corporate financing. However, <Table 3-1> shows that the coefficient on list dummy variable is not significant. We divided the whole sample into the two groups, listed companies and unlisted companies, and ran the same regression separately to the two groups. The result is that the two groups produced similar outcomes. Therefore, for the whole period (1992-2005), whether the companies go public is not an important factor in determining the level of borrowing from financial institutions.

Table 3-1. Determinants of Loan

Independent Variables :	Dependent variable Borrowing from Financial Institutions / Total Asset		
	All	Listed Firm	Unlisted Firm
Firm Size	-0.070904** (-13.31)	-0.058664** (-13.86)	-0.077335** (-9.95)
EBIT/Asset	-0.340324** (19.61)	-0.360055** (-22.95)	-0.339084** (-18.07)
Fixed Asset/ Total Asset	0.220428** (7.70)	0.265228** (7.77)	0.189588** (5.41)
List Dummy	-0.013450 (-0.84)		
Chaebol	0.070936** (2.03)	0.066479* (2.65)	0.035013 (0.63)
Chaebol* (EBIT/Asset)	0.075681 (0.40)	0.028343 (0.15)	0.220850 (0.91)
Dummy for crisis period (97~98)	0.083579** (2.10)	0.060561 * (1.74)	0.095781 * (1.82)
Year Dummy	Included	Included	Included
Industry Dummy	Included	Included	Included
Number of observations	97,182	23,452	73730

Note: 1. Number in the parenthesis are t-values.
2. * significant at the 10% significance level.
** significant at the 5% significance level.
3. Firm size is measured by the log of total asset.
4. The independent variable "Chaebol" denotes for the dummy for the big business groups legally defined by the Korea Fair Trade Commission.

<Table 3-2> shows firms behave differently before and after the economic crisis. In particular, the firms affiliated with chaebols behave differently as compared to independent firms before and after the economic crisis. Before the economic crisis, the firms affiliated with chaebols borrowed more from financial institutions. Furthermore, given the firms are affiliated with chaebols, the less profitable firms borrowed more from financial institutions. However, before the economic crisis, the opposite story shows up. The firms affiliated with chaebols borrowed less from financial institutions. Given the firms are affiliated with chaebols, the more profitable firms borrowed more from financial institutions. Since we controlled for various determinants of loans, this result could be

partially contributed to the improved lending practices of financial institutions towards big business groups after the economic crisis.

Table 3-2. Determinants of Loan for Sub-period (I)

Independent Variables :	Dependent variable Borrowing from Financial Institutions / Total Asset			
	1992~1996	1997~1998	1999~2001	2002~2005
Firm Size	-0.024909** (-7.07)	-0.009393** (-5.27)	-0.013851** (-8.95)	-0.073681** (-9.07)
EBIT/Asset	-.557000** (-11.91)	-0.343324** (-31.61)	-0.346188** (-34.09)	-0.090300** (-21.85)
Fixed Asset/ Total Asset	0.663912** (28.8)	0.233233** (19.95)	0.166466** (17.63)	0.222643** (6.15)
List Dummy	-0.042030** (-4.06)	-0.029011** (-5.22)	-0.048730** (-10.26)	-0.071567** (-2.96)
Chaebol	0.439842** (17.86)	0.003665 (0.34)	-0.093974** (-8.63)	-0.034701 (-0.61)
Chaebol* (EBIT/Asset)	-5.195336** (-22.05)	-0.126695* (-2.13)	0.877086** (19.31)	0.390003 (1.36)
Year Dummy	Included	Included	Included	Included
Industry Dummy	Included	Included	Included	Included
Number of observations	21,581	11,258	22,257	42,086

Note: 1. Number in the parenthesis are t-values.
2. * significant at the 10% significance level.
** significant at the 5% significance level.
3. Firm size is measured by the log of total asset.
4. The independent variable "Chaebol" denotes for the dummy for the big business groups legally defined by the Korea Fair Trade Commission.

<Table 3-3> shows large and small firms behave differently before and after the economic crisis. As for the large firms (top 10% in terms of total asset), the coefficient on profitability is significantly negative (-0.51) before the economic crisis (1992-96) whereas it is significantly positive (1.76) after the economic crisis. As for the small firms (bottom 10% in terms of total asset), the coefficient on profitability is significantly negative (-0.99) before the economic crisis (1992-96) whereas it is significantly negative but much larger (-0.09) after the economic crisis (2002-5). These results on size cohorts suggest, at least partially, an interpretation similar to <Table 3-2>, the improved lending practices of financial institutions after the economic crisis (towards both large and small firms).

Table 3-3. Determinants of Loan for Sub-period (II)

Independent Variables :	Dependent variable Borrowing from Financial Institutions / Total Asset			
	1992~1996		2002~2005	
	Large Firm	Small Firm	Large Firm	Small Firm
Firm Size	-0.007279* (-1.80)	-0.244772** (-6.52)	-0.047445* (-1.65)	-1.117598** (-17.60)
EBIT/Asset	-0.507112** (-7.14)	-0.985999** (13.76)	1.755744** (32.69)	-0.090402** (-14.93)
Fixed Asset/ Total Asset	0.064107** (2.65)	0.935010** (8.38)	0.473412** (3.74)	0.176363 (1.06)
List Dummy	-0.041788** (-5.23)	0.093744 (1.27)	-0.253992** (-4.44)	-0.252565** (-2.21)
Chaebol	0.069846** (5.67)	1.192548* (1.91)	-0.040005 (-0.48)	0.617450 (0.85)
Chaebol* (EBIT/Asset)	-0.454694** (-3.36)	3.655153 (0.54)	-1.464229** (-2.35)	0.531625 (0.94)
Year Dummy	Included	Included	Included	Included
Industry Dummy	Included	Included	Included	Included
Number of observations	2,745	1,168	4,340	3,540

Note: 1. Number in the parenthesis are t-values.
2. * significant at the 10% significance level.
** significant at the 5% significance level.
3. Firm size is measured by the log of total asset.
4. The independent variable "Chaebol" denotes for the dummy for the big business groups legally defined by the Korea Fair Trade Commission.

4.4. Determinants of Corporate Bond Financing

Here we regress the bond-asset ratio (defined as the bond holdings divided by total asset) on various independent variables (determinants of bonds).

As determinants of bonds, we include the same variables as in the case of loans (firm size, profitability, collateral ability, industry dummy, and the dummy variables to control for the effect of going public, chaebol effect, economic crisis effect, business cycle effect).

<Table 4-1>, <Table 4-2>, and <Table 4-3> summarize the regression results. <Table 4-1> reports the regression results for the all samples, listed companies, and unlisted companies. <Table 4-1> shows that the coefficient on list dummy variable is not significant at 5%. This result is similar to the case of loans. We then divided the whole sample into the two groups, listed companies and unlisted companies, and ran the same

regression separately to the two groups. The result is different from the case of loans. The two groups produced somewhat different outcomes. Among the listed firms, the less profitable firms borrowed more from issuing corporate bonds. In particular, the listed firms affiliated with chaebols borrowed more from corporate bonds. Furthermore, given the listed firms are affiliated with chaebols, the less profitable firms borrowed more from bonds. The listed firms depended more on corporate bonds during the economic crisis compared to before and after the crisis. According to <Table 4-1>, among the unlisted firms, the more profitable firms borrowed more from issuing corporate bonds.

Table 4-1. Determinants of Bond

Independent Variables :	Dependent variable Bond / Total Asset		
	All	Listed Firm	Unlisted Firm
Firm Size	-0.003541 (-0.34)	-0.003143** (-2.25)	0.001743 (0.07)
EBIT/Asset	0.646940** (23.88)	-0.058075** (-14.11)	1.194606** (22.42)
Fixed Asset/ Total Asset	0.180087** (2.43)	0.055056** (4.83)	0.339762** (2.29)
List Dummy	-0.051426* (-1.84)		
Chaebol	-0.011817 (-0.26)	0.043055** (7.37)	-0.096635 (-0.85)
Chaebol* (EBIT/Asset)	-0.362989 (-1.60)	-0.161076** (-4.00)	-0.731693* (-1.79)
Dummy for crisis period (97~98)	0.034752 (0.54)	0.028583** (3.15)	0.045141 (0.33)
Year Dummy	Included	Included	Included
Industry Dummy	Included	Included	Included
Number of observations	17,743	9,789	7,954

Note: 1. Number in the parenthesis are t-values.
2. * significant at the 10% significance level.
** significant at the 5% significance level.
3. Firm size is measured by the log of total asset.
4. The independent variable "Chaebol" denotes for the dummy for the big business groups legally defined by the Korea Fair Trade Commission.

In <Table 4-2>, comparing the two sub-periods, 1992-1996 and 2002-2005, suggests that some important changes occurred to the corporate bond market before and after the economic crisis. During the period of 1992-6, the less profitable and larger firms borrowed more from the corporate bond market. On the other hand, during the period of 2002-2005, the more profitable firms borrowed more from the corporate bond market and the firm size turned out to be an insignificant factor. This result could be partially contributed to the improved practices of the corporate bond market after the economic crisis.

Table 4-2. Determinants of Bond for Sub-period (I)

Independent Variables :	Dependent variable Bond / Total Asset			
	1992~1996	1997~1998	1999~2001	2002~2005
Firm Size	0.008725** (8.54)	0.010068** (5.05)	0.017390** (3.69)	-0.022567 (-0.69)
EBIT/Asset	-0.150689** (-9.33)	-0.133324** (-12.33)	-0.372309** (-15.22)	0.744636** (14.61)
Fixed Asset/ Total Asset	-0.006702 (-0.86)	-0.021120 (-1.43)	0.071228* (1.94)	0.326155 (1.49)
List Dummy	0.010239** (3.97)	0.011137** (2.07)	-0.014592 (-1.05)	-0.169590* (-1.92)
Chaebol	0.000036 (0.01)	0.058673** (7.53)	-0.044888* (-2.21)	-0.048352 (-0.29)
Chaebol* (EBIT/Asset)	0.062114 (1.00)	-0.050150 (-1.13)	0.994178** (15.53)	-0.397250 (-0.36)
Year Dummy	Included	Included	Included	Included
Industry Dummy	Included	Included	Included	Included
Number of observations	6,005	2,765	3,382	5,591

Note: 1. Number in the parenthesis are t-values.
2. * significant at the 10% significance level.
** significant at the 5% significance level.
3. Firm size is measured by the log of total asset.
4. The independent variable "Chaebol" denotes for the dummy for the big business groups legally defined by the Korea Fair Trade Commission.

V. Concluding Remarks

The paper documents that large firms, to some extent, are leaving financial institutions and going to the capital market for their financing after the crisis.[9] It also shows that small firms have better access to credit by financial institutions after the crisis. Financial institutions are reallocating their credit from large firms to small firms after the crisis.

We then attempted to empirically investigate the determinants of corporate borrowing before and after the economic crisis. The firms' affiliation with chaebols was an important (positive) determinant of corporate loans before the crisis whereas it turned out to be the opposite after the crisis. Furthermore, before the economic crisis, given the firms are affiliated with chaebols, the less profitable firms borrowed more from financial institutions. But, after the economic crisis, given the firms are affiliated with chaebols, the more profitable firms borrowed more from financial institutions. The paper also suggests that profitability became an important determinant of corporate loans for large and small firms after the economic crisis (whether they are affiliated with chaebols or not). These results could be partially contributed to the improved lending practices of financial institutions towards firms after the economic crisis.

We also investigated the determinants of corporate borrowing from the bond market. Comparing the periods before and after the economic crisis suggests that some important changes occurred to the corporate bond market. Before the crisis, the less profitable and larger firms borrowed more from the corporate bond market. On the other hand, after the crisis, the more profitable firms borrowed more from the corporate bond market and the firm size turned out to be an insignificant factor. This result could be partially contributed to the improved practices of the corporate bond market after the economic crisis.

[9] Clearly, the liberalization of financial markets, which happened at an accelerating rate after the crisis, contributed to broaden the supply base of various corporate financing sources. But, for further deepening of the supply base of various corporate financing sources Korea needs better protection of investors' rights.

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Comments on "Structure of Corporate Borrowing and Economic Crisis in Korea: A Micro-evidence"

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1. Main Findings

Through crisis, Korean firms, especially the large ones, are shifting from indirect financing (loans) to capital market (bonds, equity)

Before 97 crisis, *chaebol* firms, especially less profitable ones, borrowed more from financial institutions, whereas after the crisis *chaebol* effect on corporate loans reversed and, and is ultimately is fading away.

More profitable firms are getting access to corporate loans after the crisis.

2. Big Picture Issues

The paper's main hypothesis seems to be that "*improved*" lending practices of financial institutions and bond market contributed at least *partially* to changes in corporate financing behavior. The author should be more cautious in deriving normative implications.

Is more allocation of debt capital to *non-chaebol* or *small firms* necessarily efficient? The evaluation criterion may be a bit political

Similarly, is more allocation of debt to "more profitable firms" necessarily efficient? More profitable firms may be running out of good investment opportunities in the future. (ex. KT&G) If so, raising more debt may just aggravate "free cash flow" problem.

What is the real exogenous factor, "*improved* lending practices" or "*Regulation 200% on Debt Ratio*"?

Some of the shifts may be an artifact of structural changes in financial industry rather than "*improvement* in lending practices of financial institutions. For example, Merchant Banks have almost disappeared after the crisis

3. Methodology: Perfect Collinearity

In tables 3-1 and 4-1, dummy for crisis period (97-98) is included together with year dummies. But crisis dummy can be created by linear combination of year dummies.

For example, if you run dummy_crisis (97or 98) together with dummy97 and dummy98, then one of the 3 variables will always be dropped. If dumm98 is dropped, then the effect of dummy_crisis is not 97 and 98, but only the effect of 98.(Frisch-Waugh Theorem: Partial Regression Coefficients)

Suggestion: Year dummies should be dropped when crisis dummy is included

4. Exposition

(1) Why loans vs. bonds?

Theoretically, bank lendings are "informed/relationship based", and bonds are at "arm's length". It would be helpful if author provides some *ex ante* expectations regarding the regression coefficients.

(2) Other issues

(a) There seems to be a bit too many tables (ex. 2-2-1 to 2-2-6) and numbers.
(b) *Text* explains profitability ratio, but the descriptive *tables* are in *levels*
(c) Why top 1% (instead of 10%) in section 4.1?

CHAPTER 4-2

Pro-cyclicality of Buffer Capital and its Implications for Basel II: A Cross Country Analysis*

by

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Abstract

This paper investigates the cyclical patterns of buffer capital using an unbalanced panel data for the banks in 30 OECD countries and 7 non-OECD Asian countries. We test whether the relationships between buffer capital and business cycle are systematically different across country groups controlling for other potential determinants of bank capital. We find that the correlation is positive for developed countries while it is negative for Asian developing countries. These findings suggest that, once Basel II is implemented, developing countries are more likely to observe an increase in output volatility. We then review the policy recommendations to mitigate the pro-cyclicality problem of Basel II.

JEL Classification: E32, G21, G28
Keywords: Basel II, Regulatory Capital, Buffer Capital, Business Cycle, Procyclicality

* This paper was presented at the 2006 KDI conference "Adopting the New Basel Accord: Impact and Policy Responses of Asian-Pacific Developing Countries". We thank Ilhyok Shim for valuable comments.

I. Introduction

The new Basel accord (Basel II) is expected to promote stability in banking system by providing guidance on key banking supervisory issues. The new approach to bank capital regulation, at the same time, raises concerns from a macroeconomic standpoint. In particular, it has been repeatedly pointed out that the new regulation framework is likely to amplify business cycle fluctuations. Under the new Basel II framework, the required capital is designed so as to be closely tied to risks that banks face. In recessions, therefore, banks should hold more capital against the existing loan portfolio because higher credit risk downgrades existing borrowers. To the extent that financing external capital is costly, banks are forced to contract lending activity which, in turn, might exacerbate economic downturn. This multiplier effect is a financial regulation based propagation mechanism: an initial shock to the economy is amplified through a contraction in lending induced by bank capital regulations.

This argument focuses on the pro-cyclicality of required capital, but most banks actually hold excess capital well above the required minimum. If excess capital or buffer capital fluctuates in a way that mitigates the multiplier effect, the concerns about pro-cyclicality could be overstated. Previous research such as Ayuso, Perez, and Saurina (2004) contend that potential risks are increasing during boom before they are materialized in recessions. They argue that a positive correlation between buffer capital and business cycle is consistent with forward-looking behavior of banks. Forward-looking banks increase buffer capital during booms as they properly take into account the potential risks that may accrue during booms. A negative correlation, in contrast, suggests that banks underestimate risks over the business cycle.

Motivated by Ayuso, Perez, and Saurina (2004), this paper investigates the cyclical patterns of buffer capital using an unbalanced panel data for the banks in 30 OECD countries and 7 non-OECD Asian countries. In particular, we test whether the relationships between buffer capital and business cycle are systematically different across country groups controlling for other potential determinants of bank capital. We find that, in the periods of high economic growth, the buffer capital ratio rises in developed countries while it declines in developing countries. These findings suggest that, once Basel II is implemented, developing countries are more likely to observe an increase in output volatility. Empirical evidence, therefore, offer a support to the presumption that developing countries need more careful policy responses than developed countries.

Indeed, the concerns about the adverse macroeconomic effects appear to be more serious in developing countries. Since capital market is less developed and thus firms are more bank-dependent in developing countries, it is more difficult for firms to find an alternative source of funds when the supply of bank credit decreases. In developing countries, therefore, the risk-sensitive capital regulation is likely to exacerbate economic recessions more severely. Moreover, banks' lending decisions in developing countries are heavily dependent upon collateral values that borrowers can provide. As far as asset prices move along business cycle, asset prices and collateral values decrease in recessions and thus affect bank lending and business cycle.

This paper is organized as follows. Section II reviews the pro-cyclicality issue of bank lending associated with financial regulation and provides background motivations in the context of Basel II. Section III presents the regression model and reports the empirical results. Section IV discusses the supervisory responses suggested in previous studies. Section 5 concludes.

II. Pro-cyclicality of Bank Lending and Basel II

2.1. Procyclicality of Bank Lending and Financial Regulation

Bank lending is expected to exhibit pro-cyclical behavior as the demand for and the cost of bank loans fluctuate over business cycle. The demand for bank loans should be pro-cyclical as firms' production and investment and households' consumption are inherently procyclical. The costs to raise funds for lending fluctuate counter-cyclically, leading the supply of bank loans procyclical. Moreover, prudential regulation on financial institutions is also pointed out as another factor that reinforces the pro-cyclicality of bank lending. In particular, the regulation of minimum capital requirement has been a long-standing concern for supervisory authorities in that the pressures on bank capital in recession could lead to further cutbacks in bank lending. On the relationship between capital regulation and bank lending, academics and policy circles point out that the impact of capital regulation on the pro-cyclicality of bank lending depends on (i) the appropriateness of the risk assessment by banks over business cycle and (ii) the sensitivity of regulatory measures (e.g. minimum capital requirements) to the estimated risk.

First, if the assessment of risk fails to take into account its dynamic time-varying aspect at each point of time, bank lending would exhibit more pro-cyclical behavior. When a short horizon is used for measuring risk, as in most internal rating models of banks, the estimated risk tends to be negatively correlated with business cycle. Therefore, the estimated risk is higher in recessions, which decreases loan supply. On the contrary, risk assessment with longer-term horizon would contribute to smoothing the estimated risk and the loan supply over business cycle (Borio *et al*., 2001).[1]

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[1] It is known that there are at least two industry standard rating methods used by banks which may lead to a different amount of variability in ratings in a recession. One is the point-in-time (PIT) method and the other is the through-the-cycle (TTC) method (Borio et al., 2001, Catarinew-Rabell et al., 2003, Kashyap and Stein, 2004). First, under a rating scheme with the PIT method, the current equity price of the borrower and current information on the borrower's liabilities are used to calculate the probability of its default, therefore credit ratings may well show more variability as economic conditions change and the average rating of a bank's loan portfolio is likely to change over the course of business cycle. For example, when economic conditions are favorable, loans are likely to move up the rating scale to higher-ratings given that the probability of default in the next year (one year horizon) is relatively low. Thus the nature of PIT credit rating system means that it does not take possible changes in economic climate into account. As a result, measured risk would be negatively correlated with business cycle. Second, a rating scheme with the TTC method measures borrowers' probability of default in a constant hypothetical downside scenario and classifies borrowers with similar (stressed) probability of default to the same rating grade. Thus credit ratings are likely to remain through the business cycle, which means that credit rating scheme designed to give less variability in ratings in response to changes in economic conditions. However, even with the TTC method, an economic downturn that is worse than expected (as in stress scenario) is likely to lead to overall ratings being downgraded simultaneously, and thus we cannot exclude the possibility that the procyclicality of bank lending significantly increases. Although some banks have

In addition, if bank lending is highly dependent upon collateral values, a decrease in collateral values reduces loan supply in recessions as far as asset prices fluctuate over business cycle. Likewise, higher loan-to-value (LTV) ratio is likely to cause larger swings in bank lending since higher LTV ratio implies greater changes in new lending given the changes in asset prices.

Second, in general, a more risk sensitive financial regulation results in more pro-cyclical bank lending. In order to cover the expected loss (EL) of their loan portfolio, banks are required to make provisions which tend to show a cyclical pattern. Given the accounting and tax constraints along with the methodologies used to measure risk, banks increase provisions in economic downturns. Thus, the marginal cost of bank lending rises in recessions, which leads to more pro-cyclical bank lending. To cover the unexpected loss (UL) in a certain time horizon, supervisory authorities require banks to hold sufficiently large amount of bank capital. In recessions, an increase in the cost of capital leads banks to cut back lending rather than to increase their own capital to meet the capital adequacy ratio. Thus, more risk-sensitive capital regulations have the potential to lead to larger changes in capital requirements and larger swings in bank lending over business cycle.[2]

2.2. The Effect of Basel II on the Procyclicality of Bank Loans

The New Basel Accord (Basel II) reinforces the capital regulations by applying diversified risk weights according to the creditworthiness of the borrowers. One of the main objectives underlying the Basel II is, therefore, to substantially increase the risk sensitivity of the regulatory capital (that is, minimum capital requirements) for banks. Considering that credit risk of bank portfolio tends to increase during an economic downturn, the minimum required capital depends on the business cycle, especially when banks are under the risk-sensitive capital regulations such as Basel II (Catarinew-Rabell *et al*., 2003). In recessions, as bank profitability decreases and the cost of raising new capital rises, an increase in capital requirement would force banks to reduce their lending or curtail the supply of new loans, thereby further deepening economic downturns or prolonging recessions. Thus, the procyclicality of bank lending appears to be more serious under Basel II.

Basel II offers two approaches for the setting of credit risk-based capital requirements: Standardized Approach and Internal-Ratings Based Approach. Under the Standardized Approach (SA), banks will be permitted to make use of external credit ratings provided by the acknowledged rating agencies, so called ECAI (external credit assessment institution), to apply different risk weights that ranges from 20% to 150%. Since rating agencies consider firms' profitability and growth potential which are inherently procyclical, the ratings generally tend to move upward (downward) in expansions (recessions).

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chosen to adopt rating systems which are modeled on the approach taken by the rating agencies, most internal rating systems of banks tend to use the PIT method, and most credit rating agencies use the TTC (through-the-cycle) method.

[2] Even if capital requirement is not procyclical, bank capital ratios might still fall in boom and increase in recessions owing to market-based pressures (Borio et al., 2001). Banks believed that, after experiencing problems in particular, the banks needed to demonstrate their financial strength and their commitment to better risk management, and one way of doing so is to report high capital ratio, even if this meant severely cutting back the size of the balance sheet and sacrificing long-term banking relationships.

Under the Internal-Ratings Based (IRB) Approach, banks are allowed to use internal ratings of credit risk to calculate minimum required capital, which uses more sensitive risk weights ranging from as little as 3% to as much as 600% and more. As the risk factors including the probability of default (PD), loss given default (LGD), and exposure at default (EAD) tend to increase in expansions and decrease in recessions, it is quite natural to expect greater cyclicality of the minimum capital requirements. Further, since credit ratings measured by banks' internal model using PIT method are known to be more volatile than those by rating agencies using the TTC method over business cycle, more banks are expected to choose IRB Approach and thus bank lending is likely to become more pro-cyclical.

At an earlier stage when the first draft of the Basel II was released, extensive debates have been prompted in policy circles concerning the potential pro-cyclicality effect of bank loans due to the more risk sensitive capital requirements. Segoviano and Lowe(2002), Borio *et al*.(2001), and Turner(2000) argue that implementation of Basel II significantly extends the procyclicality of bank lending and thus economies are highly likely to have larger swings in business cycle, which will negatively affect the stability of financial system. Several studies also back up the argument by providing the simulation results that the minimum capital requirement might fluctuate more counter-cyclically under Basel II. The simulation results suggest that bank lending might become more procyclical. For example, Segoviano and Lowe (2002) use a transition matrix constructed with internal credit ratings of banks in Mexico to examine how capital requirements might have changed over time if Basel II's Foundation IRB (F-IRB) Approach had been in place. They conclude that minimum capital requirement could have increased significantly in the aftermath of the Peso Crisis in December 1994 and that if actual capital shows the same cyclical variation under the New Accord, business cycle fluctuations may be amplified.[3] Catarinew-Rabell, *et al*. (2003) also examine the potential pro-cyclicality of bank loans to find that the likelihood of sharp increase in capital requirements in recessions could be bigger under Basel II when rating schemes of banks are conditioned on the current point in the cycle (i.e. PIT type), but rating schemes designed to be more stable over the cycle (i.e. TTC type), akin to those of the external rating agencies, would increase procyclicality in a smaller scale.

Recognizing the importance of possible procyclical effects of the New Accord, the Basel Committee made various modifications to mitigate problems. For example, the slope of risk-weight curve to the default probability of corporate loans had been lowered, which implies that the new capital requirements are less risk sensitive than earlier proposals. Banks are also allowed to treat some types of SME loans as retail loans, which need lower capital requirements and are less risk sensitive.[4] For the banks to adopt the IRB Approach, it is recommended that they consider the business cycle effects when making decisions on the borrowers' credit ratings, which implicitly encourage banks to estimate TTC ratings instead of PIT ratings. In addition, the Committee has emphasized that adequate stress testing under the Pillar 2 would dampen the cyclical impact of Basel

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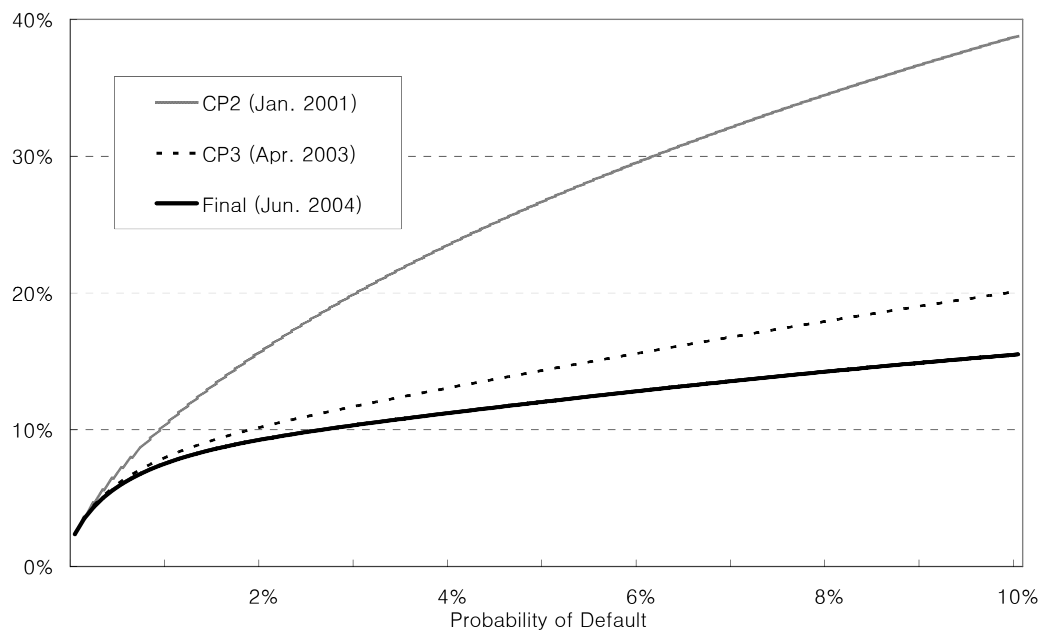
[3] According to Hong (2004), this result might be an overestimate as the proportion of rated corporate exposures in developing countries is reported as being close to 20% on average. In the result of the BIS's second Quantity Impact Study (QIS 2), the proportions of rated corporate exposures are reported as 29% for G10 and EU banks, but 19% for banks in other regions.

[4] The idea is that dispersion of small loans over many counterparties in the retail portfolio may have smaller credit risk than the same size of portfolio consisted of corporate loans.

II since banks need to show that their capital is sufficient to cope with a recession without a reduction in their lending.

Figure 1. Capital Requirements for Corporate Exposures under Basel II



Note: 1) The Capital Requirements are calculated using the formula under the Advanced Internal Ratings Based (A-IRB) Approach

2) CP2 assumes that LGD is 50%, maturity is 3 years, 99.5% confidence level, following the calibration of the Second Consultative Paper (CP2), and includes Expected Loss (EL).

3) CP3 assumes that LGD is 45%, maturity is 2.5 years, 99.9% confidence level, following the calibration of the Third Consultative Paper (CP3), and includes Expected Loss (EL).

4) Final assumes that LGD is 45%, maturity is 2.5 years, 99.9% confidence level, following the calibration of the Third Consultative Paper (CP3), excludes Expected Loss (EL), and considers Unexpected Loss (UL) only.

It is not still clear, however, whether these modifications would sufficiently reduce the pro-cyclicality of bank lending in developing countries. The impact of the modification may differ across countries.[5] Compared to advanced countries, the sophisticated financial techniques are less developed and the risk profiles of asset portfolios are different in developing countries.[6] Extending the scope of Segoviano and Lowe (2002), Hong (2004)

[5] Note, however, that Goodhart et al. (2004) find that pro-cyclicality may well still be a serious problem with Basel II even after the smoothing of the risk curves using Moody's data for the USA from 1982 to 2003, for Norway from 1988 to 2001, and for Mexico from 1995 to 2000.

[6] Similar points about the impact of Basel II on developing countries were made by Powell (2002), who claims

concludes that similar findings about pro-cyclicality of bank lending under Basel II would hold in Korea. Utilizing corporate exposure data for a major Korean bank including borrowers' internal ratings, credit scores, historical default rates, outstanding exposures, and overdue status, he finds that, though the SA of Basel II is not likely to raise minimum capital requirements to any great extent in Korea, the capital requirements under the F-IRB Approach would have increased significantly in the recession after the 1997 Crisis, if Basel II had been in place in Korea. He argues that Advanced IRB (A-IRB) Approach with PIT type credit risk models is likely to lead to much more volatile capital requirements than the F-IRB Approach. He also argues that the potential impact of Basel II on the movement of capital requirements would be significant for developing countries in recessions and that the advanced approaches of Basel II may not provide incentives for the banks in developing countries to reduce regulatory capital requirements since the calibration and revisions of Basel II have not been based on a broader area of samples that include those banks.

Meanwhile, we observe that most banks maintain excess capital (buffer capital) over the required minimum. Using a large data set of OECD countries, Bikker and Metzermakers (2004) present that between 1994 and 2001, the median BIS ratio fluctuated for around 12.2%, an ample 50% above the minimum.[7] These observations underline that banks have incentives to set a target level of capital above the required one. Banks may assess the risk of their asset portfolio as being higher than the outcome of the Basel I scheme. Or they may be more risk averse and wish to hold capital buffers for funding at lower costs. Banks also have incentives to keep buffers above the required minimum capital adequacy ratios, both for their protection against sanctions taken by supervisory authorities and to satisfy rating agencies.

Given that most banks hold sizable buffer capital, the capital requirement under Basel II may not be a binding constraint on banks' lending operations. If banks' capital targets are generally well above the minimum requirements and the buffer capital fluctuates in a way that reduces the volatility of capital, the procyclicality of bank loans would be mitigated. If banks hold buffer capital to cover the risk more than implied by Basel I, the procyclicality would increase only to a limited degree under Basel II. Therefore, findings of previous studies based on the regulatory capital without any considerations on the buffer capital do not provide sufficient evidence to address the potential problems of the pro-cyclicality. Therefore, it is important to investigate the movement of buffer capital as well as the minimum required capital since bank lending depends not only on the regulatory capital but also on the buffer capital.

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that developing countries are highly likely to have difficulties in implementing Basel II because the calibration of capital requirements for IRB Approaches does not consider the risk profiles or lending practices of banks in those countries. Also see Segoviano and Lowe (2002).

[7] Under the Basel I, the first Basel Accord on minimum capital requirements for internationally active banks that introduced in 1988, a bank's actual capital as a percentage of its risk-weighted assets (BIS ratio) must not fall below 8%.

III. Empirical Analysis

3.1. Motivation

This section empirically investigates the cyclical patterns of buffer capital using an unbalanced panel data for the banks in 30 OECD countries and 7 non-OECD Asian countries. Ayuso, Perez, and Saurina (2004) contend that potential risks are increasing during booms before they are materialized in recessions. They argue that a positive correlation between buffer capital and business cycle is consistent with forward-looking behavior of banks. Forward-looking banks increase buffer capital during booms as they properly take into account the potential risks that may accrue during booms. A negative correlation, in contrast, suggests that banks underestimate risks over the business cycle. Accordingly, we may expect that the pro-cyclicality issue is more serious if buffer capital fluctuates counter-cyclically.

Our main objective is to investigate whether the relationships between buffer capital and business cycle are systematically different across country groups controlling for other potential determinants of bank capital. Ayuso, Perez, and Saurina find a significant negative relationship using a sample of Spanish commercial and savings banks for the period of 1986-2000. Lindquist (2004) also reports that buffer capital is negatively correlated with economic growth in Norwegian bank-level panel data. As admitted in the previous research, however, it is difficult to generalize the conclusions from a single country study. To our knowledge, Bikker and Metzemakers (2004) is the only comparable study that uses an international data set, but their sample consists of the banks in advanced countries only.

Indeed, it is often argued that the adverse impacts of the new risk-sensitive bank capital regulation on business cycle fluctuations appear to be larger in developing countries. Since capital market is less developed and thus firms are more bank-dependent in developing countries, it is more difficult for firms to find an alternative source of funds when the supply of bank credit decreases. Recently, Huizinga and Zhu (2006) examine how financial structure matters for macroeconomic volatility and find that aggregate output is more variable in case of heavy reliance on debt financing. Their study indicates that countries with less developed capital market would experience more volatile business cycle.

Moreover, we can imagine that asymmetric information problems between lenders and borrowers are severe in developing countries. Reliable information on firms' credit risk, in particular on small firms' risk, is not largely available in developing countries. Banks' lending decisions in these countries, therefore, depend heavily on collateral values that borrowers can provide. Theories on credit cycles predict that collateral-based lending practice can generate a finance-based propagation mechanism through which business cycle fluctuations are amplified. In recessions, a fall in asset prices lowers the collateral values and thereby reduces the amount of bank loans. The decrease in bank loans, in turn, aggravates business cycle downturns. Pro-cyclical collateral values along with banks' lending practice intensify the concerns about the adverse impacts on business cycle.

3.2. Empirical Specification and the Data

Based on Ayuso, Perez, and Saurina (2004) and Bikker and Metzemakers (2004), we estimate the following reduced-form equation,

$$BUF_{ijt} = \alpha + \beta_1 BUF_{ijt-1} + \beta_2 ROE_{ijt} + \beta_3 NPL_{ijt} + \beta_4 SIZE_{ijt} + \beta_5 LOAN_{ijt} + \beta_6 ROA_{ijt} + \gamma GDP_{jt} + e_{ijt},$$

where i, j, t denote bank, country, and time, respectively. The dependent variable, BUF, is the buffer capital ratio defined as a bank's buffer capital (total capital less required capital) divided by its required capital. ROE is the return on equity and NPL is the ratio of non performing loans (impaired loans) to total loans. SIZE denotes the log of total asset and LOAN is the loan growth rates. ROA denotes the return on asset. GDP is the deviation of GDP growth rate from its country specific average. Other than these variables, we also include country dummies and year dummies to control for idiosyncratic country characteristics and year specific global business cycle factors.

We define the buffer capital ratio in the same manner as in Ayuso, Perez, and Saurina (2004), while Lindquist (2004) uses a ratio of buffer capital to risk-weighed asset. Given that the required capital amounts to eight percent of risk-weighted capital, however, these two buffer capital ratios are essentially the same. Moreover, it is worthwhile to note that the buffer capital ratio, whether excess capital is normalized by required capital or risk-weighted capital, also corresponds to a simple transformation of BIS capital ratio (capital divided by risk weighted asset). Therefore, replacing buffer capital ratio with BIS capital ratio should yield the same empirical results qualitatively and thus economic interpretation on the behavior of buffer capital ratio should also be valid for the behavior of BIS capital ratio.

The empirical model in this paper is consistent with a simple partial adjustment model, in which a bank's current buffer capital ratio adjusts to its optimal level. Motivated by real investment models, Ayuso, Perez, and Saurina (2004) provide a theoretical background derived from a cost minimizing problem of a representative bank. Estrella (2004) also presents a dynamic model of optimal capital in which banks minimizes costs associated with failure, holding capital, and flows of external capital.

Following the previous literature, we also assume that a representative bank sets its optimal buffer capital ratio taking into account the trade-off between cost of capital and default probability. More capital incurs higher cost of holding capital. In addition, theories on asymmetric information predict that raising capital is more costly than other types of liabilities. More capital, on the other hand, might reduce the probability of failure and thereby reduce the bankruptcy costs. Moreover, if banks fail to meet capital requirements, supervisory authorities usually place some restrictions on bank's activity and thus banks might lose reputation.

We assume that the cost of capital is proportional to the level of capital and approximated by the returns on equity (ROE). To the extent that ROE reflects the cost of raising and holding capital, ROE is expected to be negatively correlated with buffer capital ratio. We expect that NPL proxies for the risks that banks may face. Banks with more impaired loans may have higher probability of default and thus need to increase the buffer capital ratio. Thus, the expected sign of the coefficient on NPL is positive.

We also consider a bank's size variable defined by the log of a bank's asset in the regression. Lindquist (2004) provides several channels through which bank size affects the buffer capital ratio. First, scale economies enable large banks to reduce monitoring and screening cost and thereby lower optimal level of capital. Second, large banks are generally able to easily diversify the risks and thus they can keep buffer capital ratio lower than small banks. Third, according to the 'too big to fail' hypothesis, large banks may believe that they will receive support from the regulators.

In addition, we include loan growth rate and ROA in the regression. Suppose that total capital is constant or adjusting capital is very costly. Then, an increase in loans implies an increase in required capital and a decrease in buffer capital, which lowers buffer capital ratio. Therefore, as far as loan growth is pro-cyclical, buffer capital ratio is likely to be negatively correlated with business cycle. Including loan growth rate allows us to examine additional cyclical pattern of buffer capital, controlling for this possibility of mechanical negative correlation. We include ROA for similar reason as ROA indicates the ability to retain earnings which is an important part of capital.

While these bank balance sheet variables characterize the factors that may affect optimal capital level, the lagged dependent variable captures the adjustment cost. Previous theoretical and empirical literature that studies pro-cyclical aspect of bank capital use partial adjustment model to find a non-negligible adjustment cost.

Our main purpose of the regression analysis is to investigate the relationship between buffer capital ratio and the business cycle, controlling for other potential determinants of buffer capital ratio. The coefficient estimate on GDP growth provides evidence on how the banks have changed buffer capital over the business cycle. We further investigate whether the cyclical pattern of buffer capital ratio is different between advanced countries and emerging market Asian countries. To do this, we construct regional dummy variables to test for the differential effect of business cycle on the buffer capital. Asian countries include Hong Kong, Singapore, Taiwan, Thailand, Malaysia, Indonesia, Philippines, and Korea.[8] Among the OECD countries, we select and construct a dummy variable for Basel committee member countries which are believed to have more advanced banking industry.[9]

We obtain bank balance sheet data from the Bankscope database and GDP series from the International Financial Statistics. The sample consists of large commercial banks from 37 countries with valid information on capital, total asset, loans, ROE, ROA, non-performing loans over the 1995-2004 period.[10]

3.3. Estimation Results

Table 1 presents the sample mean of the bank characteristics for each country group. The average buffer capital ratio in our sample is 50.6% which is equivalent to 12.1% of BIS capital ratio. Banks in Asian countries maintain much higher buffer capital and BIS capital ratio than OECD countries during the sample period. The outbreak of East Asian financial crisis in 1997 and the subsequent restructuring of financial institutions in East Asia could cause higher buffer capital ratio in the region, yet the number is still above 70% over the period 2002-2004. Financial crisis also explains high non-performing loan ratio (NPL) in Asian countries.

The profitability of banks in Asian countries, however, is lower than OECD countries: ROE for the banks in Asian countries recorded 7.4% on average, which is lower than

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[8] Although Korea is an OECD member, we classify Korea as an Asian country.

[9] Basel committee member countries are Belgium, Canada, France, Germany, Italy, Japan, Luxembourg, the Netherlands, Spain, Sweden, Switzerland, UK, and the US.

[10] Some outliers are excluded from the sample. The sample requires that BIS capital ratio is between 0 and 0.3, ROE is between -50% and 100%, NPL is less than 50%, and loan growth rate is between -100% and 100%.

11.3% in OECD countries and 15.6% in the US. Loan growth rate is also lower in Asian countries compared to other advanced countries.

Table 1. Sample mean of bank characteristics

	Total	OECD	Basel	US	Other OECD	Asia
BUF	50.56	47.79	47.62	58.41	50.08	80.87
BIS	12.05	11.82	11.81	12.67	12.01	14.47
ROE	10.97	11.30	11.11	15.59	13.81	7.35
NPL	3.31	2.89	2.90	0.68	2.79	7.95
SIZE	8.66	8.66	8.57	8.54	9.87	8.70
LOAN	9.65	9.81	9.37	12.13	15.51	7.90
ROA	0.90	0.92	0.91	1.32	0.95	0.69

We first examine how buffer capital ratio has changed over the business cycle on average. Table 2 reports the coefficient estimates on bank characteristics and GDP with the associated t-values. The second column shows the estimation results from pooled OLS with country dummy variables and year dummy variables. Since the correlation between GDP and year dummy variable may affect the coefficient estimate on GDP, we re-estimate the equation without year dummy variables. The result for this exercise is reported in the third column (Model II). We also attempt to estimate cyclical pattern of buffer capital ratio excluding loan growth which is also believed to be pro-cyclical and thus affect the coefficient on GDP (Model III).

The coefficient on the lagged buffer capital ratio is estimated significantly, suggesting a substantial adjustment cost. The coefficient estimate on ROE, a proxy for the cost of capital, is negative and statistically significant, implying that higher cost of capital has a negative impact on bank's capital accumulation. The buffer capital ratio, however, is not correlated with our risk proxies. The coefficient estimate on NPL is negative though not statistically significant. This result is counter-intuitive because theory predicts that high-risk banks are better capitalized relative to their overall level of risk. Ayuso, Perez, and Saurina (2004) also find that buffer capital ratio is negatively correlated with NPL. They argue that the estimated sign is negative since NPL is an ex-post measure of risk.

Meanwhile, we find that the coefficient on SIZE is negative, though significant only at 10% level. It predicts that large banks are more likely to hold less buffer capital. The negative size effect, as discussed earlier, is consistent with economies of scale, the ability to diversify risks, or 'too big to fail' hypothesis. Previous studies also report negative size effect. As expected, we find buffer capital ratio is negatively correlated with loan growth rate and positively correlated with ROA.

Now we turn to the estimated relationship between buffer capital and business cycle. Model I in Table 1 shows that coefficient estimate on GDP is 0.16, but not statistically significant, implying that, on average, buffer capital ratio is not correlated with business cycle. Since the estimation results in Model II and Model III are qualitatively the same, we conclude that year dummy variables or loan growth rate do not affect the estimated cyclical aspect of buffer capital ratio.[11]

Table 2. Estimation results I

	Model I	Model II	Model III
Constant	44.919 (2.22)**	44.202 (2.34) **	21.304 (1.19)
Lagged Dep. Var.	0.641 (9.65) ***	0.641 (9.67) ***	0.645 (9.67) ***
ROE	-0.543 (-3.34) ***	-0.534 (-3.34) ***	-0.559 (-3.37) ***
NPL	-0.281 (-1.61)	-0.277 (-1.60)	-0.032 (-0.18)
RW			
SIZE	-0.518 (-1.73) *	-0.539 (-1.75) *	-0.255 (-0.85)
LOAN	-0.298 (-9.71) ***	-0.296 (-9.87) ***	
ROA	10.030 (4.18) ***	9.927 (4.18) ***	9.859 (4.00) ***
GDP	0.159 (0.75)	0.005 (0.03)	0.225 (0.97)
Country dummy	Yes	Yes	Yes
Year dummy	Yes	No	Yes
No. observation	3907	3907	3907
R2	0.70	0.70	0.69

Note: Numbers in parentheses are t-values. *, **, and *** denote statistical significance at the 10%, 5%, and 1% confidence levels.

The findings in Table 1 suggest that, in general, buffer capital ratio does not fluctuate systematically over the business cycle. Nevertheless, it is possible that buffer capital ratio shows pro-cyclical or counter-cyclical patterns in some countries or regions. We attempt to find a heterogeneous behavior among country groups.

Table 3 presents the estimation results from the regression allowing for a possibility of different correlation between buffer capital ratio and business cycle across country groups. The second column in Table 3 reports the coefficient estimates on GDP along with other coefficient estimates for two country groups: Asian countries and OECD countries.[12] In contrast to Table 2, the estimation result in Table 3 tells a different story: buffer capital is positively correlated with GDP in OECD countries while negatively correlated with GDP in Asian countries. The coefficient estimate is 1.03 for OECD countries and it is statistically significant, but it is -0.55 for Asian countries with marginal significance.

We further classify OECD countries into two groups, the Basel committee member countries and non-member OECD countries, to compare the pro-cyclical aspects of the buffer capital ratio among OECD countries. The third column in Table 3 shows that buffer capital ratio is positively correlated with GDP for the Basel committee member countries. In contrast, the correlation is negative and not statistically significant for other OECD countries. These results tell us that the banks in the Basel committee member countries increase their buffer capital ratio in expansions while the banks in other countries do not

[11] Other balance sheet variables are also correlated with business cycle. For example, ROE tends to increase in expansionary periods while NPL rises in recessions.

[12] Korea is a member of OECD, but is included in Asian country group.

increase or decrease the buffer capital ratio. In the fourth column in Table 3, we test whether the positive correlation is driven by the US. The results show that although the pro-cyclicality of buffer capital appears to be stronger in the US banks, a statistically significant positive relationship between buffer capital ratio and GDP is estimated in the other Basel committee member countries as well.

The estimation results in Table 3 show different cyclical patterns of buffer capital across country groups. The buffer capital ratio rises in Basel committee member countries while it declines in Asian countries in the periods of high economic growth. These findings suggest that, once Basel II is implemented, Asian countries are more likely to observe an increase in output volatility. The empirical findings reinforce the concern that developing countries are more likely to be influenced by the new bank capital regulation. Indeed, since bank credit is the more important source of funds in developing countries, a decrease in bank loans might exacerbate economic recession more severely. In advanced countries such as Basel committee member countries, in contrast, the pro-cyclicality issue might not be a great concern. Nevertheless, it should be noted that the empirical results are from the regression using the sample observations under Basel I and the predictions are based on the assumption that banks continue to maintain their behavior under Basel II. If banks change their behavior under Basel II, our predictions may be changed.

Table 3. Estimation Results II

	I	II	III
Constant	48.336 (2.38) **	44.114 (2.19) **	44.445 (2.20) **
Lagged Dep. Var.	0.640 (9.65) ***	0.640 (9.66) ***	0.640 (9.66) ***
ROE	-0.552 (-3.41) ***	-0.558 (-3.45) ***	-0.547 (-3.37) ***
NPL	-0.287 (-1.65) *	-0.293 (-1.69) *	-0.306 (-1.77) *
RW			
SIZE	-0.528 (-1.76) *	-0.551 (-1.84) *	-0.583 (-1.94) *
LOAN	-0.296 (-9.67) ***	-0.293 (-9.60) ***	-0.291 (-9.57) ***
ROA	10.058 (4.21) ***	10.061 (4.21) ***	9.974 (4.16) ***
GDP OECD	1.034 (2.38) **		
Basel		2.033 (5.27) ***	
USA			2.754 (4.40) ***
others			1.528 (3.40) ***
Non-Basel		-0.229 (-0.62)	-0.198 (-0.53)
Asia	-0.547 (-1.98) **	-0.490 (-1.78) *	-0.511 (-1.86) *
Country dummy	Yes	Yes	Yes
Year dummy	Yes	Yes	Yes
No. observation	3907	3907	3907
R2	0.70	0.70	0.69

Note: Numbers in parentheses are t-values. *, **, and *** denote statistical significance at the 10%, 5%, and 1% confidence levels.

IV. Policy Implications

Empirical findings in this paper suggest that developing countries need appropriate policy responses to the potential pro-cyclicality problems under Basel II. In what follows, we review some policy recommendations which have been discussed among academics and policy circles.[13]

First, the financial supervisory authorities need to encourage banks to have longer time horizon over which risk is measured and managed.[14] It is important to recognize that risk is actually building up in booms, and that bad loans are materialized in recessions, which does not necessarily imply an increase in risk. If banks do not under-estimate risks in booms and do not over-estimate risks in recessions, the potential problem of excessive business cycle fluctuation could be alleviated. For this purpose, the supervisory authorities can establish rules contingent to business cycle to promote long-horizon risk measurement. In fact, Basel Committee recommends banks to adopt the IRB Approach in the revised draft of the new accord, in which banks are encouraged to use forward looking TTC method instead of PIT ratings for their credit rating system.[15]

Second, the authorities can use its supervisory instruments in a discretionary fashion. For instance, the supervisory authorities can require banks to increase buffer capital during booms if they judge, based on all available evidence, that risks are under-estimated. Another example is that the supervisory authorities can change loan-to-value ratios in lending for real estate property. If the authorities could correctly evaluate risk arising from an excessive increase in property prices, the loan-to-value ratios might be lowered until the property prices are stabilized. This discretionary approach could prevent undesirable swings in property prices, and also could help accomplish the stability of collateral values and business cycle.

Third, the financial authorities in developing countries need to improve the infrastructure of financial system. Among others, creating and upgrading credit bureaus is crucial. If reliable credit information is largely available to banks, lending decisions would become less dependent upon collateral and thus the impact of asset price cycle on business cycle would decline. In addition, establishing a good accounting and governance standard is a prerequisite for better financial system.

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[13] Borio, Furfine, and Lowe (2001) provide a good reference on the policy options to the pro-cyclicality problems.

[14] If banks have excessively long horizon to the extent that the measured risk converges to the historical average, capital requirement would become less sensitive to risk. Thus, it should be addressed that excessively long horizon is not consistent with the main goal of Basel II to achieve the stability in banking system.

[15] Catarineu-Rabell et al. (2003) also concludes that, under the IRB Approach with PIT method where current information on borrowers' equity price and book liabilities is used to obtain estimates of borrowers' probability of default, and the risk weights determined based on this model are highly sensitive to current economic conditions since cyclical effects in asset valuation would be reflected in the default probabilities.

V. Concluding Remarks

As minimum requirements for bank capital will become more risk-sensitive and thus fluctuate more strongly with the business cycle under Basel II, it is widely expected that bank lending might be reduced during cyclical downturns and this could harm economic development if minimum capital requirements were binding. However, the question arises whether actual capital levels also become more cyclical under Basel II. As almost all banks have their capital well above the required minimum, more volatile regulatory capital would increase procyclicality of bank lending only to a limited degree in Basel II. Therefore, even if the minimum capital required by regulations fluctuate to a greater extent under Basel II, it is necessary to investigate the movement of buffer capital of banks.

To address this call, this paper empirically investigates the cyclical patterns of buffer capital using an unbalanced panel data for the banks in 30 OECD countries and 7 non-OECD Asian countries. The estimation results show systematically different cyclical patterns of buffer capital across country groups. The buffer capital ratio rises in Basel committee member countries while it declines in Asian countries in the periods of high economic growth. These findings suggest that, once Basel II is implemented, Asian countries are more likely to observe an increase in output volatility. Furthermore, in some of the Asian countries where bank credit is the more important source of funds, a decrease in bank loans induced by the risk-sensitive capital regulation by Basel II might exacerbate economic recession more severely.

These findings suggest that some appropriate policy responses will be requested, especially in Asian developing countries. Regulatory authorities of these countries should keep in mind that the possibility of expanding procyclicality can be emerged as the most critical constraint on the economic policy planning, especially in a downturn. Therefore, successful implementation of the new capital standard will depend on how one might design a credible, transparent formula that links capital requirements to some measure of aggregate economic conditions. This is a difficult question and one that we are not prepared to answer fully.

This paper reviews some of such policy responses commonly suggested in the previous literature and draws implications for Basel II implementation that it is important to balance the pros and cons of the measures for reducing procyclicality since some measures may not help the banking system to accomplish stability if they restrict risk assessment of banks too strictly.

Lastly, it should be noted that those predictions regarding procyclicality are from the regression using the sample observations under Basel I. It is not clear in advance whether banks will change their capital accumulation behavior after the implementation of Basel II. If banks change their behavior under Basel II, our predictions are not valid and we may reach different conclusions. Nevertheless, it is worth to investigate the cyclical behavior of banks over the last decade, since this behavior will probably also be typical after Basel II and the detected patterns also may be continued.

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Comments on "Procyclicality of Buffer Capital and its Implications for Basel II: A Cross-country Analysis"

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It has been repeatedly pointed out that adoption of Basel II would amplify business cycle fluctuations by forcing banks to employ pro-cyclical lending practices. Such prediction relies heavily on the assumption that banks would maintain stable risk-weighted capital ratios. This paper challenges such assumption: By investigating panel data for banks in 30 OECD countries and 7 non-OECD Asian countries, the paper shows that most banks actually hold excess capital well above the required minimum. The average buffer capital ratio for all banks is 50.6%, which can be translated into BIS capital ratio of 12.05 percent.

The authors then conjecture that, because most banks hold sizable buffer capital, the capital requirement under Basel II might not be a binding constraint on banks' lending operations. They found that, even though average buffer capital ratio does not fluctuate systematically over the business cycle, there is clear difference between two country groups. In expansions, banks in the Basel committee member countries increased their buffer capital ratio while banks in other countries decreased buffer capital ratio. They interprete the result as evidence of more prudent capital management practices of Basel country banks, and claimed that Asian countries are more likely to observe an increase in output volatility induced by pro-cyclicality of bank lending behavior under Basel II.

It may be reasonable to assume that Basel country banks employ more sophisticated risk management practices. But this does not necessarily imply that they are better prepared to cope with pro-cyclicality. An alternative interpretation of the empirical findings of this paper can be provided because the results are from regression using sample observations under Basel I. We all know that Basel I does not distinguish credit risk of individual loans within the same class. This implies that banks with advanced risk measurement systems may become more reluctant to originate high quality loans during boom period because they cannot charge high interest rates that compensate for the cost of regulatory capital. These banks would originate more lower-quality loans with larger economic capital than regulatory capital, and, knowing that the quality of their loan portfolios is deteriorating, increase buffer capital. In other words, Basel country banks may already be operating as if they are under Basel II - that is, they are aligning capital with risk.

One may say that the very objective of Basel II is to achieve better alignment of capital and risk, and pro-cyclicality is simply a byproduct of such behavior. Evidence presented in this paper is not strong enough to justify the claim that banks in Asian countries are systematically more prone to pro-cyclicality. Supervisory authorities in Basel countries as well as non-Basel Asian countries should pay much attention to bank lending practices in order to better understand the effects of Basel II. Positive correlation between buffer capital and business cycles may be interpreted as evidence of more resilient risk management practices under Basel I, but resilience alone will not preclude the problem of pro-cyclicality.

CHAPTER 5-1

Ownership Structure and the Roles of Institutional and Foreign Investors: Evidence from the 1997 Korean Crisis

by

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Abstract

We examine the relationship between the ownership structure of the Korean stock market and various firm characteristics around the Korean crisis period. We are especially interested in the implications for the active and passive roles of institutional investors in Korean firms. The active role of institutional investors is their influence on the governance structure, while their passive role is to invest in Korean stocks from the portfolio management perspective. We find empirical evidence supporting both roles of institutional investors. We also find different preferences by domestic and foreign investors toward firm characteristics. We discuss the implications of the differential behaviors.

I. Introduction

It is still debatable whether the 1997 Asian crisis was due to fundamental weaknesses in the emerging markets or to a short-run liquidity shock. The fact that corporate governance has become a hot topic since the crisis demonstrates the severity of poor governance structures in corporate Korea. However, it still remains to be determined whether poor corporate governance was the direct cause of the Asian crisis. However, given ample evidence of the governance role of institutional investors, the Asian market crisis in 1997 provides a natural setting to examine the behavior of institutional investors for the implications for ownership structure, firm performance and market stability.[1]

[1] One major aspect of the Korean crisis in 1997 was its currency fallout. For example, the exchange rate at the end of October 1997 was 902 won per US dollar. This was one month before the Korean government sought aid from the IMF to control the financial crisis. The rate increased to 1,836 won per dollar. Another dramatic

In this paper, we explore some evidence regarding firms' susceptibility before and during the Korean crisis (external shock) and infer the active and passive roles of institutional investors in Korean firms. The active role of institutional investors is their influence on firm performance possibly through governance structure, while the passive role is their investment in Korean stocks from the portfolio management perspective. In reality, we recognize these two roles are not mutually exclusive.

It is fair to argue that governance structure affects the sensitivity of firm performance to the external shock. Xu and Wang (1997) argued that Chinese *domestic* institutional investors played a significant role in corporate governance. Smith (1996) also provided evidence that institutional investors were successful in changing governance structures within firms, although their impact on operating performance was not verified. However, Khana and Palepu (1999) were skeptical of the role of Indian institutional investors as an effective monitoring mechanism, although they argued that foreign investors seemed to have played a positive governance role.

Most recent studies (e.g., Mitton 2002; Joh 2003; and Baek, Kang, and Park 2004) of the 1997 Korean crisis support the argument that corporate governance significantly influences firm performance especially during a crisis. Mitton (2002) considered disclosure quality, transparency, ownership, and corporate focus. In this paper, we focus on the ownership structure of the Korean stock market and its association with firm performance. We especially explore the role of domestic and foreign institutional investors as a corporate governance mechanism in Korean firms. We find evidence that in general, Korean and foreign institutional investors seem to contribute to enhancing firms' efficiency. In particular, we find a positive relationship between institutional ownership and performance variables such as profitability.

Especially, we pay attention to a potentially different pattern of the relationship *before* and *during* the Korean financial crisis. We conjecture that the relationship between some firm characteristics and ownership structure may be a function of the objectives of institutional investors. In this regard, we consider two plausible roles of institutional investors – active and passive roles. The active (governance) role is to influence a firm's profitability or growth potential through its major holdings. The passive role of institutional investors is simply to invest in more favorable stocks for their portfolio. The two different roles, not exclusive in nature, pose a serious empirical problem, also known as the endogeneity problem. Choe, Kho, and Stulz (1999) showed evidence of positive feedback trading by foreign investors around the crisis. Further, Brennan and Cao (1997) suggest that foreign investors learn more from stock price movements than domestic investors do. Thus, the crisis drives out these feedback traders from the Korean market, implying that Korean firms are likely to be owned by foreign investors who are interested in firms' long-term values.

Baek, Kang, and Park (2004) provide some evidence regarding the active roles of institutional investors. They claimed to have resolved some of the endogeneity problem, by examining how the governance structure *before* the Korean crisis affected firm market value *during* the crisis. Choe, Kho, and Stulz (1999) also examined the role of institutional investors before and during the Korean crisis. Similarly, we compare the ownership-performance relation *before* and *during* the crisis and infer the role of institutional investors – domestic vs. foreign. We focus on the accounting measure of firm performance instead of on market measure, as suggested by Joh (2003). He argues that the accounting measure may be better due to market inefficiency, especially in emerging markets (see Butler and Malaikaj, 1992; Kim and Singal, 1997). Also, accounting

demonstration of the impact of the crisis was the collapse of the stock market. The stock market index plummeted from 520 to 300 by the end of December 1997.

profitability is more likely to capture financial stress (Altman, 1968; Takahashi et al., 1984). Any market value change, especially short-tem changes, during the crisis may be driven by speculative institutional trading as well as by governance structures.

Recently, Dahlquist and Robertsson (2001) examined the relationship between ownership and various characteristics of Swedish firms from a perspective different from the governance role of institutional investors. To be more specific, the governance perspective suggests that institutional investors play a monitoring role that affects firm performance. In contrast, Dahlquist and Robertsson (2001)'s perspective is that these investors simply invest in firms in favorable prospect. We will discuss this endogeneity issue when we estimate the determinants of institutional ownership. Again, we focus on any differential relationship *before and during* the crisis to infer the roles of institutional investors.

The next section reviews existing literature on institutional investors' roles in corporate governance. In Section 3, we discuss empirical methodology and also provide empirical hypotheses. In Section 4, we describe the data and test the relationship between corporate performance and stock ownership by institutional investors. Section 5 discusses empirical results. Sections 6 further extend our discussion of institutional ownership. Section 7 concludes the paper.

II. Literature on Institutional Investors and Empirical Implications

The institutional investors' role in corporate governance has been an important topic for finance literature. Lowenstein (1988) argued that the institutionalization of the stock market has a negative influence on the market and listed companies. Samuel (1996) also claimed that institutional investors and fund managers may emphasize short-term performance, and therefore, trade frequently, raising the cost of capital. This occurrence is most likely due to the linkage between institutional investors' compensation structure and short-term portfolio performance.

On the other hand, Jones et al. (1990) showed that an increase in institutional stock ownership is positively related to stock market liquidity and corporate performance. Also, institutional investors were claimed to reduce the cost of equity capital by increasing stock market liquidity and reducing volatility (Coffee, 1991). Furthermore, they may contribute to efficient capital allocation based upon informational efficiency and invest in firms with positive NPV projects. In this regard, Crutchley et al. (1999) provided evidence that many institutions have become active monitors, and managers view the outside monitoring as a substitute for internal monitoring devices such as debt, dividends, and insider ownership.

According to the agency cost of debt hypothesis (e.g., Jensen and Meckling, 1976; Fama and Jensen, 1983), there exists an agency problem between shareholders and creditors. Hence, creditors may insist on various types of protective covenants and monitoring devices in order to protect their wealth from moral hazards by managers (and shareholders). This problem would be more severe in growing firms. As a result, high-growth firms have incentives to use less debt in order to reduce the agency cost of debt. However, if institutional investors actively monitor firms and exert some influence on management, the agency cost of debt can be reduced. Thus, high-growth firms with higher institutional ownership may have higher debt ratios.

Stulz (1999) asserts that a firm's cost of capital depends on its governance structure, and that globalization particularly affects the structure. Accordingly, the emergence of a new investor group, i.e., foreign investors, transforms the relationship between firms and capital providers in that foreign investors have better skills and information to monitor management than local counterparts do. Khanna and Palepu (1999) studied the effects of

Indian domestic institutional investors and foreign investors on the Indian companies' governance structure. They found that Indian institutional investors monitored local firms inefficiently, but that foreign investors played a significant monitoring role. However, Xu and Wang (1997) found that institutional investors play a significant role in monitoring Chinese firms efficiently.

Using data from East Asian countries, Mitton (2002) showed that corporate governance affected firm performance during the Asian crisis. Baek, Kang, and Park (2004) more recently showed a similar result. Relevant to our research, they showed that firms with greater foreign ownership experienced a smaller decline in market value. There are many other factors affecting firm performance. Debt/equity ratio has mixed effects on profitability. The effect can be positive because debt may decrease agency problems (Jensen, 1986; Stulz, 1990). At the same time, the result could be negative because debt can increase agency problems between shareholders and creditors. Especially, during an economics crisis, firms with high debt ratios tend to experience more difficulties (Lang and Stulz, 1992; Opler and Titman, 1994). Growth opportunity measured by sales growth rates can positively affect firm profitability. Also, firm size and risk can affect profitability.

III. Empirical Hypotheses and Methods

3.1. Domestic Institutional Investor-Related Hypotheses

The major question with regard to the role of institutional investors is whether institutional stock ownership favorably affects firms' performance. Managers may disregard investments contributing to firms' long-term growth, such as R & D investments, and instead focus on short-term performances. However, institutional investors, by maintaining favorable long-term relationships with managers, may play a positive monitoring role in protecting management rights from hostile takeovers, and encouraging management focus on long-term performances.

The agency problem among managers, shareholders and creditors may be more severe in firms with more growth potential. In this case, institutional investors may reduce the agency costs of debt by playing a monitoring role. For companies with substantial institutional ownership, the debt-to-equity ratio may be lower due to the substitution effect that institutional ownership has as a monitoring mechanism we previously discussed. It is worthwhile to mention that one of the difficulties of measuring the effect of governance on firm performance is that there are more than one major governance variable. For example, as mentioned earlier (Clutchley, 1999), managers view outside monitoring as a substitute for internal monitoring devices such as debt, dividends, and insider ownership. Thus we test the following hypothesis: Institutional stock ownership is positively related to firm performance, controlling for debt-equity ratio and size.

3.2. Foreign Investor-Related Hypotheses

Hanazaki and Horiuchi (2000) showed that from the mid-1970's, foreign stock ownership in Japanese firms was increasing, and from the late 1980's the trend was more abrupt. They argued that foreign investors focus more on the firm's profitability than on the *keiretsu* relationship or business size, on which Japanese domestic investors focus. Moreover, in their study of Indian companies, Khana and Palepu (1999) showed that foreign institutional investors monitor Indian management better than their Indian counterparts do. If indeed the role of monitoring by foreign investors exists, we may observe the effect more clearly in emerging markets. Thus, we expect that foreign stock ownership will also positively affect Korean firms' profitability.

3.3. Institutional Trading during the Crisis

We will examine domestic and foreign institutional investors' behavior around the crisis. Froot et al. (1998) showed that emerging markets were inefficient in that foreign investors with information advantages relative to local investors earned abnormal returns using trend-chasing or positive feedback trading strategies. Further, some argued that foreign investors may contribute to destabilized markets.[2] However, Choe, Kho, and Stulz (1999) have recently shown that foreign investors did pursue positive feedback and herding but did not contribute to destabilizing the Korean stock market during the 1997 financial crisis. They argued that Korean investors intervened and offset the positive feedback trading of foreign investors, which may have prevented the potentially destabilized market during the crisis. We expect that the effect of ownership on performance may be complicated during the crisis due to a potentially different trading pattern between domestic and foreign investors. Positive feedback trading by foreigners during the crisis is one of the reasons why we may see a different relationship between ownership and firm characteristics before and during the crisis.

IV. Data

4.1. Data and Variables

The data include 518 Korean manufacturing firms listed on the Korea Stock Exchange from 1992 to 1999. Stock ownership and financial data are obtained from Korea Investors Service's KIS-FAS (Korea Investors Service-Financial Analysis System), and stock price data from KIS-SMAT (Korea Investors Service-Stock Market Analysis Tool).

We examine institutional ownership and various firm characteristics, especially before and during the crisis, covering the years 1995 through 1998. 1997 is generally accepted as the crisis year in Korea (See Choe, Kho, and Stulz (1999) and Baek, Kang, and Park (2004)). The explanatory variables in the annual cross-sectional regression analysis are firm size, debt-equity ratio, beta, and sales growth rates as control variables and stock ownership ratio of institutional investors, which are categorized into Korean domestic institutional investors and foreign investors. For the dependent variables, we use two performance variables: returns on equity (ROE) and Tobin's Q (Chung and Pruitt, 1994). Since we examine a dynamic period with financial and structural changes, we estimate the relationship for a given year and then compare it over time. Actually, Zhou (2001) and Hermalin and Weisbach (1991) argued that ownership-performance relationships can be better captured with the cross-section analysis than with fixed-firm pooling regressions.

Stock liquidity is measured by listed stock turnover ratios annually made public by the Korea Stock Exchange. Measurement of risks is the firm's annual beta. Financial stability measures include debt-to-equity ratios, financial cost-to-debt ratios, financial cost-to-total cost ratios, and financial cost-to-sales ratios. The firm's long-term investment tendency is measured by the ratio of R & D expenses to sales, and the ratio of advertising expenses to sales. The degree of globalization is measured by foreign sales-to-total sales ratios.

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[2] Refer to Dornbusch and Park (1995) and Stiglitz (1998) for a potential destabilizing effect of foreign investors.

4.2. Preliminary Statistics

4.2.1. Ownership Structure

According to Table 1, the number of stocks owned by foreign investors had been increasing since the opening of the Korean stock market, but the trend was reversed around the Asian and Korean financial crises in 1997. However, the average ownership ratio was still high in 1998 and 1999 at 7.9% and 7.2%, respectively, while it was 6.4% and 6.7% in 1995 and 1996. Foreign investors seem to concentrate their ownership in selective firms after the crisis. The number of stocks owned by foreigners was 411 in 1995 before the crisis and was reduced to 307 in 1998. Furthermore, Table 1 reports that both the number of stocks owned by domestic institutional investors and their ownership ratios decline slightly overall in and after 1997. This observation suggests that institutional investors in general did not abruptly change their ownership in response to the crisis.

Throughout the 1990's, individual stock ownership ratios continued to be high in terms of the number of shares owned by individual investors. Ownership ratios of a single large shareholder continued to decline from 28.5 percent to 23.8 percent from 1992 to 996. However, the ownership ratios reverted to a high 28.3 percent in 1999 in the aftermath of the financial crisis. This may imply that ownership concentration in Korean *Chaebol* firms may emerge again. We need to expand our data to identify those stocks affiliated with *Chaebol*. Reflecting the privatization trend, the government's ownership ratios declined to 2.9 percent in 1999 from 5.8 percent in 1992.

4.2.2. Firm Characteristics and Their Correlation

Table 2 describes firm characteristics around the Korean crisis period from 1995 to 1998. Panel A reports the description of the sample firms' characteristics, while Panel B describes the sample which has a positive foreign ownership. It shows that the firm characteristics of these two samples are very similar. One exception is that overall sales growth sharply declined in 1998, but the sales growth rate of the foreign-owned firms did not decrease as much. Striking are the changes in some variables around the crisis. Debt ratio was the highest in 1996 and dropped quickly after the crisis in 1998. Firm share value began decreasing in 1997. Share turnover, which measures stock liquidity, jumped from 237% in 1996 to 403% in 1998. Return-on-equities (ROE) were already very poor even before the crisis. The overall mean ROE in 1996 was -0.95%.

The sample with positive foreign ownership also showed a negative ROE in 1996. However, the median ROEs were 5.14% overall and 5.35% for foreign-owned firms. This implies that the negative mean ROE may be driven by a few large, negative ROEs in the sample. Interestingly, the systematic risk and Tobin Q remained very stable throughout the crisis period. Firms' emphasis on long-term investment after the crisis is evident from the R&D expense ratio, whose average value in 1998 is about eight times that in 1997.

Table 3 shows the correlation among the relevant variables before and during the crisis period. Note in Panel A that Tobin Q has fairly high correlations with domestic institutional ownership and debt-equity ratio, stable over time. ROE also has a positive correlation with domestic ownership but negative correlations with debt ratio and Q. The negative correlation between these two performance measures may lead to mixed estimations in the regression analyses. We interpret ROE and Q as short-term and long-term measures of performance, respectively. Furthermore, ROE is an accounting measure while Q is a market measure. We will discuss this further in examining our empirical results.

It is interesting to observe a very high positive correlation between Q and the debt ratio, at 0.50 for all three years including the crisis period. This may indicate the disciplinary effect of debts, which affects long-term firm value and hurts the short-term performance. The expected negative correlation between beta and firm size is observed. It seems that the correlations are consistent before and during the crisis period, except for share turnover and size. Regarding size, the profit margin is highly correlated with size in 1997, but not in 1996 or 1998. The correlation between share turnover and other characteristics is very striking. Share turnover is negatively correlated with Tobin’s Q in all three years. It is also worthwhile to explore its strong correlation with ROE and beta. High turnover may be driven by low performance. The firm’s beta may be correlated with share turnover in 1998 probably because large institutional selling may have led to a price decline, facilitated by a significant stock market collapse in 1997.

Finally, we observe a very high and negative correlations with share turnover and institutional ownership in 1997 and 1998. This means that institutional investors own more liquid stocks. It is not clear whether this phenomenon is unique for the crisis period or for emerging markets. This same observation holds for foreign investors, a finding that contradicts the previous results. Dahlquist and Robertsson (2001) found a high positive correlation between stock liquidity and foreign ownership, consistent with the argument that informational asymmetries may be the factor behind the home bias of foreign ownership. Panel B shows a similar correlation for foreign ownership. In general the pattern is very similar to Panel A. One notable correlation is between size and foreign ownership. Foreign investors hold large firms in all three years.

V. Regression results: Ownership as a Determinant of Profitability

This section provides regression results of the effect of ownership on profitability around the Korean crisis period. Instead of pooling estimation with fixed- firm regression, we report cross-sectional analyses by year. Zhou (2001) argues that fixed-firm estimation may not detect the ownership-performance relationship because in general, ownership is fairly stable over time but varies much in cross-section and fixed firm estimation eliminates the cross-sectional variation.

Table 4 (Table 5) reports the regression results between the ownership of domestic (foreign) institutional investors and two performance measures - returns on equity (ROE) and Tobin Q around the crisis period. The coefficients of domestic ownership ratio are positive and significant for two years before the crisis period, 1995 and 1996. This is consistent with the governance role of domestic institutional investors. The relationship becomes weaker and mixed during the crisis. The coefficient of foreign ownership (in Table 5) is also positive and significant before and during the crisis, but only for Tobin Q. We argue that foreign investors are more interested in long-term value rather than in short-term profitability. The sales growth rate has, as expected, a positive effect on short-term profitability.

There is mixed evidence on the effect of debt ratio on profitability. It has a strong negative effect on short-term profitability (ROE) but a strong positive effect on long-term value (Q). It may reflect long-lasting structural problems in Korean firms before the crisis with low returns and high debts. However, the disciplinary effect of debts may be shown by the positive coefficient estimates for Tobin Q for both domestic and foreign investors. McConnell and Servaes (1990) also showed a significant and positive relationship between Tobin's Q as a proxy for corporate value and institutional ownership using NYSW and AMEX firms in 1976 and 1986, thus supporting the efficient monitoring hypothesis. Systematic risks do not seem to affect short-term and long-term profitability. Overall, the effect of foreign investors on firm performance was quite similar to that of domestic institutional investors.

VI. Determinants of Institutional and Foreign Ownership

Thus far, we have interpreted the relationship between ownership and firm performance from the governance perspective. However, since the regression analysis does not address causality, we cannot distinguish between the two alternative propositions: (a) Institutional and foreign investors exert a monitoring influence and positively affect corporate performance, and (b) Institutional and foreign investors invest in those firms with favorable performance measures. Therefore, in this section, we explore the determinants of ownership, which is assumed to be a function of various firm characteristics.

We run multivariate regressions of institutional and foreign ownership on firm characteristics. Very recently, Dahlquist and Robertsson (2001) examined the relationship between ownership and various characteristics of Swedish firms. They show that foreign and institutional investors prefer large firms, firms with low dividends and large cash positions. Table 6 shows the relationship between domestic and foreign ownership and firm characteristics of Korean firms around the crisis. Firm size has a significant positive effect on foreign ownership. However, domestic institutional investors do not show any preference toward large firms during the crisis (1996 and 1997). The preference of foreign investors toward large firms is well documented. Merton (1987) and Huberman (1999) argue that investors favor firms which they are familiar with and have more knowledge about. We believe that this preference toward large firms may have become strong during the crisis. A similar argument can be applied to the positive relationship between globalization and foreign ownership in 1997.

Institutional investors seem to prefer firms with high Q values. This is consistent with McConnell and Servae (1990) who also find a strong preference by institutional investors toward firms with high Tobin’s Q, which are high-growth and low-dividend oriented. Further, given that the market-to-book ratio is similar to Tobin's Q, these relationships are consistent with the Swedish cases in Dahlquist and Robertsson (2001). That is, foreign investors seem to prefer Korean firms with high potential growth and large size. The other characteristics do not seem to affect foreign ownership, except for share turnovers, which have a negative impact on foreign ownership particularly in 1997 and 1998. This result regarding share turnover ratios is in contrast with Dahlquist and Robertsson (2001)'s in which foreign investors preferred Swedish firms with the most liquid stocks. We consider this as a short-term crisis effect. The large trading during the crisis is mainly a result of selling pressure due to the negative shock to the Korean stock market. This is interesting, given the result of positive feedback trading by foreign investors in Choe, Kho, and Stulz (1997). More thorough analysis is warranted in this area.

There are several interesting contrasts between foreign and domestic institutional investors' behaviors particularly around the 1997 Korean crisis. Unlike foreign investors, domestic institutional investors prefer firms with high earnings to sales and low advertising-to-sales ratio. Korean institutional investors did not show any preference towards large firms in 1996 and 1997. However, they invested in larger firms in 1998. Korean domestic institutional investors may have had better information about small firms and thus have invested in them as much as in large firms. After the 1997 crisis, they may have returned to large firms for safety. This reversal behavior between foreign and domestic institutional investors can also be observed in their preference toward Tobin's Q.

While foreign investors consistently chose firms with high Tobin's Q's until 1997, Korean institutional investors did not show any preference in 1997 and 1998.

Another interesting comparison between foreign and institutional investors' behaviors can be noted in employing accounting ratios as important determinants. For example, it seems that domestic institutional investors prefer firms with high profit to sales ratios and low advertising expenses, while foreign investors do not consider this accounting information. This may imply that domestic institutional investors have a relative information advantage over foreign investors in interpreting accounting numbers, and thus institutional investors rely more on these accounting variables for investment decisions than foreign investors do.

VII. Summary and Conclusions

We investigated the relationship between institutional ownership and firm characteristics around the Korean financial crisis. In the introductory statistical analysis on stock ownership changes, we found that both Korean domestic institutional and foreign investor ownership in Korean firms, which continued to rise since the Korean stock market opening in 1992, fell sharply around the Korean financial crisis in 1997. In contrast, individual ownership including one largest shareholder remained fairly stable even during the Korean crisis. The changes in institutional investors may provide some insights into the role of institutional ownership.

Korean institutional investors and foreign investors seem to value Korean firms based on fundamentals, such as profitability, and to positively affect Korean firms' efficiency. Together with the result that high institutional ownership is associated with the reduced agency cost of debt, this suggests that institutional investors may monitor firms efficiently. A high ownership ratio was observed for firms with higher overseas sales ratios, especially in 1997 when the Korean domestic economy was in recession.

Foreign investors seem to behave like Korean institutional investors in contributing to lower turnover ratios and financial stability. More analyses are warranted to examine the relationship between share turnover and ownership. Finally, firm size and Tobin's Q seem to be major determinants of institutional ownership in the Korean market. At the same time, it seems that domestic institutional investors seem to focus more on accounting information such as profits to sales and advertisement expenses, which determine ownership in comparison with foreign investors.

In sum, our empirical results support both the active and passive roles of institutional investors. Future work should focus on the process of effecting governance structure, which can be different for domestic and foreign institutional investors. Furthermore, we recognize the importance of substitution effects among various governance mechanisms. Exploring an optimal governance structure theoretically and empirically would be a challenging and rewarding exercise in the future.

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Table 1. Korean Domestic Institutional Ownership, Foreign and Individual Ownership before and after the Asian crisis from 1992 to 1999.

Shareholders		Statistics	1992	1993	1994	1995	1996	1997	1998	1999
Korean institutions	Financial institutions	N	473	476	460	443	448	370	279	314
		Mean	13.9	12.5	9.7	11.3	10.2	8.8	6.0	8.1
		Std. Dev.	9.77	9.77	9.14	7.61	8.64	8.07	6.0	8.1
	Securities companies	N	497	490	490	463	447	448	400	413
		Mean	7.7	7.2	8.3	6.2	5.7	5.2	3.8	4.0
		Std. Dev.	5.32	5.11	6.66	6.16	6.35	7.0	5.37	7.57
	Insurance companies	N	281	284	276	279	269	321	308	316
		Mean	3.2	3.5	3.4	4.0	4.2	3.9	3.1	2.1
		Std. Dev	3.48	3.45	3.31	3.46	3.59	3.98	3.22	3.0
	Others (pension and funds)	N	475	478	485	485	488	480	459	454
		Mean	13.4	12.3	13.2	14.8	16.6	18.1	17.6	17.9
		Std. Dev	15.37	14.23	14.44	14.88	14.84	17.25	15.40	15.90
Foreigners		N	287	386	397	411	390	331	307	340
		Mean	6.9	7.1	7.8	6.4	6.7	6.6	7.9	7.2
		Std. Dev.	11.06	8.35	10.15	7.08	8.77	9.60	12.83	11.98
Governments		N	184	213	211	218	210	205	108	118
		Mean	5.8	5.7	4.7	5.6	6.0	4.5	4.1	2.9
		Std. Dev.	7.83	6.98	6.35	6.19	6.52	6.14	7.64	7.24
Individuals		N	505	500	508	494	493	480	465	467
		Mean	59.2	59.8	61.3	59.6	59.0	61.4	67.8	66.6
		Std. Dev	22.27	20.85	21.66	21.07	20.55	21.03	20.60	24.39
One large shareholder		N	500	492	496	482	467	459	436	459
		Mean	28.5	26.6	25.3	24.4	23.8	27.1	27.8	28.3
		Std. Dev	14.61	13.46	12.75	12.34	13.16	13.89	14.64	16.66

Note: each category of investors should have a positive stock ownership among the total 519 sample firms.

Table 2. Description of firm characteristics for 1995 - 1998

Advertsiement ratio, interest expense ratio, and R&D expense ratio are based on total sales. Profit margin is the net earnings divided by total sales. ROE is net income divided by book value of equity. Share turnover is the total number of shares traded over a period by the average number of shares outstanding for the period.

Panel A: Domestic Institutional Ownership

Variables	obs	1995 Mean	1995 Median	1996 Mean	1996 Median	1997 Mean	1997 Median	1998 Mean	1998 Median
Advertisement ratio (%)	502	1.36	0.2	1.33	0.23	1.30	0.20	0.88	0.11
Interest expense ratio (%)	514	5.56	5.22	5.40	5.07	7.45	7.09	9.50	9.65
Sales Growth Rate (%)	508	17.33	15.39	11.45	10.77	11.55	8.85	0.81	1.23
Profit Margin (%)	514	5.81	5.8	5.18	5.565	4.18	5.75	3.36	5.85
Debt/Equity Ratio (%)	488	313.83	209.06	457.08	224.88	408.18	239.57	281.51	171.47
R&D expense ratio (%)	244	1.21	0	1.34	0.39	1.48	0.45	9.15	0.53
Tobin Q	506	0.34	0.32	0.35	0.34	0.36	0.36	0.35	0.33
ROE (%)	499	5.58	6.3	-0.95	5.14	3.88	4.63	6.19	6.95
Beta	505	1.15	1.16	1.06	1.109	0.96	1.00	0.95	0.95
Share Turnover (%)				237.85	198.165	292.51	232.44	403.24	342.65

Panel B: Foreign Ownership

Variable	Obs.	1995 Mean	1995 Median	1996 Mean	1996 Median	1997 Mean	1997 Median	1998 Mean	1998 Median
Advertising Expense	403	1.294988	0.2	1.301723	0.24	1.40538	0.28	0.915179	0.14
Interst expense	411	5.531752	5.17	5.268737	4.965	7.416277	6.77	9.319772	9.53
Sales Growth Rate	407	18.684324	16.61	11.076447	10.845	12.787452	9.99	2.859472	3.29
Profit Margin	411	6.364623	5.99	5.61232	6.01	5.465772	6.54	4.757789	6.6
Debt/Equity Ratio	403	303.23859	214.44	471.75059	220.27	325.76482	226.4	233.80366	164.15
R&D expense	193	1.317513	0	1.420208	0.42	1.708276	0.46	13.636014	0.72
Tobin Q	410	0.316268	0.31	0.337039	0.34	0.340926	0.36	0.309187	0.31
ROE	400	6.2844	6.84	-0.496836	5.38	4.118074	4.65	8.99898	7.82
Beta	400	1.144894	1.14	1.064903	1.111854	0.973533	1.018764	0.949292	0.945588
Share Turnover				238.56923	195.91	260.88725	205.97	371.44984	314.03

Table 3. Correlation among ownership and other control variables around the Korean crisis period, 1996-1998

Salegr is the sales growth rate. Profit is the profit margin. Q is Tobin's Q. ShTO is the sahre turnover. Mcap is the market capitalization. More detailed defintions of the variables are in Table 2.

Panel A. Domestic institutical Investor ownership

		Owner	Adv	Salegr	Profit	D/E	Q	ROE	Beta	ShTO	Mcap
1996	Owner	1	-0.08988	0.070154	**0.123269**	0.015703	**0.151516**	**0.114005**	0.01142	-0.036411	0.010026
	adv	-0.08988	1	-0.030822	**0.281991**	0.026801	**-0.199936**	0.092077	0.029905	-0.002949	0.037529
	salegr	0.070154	-0.030822	1	**0.169223**	-0.032699	0.061385	**0.241185**	**0.044143**	-0.025978	**0.143188**
	prof	0.123269	0.281991	0.169223	1	-0.088188	-0.094931	**0.332101**	0.067676	0.041964	0.021167
	de	0.015703	0.026801	-0.032699	-0.088188	1	**0.467863**	**-0.494741**	-0.075054	-0.050397	**-0.14949**
	q	0.151516	-0.199936	0.061385	-0.094931	0.467863	1	**-0.199655**	0.029625	**-0.112863**	**-0.161187**
	roe	0.114005	0.092077	0.241185	0.332101	-0.494741	-0.199655	1	0.069679	-0.012852	0.089682
	beta	0.01142	0.029905	0.044143	0.067676	-0.075054	0.029625	0.069679	1	0.044615	**-0.112374**
	sh_to	-0.036411	-0.002949	-0.025978	0.041964	-0.050397	-0.112863	-0.012852	0.044615	1	0.002806
	macap	0.010026	0.037529	0.143188	0.021167	-0.14949	-0.161187	0.089682	-0.112374	0.002806	1
1997											
	Owner	1	-0.073921	-0.029867	**0.151471**	0.019965	**0.101846**	0.033213	**0.131959**	**-0.297135**	0.056361
	adv	-0.073921	1	-0.060761	**0.25627**	-0.020104	**-0.176633**	**0.149679**	-0.071717	0.011747	**0.107277**
	salegr	-0.029867	-0.060761	1	0.065169	0.055839	-0.010484	0.049739	-0.044398	**0.122888**	0.007451
	prof	0.151471	0.25627	0.065169	1	0.044112	0.075738	**0.258148**	0.028916	**-0.103568**	**0.123659**
	de	0.019965	-0.020104	0.055839	0.044112	1	**0.483767**	**-0.202519**	-0.086514	**-0.156991**	**-0.124457**
	q	0.101846	-0.176633	-0.010484	0.075738	0.483767	1	**-0.204496**	0.056862	**-0.184672**	**-0.17724**
	roe	0.033213	0.149679	0.049739	0.258148	-0.202519	-0.204496	1	-0.016231	0.017302	**0.275211**
	beta	0.131959	-0.071717	-0.044398	0.028916	-0.086514	0.056862	-0.016231	1	0.014505	-0.085375
	sh_to	-0.297135	0.011747	0.122888	-0.103568	-0.156991	-0.184672	0.017302	0.014505	1	**-0.134057**
	macap	0.056361	0.107277	0.007451	0.123659	-0.124457	-0.17724	0.275211	-0.085375	-0.134057	1
1998											
	owner	1	-0.020809	**0.105022**	**0.133791**	0.063832	0.066757	**0.161551**	0.073564	**-0.284899**	0.135349
	adv	-0.020809	1	-0.092681	**0.232449**	-0.04057	-0.145989	0.078028	0.027963	0.062118	0.096978
	salegr	0.105022	-0.092681	1	**0.219591**	**0.103496**	0.060275	**0.207664**	0.019092	-0.02176	0.053372
	prof	0.133791	0.232449	0.219591	1	-0.088766	-0.044728	**0.195301**	-0.017436	-0.072362	0.082249
	de	0.063832	-0.04057	0.103496	-0.088766	1	**0.504321**	**-0.186432**	0.071262	-0.054047	-0.091608
	q	0.066757	-0.145989	0.060275	-0.044728	0.504321	1	**-0.190659**	**0.125139**	**-0.172646**	-0.09357
	roe	0.161551	0.078028	0.207664	0.195301	-0.186432	-0.190659	1	-0.058828	**-0.24152**	**0.256927**
	beta	0.073564	0.027963	0.019092	-0.017436	0.071262	0.125139	-0.058828	1	**0.153984**	-0.080425
	sh_to	-0.284899	0.062118	-0.02176	-0.072362	-0.054047	-0.172646	-0.24152	0.153984	1	**-0.205097**
	macap	0.135349	0.096978	0.053372	0.082249	-0.091608	-0.09357	0.256927	-0.080425	-0.205097	1

Table 3. Correlation among ownership and other control variables around the Korean crisis period, 1996-1998

Panel B. Foreign Investor ownership

		forgn	adv	salegr	prof	de	q	roe	beta	sh_to	macap
1996											
	forgn	1	0.062384	0.051088	**0.112793**	**-0.104501**	0.015761	**0.126435**	-0.061572	-0.015798	**0.18069**
	adv	0.062384	1	-0.04309	**0.202716**	0.003513	**-0.200096**	0.043808	0.014367	0.010253	0.049477
	salegr	0.051088	-0.04309	1	**0.18081**	-0.069623	0.067805	**0.279184**	0.028675	0.005525	**0.217145**
	prof	0.112793	0.202716	0.18081	1	**-0.129135**	-0.075334	**0.312325**	0.094393	0.039042	0.043643
	de	-0.104501	0.003513	-0.069623	-0.129135	1	**0.447131**	**-0.714157**	-0.013293	-0.040839	**-0.169831**
	q	0.015761	-0.200096	0.067805	-0.075334	0.447131	1	**-0.220557**	0.036719	**-0.103787**	**-0.185808**
	roe	0.126435	0.043808	0.279184	0.312325	-0.714157	-0.220557	1	0.052456	-0.054201	**0.144183**
	beta	-0.061572	0.014367	0.028675	0.094393	-0.013293	0.036719	0.052456	1	0.069039	**-0.119063**
	sh_to	-0.015798	0.010253	0.005525	0.039042	-0.040839	-0.103787	-0.054201	0.069039	1	0.014395
	macap	0.18069	0.049477	0.217145	0.043643	-0.169831	-0.185808	0.144183	-0.119063	0.014395	1
1997											
	forgn	1	-0.013325	-0.00297	**0.171031**	-0.066133	0.055341	**0.206968**	-0.038113	**-0.269662**	**0.355819**
	adv	-0.013325	1	-0.059079	**0.232912**	-0.047949	**-0.174152**	**0.151535**	-0.069741	0.025755	**0.111896**
	salegr	-0.00297	-0.059079	1	0.043645	0.0514	-0.014098	0.03922	-0.050322	**0.165056**	0.00569
	prof	0.171031	0.232912	0.043645	1	0.008928	0.058221	**0.306241**	0.018355	-0.070201	**0.126149**
	de	-0.066133	-0.047949	0.0514	0.008928	1	**0.454973**	**-0.170028**	-0.082139	**-0.121434**	**-0.130927**
	q	0.055341	-0.174152	-0.014098	0.058221	0.454973	1	**-0.172064**	0.079743	**-0.151854**	**-0.187196**
	roe	0.206968	0.151535	0.03922	0.306241	-0.170028	-0.172064	1	-0.061752	0.00639	**0.324518**
	beta	-0.038113	-0.069741	-0.050322	0.018355	-0.082139	0.079743	-0.061752	1	-0.012764	-0.09481
	sh_to	-0.269662	0.025755	0.165056	-0.070201	-0.121434	-0.151854	0.00639	-0.012764	1	**-0.136295**
	macap	0.355819	0.111896	0.00569	0.126149	-0.130927	-0.187196	0.324518	-0.09481	-0.136295	1
1998											
	forgn	1	0.072205	0.012533	**0.158284**	-0.090734	-0.016155	**0.163922**	-0.052881	**-0.315236**	**0.230749**
	adv	0.072205	1	-0.11213	**0.179199**	-0.006706	-0.016932	0.065427	0.022939	-0.003277	**0.103796**
	salegr	0.012533	-0.11213	1	**0.226657**	**0.138936**	0.074952	**0.205203**	0.028359	0.095795	0.021436
	prof	0.158284	0.179199	0.226657	1	**-0.104611**	-0.007593	**0.192665**	-0.013474	-0.077273	0.076908
	de	-0.090734	-0.006706	0.138936	-0.104611	1	**0.499455**	**-0.172137**	0.030693	-0.046147	-0.079292
	q	-0.016155	-0.016932	0.074952	-0.007593	0.499455	1	**-0.180148**	**0.100089**	**-0.167697**	-0.08177
	roe	0.163922	0.065427	0.205203	0.192665	-0.172137	-0.180148	1	-0.052064	**-0.262549**	**0.288671**
	beta	-0.052881	0.022939	0.028359	-0.013474	0.030693	0.100089	-0.052064	1	**0.130667**	-0.071787
	sh_to	-0.315236	-0.003277	0.095795	-0.077273	-0.046147	-0.167697	-0.262549	0.130667	1	**-0.198873**
	macap	0.230749	0.103796	0.021436	0.076908	-0.079292	-0.08177	0.288671	-0.071787	-0.198873	1

TABLE 4. Regression Results when ROE and Q are regressed against domestic institutional ownership including several control variables. T-values are in the parentheses.

	1995		1996		1997		1998	
	ROE	Q	ROE	Q	ROE	Q	ROE	Q
Constant	-41.201***	0.573***	-10.60	0.8766***	-40.71***	0.7519***	-92.15***	0.879***
	(-2.27)	(4.72)	(-0.542)	(7.4787)	(-3.918)	(9.028)	(-6.060)	(8.077)
Ownership	0.172*	0.0017***	0.312***	0.0025***	0.0077	0.0018**	0.310*	0.00193
	(1.725)	(2.488)	(2.73)	(3.382)	(0.080)	(2.065)	(1.72)	(1.5003)
Sales Growth	0.1184*	0.0002	0.341***	0.0004	0.026	0.0001	0.185***	0.0004
	(1.86)	(0.494)	(5.44)	(1.0750)	(1.088)	(0.396)	(3.392)	(0.983)
Debt/Equity	-0.025***	0.00026***	-0.047***	0.00001***	-0.0077**	0.00003***	-0.014*	0.00012***
	(-6.7)	(12.07)	(-10.855)	(3.410)	(-2.278)	(4.559)	(-1842)	(5.135)
Beta	4.23	0.018	1.5960	0.0078	-1.341	0.016	-0.4889	0.0393
	(1.45)	(0.900)	(0.4477)	(0.336)	(-0.407)	(0.5428)	(-0.1434)	(1.48)
Log of Mcap	4.484***	-0.039***	1.386	-0.0612***	5.1237***	-0.0543***	10.024***	-0.0738***
	(2.54)	(-3.30)	(0.749)	(-5.405)	(5.052)	(-6.450)	(6.607)	(-6.631)
N	462	470	448	459	382	420	319	379
Adj. R^2	0.13	0.273	0.3	0.114	0.106	0.128	0.198	0.208

***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

Table 5. Regression Results when ROE and Q are regressed against foreign ownership including several control variables. T-values are in the parentheses.

	1995		1996		1997		1998	
	ROE	Q	ROE	Q	ROE	Q	ROE	Q
Constant	-58.68***	0.546***	15.781	1.0422***	-48.19***	0.591***	-85.352***	0.690***
	(-3.093)	(3.852)	(0.960)	(7.814)	(-4.328)	(5.8628)	(-5.032)	(4.996)
Ownership	0.196	0.0026*	0.171	0.0020*	0.186	0.0040***	0.042601	0.001174
	(1.089)	(1.88)	(1.336)	(1.7805)	(1.39)	(3.14)	(0.4026)	(1.289)
Sales Growth	0.120	0.0005	0.376***	0.0010*	0.0154	-0.00002	0.168***	0.00089
	(0.760)	(0.623)	(6.39)	(1.84)	(0.667)	(-0.108)	(3.05)	(0.833)
Debt/Equity	-0.0162***	0.0003***	-0.0712***	0.00001***	-0.0041	0.00022***	-0.0119*	0.0003***
	(-3.55)	(10.922)	(-18.627)	(2.767)	(-1.25)	(7.4765)	(-1.654)	(7.022)
Beta	6.047**	0.027	3.27	0.0016	-2.1064	0.045628	-0.144	0.03386
	(2.043)	(1.20)	(1.03)	(0.059)	(-0.60)	(1.497)	(-0.0421)	(1.1985)
Log of Mcap	6.170***	-0.037***	-0.393	-0.075***	5.728***	-0.046***	9.436***	-0.058***
	(3.312)	(-2.67)	(-0.249)	(-5.828)	(5.2072)	(-4.670)	(5.6022)	(-4.217)
N	381	388	352	358	284	300	236	261
Adj. R^2	0.097	0.265	0.557	0.115	0.147	0.254	0.163	0.274

***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

Table 6. Regression between Ownership and Firm Characteristics for 1996 -1998. D (F) stands for domestic (foreign) institutional investors.

	1995D	1995 F	1996D	1996 F	1997D	1997 F	1998D	1998 F
Constant	-23.96***	-27.169***	3.6956	-26.352***	7.558	-22.06***	-5.377	-26.54**
	(-2.72)	(-4.88)	(0.4401)	(-3.578)	(1.0827)	(-3.194)	(-0.985)	(-2.160)
LNMAT	3.966***	3.595***	0.9153	3.267***	0.598	3.317***	1.4045***	4.077***
	(4.756)	(6.79)	(1.166)	(4.743)	(0.900)	(5.073)	(2.684)	(3.484)
Q	5.475*	3.181*	10.284***	6.180**	4.382	7.589**	0.7469	3.117
	(1.683)	(1.60)	(3.374)	(2.12)	(1.1560	(2.145)	(0.3134)	(0.614)
ROE	0.032	0.011	0.035	0.005	-0.015	0.034	0.0115	-0.019
	(1.395)	(0.745)	(1.735)	(0.1994)	(-0.483)	(0.019)	(0.642)	(-0.4394)
BETA	-0.759	-2.927***	0.6758	-0.829	3.847**	-1.560	2.552***	0.416
	(-0.541)	(-3.464)	(0.438)	(-0.585)	(1.926)	(-0.837)	(2.391)	(0.1896)
Debt/Equity	0.0008	-0.0017	0.0008	-0.0013	-0.0005	-0.0023	0.0038	-0.004
	(0.351)	(-1.087)	(0.3347)	(-0.487)	(-0.236)	(-1.359)	(1.463)	(-0.774)
SALEGR	0.078***	0.0297	0.0042	-0.013	-0.0012	-0.003	0.0005	-0.008
	(2.512)	(1.53)	(0.1555)	(-0.468)	(-0.096)	(-0.278)	(0.028)	(-0.226)
PROFIT	0.190***	0.0519	0.175**	0.108*	0.1326	0.094	0.075*	0.127
	(2.373)	(1.09)	(2.377)	(1.747)	(1.154)	(0.839)	(1.643)	(1.353)
Advertising	-0.412*	0.10	-0.572**	0.093	-0.4315**	-0.211	-0.099	0.31623
	(-1.73)	(0.675)	(-2.452)	(0.426)	(-1.927)	(-1.013)	(-0.466)	(0.6423)
Share Turnover			-0.0007	0.0002	-0.012***	-0.011***	-0.006***	-0.014***
			(-0.0122)	(0.08)	(-4.027)	(-3.555)	(-4.054)	(-3.647)
Globalization	0.0046	0.0172	-0.0093	0.0095	0.0176	0.049**	0.0202	0.029
	(0.223)	(1.401)	(-0.465)	(0.529)	(0.757)	(2.190)	(1.405)	(0.9278)
N	451	367	422	331	264	202	318	228
Adj. R^2	0.086	0.168	0.046	0.071	0.101	0.259	0.12	0.141

***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

Comments on "Ownership Structure and the Roles of Institutional and Foreign Investors: The Korean Case"

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The paper attempts to investigate the relationship between ownership structure and firm performance using the firm-level data over the period of 1995-1998 in Korea. From the year-by-year cross-section regressions, the authors find that the domestic institutional/foreign ownership is positively correlated with firm performance. Then, the authors argue that the estimation results suggest an efficient monitoring role of institutional/foreign investors. Although I believe the paper is on a very interesting and important topic, I have some difficulties to find sufficient evidence from current version of the paper. I hope that my comments help improve the paper.

First, the authors may want to investigate the post-crisis sample period because there existed regulations on foreign ownership during the pre-crisis sample period (1995-1998) examined in the paper. Foreign ownership was limited to 10% in 1992 and then the ceiling was subsequently raised to 15% in July 1995, 20% in October 1996, 26% in November 1997, and 55% at the end of 1997. Finally, the Korean stock market was completely opened in May 1998. Thus, in the pre-crisis period, foreign investors could not raise the ownership above the regulated level. In fact, existing papers report different results for different sample periods. For example, Park, Shin, and Choi (2004) find that firm value is positively correlated with foreign ownership over the sample period of 1992-2001. In contrast, Cho (2005) fails to find a significant contemporaneous relationship in the period of 1999-2004.

Second, the paper needs more careful discussions/interpretations on the different results between two types of investors: domestic institutional investors and foreign investors. Previous literature suggests asymmetric information and/or investor sophistication as a distinction between two types of investors, but it is not clear why we should expect and how we can explain that foreign investors are different from domestic institutional investors in these contexts. In addition, the estimation equation needs to control for the ownership of insiders or largest shareholders.

Third, the paper correctly points out that the regressions could suffer from endogeneity problems. It is true that, theoretically, higher foreign ownership can potentially increase the firm value and that we may have some anecdotal evidence for positive role of foreign investors. Nevertheless, we should be careful in the interpretation of the empirical results since the results do not necessarily imply causal relations. We should note that the empirical results are also consistent with an alternative explanation that domestic institutional/foreign investors simply invest in good firms since they are more sophisticated investors than domestic individual investors. If this is the case, higher ownership of domestic institutional/foreign investors should be correlated with higher market price of stocks. Indeed, the authors find that the correlation between the ownership structure and Tobin's q (which is directly affected by market price) is stronger than the correlation between the ownership structure and ROE (which is a book value).

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CHAPTER 5-2

Characterizing Exchange Rate Policy in East Asia: A Reconsideration

by

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Abstract

Frankel and Wei (1994) developed and popularized a method for uncovering the implicit weights assigned to currencies constituting a currency basket. This technique has been applied to the East Asian countries and resulted in the characterization of the region as a "dollar bloc". To better understand medium to long term exchange rate policy in East Asia, we extend the methodology in three dimensions: replace nominal exchange rates with real exchange rates; include regional competitive pressure; and employ a VAR model to overcome simultaneity bias. With these modifications, we confirm that the role of the US dollar is prominent even beyond the short term. However, there is also strong evidence that the East Asian countries exercise a fair degree of flexibility in real exchange rate management before the crisis. The findings for the post-crisis period suggest that exchange rate regimes have become more diverse, with greater benchmarking by the crisis countries (except Malaysia) towards regional competitors' currencies including the yen.

JEL Classification: F33, F41

Key Words: real exchange rate management, basket peg, regional competitive pressure

I. Introduction

The choice of exchange rate regime is a perennial issue in international finance. Indeed, the frequent occurrences of financial crises and speculative attacks on the adjustable peg system underscore the need for a judicious choice of a country's exchange rate regime. Various East Asian countries such as China, Korea, Malaysia, Thailand and Singapore are known to have ever pegged to or are currently targeting broad baskets of currencies,[1] not least because of their geographically diversified trade patterns. Under a basket peg system, the weights assigned to various currencies are usually not publicly announced and often subject to manipulation. In a seminal paper, Frankel and Wei (1994) developed and popularized a method of uncovering the implicit weights assigned to major currencies that constitute the currency basket. This regression method has been applied to the East Asian countries and the weight assigned to the US dollar is found to be way above that for the yen. As a result, the region has been characterized as a "dollar bloc" rather than a "yen bloc".

However, such *de facto* pegging of the regional currencies to the US dollar is blamed by some for contributing to the 1997 financial crisis by inviting excessive capital inflows and moral hazard problems. (Frankel, 2003) Consequently, many economists have called for greater flexibility in the exchange rate movement of regional currencies. (See, inter alia, Mishkin (1999) and Fischer (2001).) While nominal exchange rates are more flexible in the immediate aftermath of the crisis, the variability of their fluctuations has by now diminished to the pre-crisis level. According to McKinnon and Schnabl (2004) many East Asian countries have returned to a dollar peg system, termed "the East Asian Dollar Standard". We note that the empirical evidence provided in both McKinnon and Schnabl (2004) and Frankel and Wei (1993) are obtained using high frequency data such as daily or weekly nominal exchange rates series. As such, their findings may not adequately describe longer term exchange rate policy. Questions remain as to whether the East Asian economies have adopted the dollar peg system as a medium to long-term real exchange rate policy and whether any shift in exchange rate policy has occurred following the crisis.

This paper attempts to answer these questions by extending the Frankel and Wei methodology in the following three dimensions. First, we focus on real exchange rates instead of nominal exchange rates. The former takes into account potential differences in inflation across countries and thus, has more direct relevance to exchange rate policy over the longer-term horizon. Second, in addition to the G3 currencies, we include in the currency basket a measure that captures the competitive pressure in the third market from regional neighbors. We maintain that the specification of the model should include regional competitors' currencies in view of the export-orientated nature of East Asian economies and the real specter of competitive devaluation within the region. Third, in order to overcome simultaneity bias, we replace the regression model by a vector autoregressive (VAR) model that allows for endogenous interactions among the exchange rate variables. The resulting model for real exchange rate determination in East Asia can be viewed as a multivariate generalization of the purchasing power parity model

This model is applied to monthly data of the following nine countries: China, Indonesia, Korea, Malaysia, the Philippines, Singapore, Taiwan, Thailand, and Hong Kong. By assessing the relative sensitivities of these regional currencies to structural

[1] See Tan (2003) for a classification of the exchange rate arrangements in East Asia.

shocks to the US dollar, yen, regional competitors' and home currencies, we identify the exchange rate policy as currently practiced in East Asia. To anticipate the main findings of the paper, we confirm that the US dollar plays a dominant role even in longer term exchange rate policy. However, during the pre-crisis period, each of these East Asian countries (except Hong Kong) possesses a substantial amount of flexibility in its real exchange rate management regardless of the degree of commitment to nominal exchange rate stability. By comparison, the real exchange rate regimes in the region are more diverse post-crisis. At one extreme, countries like China, Malaysia, and Hong Kong adopt a rigid dollar peg; at the other, the crisis countries of Indonesia, Korea, Philippines and Thailand retain a greater degree of monetary policy autonomy as well as increase their benchmarking towards the region including Japan.

The rest of this paper proceeds as follows: the next section discusses the deficiencies in the Frankel-Wei regression model. Section 3 describes the econometric methodology for building the real exchange rate determination model. Empirical results on real exchange rate dynamics are discussed in Section 4. Section 5 ends with some concluding remarks.

II. The Frankel-Wei Regression Model

To uncover the composition of weights given to the currencies in a currency basket, Frankel and Wei (1994) estimate regressions in the form of equation (1).

$$\Delta\tilde{e}_t^i = \gamma + \delta_{US}\Delta\tilde{e}_t^{US} + \delta_J\Delta\tilde{e}_t^J + \delta_G\Delta\tilde{e}_t^G + \varepsilon_t \qquad (1)$$

where the $\tilde{e}$ terms denote the value of each currency in terms of the Swiss franc which is used as the numeraire currency. The superscripts *i, US, J and G* denote an East Asian country, the US, Japan and Germany respectively. Given the way the exchange rate is defined, an increase in $\tilde{e}$ denotes a depreciation of that currency against the Swiss franc. In this regression, the δ_i coefficients are considered to represent the weights of the respective currencies in the basket. Applying this regression to East Asian countries yields coefficients on the dollar (δ_{US}) that are close to one while those on the yen (δ_J) and the German mark (δ_G) are small and insignificant in most cases. Based on this finding, Frankel and Wei (1994) conclude that the East Asian countries, in their actual exchange rate policy making, are a dollar bloc. More recent estimates reported in McKinnon and Schnabl (2004) basically show the same relationship. McKinnon (2001) terms such mutual exchange rate stabilization in the region "The East Asian Dollar Standard".

While this technique seems reasonable as a description of high-frequency or very short term exchange rate policy, equation (1) misses two important factors that are crucial for the understanding of medium to long-term exchange rate policy in East Asia. First, the export-led growth policy in East Asia dictates the need for these economies to maintain trade competitiveness. (See, inter alia, Glick and Rose (1999) and Williamson (2000).) Hence, stabilizing the nominal exchange rate may not be a suitable policy goal over a longer time period, particularly when the country's domestic inflation rates are significantly different from those of its competitors. Rather, the linkage among the currencies has to be specified in real terms for the model to be useful beyond the short-run.

The second deficiency is that the regression model does not incorporate regional competitive pressure. This is a serious omission in view of the intense competition amongst East Asian countries, which in turn can be explained by two key developments.

First, the spread of regional production networks means firms are increasingly aware of the potential cost shifts facing their particular industry. Second, the integration of China into the world economy continues to exert downward pressure on the world market prices of labor intensive manufactures. This pressure results in "knife-edge" comparative advantage (Bhagwati, 1997) whereby small variation in costs could lead large shifts in competitive advantage. Going forward, as China's exports move up the value-added chain, trade patterns of China and other East Asian countries are likely to evolve to become even more competitive, see IMF(2004).

Along with this greater competitive pressure, there is also a rising intensity in intra-East Asian trade flows. According to Table 1, by early 1990s, over 40 percent of East Asia's exports and imports are with countries of the same region. It follows that intra-regional exchange rate stability can be considered to be at least as important as the stability of the exchange rate vis-à-vis major currencies.

Table 1. Intraregional Merchandise Trade within East Asia

(as share of group total)

Year	80	85	90	96	97	98	99	00	01	02	03
Imports	33.1	38.0	39.1	45.3	45.8	47.1	47.9	49.1	47.8	49.5	50.4
Exports	33.7	33.1	36.5	45.8	44.8	42.7	40.1	42.7	43.6	45.0	45.9

Source: IMF, Direction of Trade Statistics, 2004 as reported in Chow et al (2005).

In this paper, we introduce a regional competitor currency (RC) term $\tilde{e}_t^{RC}$ to capture the competitive pressure from neighboring countries. We construct the $\tilde{e}_t^{RC}$ term for each country as the trade-weighted average of the currency of its top four trading partners in the region. In constructing the country weights, four most important trading partners within the region (excluding Japan) are chosen based on the bilateral exports and imports trade data.[2] After all, Williamson (2000) has shown through the use of export similarity indices, direction of trade statistics and principal component analysis that these nine East Asian countries are close competitors to each other. For robustness check, we repeat the analyses in this paper with a regional competitor currency that uses Williamson's weights. The results turn out to be qualitatively similar to the ones obtained with our constructed $\tilde{e}_t^{RC}$ term.

As a preliminary analysis and for comparison with previous studies, we re-estimate equation (1) for each of nine afore-mentioned East Asian countries with and without the regional competitor currency (RC) term, $\tilde{e}_t^{RC}$. Without this term, the results are similar to those of Frankel and Wei (1994) and McKinnon and Schnabl (2004). To conserve space, we report in Table 2 only the results for the case which includes the regional competitor term, i.e. for the following equation:

$$\Delta\tilde{e}_t^i = \gamma + \delta_{US}\Delta\tilde{e}_t^{US} + \delta_J\Delta\tilde{e}_t^J + \delta_G\Delta\tilde{e}_t^G + \delta_{RC}\Delta\tilde{e}_t^{RC} + \varepsilon_t \qquad (2)$$

[2] These are obtained from Direction of Trade Statistics (IMF, CD-ROM, 2004). Taiwan data are from Aremos databank. Hong Kong is excluded among the four countries since its CPI data are available only from 1990:1.

Table 2. The Frankel-Wei Regression (with nominal ER)

	Est. Period	Dollar	Yen	Euro	RC	$\bar{R}^2$ ⊥	DW
China	WP	0.83**	-0.01	0.27**	-0.01	0.53	1.93
	I	0.56**	-0.05	0.54**	0.02	0.74	2.27
	II	0.72*	0.08	-0.02	0.15	0.55	1.45
	III	1.98*	0.07	0.59	-1.19	0.39	2.08
	IV	0.99**	0.00	0.00	-0.00	0.99	2.57
Indonesia	WP	-0.27	0.07	-0.12	1.18**	0.18	1.98
	I	0.75*	0.30+	-0.08	-0.45	0.18	1.89
	II	0.93*	-0.00	0.24	0.05	0.42	2.01
	III	0.96**	0.01	0.02	0.03	0.99	1.79
	IV	-1.56*	0.30	-0.91	2.12*	0.16	1.90
Korea	WP	0.80**	0.17**	0.06	0.11	0.57	1.91
	I	1.03**	0.10	0.05	-0.04	0.74	2.06
	II	0.89**	-0.05	-0.04	0.06	0.78	0.95
	III	0.93**	0.11**	-0.05	-0.00	0.96	1.64
	IV	0.60**	0.25*	0.75+	0.34+	0.59	1.78
Malaysia	WP	-0.21**	-0.10**	0.05	1.28**	0.81	2.25
	I	-0.35**	0.05	0.17**	1.20**	0.93	2.17
	II	0.29**	-0.02	0.02	0.61**	0.92	1.60
	III	0.54*	0.04	0.19+	0.41	0.89	1.81
	IV	0.61**	-0.08	0.06	0.43**	0.85	2.20
Philippines	WP	0.35**	-0.06	-0.01	0.76**	0.54	1.68
	I	0.80*	-0.05	0.03	0.17	0.41	0.81
	II	0.74+	0.06	-0.11	0.35	0.54	2.13
	III	0.77+	-0.05	0.28	0.32	0.76	1.88
	IV	-0.05	-0.01	0.02	0.95**	0.62	2.06
Singapore	WP	0.23**	0.10**	0.13**	0.51**	0.89	2.08
	I	-0.31**	-0.00	0.11**	1.12**	0.94	2.16
	II	0.16	0.08*	0.01	0.68**	0.91	2.01
	III	0.51**	0.12**	0.14*	0.24*	0.95	2.18
	IV	0.10	0.18**	0.23	0.58**	0.85	1.94
Taiwan	WP	0.80**	0.08**	-0.05	0.16**	0.92	1.45
	I	0.84**	0.04*	-0.10**	0.17**	0.98	1.40
	II	0.87**	0.02	-0.08	0.13+	0.92	1.38
	III	0.96**	0.08*	0.15+	-0.06	0.94	1.50
	IV	0.55**	0.12*	-0.05	0.39*	0.90	1.47
Thailand	WP	-0.15*	-0.06	-0.03	1.26**	0.73	2.03
	I	0.93**	-0.01	-0.02	0.09*	0.99	1.96
	II	0.75**	0.07	-0.00	0.09	0.78	2.01
	III	0.82**	0.11**	0.05**	0.01	0.99	2.15
	IV	-0.48*	-0.07	0.08	1.45**	0.72	2.01
Hong Kong	WP	0.99**	-0.00	-0.01	-0.00	0.99	2.58
	III	0.95**	0.01	-0.02	0.06**	0.98	2.13
	IV	0.82**	-0.06**	-0.05	0.19*	0.97	1.79

Note: A constant term is included in regression but not reported. "+", "*" and "**" refer to significance at 10, 5 and 1 percent, respectively. Estimation periods WP, I, II, III, and IV are the whole period, (1970:1-1979:12), (1980:1-1989:12), (1990:1-1997:5), and (1998:7-2003:12), respectively.

Focusing on the results for the overall sample period, we observe from Table 2 that the yen is insignificant in many countries. Even when the coefficient on the yen is significant, its magnitude is much smaller than that on the dollar. This suggests that, in terms of nominal exchange rate policy, East Asia is closer to a dollar bloc than a yen bloc. Interestingly, the inclusion of the regional competitor currency term in the regression significantly affects the estimation results. In more than half the cases—namely Indonesia, Malaysia, the Philippines, Singapore and Thailand—the regional competitor currency takes over the role of the US dollar. This suggests that the short-term exchange rate management in these countries is closely related to the actions taken by their regional competitors.[3]

For a clearer insight into the dynamics of exchange rate management over time, we split the overall sample period into four different sub-periods: the 1970s (Period I), the 1980 (Period II), the pre-crisis 1990s (Period III), and the post crisis (Period IV). The estimates for these sub-periods are also found in Table 2 and they reveal the variation of the coefficients over time.[4] It turns out that the coefficient on the dollar δ_{US} exhibits a general trend. For all countries, except Malaysia, δ_{US} increases from Period II, peaks in Period III and then decreases noticeably in Period IV. As for the coefficient on the yen δ_J , the latter increases from Period III to Period IV in such countries as Korea, Singapore and Taiwan but not in the other countries. By contrast, the coefficient on the regional competitor currency δ_{RC} , increases in every country except China in the post-crisis period.

These shifts in the coefficient estimates suggest systematic changes in the exchange rate policy in the region over the last three decades. First, the extent of pegging to the dollar in all countries increases in the decade leading up to the crisis between the 1980s and the 1990s. It is thus not surprising that dollar pegging hard or soft alike, have been cited as an important cause of the financial crisis. (Mishkin, 1999; Fischer, 2001) Second, the increase in the role of the yen in the post-crisis period seems to be limited to a small number of countries. Third and most interestingly, all East Asian countries appear to watch the movements of their neighbors' exchange rates with much greater interest and try to match them in the post-crisis period.

III. Modeling Real Exchange Rate Dynamics

One important caveat of the above regression is that the regional competitor currency variable may not be exogenous and hence, its coefficient may not be treated as the weight of the regional competitors in the currency basket. For instance, if the exchange rates of East Asian countries are simultaneously affected by shocks originating from the US or other countries, the correlations between the local exchange rate and the regional competitor exchange rate would be high, resulting in large δ_{RC} coefficients. However, the implications on exchange rate policy would be totally different. When an explanatory

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[3] It is interesting that the coefficient on EA is greater than one in Indonesia, Malaysia, and Thailand. They are particularly severely affected in the financial crisis relative to their EA competitors. Consequently, it appears that they over-adjust to changes in the EA competitors' exchange rate changes while responding to the dollar shocks in the negative direction. This observation reaffirms that the regression suffers from simultaneity bias, as discussed below.

[4] Esaka (2003) highlights the time-varying nature of these coefficients.

variable is determined simultaneously with the dependent variable, the former is generally correlated to the error term which leads to biased and inconsistent ordinary least squares (OLS) estimates. There is, therefore, a need to disentangle the simultaneity bias in regression equation (2).

In light of the endogeneity and mutual interactions of the variables, we propose using the following VAR model to estimate the relationships among the four real exchange rates series:[5]

$$\Delta r_t = \beta_0 + \sum_{k=1}^{p} \beta_k(L)\Delta r_{t-k} + \varepsilon_t \tag{3}$$

where the real exchange rate is given by $r_t^j = \tilde{e}_t^j - \tilde{p}_t^j$ and $\tilde{p}_t^j$ is the price level of country j relative to that of the numeraire country; $\Delta r_t = (\Delta r_t^{US}, \Delta r_t^{JP}, \Delta r_t^{RC}, \Delta r_t^{i})'$; $\beta_k(L)$ is a 4×4 matrix of lag polynomials, and β_0 is a vector of constants.

We employ a VAR model in differences instead of levels based on the unit root and cointegration tests results.[6] Without exception, the real exchange rate data series are found to be integrated of order one. Granted this, we checked for cointegration between the four variables using Johansen's tests and found that no cointegrating relationship exists amongst them except for the case of Indonesia. Thus, we model the first differences of the real exchange rate series as in equation (3). As for the number of lags (p) in the model, the Akaike Information Criterion (AIC) selects for the pre-crisis period, an optimal lag length 5 for all countries except Malaysia where 3 lags seem to work better.[7] For the post-crisis period, we use a common lag length 1 for all countries.[8]

The VAR model is estimated using monthly data for the period of 1970:1 - 2003:12 for the nine East Asian countries.[9] The consumer price index is used as the price level. All data are obtained from the IFS-CD ROM, except those for Taiwan which are extracted from *Aremos databank*. In view of the 1997 financial crises and associated structural breaks in the region, we divide the sample into the pre-crisis period (1970:1 – 1997:5) and the post-crisis period (1998:7 – 2003:12). Separate estimations for the two sample periods allow us to detect any shift in exchange rate policy that have might have occurred following the crisis.

IV. Empirical Results

The empirical results from the VAR model are reported in the form of variance decompositions (Table 3) and impulse responses (Figure 1). To assess the relative importance of shocks from the US dollar, the yen and the regional competitor currency as sources of domestic real exchange rate variation, we compute the variance

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[5] We omitted the Δr_t^G variable as it turns out to be insignificant in almost all cases.

[6] The results of unit root and cointegration tests are available upon request.

[7] In some cases, the AIC identifies a shorter lag length that does not adequately capture the underlying dynamics of the system. For valid post-estimation inferences, we increase these lag lengths to eliminate serial correlation in the residuals.

[8] The short optimal lag length in the post-crisis period is perhaps due to the shorter sample period.

[9] For Hong Kong, monthly price data are available from 1990:1.

decompositions for the home currency and regional competitor currency variables. Table 3 reports these variance decompositions that give the share of fluctuations in the real exchange for the home country (HX) and the regional competitors (RCX) induced by the four structural shocks. The variance decompositions are for 12-month forecast horizon, by which time both the RCX and HX forecast error decompositions due to the various disturbances have stabilized. Each column gives the percentage of forecast error variance due to innovations to the variable listed in the column, so that each row adds up to 100.

Table 3. Variance Decomposition

(VAR in differences with optimal lag length)

	ε^{US}	ε^{JP}	ε^{EA}	ε^{I}	ε^{US}	ε^{JP}	ε^{EA}	ε^{I}
		Pre-crisis				**Post-crisis**		
China								
RCX	77.2	3.9	18.0	0.9	55.7	16.9	24.5	2.9
HX	33.6	2.5	12.0	52.0	98.1	1.2	0.2	0.6
Indonesia								
RCX	71.0	5.5	23.5	0.0	80.8	12.5	6.6	0.0
HX	55.4	0.9	8.3	35.4	2.4	9.4	10.8	77.4
Korea								
RCX	64.3	2.3	33.2	0.2	63.2	11.5	25.3	0.0
HX	75.7	4.6	1.4	18.3	47.9	19.3	2.7	30.1
Malaysia								
RCX	70.5	1.9	26.7	0.9	85.8	7.6	6.5	0.1
HX	57.1	1.7	21.3	19.9	98.5	0.5	0.1	0.8
Philippines								
RCX	74.4	5.5	20.0	0.1	66.3	5.8	17.1	10.8
HX	68.2	0.4	11.3	20.1	38.3	9.6	16.0	36.1
Singapore								
RCX	71.3	5.4	21.7	1.6	87.6	4.7	5.8	1.9
HX	53.1	4.3	19.6	23.0	82.4	8.2	3.7	5.7
Taiwan								
RCX	59.2	4.6	35.7	0.5	91.2	6.6	1.8	0.4
HX	62.4	5.8	10.2	21.6	69.5	13.7	2.8	14.1
Thailand								
RCX	70.0	5.5	22.8	1.6	84.5	9.3	6.1	0.0
HX	72.3	4.3	6.9	16.5	50.6	9.8	12.3	27.3
Hong Kong								
RCX	45.9	1.4	51.2	1.5	60.4	1.3	37.7	0.6
HX	92.6	1.2	2.6	3.6	93.7	0.9	0.3	5.1

Note: Lag lengths are 3 and 5 for Malaysia and all other countries respectively for the pre-crisis period.
A common lag length 1 is adopted for all countries in the post-crisis period.

We first focus on the pre-crisis findings. As expected, the US dollar plays a dominant role for the home currency (HX). In the pre-crisis period, US dollar shocks explain more than half of the real exchange rate variations in all East Asian countries other than China. In sharp contrast, yen shocks matter little to domestic currency fluctuations. The proportion of the domestic exchange rate forecast error variance due to the yen is minimal, amounting to less than 6 percent in all countries. Indeed, the influence of the yen is smaller than that of the regional competitor currency in all cases except Korea. The role of regional competitor currency is particularly noticeable in Singapore and Malaysia, contributing around one-fifth of their home currency fluctuations.

It is interesting to note that country-specific shocks account for a significant proportion of variations in the domestic real exchange rate. The role of country-specific shocks is particularly high in China perhaps because the country has not been integrated into world trade for the substantial part of the pre-crisis period. Idiosyncrasy with the Indonesia's real exchange rate could be due to the nature of the country's trade as exporter of primary commodities. Country-specific shocks in the other countries are also far from negligible—they explain around 20 percent of the real exchange rate movements in all countries other than Hong Kong. It follows that the East Asian countries maintain a fair degree of flexibility in their real exchange rate management before the crisis.

The real exchange rate policies in the region are more varied following the crisis. US dollar shocks account for virtually all (over 90%) of the domestic exchange rate variations in China, Malaysia and Hong Kong. It is not surprising for US dollar disturbances to exert such a strong influence since all three countries maintain a rigid US dollar peg during the entire post-crisis period.10 The US dollar continues to play an important role for two other countries—Singapore and Taiwan—explaining more than two-thirds of their domestic currency fluctuations.

Interestingly, the real exchange rate determination for the crisis countries of Indonesia, Korea, the Philippines and Thailand turn out to be rather different. Compared to the pre-crisis period, country-specific shocks contribute more significantly to the real exchange rate movements of these countries after the crisis, suggesting that they now retain a greater degree of monetary policy autonomy. Similarly, the yen assumes greater explanatory power for these countries in the post-crisis period. In fact, the combined share of the forecast error variance for the home currency attributed to the yen shocks and regional competitor currency shocks is greater than 20% in each crisis country. This reflects an increase in benchmarking by these countries towards the region (including Japan) following the crisis.

Since the regional competitor currency shocks explain non-negligible fractions of domestic real exchange rates in some countries, we next investigate the key factors affecting regional competitor currency (RCX) fluctuations. It is clear from Table 3 that the real exchange rates of regional competitors are themselves heavily influenced by the US dollar in both sample periods. Nevertheless, a substantial part of these variations is due to its own shocks, particularly before the crisis. This indicates that the movements in the domestic real exchange rates are not fully explained by the US dollar, but can partially be attributed to the real exchange rates of regional competitors.

[10] The three currencies have been pegged to the US dollar at the current rate since January 1994, October 1983 and September 1998 for China, Hong Kong and Malaysia respectively.

Figure 1. Impulse responses for pre-crisis period

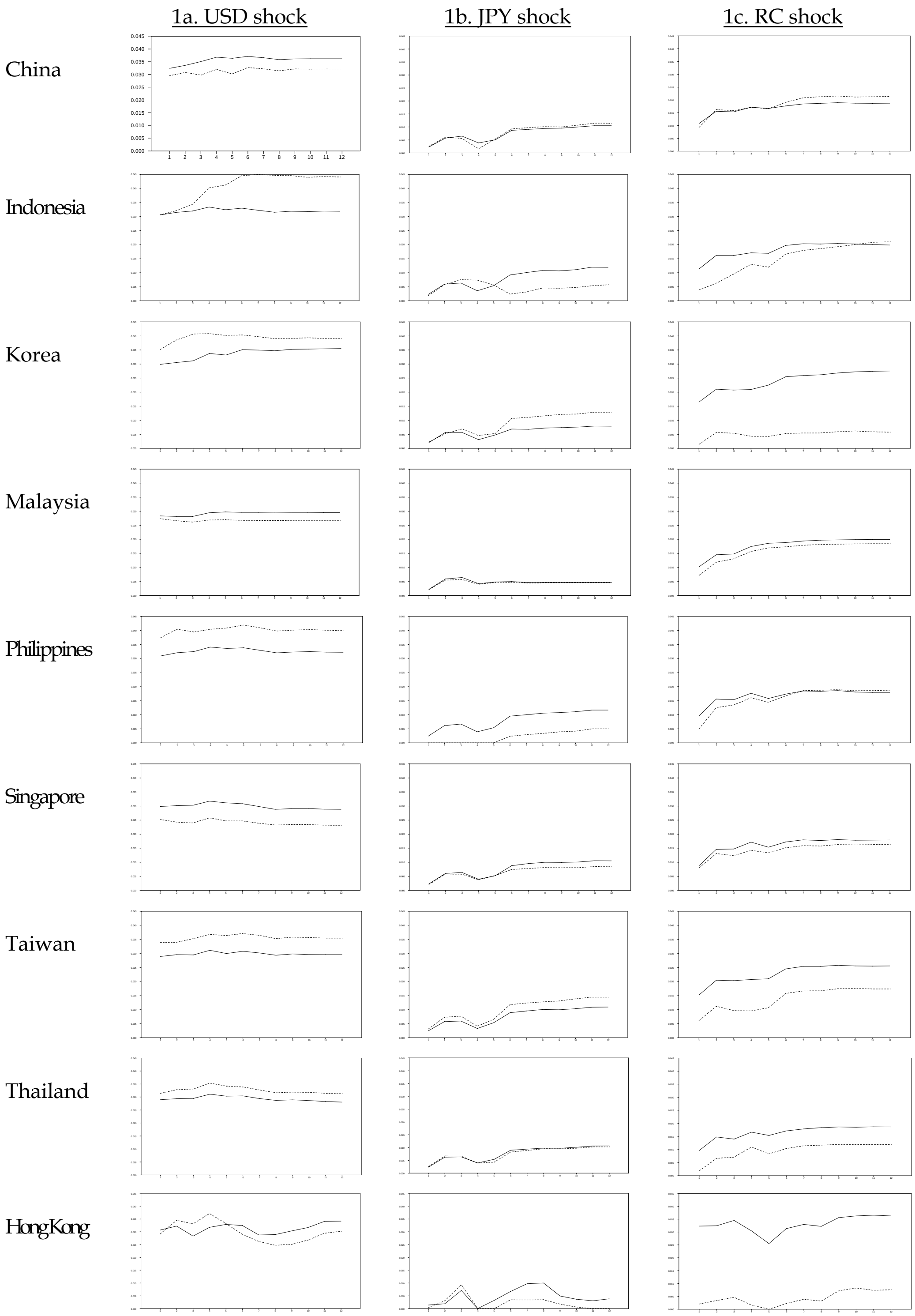
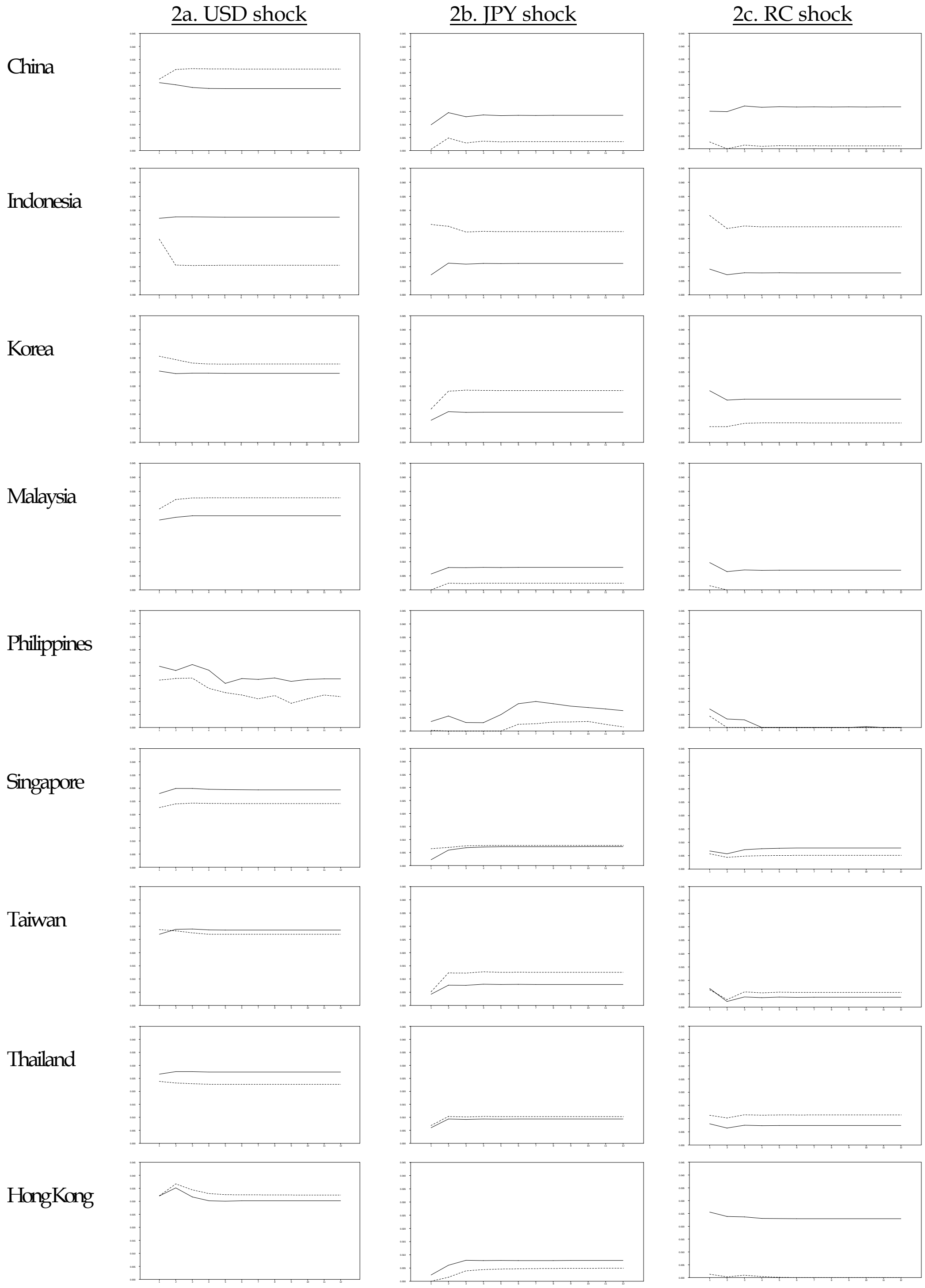


Figure 2. Impulse responses for post-crisis period



Panels 1a, 1b and 1c in Figure 1 show the responses of the home currency (HX) and the regional competitor currency (RCX) to a unit shock in the US dollar, the yen, and the regional competitor currency respectively during the pre-crisis period. The responses of HX are shown in bold lines while those of RCX are in light lines. Panels in Figure 2 display the corresponding impulse responses for the post-crisis period. The impulse responses are plotted in levels and extend to 12 months. For ease of comparison, impulse responses for all countries are drawn on the same scale.

Two features stand out clearly in Figures 1 and 2. First, shocks to the US dollar elicit rather different impulse responses compared with the two other shocks to the Japanese yen and regional competitor currency. Both HX and RCX are more responsive towards to innovations in the US dollar in both sample periods. This concurs with the variance decomposition results whereby US dollar shocks dominate yen and regional competitor currency shocks in determining home currency as well as regional competitor currency movements. In view of the widespread use of the US dollar in trade invoicing and reserve composition in East Asia, it is not surprising that the US dollar plays such a prominent role in regional real exchange rate management for both sample periods. Second, there is a striking consistency in the impulse response patterns of the home currency and regional competitor currency. With few exceptions, HX and RCX respond by similar magnitudes regardless of whether the shock stems from the US dollar, the yen or regional competitor currency, see Figures 1 and 2. A possible explanation for such co-movements is that the East Asian countries are keen to maintain their competitiveness vis-à-vis regional competitors.

In the pre-crisis period, the magnitude of responses to a shock in the regional competitor currency is smaller than those corresponding to a US dollar shock but greater than those corresponding to a yen shock, see Figure 1. This reflects the variance decomposition finding that the role of the yen in domestic exchange rate determination is smaller than that of the regional competitor currency before the crisis. However, Figure 2 shows that in the post-crisis period, with the lone exception of Hong Kong, both the yen shock and the regional competitor currency shock yield similar response magnitudes from HX. This suggests that in their exchange rate policy making East Asian countries target both Japan and other competitors in the region.

V. Conclusion

In this paper, we study the medium-term to long-term exchange rate policy in East Asian countries by building up on the method developed by Frankel and Wei (1994) in three important directions. We consider real exchange rate in place of nominal exchange rate, include regional competitive pressure, and employ a VAR model in view of the endogenous interaction among the real exchange rates of the US, Japan, East Asian competitors and the local currency.

The key findings of this paper can be summarized as follows. We confirm that the US dollar plays a prominent role for real exchange rate determination in the region even beyond the short-run. Concomitantly, the yen plays a minimal role and is in fact, of less importance than regional competitors' currencies before the crisis. Thus, the region can hardly be viewed as a yen bloc as proposed by Kwan (2001), Ogawa and Ito (2000), and others. However, all East Asian countries except Hong Kong maintain a sizable degree of independence in exchange rate policy making particularly during the pre-crisis period. Despite formal or informal pegs to the US dollar, each country appears to have adjusted its real exchange rate in response to the changing economic environment.

In comparison, the exchange rate regimes in the region seem more varied after the crisis. China and Malaysia have joined Hong Kong in adopting a fixed dollar exchange rate. By contrast, the crisis countries of Indonesia, Korea, the Philippines and Thailand have chosen greater flexibility in real exchange rate management. Along with this change, the role of the US dollar declines while that for the yen increases for these countries. Further, there is evidence that these countries have increased benchmarking their regional neighbors including Japan.

With such diverse exchange rate regimes, policy makers in East Asia are confronted by the transfer of swings in major currencies into regional bilateral exchange rates. This alters relative trade competitiveness which, being close competitors, raises the specter of competitive devaluation. It follows that there is a need to stabilize intra-regional exchange rates through regional exchange rate cooperation. Besides, the ongoing trade shifts from outside the region towards more intra-regional trade highlight the need for stability in intra-regional exchange rates. Nevertheless, the fluidity of the economic environment in East Asia such as the economic emergence of China, calls for a flexible regime that provides for orderly adjustments, Hefeker and Nabor (2005). In this regard, we concur with Wyplosz (2001) and Wilson (2004) that an EMS-type system that allows for regular realignments and that uses an Asian currency unit—a composite of regional currencies and the yen—for benchmarking could well be a way forward for future exchange rate management in East Asia.

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Comments on "Characterizing Exchange Rate Policy in East Asia: A Reconsideration"

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The Asian crisis in 1997 prompted the question of an exchange rate regime more seriously than before, since one of the root causes of the crisis was pointed out to be to the rigid exchange rate arrangement. Recently, serious concerns about an exchange rate system in East Asia have been raised only recently, due to the heterogeneity of exchange rate regimes in the region. The center of the debate lies in whether emerging market economies with a weak financial system and increasing capital mobility will be able to maintain an intermediate exchange regime in the long run. According to the bipolar view of exchange rate arrangements, countries should generally be moving to one extreme or the other, as any intermediate regimes are nonviable due to increasing capital mobility. On one end of the spectrum lies a perfectly flexible exchange rate regime, and on the other lies a hard peg or a credible peg, such as a currency board or dollarization. Any other exchange rate regime between the two extremes would be inherently unstable and crisis-prone (Eichengreen 1994; Fisher 2001). Acknowledging this, crisis-hit countries in East Asia have adopted more flexible exchange rate regimes since 1997. However, Calvo and Reinhart (2002) argue that while countries say they mostly allow their exchange rate to float, this is not true in practice. There seems to be an epidemic case of a fear of floating. Emerging market economies generally face several difficulties with the two extreme regimes, and have a tendency toward intermediate regimes due to a weak financial system, fiscal instability, currency substitution and liability dollarization, and vulnerability to sudden stops of capital flows (Calvo and Mishkin 2003).

For emerging East Asian countries, there has been an increase in the number of countries in East Asia that have adopted more flexible exchange rate regimes since the Asian crisis. However, there have also been differences among the floaters in the way they manage exchange rates. It seems that East Asian countries tend to move in the direction of relatively inflexible exchange rates and freer capital movements. In the spectrum of exchange rate arrangements, the choices of exchange rate regimes in East Asia are limited. Before the Asian crisis, most currencies in East Asia were generally pegged to the US dollar with different degrees of fixity. However, the Asian crisis produced diversified exchange rate regimes in East Asia. After the Asian crisis in 1997, crisis countries chose freer-floating exchange regimes and implemented capital and foreign exchange market liberalization. However, some argued that when the crisis subsided, some countries moved toward a rigid pegged system due to difficulties in maintaining a floating exchange rate regime, known as a fear of floating. Nevertheless, the current exchange rate regimes in East Asia are different from those in the pre-crisis era. Various exchange arrangements co-exist in the region, from a hard peg (currency board) in Hong-Kong, a fixed regime in China and Malaysia, relatively flexible regimes in Korea, Thailand, and Indonesia, to mostly free-floating in Japan. This section will analyze the stylized facts on exchange-rate related issues in East Asia, especially before and after the Asian crisis.

Against this background, it is important to identify the de-facto exchange rate arrangement in East Asia in order to evaluate the stability and effectiveness of the exchange rate regimes in the region. Recently, East Asia policy makers and academia heavily discussed the coordination of exchange rate policy in the region. In particular, under the ASEAN+3 policy dialogue, Asian Currency Unit has been heavily discussed. Furthermore China' s new exchange rate managements provoke many interesting macro-economic policy coordination issues which stem from the due course of rebalancing the global imbalance. This paper sheds a light on the issue of exchange rate arrangement in East Asia.

In this regard, this paper can contribute to identify the current status for the issue. This paper contributes to the issue by extending the methodology of Frankel and Wei. First the paper aims to eliminate simultaneity bias by utilizing VAR model, and including includes competitive devaluation endogenous variable (eRC). Major conclusion comes up to the empirical findings. First, the paper finds that the US dollar is still a major currency in the region. Second, East Asia increases exchange rates flexibility after the crisis, and finally, East Asia exercises a fair degree of flexibility in real exchange rate management before the crisis. I agree with the authors in general, but the following comments are to clarify the author's propositions and suggestions.

First, it is interest that if the empirical estimation use high frequency data, the coefficient of the U.S dollar increase. The authors should try estimate the equation (1) or (2) with different frequency of exchange rate data to confirm the general conclusion.

Second, according to the authors' estimation, there is a structural break before and after the crisis, but it is a little bit suspicious that a relative flexibility before the crisis. Even if variance decomposition shows less US shock before the crisis, the shocks affects less domestic currency, but more other macroeconomic variables such as interest rates and monetary bases. Therefore, it seems that the VAR model should include other macroeconomic variables such as interest rates and monetary bases

Third, there is a possibility of misspecification of the VAR structure. If the structural shocks such as the US shock and the regional currency shock have contemporaneous effects, then impulse function analysis and variance decomposition may be misinterpreted. Therefore it is better to examine the correlation of the U.S shock and the regional currency shock in the VAR specification.

CHAPTER 6-1

Measurements of Sectoral Shifts: Dispersion and Skewness

by

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Abstract

Since Lilien (1982) proposed the cross-sectional dispersion of sectoral shocks as a measure of sectoral shifts it has been the most common measure used in the literature. This paper presents numerical examples that clearly illustrate the importance of skewness when sectoral shocks have an asymmetric distribution. We introduce the empirical measure of skewness into the unemployment rate equation and test the sectoral shifts hypothesis in the Lilien type models which generally support the hypothesis and in the Abraham and Katz (1984) type models which generally reject the hypothesis. Our empirical results show a strong support for the hypothesis in both models, and identify the source of the lack of support in the past studies of Abraham-Katz model.

I. Introduction

Since Friedman (1968) introduced the concept of natural rate of unemployment to argue against the feasibility of achieving full employment by monetary policy it has become a key concept in macroeconomic analysis of the unemployment and monetary policy debates[1]. Friedman's natural rate of unemployment is a general equilibrium level of unemployment in the labor and commodity markets, imbedding in them "market imperfections, stochastic variability in demands and supplies, the cost of gathering information about job vacancies and labor availabilities, the costs of mobility, and so on."

There is large volume of literature on the determination of the equilibrium unemployment. Earlier studies (Phelps (1968), Holt (1970), Mortensen (1970a, 1970b)

[1] The natural rate of unemployment is often defined as the lowest level of unemployment that will not begin accelerating inflation, i.e., the non-accelerating inflation rate of unemployment (NAIRU).

focused their analyses on the search equilibrium in the labor market where workers and/or employers search[2]. The commodity market was not considered in these studies. It was Lucas and Prescott (1974) who analyzed a model that includes the commodity market as well as labor search. They show the existence of a steady state aggregate unemployment in an economy where different markets (industries) are subject to idiosyncratic stochastic demand shocks and workers leave low-wage markets for high-wage markets. This frictional unemployment exists even in the absence of any aggregate shocks, and its level depends on the distribution of idiosyncratic shocks across the markets and on the size of each market.

Lilien (1982) exploits this empirical implication of the Lucas-Prescott model and derives an empirical relationship between the unemployment rate and a measure of sectoral shifts. In his model, sectoral shifts affect the aggregate layoff rates which in turn affect the unemployment rates through the flow identity of the change in unemployment rates. The aggregate layoff rate is defined as the right-censored mean of net hiring rates of individual firms, i.e., the average layoff rate of the firms with negative net hiring. Lilien approximates the aggregate layoff rate as a linear function of the mean and the dispersion of the distribution, and his simple numerical example illustrates a positive relationship between the aggregate layoff rate and the dispersion. He analyzed the annual data of 11 nonagricultural industries over the post war period, and found that the dispersion measure has a significant long-run effect on the unemployment rate, and that a significant portion of the cyclical variation in unemployment is due to sectoral shifts of labor demand[3].

A critical issue in the empirical test of the 'sectoral shifts hypothesis' is the proper identification of the sectoral shocks from which the dispersion measure is estimated. Lilien's initial estimate of the measure of sectoral shifts drew a heavy criticism. In particular, Abraham and Katz (1984) pointed out that the dispersion of employment growth rates and the change in the unemployment rate can be positively correlated even in the absence of sectoral shifts if "industries differ in their cyclical sensitivities and labor force adjustment costs are asymmetric such that an increase in employment costs more than a decline of equal magnitude." They proposed an alternative method to 'purge' all monetary and non-monetary aggregate effects on employment in the estimation of the actual impact of sectoral shifts. Their empirical results contradict Lilien's results: when

[2] Holt (1970) describes the search by unemployed workers under imperfect information and costly search, whereas Phelps (1968) considers choice problems faced by employers in such a labor market. Mortensen (1970a, 1970b) considers search by both employers and workers. See Phelps et al. (1970) and chapter 1 of Pissarides (2000) for earlier works on search behavior in labor market and determination of equilibrium wage and employment.

[3] The idea of 'sectoral shifts hypothesis' has been used in more recent studies to examine the jobless recovery after the 2001 recession in the U.S. (Rissman (2003), Aaronson, Rissman and Sullivan (2004)), to introduce the persistent unemployment in the real business cycle model (Mikhail, Eberwein and Handa (2003)), to study the macroeconomic effects of reallocation shocks in European countries (Panagiotidis, Pelloni and Polasek (2003)), and to examine the effect of sectoral shifts and employment specialization on the efficiency of the process with which unemployed workers are matched to available job vacancies in regional labor market in UK (Robson (2005)).

non-monetary aggregate effects are eliminated by their purging method, their measure of dispersion has no significant long-run effect on the unemployment rate and the fluctuations of the natural rates of unemployment are much smaller than Lilien's findings.

A fundamental issue that has not been addressed in the literature is how to incorporate the distributional characteristics of the net hiring rates of individual firms into the approximation of the aggregate layoff rates. As noted above, Lilien used only the dispersion of the distribution in his linear approximation of the aggregate layoff rates, and subsequent studies accepted it as a proper measure of the sectoral shifts and focused on the refinements of its estimation. The dispersion may be sufficient to capture the major property of a distribution function when it is a symmetric location-scale distribution such as a normal distribution. However, it can be an insufficient measure for a skewed and leptokurtic distribution because a change in the shape of the distribution can have a significant effect on the right-censored mean even when there is no change in the dispersion. Additional measures such as the skewness and kurtosis coefficients can provide an improvement in the approximation of the aggregate layoff rates.

In this paper we present two numerical examples that illustrate the importance of higher moments in the approximation of the aggregate layoff rates. The first example is an extension of Lilien's example of a mean-preserving spread to the case of a mean-variance preserving transformation, or a mean-variance-skewness preserving transformation, of the underlying distribution. It clearly shows that Lilien's assertion of positive correlation between the dispersion and the aggregate layoff rates can be invalid and the skewness and kurtosis can be important factors. The second example shows the magnitude of improvement in the linear approximation of the aggregate layoff rates when the skewness and the kurtosis are included in addition to the dispersion measure. The skewness measure, in particular, improves the approximation by 55%-93% compared to the case of approximation by the dispersion measure alone.

We define an empirical measure of the skewness that is similar to the empirical measure of the dispersion in Abraham and Katz. This allows for the differences in scales of the measures across industries and captures only the time varying components of the dispersion and skewness. The significance of the dispersion and skewness is then tested individually as well as jointly. The joint test is the test of the sectoral shifts hypothesis. The empirical model has three equations: the equation for money growth rates from which unanticipated and anticipated monetary shocks are estimated, the 'purging' equation from which the dispersion of sectoral shocks is estimated, and the unemployment rate equation from which the sectoral shifts hypothesis is tested. Since there is a wide range of model specifications in the literature, we classified them into two broad groups. One group follows and extends the basic structure of Lilien's empirical specifications and the other group follows the specifications of Abraham and Katz, in particular, the specification of the purging equation. This classification is based on the fact that the Abraham-Katz study was the first to raise a serious doubt about sectoral shifts hypothesis, and that their purging equation involves estimation of unobservable non-monetary aggregate shocks while the Lilien type models do not.

The Lilien type and Abraham-Katz type empirical models are estimated for the sample period of 1955-1982 for comparability with the Abraham-Katz results and also for a longer sample period of 1955-2003. As expected, the dispersion measure has a positive effect and the skewness measure has a negative effect on the unemployment rate. And, our estimation results strongly support the sectoral shifts hypothesis with extremely small p-values in both models and in both sample periods. A close examination of our results reveals that the lack of support for the sectoral shifts hypothesis in the Abraham-Katz study is because they did not consider the effects of the skewness and because they computed the dispersion measure from the estimates of innovation term in serially correlated sectoral shocks. Our results also show that the natural rate of unemployment fluctuates more closely with the actual rate of unemployment compared to the Abraham-Katz's result of relatively flat natural rate. This difference is more pronounced since the 1980s, suggesting an increased importance of the skewness.

The paper is organized as follows. In section 2, Lilien's theoretical model that links the dispersion measure and the aggregate layoff rates is briefly reviewed, and two numerical examples are presented to illustrate the importance of the skewness in the linear approximation of the aggregate layoff rates. In section 3, econometric issues concerning the estimation of empirical models are discussed, focusing on the estimation of the unobservable non-monetary aggregate shocks in the Abraham-Katz type models and the implication of cross sectional heteroscedastic sectoral shocks on the estimation of the dispersion and skewness measures. The Abraham-Katz estimator of the non-monetary aggregate shocks has been criticized by Gallipoli and Pelloni (2001) as an *ad hoc* estimator[4]. In section 3 we provide a theoretical basis for their estimator by showing that it can be interpreted as a special case of a nonlinear regression estimator of an unobservable variable subject to certain linear restrictions. We also show that the nonlinear regression estimator without the restrictions is the first principal component of the linear regression residuals. In Section 4, the Lilien type and Abraham-Katz type models are specified and the empirical results are reported. Section 5 concludes the paper.

II. Lilien's Model and Effects of Higher Moments on Aggregate Layoff Rates

Lilien (1982) starts with the flow identity of the change in unemployment rate, $\Delta U_t = FIU_t - FOU_t$, where FIU_t is the flow into unemployment and FOU_t is the flow out of unemployment in period *t*. He assumes that the FOU_t has two components: a fixed fraction of the last period's unemployment U_{t-1} and a distributed lag function of Barro's measure of unanticipated monetary shock DMR_{t-s}. The flow into unemployment FIU_t is divided into two components, $FIU_t = L_t + NL_t$, where L_t denotes the layoffs and NL_t denotes the non-layoff flow into unemployment such as quits and new entrants. Assuming that the quit rate is inversely related to the current unemployment rate, he specifies NL_t as a linear function of U_t: $NL_t = NL(U_t)$.

The key feature of Lilien's model is his specification of the *aggregate* layoff function which is derived from individual firm's hiring and layoff decisions. The net hiring rate h_t

[4] The purging method of Abraham and Katz has also been criticized on the ground that it tends to 'over-purge' the effects of non-monetary aggregate shocks. There are numerous studies that attempted to construct a better measure of the sectoral shocks, including Loungani (1986) who estimated the unobservable non-monetary shocks by using a common factor analysis, Loungani, Rush and Tave (1990) and Brainard and Cutler (1993) who suggested a dispersion of sectoral stock prices instead of sectoral employment.

of a typical firm is divided into two components, $h_t = H_t + \varepsilon_t$, where H_t is the aggregate hiring rate which is determined by the factors that affect all firms, and ε_t is the idiosyncratic component which represents the factors that are specific to individual firms. Lilien assumes

(i) ε_t is distributed as $f(\varepsilon_t \mid \theta_t)$ with mean zero and *time-varying* distribution parameters θ_t.

(ii) The layoff rate of individual firm is defined by $l_t = \max(0, -h_t)$

(iii) The aggregate layoff rate L_t is equal to the average layoff rate of firms which experience layoffs.

Under these assumptions he derives the aggregate layoff rate as the negative of the censored mean of net hiring rates:

$$L_t = E(l_t \mid H_t) = P(h_t \le 0)E(-h_t \mid h_t \le 0) = \int_{-\infty}^{-H_t} -(H_t + \varepsilon_t) f(\varepsilon_t \mid \theta_t) d\varepsilon_t$$
$$= -F(-H_t \mid \theta_t)\left[H_t + E(\varepsilon_t \mid \varepsilon_t \le -H_t)\right] \equiv L(H_t, \theta_t)$$

where *F* is the cumulative distribution function of ε_t.

Lilien further assumes that all separation from the firm is either layoffs or quits. Under this assumption we have $H_t = \Delta E_t + Q_t$, where ΔE_t is the aggregate rate of change in employment and Q_t is the aggregate quit rate. He closes the model by using the identity $\Delta E_t + \Delta U_t = 0$ such that

$$H_t = \Delta E_t + Q_t = -\Delta U_t + Q(U_t) = H(U_t, U_{t-1})$$

Substituting these expressions into the flow identity of the change in unemployment rate, we can write

$$\Delta U_t = FIU_t + FOU_t = \left\{L\left[H(U_t, U_{t-1}), \theta_t\right] + NL(U_t)\right\} - FOU(U_{t-1}, DMR_{t-s})$$

Rearrangements of the terms then gives his dynamic reduced form equation for the unemployment rate

$$U_t = U(U_{t-1}, \theta_t, DMR_{t-s})$$

where θ_t represents the effects of changes in the distribution function of sectoral shifts in employment demand through their effects on the aggregate layoff rates[5].

For empirical applications, the aggregate layoff function is approximated by a *linear* function of (H_t, θ_t) or by a linear function of (H_t, H_t^2, θ_t). Lilien includes only the dispersion parameter

σ_t of the distribution function of the idiosyncratic random shock ε_t. His simple example of a mean-preserving spread provides a powerful motivation for the dispersion measure. His example compares two economies: An economy where employment grows at 2 percent in all firms and an economy where employment in half of the firms grows at 8 percent and employment in the remaining half of the firms grow at -4 percent. Both economies have identical aggregate growth rates of 2 percent, but the latter economy will experience far more layoffs than the economy with zero dispersion.

The dispersion measure captures an important property of a distribution function and it may be sufficient to approximate the aggregate layoff rates for a symmetric location-scale distribution such as a normal distribution. However, the dispersion measure alone is not sufficient to capture the effects of distributional changes on aggregate layoff rates for asymmetric and leptokurtic distributions. This can be shown by extending Lilien's example of the symmetric mean-preserving spread to asymmetric distributions via a mean-variance preserving transformation and a mean-variance-skewness preserving transformation[6]. Table 1 presents a few discrete densities, their first four centered moments and the aggregate layoff rates. *sk* and *kt* denote the skewness and the kurtosis coefficients, respectively.

First two rows (f_1 and f_2) are the distributions in Lilien's example. Density f_3 is a mean-variance preserving transformation of f_2, and f_4 is a mean-variance-skewness preserving transformation of f_2. Densities f_2 through f_5 have identical means and variances, and yet they generate different number of layoffs. The difference between f_2

[5] Lilien argues that "the process of adjustment to sectoral shifts tends to be slow and typically involves significant unemployment before labor adjusts fully to new patterns of employment demand." A change in its distribution affects the duration of unemployment spell and thereby the aggregate unemployment rate.

[6] See Menezes et al. (1980) and Menezes and Wang (2004) for the details of the transformation.

and f_4 highlights the role of the kurtosis as they have identical first three moments. The difference between f_3 and f_5 highlights the role of the direction of skewness in determining the number of layoffs as the only difference between them is the sign of the skewness coefficient. The last row f_6 has a smaller variance than other distributions, but it generates a larger number of layoffs than distributions

f_4 or f_5, contradicting Lilien's assertion that a wider dispersion will generate more layoffs.

Though these examples clearly indicate that changes in dispersion alone can not explain all the variations in layoffs and the skewness and kurtosis of the distribution can be important factors, they do not provide a clear idea about the relative magnitudes of the explanatory powers of the skewness and kurtosis in the approximation of the aggregate layoff rates L_t. To examine this issue we conducted numerical experiments by using the distribution function of Johnson's hyperbolic sine transformation, $\sinh(X)$, of a normal random variable $X \sim N(\mu,\sigma^2)$. This distribution function is unimodal and has a wide range of kurtosis and skewness. The location and scale parameters of the underlying normal distribution become shape parameters of $Y = \sinh(X)$, which has the density function

$$f(y;\mu,\sigma^2) = \frac{1}{\sqrt{2\pi\sigma^2(y^2+1)}} \exp\left\{-\frac{(\sinh^{-1} y - \mu)^2}{2\sigma^2}\right\}$$

The mean of this distribution is $\mu_y = [\exp(\sigma^2)]^{1/2}\sinh(\mu)$. When idiosyncratic shocks $\varepsilon = Y - \mu_y$ have this distribution function it is easy to show that the aggregate layoff rates are given by

$$L = -F(\mu_y - H)\left[H + E(Y \mid Y \le \mu_y - H) - \mu_y\right] = -F(c)[E(Y \mid Y \le c) - c]$$
$$F(c) = \Phi\left(\frac{(\sinh^{-1}(c) - \mu)^2}{\sigma}\right)$$
$$E(Y \mid Y \le c) = \frac{1}{2}\left(e^{\mu+\sigma^2/2}\frac{\Phi(b-\sigma)}{\Phi(b)} - e^{-\mu+\sigma^2/2}\frac{\Phi(b+\sigma)}{\Phi(b)}\right)$$

and $c = \mu_y - H$, $b = [\sinh^{-1}(c) - \mu]/\sigma$, and Φ is the cumulative distribution function of a standard normal[7].

We conducted two experiments. For a given value of parameter σ^2, we compute the aggregate layoff rates (ALR) for *n* equally spaced values of μ in the range of [-0.5, 0.5], and then estimate the linear regression models of ALR on three different sets of regressors: {H, SD}, {H, SD, SK} and {H, SD, SK, KT} where SD is the standard deviation, SK is the skewness coefficient and KT is the kurtosis coefficient of idiosyncratic shock. A similar experiment is conducted with a given parameter μ and *n* equally spaced values of σ^2 in the range of [0.1, 1.0]. The value of the aggregate hiring rate *H* is set to 2 for both cases.

The true ALR and predicted ALR by the linear regression estimates are shown on the left hand side panel of Figure 1 for the first experiments with three values of σ^2, and on the right hand side panel for the second experiments with three values of μ. The horizontal axis represents the values of skewness coefficients. Figure 1 clearly indicates the strong explanatory power of the skewness coefficient in the approximation of the ALR. The kurtosis coefficient plays a very minimal role in our experiments. Improvements in the accuracy of approximation due to the skewness coefficient are substantial: the mean squared error is reduced by 55% to 93% compared to the case of regression on {H, SD}. The least improvement of 55% occurs in the first case on the left hand side panel, but the ALR is extremely small in this case. Although these results are based on a specific distribution function, they clearly indicate a significant potential gain in introducing the skewness coefficient in the linear approximation of the aggregate layoff function.

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[7] Detailed derivation is available upon request.

III. Estimation Methods of Purging Equation and Sectoral Shifts Variables

The most important empirical issue in testing the sectoral shifts hypothesis is the proper estimation of sectoral shocks from which the cross-sectional moments such as the dispersion and skewness are estimated. This requires elimination of aggregate cyclical effects from the net hiring rates h_{tj} of industry *j* in period *t*. Lilien's method of purging aggregate cyclical effects has been severely criticized[8] by Abraham and Katz (1984, 1986), and it is now generally accepted that Lilien's original method is not sufficient to 'purge' all monetary and non-monetary aggregate effects. We briefly review the specification of the purging regression equation in the literature, focusing on two issues: the estimation of the non-monetary aggregate shocks and the estimation of dispersion and skewness measures.

Previous studies used various sets of purging regressors which can be classified into three groups: the aggregate net hiring rate H_t, a set of variables X_t that include a time trend, aggregate monetary shocks (DMR_t) and anticipated money growth rate (DMF_t), and an estimate of 'unobservable' non-monetary aggregate shocks g_t. A general model of the purging regression equation can be written as

$$h_{tj} = \alpha_j H_t + X_t \beta_j + \gamma_j g_t + \varepsilon_{tj} = \bar{h}_{tj} + \varepsilon_{tj}, \quad \varepsilon_{tj} = \rho_j \varepsilon_{t-1,j} + u_{tj}, \qquad t = 1, 2, \cdots, T, \quad j = 1, 2, \cdots, J \tag{3.1}$$

where $\bar{h}_{tj}$ is the mean function of h_{tj}, and ε_{tj} is the sectoral shock. Lilien's (1982) original model imposed restrictions $\alpha_j = 1$ and $\beta_j = \gamma_j = \rho_j = 0$. The models proposed by Abraham and Katz (1984), Loungani (1986) and Neelin (1987) have a restriction $\alpha_j = 0$, and Samson's (1990) model has restrictions $\alpha_j = 1$ and $\gamma_j = \rho_j = 0$ [9]. The restriction $\alpha_j = 0$ implies a time invariant constant intercept term for each industry, while restriction $\alpha_j = 1$ can be interpreted as a model of time varying intercepts for each industry and the difference between time varying intercepts of two industries is

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[8] They showed that the dispersion of employment growth rates and the change in the unemployment rate can be positively correlated if "industries differ in their cyclical sensitivities and labor force adjustment costs are asymmetric such that an increase in employment costs more than a decline of equal magnitude."

[9] Neelin's model of sectoral net hiring rates is same as AK's first model, but she also estimates the dispersion of aggregate net hiring rate and include it in the estimation of the aggregate unemployment rate. Loungani's model does not include the time trend and includes changes in oil prices in his second model. Samson's model does not include time trend and includes the expected money growth rates.

independent of time[10]. An unrestricted coefficient α_j allows a more general time varying intercept term.

There is no consensus about the best way to purge the non-monetary aggregate shocks from the net hiring rates. Some authors prefer purging only the monetary aggregate shocks because the estimates of non-monetary aggregate shocks (g_t) tend to 'over-purge' them. There are two approaches to estimate g_t. Abraham and Katz (1984) proposed a weighted average of the least squares residuals as the estimator of g_t

$$\hat{g}_t = \sum_{j=1}^{n} w_{tj} \hat{\varepsilon}_{tj} \qquad (3.2)$$

where w_{tj} is the employment share of industry *j* in period *t*, and $\hat{\varepsilon}_{tj} = h_{tj} - X_t \hat{\beta}_j$ is the ordinary least squares residuals of (3.1) subject to $\alpha_j = \gamma_j = \rho_j = 0$. This estimator has been used widely, but Gallipoli and Pelloni (2001) criticized it on the ground that it is an *ad hoc* estimator and tends to 'over-purge' the effects of non-monetary aggregate shocks. An alternative estimator of g_t is the first principal component of lease squares residuals $\hat{E} = (\hat{\varepsilon}_1, \hat{\varepsilon}_2, \cdots, \hat{\varepsilon}_n)$. Loungani (1986) seems to have used this estimator though he did not elaborate on how his 'factor score' is computed[11].

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[10] Let β_{1j} be the intercept coefficient in β_j. When $\alpha_j = 1$, the intercept is $c_{tj} = H_t + \beta_{1j}$ and the cross sectional difference $c_{tj} - c_{tk} = \beta_{1j} - \beta_{1k}$ is independent of time.

[11] Loungani (1986) estimated g_t by 'a factor score using common factor analysis.' He did not specify the set of variables of which the factor score is computed. If he used the set of Abraham-Katz's residuals and used the principal factor analysis to compute the factor, then his estimator will be the first principal component. Several papers mentioned that Lilien (l983) used a time fixed effect for g_t. We were unable to locate the paper and do not know exactly how Lilien estimated g_t.

These estimators can be considered as special cases of the nonlinear least squares estimator of g_t that minimizes the sum of the squared residuals

$$\min_{\beta_j,\gamma_j,g} \sum_{j=1}^{n} (h_j - X\beta_j - \gamma_j g)'(h_j - X\beta_j - \gamma_j g) \qquad (3.3)$$

subject to a normalization restriction $\gamma'\gamma = 1$, where $\gamma = (\gamma_1, \gamma_2, \cdots \gamma_n)'$. γ_j and g_t are not identifiable without this restriction because $\gamma_j g = (c\gamma_j)(g/c)$ for any nonzero constant *c*. It is shown in Appendix that the normal equation system for *g* can be written as

$$Qg = (\gamma' \otimes Q)h \qquad (3.4)$$

where $Q = I - X(X'X)^{-1}X$ is an idempotent matrix and $h = vec(h_1, h_2, \cdots, h_n)$.

Though the linear system in (3.4) does not have a unique solution for *g* because *Q* is singular, it is a consistent system and has a solution

$$\hat{g} = Q^{-}(\gamma' \otimes Q)h + (I_T - Q^{-}Q)g_0 = (\gamma' \otimes Q)h + (I - Q)g_0 \qquad (3.5a)$$

where Q^{-} is the generalized inverse of *Q* and g_0 is any real vector. The second equality in (3.5a) is due to the well known fact that the generalized inverse of an idempotent matrix is itself. It is shown in Appendix that the estimator $\tilde{\gamma}$ is the normalized characteristic vector of $\hat{E}'\hat{E}$ corresponding to its largest characteristic root. Therefore, (3.5a) becomes

$$\hat{g} = (\tilde{\gamma}' \otimes Q)y + (I_T - Q)g_0 = \hat{E}\tilde{\gamma} + X(X'X)^{-1}X'g_0 \qquad (3.5b)$$

If we choose $g_0 = 0$, $\hat{g}$ is the first principal component of the least squares residuals $\hat{E}$.

It is also shown in Appendix that the minimization of (3.3) subject to constraints $\gamma_j = 1$ for all *j* gives

$$\hat{g} = \frac{1}{n}\sum_{j=1}^{n} Qh_j = \frac{1}{n}\sum_{j=1}^{n} \hat{\varepsilon}_j \qquad (3.6)$$

which is similar to the Abraham-Katz estimator except for the weights. The Abraham-Katz estimator uses employment share weights w_{tj} in the place of the uniform weights 1/n. Their estimator in (3.2) can be written as

$$g = diag(EW') = diag(Q(h_1, h_2, \cdots, h_n)W') = diag(Q(h_1^*, h_2^*, \cdots, h_T^*)) \qquad (3.7)$$

where $W = (w_{tj})$ is the matrix of employment shares and $(h_1^*, h_2^*, \cdots, h_T^*) = (h_1, h_2, \cdots, h_n)W'$. This indicates that the Abraham-Katz estimator of g can be considered as the estimator that minimizes (3.3) subject to constraints $\gamma_j = 1$ for all j and employment share adjusted net hiring rates as the dependent variables. Therefore, the Abraham-Katz estimator g appears to be a more restrictive estimator than the principal component estimator g.

We now turn to the estimation of dispersion and skewness measures from the purging equation (3.1). Let $\hat{\varepsilon}_{tj}$ be the OLS residuals in (3.1) under the assumption of no serial correlation, and let $\tilde{\varepsilon}_{tj}$ and $\tilde{u}_{tj}$ be the GLS estimates of the sectoral shock ε_{tj} and the innovation term u_{tj}, respectively. Past studies can be classified into two groups. One group of studies assumes no serial correlation ($\rho_j = 0$) and uses $\hat{\varepsilon}_{tj}$ to estimate the dispersion measure. Samson (1990), Mills, Pelloni and Zervoyianni (1995), Rissman (2003), Aaronson, Rissman and Sullivan (2003), and Garona and Sica (2000) belong to this group.

Another group includes Abraham and Katz (1984) and Loungani (1986) who assume a serial correlation in ε_{tj} and estimates the dispersion measure from the estimates of normalized innovation term, $\tilde{u}_{tj} / \tilde{\theta}_j$, where $\tilde{\theta}_j$ is an estimate of the scale parameter for industry j that does not change over time[12]. This normalization is equivalent to the assumption of cross sectional heteroscedasticity in the innovation term, $E(u_{tj}^2) = \theta_j^2 \sigma_t^2$, and the dispersion measure captures only the time-varying component σ_t of the standard deviation. It should be noted that Lilien's theory is concerned about the dispersion of net hiring rates h_{tj}, and hence, it is the dispersion of ε_{tj} that matters to Lilien's theory even if ε_{tj} is serially correlated. It is thus theoretically preferable to estimate the dispersion measure from its GLS estimate $\tilde{\varepsilon}_{tj}$.

The dispersion and the scale parameters are estimated by

$$\hat{\sigma}_t^2 = \sum_{j=1}^{n} w_{tj} \left(\frac{\tilde{\eta}_{tj}}{\tilde{\theta}_j} \right)^2, \qquad \tilde{\theta}_j = \left(\frac{1}{T} \sum_{t=1}^{T} \tilde{\eta}_{tj}^2 \right)^{1/2} \tag{3.8}$$

where $\tilde{\eta}_{tj}$ can be either $\hat{\varepsilon}_{tj}$ or $\tilde{\varepsilon}_{tj}$ or $\tilde{u}_{tj}$. The weights are introduced to capture the differences in the number of firms across industries[13]. It should be noted that the dispersion estimator based on the OLS residuals $\hat{\varepsilon}_{tj}$ have not normalized the residuals in

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[12] Abraham and Katz (1984) argued for the use of normalized residuals because the "normalized measure captures more of the variation in unemployment ... than does a non-normalized measure." Loungani (1986) used the normalized residuals to "capture scale differences in variances."

[13] Most studies used time varying weights w_{tj}, but Lilien's (1982) analysis of manufacturing industry and Loungani (1986) used the employment-shares in a particular year as the weights.

the past studies, i.e., θ_j is set to 1 for all *j*. However, we will normalize $\hat{\varepsilon}_{tj}$ for comparability with the Abraham-Katz estimator.

The measure of the third moment to compute the skewness is defined in a similar way. Allowing for scale differences in the third moment across industries such that $E(\eta_{tj}^3) = \tau_j^3 \mu_{3t}$, the time-varying component of the third moment is estimated by

$$\hat{\mu}_{3t} = \sum_{j=1}^{n} w_{tj} \left(\frac{\tilde{\eta}_{tj}}{\tilde{\tau}_j} \right)^3, \qquad \tilde{\tau}_j = \left(\frac{1}{T} \sum_{t=1}^{T} \left| \tilde{\eta}_{tj} \right|^3 \right)^{1/3} \tag{3.9}$$

The skewness measure is then estimated by $\hat{sk}_t = \hat{\mu}_{3t} / \hat{\sigma}_t^3$. The scale parameter τ_j is estimated by using the absolute values of estimated residuals to avoid the cancellation of positive and negative residuals.

IV. Empirical Analysis

4.1. Specification of Empirical Models

Empirical estimation and test of sectoral shifts hypothesis involve specification of the unemployment rate equation, purging equation and monetary aggregate shock equation. There is a wide range of specification of these equations and differences in the conclusion about the sectoral shifts hypothesis seem to be partly due to the differences in the model specifications. We classify specifications in previous studies into two types of models. The first type of model follows and extends Lilien's earlier studies and the second type of model is the specification in Abraham and Katz. This classification is based on the fact that a serious doubt about sectoral shifts hypothesis was first raised by the Abraham and Katz study, and their model and its variation include an estimate of unobservable non-monetary aggregate shocks while other empirical models do not. The quarterly version of Lilien's unemployment rate equation including the skewness measure is specified as

$$UR_t = \alpha_0 + \alpha_1 t + \sum_{s=0}^{4} \beta_s \sigma_{t-s} + \sum_{s=0}^{4} \lambda_s sk_{t-s} + \sum_{s=0}^{8} \gamma_s DMR_{t-s} + \sum_{s=1}^{4} \delta_s UR_{t-s} + \eta_t \tag{4.1}$$

where UR_t is the aggregate rate of unemployment, DMR_t is the estimate of monetary aggregate shocks and η_t is assumed to be an i.i.d. disturbance term with a zero mean and a finite variance. The unemployment rate equation in the Abraham-Katz model is specified as

$$DUR_t = \alpha_0 + \sum_{s=0}^{8} \beta_s \sigma_{t-s} + \sum_{s=0}^{8} \lambda_s sk_{t-s} + \sum_{s=0}^{8} \gamma_s DMR_{t-s} + \nu_t, \qquad \nu_t = \sum_{s=1}^{4} r_s \nu_{t-s} + \eta_t \quad (4.2)$$

where DUR_t is the detrended aggregate rate of unemployment[14] and η_t is assumed to be an i.i.d. disturbance term with a zero mean and a finite variance.

These two models differ in the detrending method and in the number of lag lengths for dispersion and skewness variables. More importantly, the Lilien model includes lagged dependent variable with serially independent disturbance term, while the Abraham-Katz model does not include lagged dependent variable, but assumes the fourth-order serial correlation in the disturbance term.

We also consider two types of purging equation models, one that is usually used for the Lilien type unemployment rate equation and another one that is used in the Abraham-Katz model. The first model generally includes *DMR* and *DMF* as regressors and does not involve the estimation of unobservable non-monetary aggregate shocks. For example, Samson (1990) specifies the purging equation as a linear regression equation of each industry's net hiring rate $h_{tj} = \ln(E_{tj} / E_{t-1,j})$ on three regressors

$$h_{tj} = a_{j0} + a_{j1} H_t + \sum_{s=0}^{4} b_{js} DMR_{t-s} + \sum_{s=0}^{4} c_{js} DMF_{t-s} + \varepsilon_{tj}$$

with a restriction $a_{j1} = 1$ for all industries and ε_{tj} is assumed to be an i.i.d. error term. As discussed earlier, it is unlikely that the aggregate net hiring rate has an identical effect on

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14 DUR_t is defined by $DUR_t = UR_t - bt$ where b is the estimate of the linear regression coefficient of UR_t on a constant and time.

each industry's net hiring rate. We generalize Samson's specification by removing the restriction

$a_{j1} = 1$ and adding the time trend term and a lagged dependent variable

$$h_{tj} = a_{j0} + a_{j1}H_t + a_{j2}t + \sum_{s=0}^{4} b_{js}DMR_{t-s} + \sum_{s=0}^{4} c_{js}DMF_{t-s} + d_j h_{t-1,j} + \varepsilon_{tj} \qquad (4.3)$$

The trend term is added for the comparability with the Abraham-Katz specification of their purging equation. The lagged dependent variable is included partly for the autoregressive nature of the net hiring rate and partly for the consistency with the aggregate unemployment rate equation in (4.1) which includes lagged unemployment rates as regressors. As we will report later, the restrictions $a_{j1} = 1$, $a_{j2} = 0$ and $d_j = 0$ are strongly rejected individually for most industries and strongly rejected jointly for all industries. We also allow ε_{tj} to be cross-sectionally heteroscedastic in our computation of the dispersion and skewness measures for comparability with the Abraham-Katz method.

Abraham and Katz specified the purging equation as

$$h_{tj} = a_{j0} + a_{j1}t + \sum_{s=0}^{4} b_{js}\Delta DMR_{t-s} + c_j g_t + \varepsilon_{tj}, \qquad \varepsilon_{tj} = \rho_j \varepsilon_{t-1,j} + u_{tj} \qquad (4.4a)$$

Note that they used changes in DMR_t as regressors. For comparability with (4.3) and because anticipated monetary shocks can have short-run effects we generalize (4.4a) by including the current and lagged DMF_t terms

$$h_{tj} = a_{j0} + a_{j1}t + \sum_{s=0}^{4} b_{js}^{r}\Delta DMR_{t-s} + \sum_{s=0}^{4} b_{js}^{f}\Delta DMF_{t-s} + c_j g_t + \varepsilon_{tj}, \quad \varepsilon_{tj} = \rho_j \varepsilon_{t-1,j} + u_{tj} \quad (4.4b)$$

We use the Abraham-Katz estimator or the first principal component estimator for g_t. Abraham and Katz estimate the dispersion measure from the estimates of normalized residuals of innovation terms u_{tj}. However, as discussed in the previous section, it is the dispersion of ε_{tj} that is relevant to Lilien's theory. Hence, we will focus on the computation of dispersion and skewness measures from the estimates of ε_{tj} .

A comparison of the two purging equations (4.3) and (4.4b) shows some minor differences in the way DMR_t enters the equation and the lagged dependent variable versus serial correlation in error term. An important contrast is the interpretation of H_t and g_t. The term g_t in (4.4b) is designed to capture the non-monetary aggregate shocks. We may capture them from H_t after removing the effects of monetary variables by regressing H_t on the time trend, DMR_t and DMF_t. The residuals of this regression can be considered as a measure of non-monetary aggregate shocks in (4.3). This procedure results in the same specification as (4.3) [15]. Therefore, we may interpret that the non-monetary aggregate shocks are captured by H_t in (4.3) and by the estimated g_t in (4.4b).

The aggregate monetary shock variables DMR_t and the anticipated money growth rate DMF_t in (4.3) are estimated by the residual term $\hat{e}_t$ and the estimated mean $\hat{DM}_t$ in a linear regression equation

$$DM_t = a_0 + \sum_{s=1}^{8} b_s DM_{t-s} + \sum_{s=0}^{3} c_s FEDV_{t-s} + \sum_{s=1}^{4} d_s UN_{t-s} + e_t \qquad (4.5)$$

where $DM_t = \ln(M_t / M_{t-1})$ is the growth rate of M1, $FEDV_t$ is the real federal government expenditure in excess of its normal level as defined in Barro (1977), and $UN_t = \ln(UR_t / (1 - UR_t))$. This is the quarterly version of Barro's specification and used in Rissman (1993). Lilien (1982) used the annual version of Barro's specification. The aggregate monetary shock DMR_t in Abraham-Katz model (4.4) is estimated by the regression residuals $\hat{e}_t$ in a linear regression model

[15] The only difference is the interpretation of the coefficients since they will include the estimated coefficients of the regression of H_t on a constant, time trend, DMR_t and DMF_t.

$$DM_t = a_0 + a_1 t + \sum_{s=1}^{4} b_s DM_{t-s} + \sum_{s=1}^{4} c_s TB_{t-s} + e_t \qquad (4.6)$$

where TB_t is the interest rate on three month treasury bills.

We estimate two models which we will call the Lilien model and the AK model for brevity. The Lilien model consists of specifications (4.1), (4.3) and (4.5) and the AK model consists of specifications (4.2), (4.4b) and (4.6). The dispersion and skewness measures are computed by using (3.8) and (3.9) which assume cross sectional variations of scales in the second and third moments of error terms. The Lilien model uses the OLS residuals ε_{tj} in (4.3) and the AK model uses the GLS residuals ε_{tj} in (4.4b). Following Abraham and Katz (1984) and Loungani (1986), the non-monetary aggregate shocks g_t are estimated from the OLS residuals of (4.4b).

4.2. Data

Quarterly data used in this paper is mainly drawn from Bureau of Labor Statistics (BLS) and Federal Reserve Economic Data (FRED). Seasonally adjusted number of employees series are taken from Current Employment Statistics (CES) survey of nonfarm payroll records from BLS. With the release of May 2003 data, the CES Nonfarm Payroll series underwent a complete industry reclassification, changing from the 1987 Standard Industrial Classification System (SIC) to the 2002 North American Industry Classification System (NAICS). Historical time series were reconstructed as part of the NAICS conversion process, but most NAICS series still have a short history back to only 1990. In order to cover Lilien and AK's sample period, this paper draws employment data based on SIC classification which dates back farther and is available through the first quarter of 2003. The sample period in this paper covers the first quarter of 1955 through the first quarter of 2003[16].

The 30-industry classification is used in this paper. It matches two-digit 1987 SIC code with detailed classification of manufacturing sector. Seasonally adjusted unemployment rate of civilian noninstitutional population is drawn from Current Population Survey (CPS) of BLS. Seasonally adjusted M1 money stock series and 3-month Treasury Bill secondary market rate are from FRED.

4.3. Test of Sectoral Shifts Hypothesis

As noted earlier, purging equations (4.3) and (4.4b) are the extended versions of the Samson (1990) and Abraham and Katz (1984) models, respectively. We first conduct the specification tests of these extensions. We test the null hypotheses $a_{j1} = 1$, $a_{j2} = 0$ and $d_j = 0$ in (4.3) individually as well as jointly for each industry. Each hypothesis is

[16] The actual sample period is not identical for all specifications because of differences in the number of lagged variables.

rejected at 5% level of significance in 22 industries for $a_{j1} = 1$, in 8 industries for $a_{j2} = 0$, and in 21 industries for $d_j = 0$. The joint hypotheses are rejected at 5% level in 27 industries with extremely small *p*-values. Although the hypothesis that the coefficient of the trend term is zero is not rejected in most of the 30 industries, the joint hypothesis $a_{j2} = 0$ for all *j* is strongly rejected with a *p*-value close to zero. The null hypothesis of zero coefficients, $b^f_{js} = 0$, for the current and lagged values of DMF_t in the Abraham-Katz purging equation (4.4b) is rejected at 5% level in 24 industries regardless of the choice of non-monetary aggregate shocks. Therefore, we conclude that equations (4.3) and (4.4b) are reasonable modifications of the models in previous studies.

Unemployment rate equations (4.1) and (4.2) are estimated and the long run effects of the dispersion and skewness measures are tested. Table 2 presents the sum of the estimated coefficients of dispersion and skewness measures, their estimated standard errors and *p*-values. For the AK model, we consider both the Abraham-Katz estimator g_{ak} and principal component estimator g_{pc} of g_t. As expected, the dispersion measure has a positive effect and the skewness measure has a negative effect on the unemployment rate. As the distribution of sectoral shocks become more dispersed and more negatively skewed, the aggregate unemployment rate increases. The null hypothesis of zero long-run effects of the dispersion and skewness measures are rejected individually as well as jointly in all three cases reported in Table 2 with small *p*-values. The test of sectoral shifts hypothesis is the test of joint hypothesis and it is supported with extremely small *p*-values in all three cases.

The results for the AK model in our estimation are drastically different from the results of the Abraham-Katz study, in which the effect of the dispersion of sectoral shocks was insignificantly different from zero. There are four major differences between their model and our model: (i) their sample period 1955Q1-1982Q1 is shorter than our sample period reported in Table 2, (ii) their purging equation does not include the DMF_t variable, (iii) they estimate the dispersion from the estimates of innovation term u_{tj} while we use the estimates of sectoral shocks ε_{tj}, and (iv) they do not include the skewness measure in the unemployment rate equation.

To identify the potential sources of the difference in the estimation results we conducted a few more estimations and reported the results in Table 3. The first column indicates the sample period, the second column indicates the inclusion or exclusion of *DMF* variable in the purging equation, and the third column indicates whether the dispersion and skewness are estimated from

$\tilde{\varepsilon}_{tj}$ or $\tilde{u}_{tj}$. The remaining four columns show the *p*-values of the tests of sectoral shifts hypothesis when the unemployment equation includes both the dispersion and skewness measures and when it includes only the dispersion measure. The *p*-value of 0.101 in the last row and the last column is the estimate of the Abraham-Katz model, which is estimated for a shorter sample period. It excludes *DMF* in the purging equation, computes the dispersion from $\tilde{u}_{tj}$, and does not include the skewness measure.

The *p*-values of the test of sectoral shifts hypothesis reported in the fourth column of Table 3 shows that the AK model with g_{ak} supports strongly the sectoral shifts hypothesis regardless of the sample period, inclusion or exclusion of *DMF*, and the choice of $\tilde{\varepsilon}_{tj}$ or $\tilde{u}_{tj}$. However, the *p*-values in the fifth and the sixth columns reveal an interesting observation. The dispersion measure based on $\tilde{u}_{tj}$ has higher *p*-values than the dispersion measure based on $\tilde{\varepsilon}_{tj}$ in all cases, while their effects on the *p*-values of the skewness measure are mixed. Such effects also appear in the last column when only the dispersion measure is included in the unemployment rate equation. These observations lead to a conclusion that the lack of support for the sectoral shifts hypothesis in the

Abraham and Katz study is due to their use of $\tilde{u}_{tj}$ rather than the theoretically more valid measure based on $\tilde{\varepsilon}_{tj}$ and because they did not consider the effects of the skewness.

We showed earlier that the principal component estimator g_{pc} of the non-monetary aggregate shocks is intuitively more appealing in the least squares sense than the Abraham-Katz estimator g_{ak} . Table 4 summarizes the effects of these alternative estimators on the test of sectoral shifts hypothesis in the AK model that includes the *DMF* variable in the purging equation[17]. When both the dispersion and the skewness measures are included in the unemployment rate equation, the g_{pc} estimator gives smaller *p*-values than the g_{ak} estimator in the joint as well as in the individual tests of significance in all cases. When the skewness measure is omitted from the unemployment rate equation, it is reversed, i.e., the g_{ak} estimator gives smaller *p*-values than the g_{pc} estimator. However, both estimators lead to the same conclusion about the sectoral shifts hypothesis. That is, the hypothesis is not rejected at the 5% level of significance when both the dispersion and the skewness measures are included regardless of the choice of the estimator of g . When the skewness measure is omitted, both estimators of g also lead to the same conclusion in either supporting or rejecting the hypothesis.

4.4. Natural Rate of Unemployment

Natural rates of unemployment are computed by using the procedures of Lilien and Abraham and Katz. The coefficients of the current and lagged *DMR* terms in (4.1) and (4.2) are set to zero, and we use the estimated values of the remaining coefficients. The natural rates of unemployment are thus the rates that would have been observed if all monetary shocks and the disturbance terms have been zero. In the Lilien type model, the natural rate of unemployment is thus computed from

$$NR_t = \hat{\alpha}_0 + \hat{\alpha}_1 t + \sum_{s=0}^{4} \hat{\beta}_s \sigma_{t-s} + \sum_{s=0}^{4} \hat{\lambda}_s sk_{t-s} + \sum_{s=1}^{4} \hat{\delta}_s NR_{t-s} \qquad (4.7)$$

[17] The results in the case of exclusion of DMF are similar to the results shown in Table 4.

the initial values of lagged natural rates set to the actual rates of unemployment. The effects of initial values will die out as time passes. Abraham and Katz computed the natural rate of unemployment from[18]

$$DNR_t = \tilde{\alpha}_0 + \sum_{s=0}^{8} \tilde{\beta}_s \sigma_{t-s} + \sum_{s=0}^{8} \tilde{\lambda}_s sk_{t-s}, \qquad NR_t = DNR_t + bt \tag{4.8}$$

where *b* the estimated coefficient of time trend in the detrending equation of UR_t .

The natural rates of unemployment NR_t are plotted in Figure 2 for the cases reported in Table 2 and for the case of Abraham-Katz original study. A cursory inspection of the figure reveals that the NR_t in the Lilien type model follow the actual rates of unemployment more closely than the NR_t in the Abraham-Katz type models. This is more pronounced for the period since 1980. There is not much difference between the AK models with g_{ak} and g_{pc} though the latter tends to generate slightly more volatile NR_t . The NR_t in the original Abraham-Katz model (AK-org) which includes only the dispersion measure are clearly flatter than the NR_t in other models. These differences are also reflected in the R^2 values of the regression of UR_t on a constant and NR_t in each model.

The effects of the skewness measure on NR_t are shown in Figure 3a where the NR_t with only the dispersion measure and with both sectoral shifts measures are plotted against the actual rates of unemployment. In general, inclusion of the skewness measure generates the NR_t that follows the actual rates of unemployment more closely. This is most visible in the Lilien type model after 1980. It is interesting to note that the skewness

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[18] One may want take into account of the serial correlation in (4.2) for the computation of DNR_t

$$DNR_t = \tilde{Z}_t + \sum_{s=1}^{4} \tilde{r}_s \left(DNR_{t-s} - \tilde{Z}_{t-s} \right), \qquad NR_t = DNR_t = bt$$

where $\tilde{Z}_t$ is the right hand side expression in (4.8). The second term, however, dies out quickly and this gives almost identical results as (4.8) after a few periods.

measure has a significant effect on the R^2 values in the Lilien and $AK(g_{pc})$ models, but has no effect in the $AK(g_{ak})$ model.

Although both the Lilien and Abraham-Katz type models support the sectoral shifts hypothesis, they show sizable differences in the natural rates of unemployment. The source of these differences is not the differences in the estimators of the dispersion and skewness measures. When the estimates of the dispersion and skewness measures from the Lilien type models are used to estimate the Abraham-Katz unemployment rate equation, the resulting NR_t is not much different from the natural rates of unemployment shown in Figure 3.

V. Conclusions

We demonstrated by numerical examples that the measurement of sectoral shifts by dispersion alone is not sufficient and the skewness of the sectoral shocks can improve the measurement of sectoral shifts substantially. One of the hotly debated issues in the test of sectoral shifts hypothesis is how to purge monetary and non-monetary aggregate shocks. The Lilien type models that use only observable variables in the purging equation tends to support the hypothesis, while the Abraham-Katz type models which estimate the unobservable non-monetary aggregate shocks g_t tend to reject the hypothesis. The estimator of g_t in the latter models has been criticized as an *ad hoc* procedure, but we showed that they can be interpreted as nonlinear regression estimators of an unobservable variable.

Following Abraham and Katz, we assumed cross-sectional heteroscedasticity in the sectoral shocks and compute the dispersion and skewness measures from the 'normalized' sectoral shocks. This procedure captures only the time varying component of the dispersion and skewness. The Lilien type model and Abraham-Katz type model are estimated by using the quarterly data for a short sample period that is comparable to the study of Abraham and Katz and for a longer sample period. The estimation results of both models strongly support the sectoral shifts hypothesis regardless of the choice of purging methods. Our estimation results also indicate that the lack of support for the hypothesis in the Abraham-Katz study is due to the omission of the skewness measure and due to their use of dispersion of the innovation terms in serially correlated sectoral shocks instead of the dispersion of the sectoral shocks themselves.

The natural rates of unemployment estimated from these models show more volatility than the relatively flat natural rates of unemployment reported in the Abraham-Katz study, and tend to follow the actual rates of unemployment more closely when the skewness measure is included. Although both types of models support the sectoral shifts hypothesis, there is a sizable difference in the natural rates of unemployment generated by these models. This difference seems to lie in the difference in the structure of the unemployment equation rather than the differences in the estimates of the dispersion and skewness measures.

Table 1. Effects of Skewness and Kurtosis on Aggregate Layoff Rates

	h_t								Moments				L
	-10	-7	-4	-1	2	5	8	14	μ	σ	*sk*	*kt*	
f_1					1				2	-	-	-	-
f_2			4/8				4/8		2	6	0	1	2
f_3	1/8		1/8		3/8		3/8		2	6	-0.75	2.5	1.75
f_4	1/8				6/8			1/8	2	6	0	4	1.25
f_5			3/8		3/8		1/8	1/8	2	6	0.75	2.5	1.5
f_6		1/8	1/8	2/8		1/8	3/8		2	5.61	-0.23	1.51	1.625

Table 2. Estimates of Sectoral Shifts Variables (1955Q1 - 2003Q1)

Model	Variable	sum of coefs	SD	*p*-value	joint *p*-value
Lilien	σ	0.289	0.113	0.012	0.000
	sk	-0.324	0.092	0.001	
$AK(g_{ak})$	σ	1.747	0.755	0.022	0.002
	sk	-0.858	0.427	0.047	
$AK(g_{pc})$	σ	1.684	0.650	0.011	0.000
	sk	-0.895	0.427	0.012	

Table 3. Alternative Specifications of $AK(g_{ak})$ *p*-values of the tests of hypotheses

Sample Period	*DMF*		σ and *sk*			σ only
			σ & *sk*	σ	*sk*	
1955Q1 - 2003Q1	included	ε_{tj}	0.002	0.022	0.047	0.007
		u_{tj}	0.014	0.197	0.014	0.198
	excluded	ε_{tj}	0.001	0.015	0.030	0.005
		u_{tj}	0.017	0.048	0.077	0.044
1955Q1 - 1982Q1	included	ε_{tj}	0.000	0.010	0.001	0.085
		u_{tj}	0.021	0.098	0.031	0.180
	excluded	ε_{tj}	0.001	0.040	0.010	0.041
		u_{tj}	0.034	0.091	0.093	0.101

Table 4. Effects of Alternative Estimators of *g* (*DMF* included) *p*-values of the tests of hypotheses

Sample Period		*g*	σ and *sk*			σ only
			σ & *sk*	σ	*sk*	
1955Q1 - 2003Q1	ε_{tj}	g_{ak}	0.002	0.022	0.047	0.007
		g_{pc}	0.000	0.011	0.011	0.010
	u_{tj}	g_{ak}	0.014	0.197	0.014	0.198
		g_{pc}	0.010	0.139	0.010	0.227
1955Q1 - 1982Q1	ε_{tj}	g_{ak}	0.000	0.010	0.001	0.085
		g_{pc}	0.000	0.003	0.000	0.182
	u_{tj}	g_{ak}	0.021	0.098	0.031	0.180
		g_{pc}	0.000	0.012	0.000	0.273

Figure 1. Effects of Skewness and Kurtosis on Estimation of Aggregate Layoff Rates

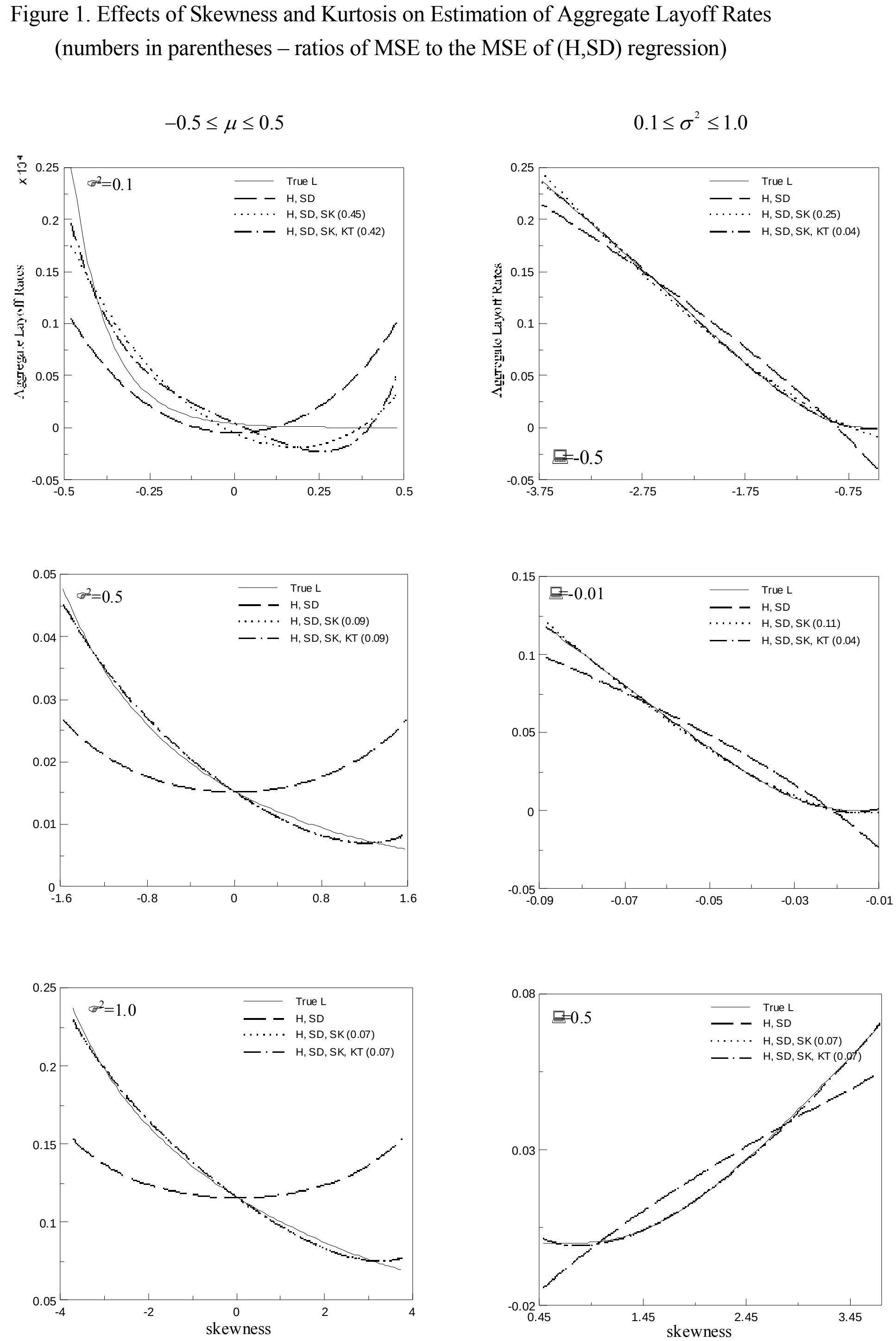


Figure 2. Natural Rates of Unemployment (numbers in parentheses are R^2 of UR on each natural rates)

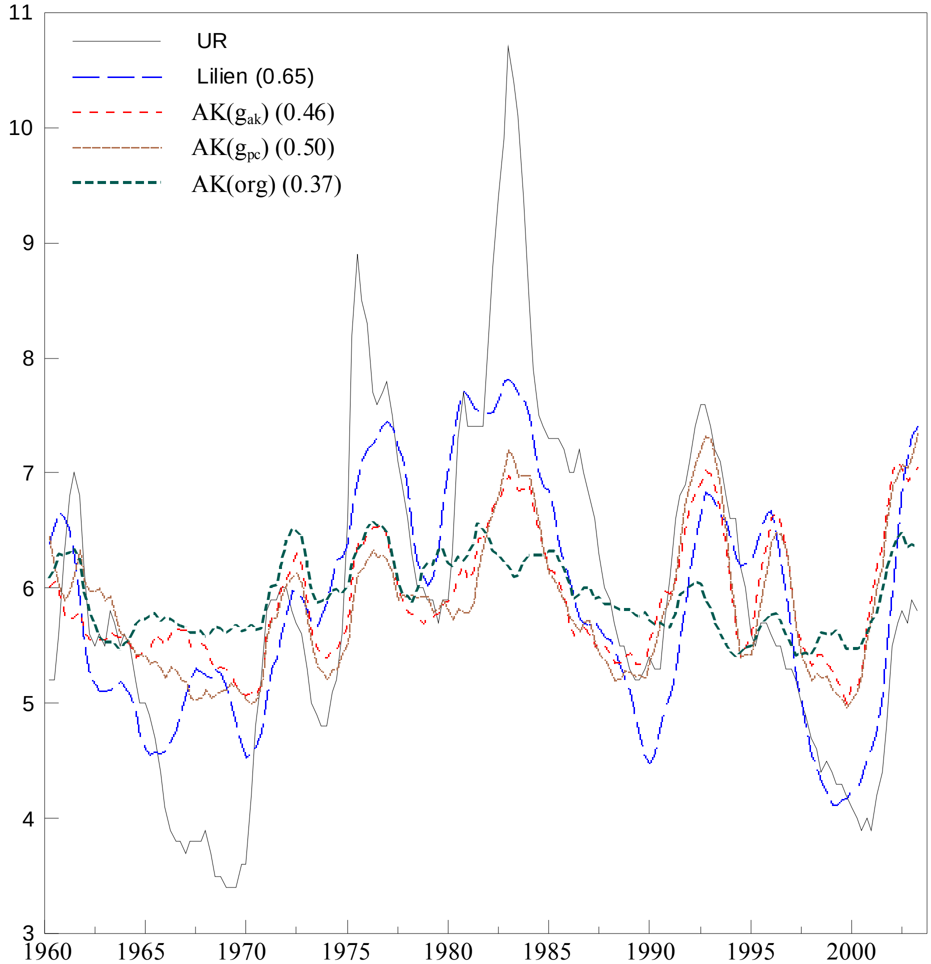


Figure 2b. Natural Rates of Unemployment (numbers in parentheses are R^2 of UR on each natural rate)

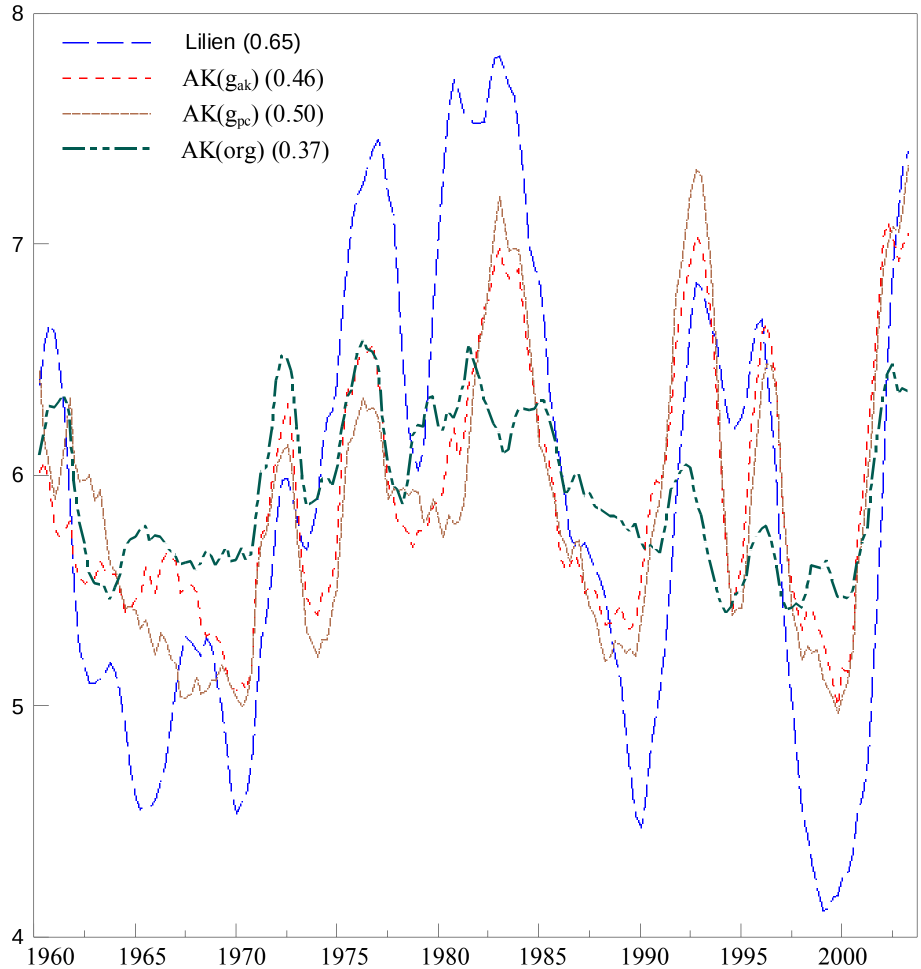


Figure 3a. Natural Rates of Unemployment Effects of Skewness (numbers in parentheses are R^2 of UR on each natural rates)

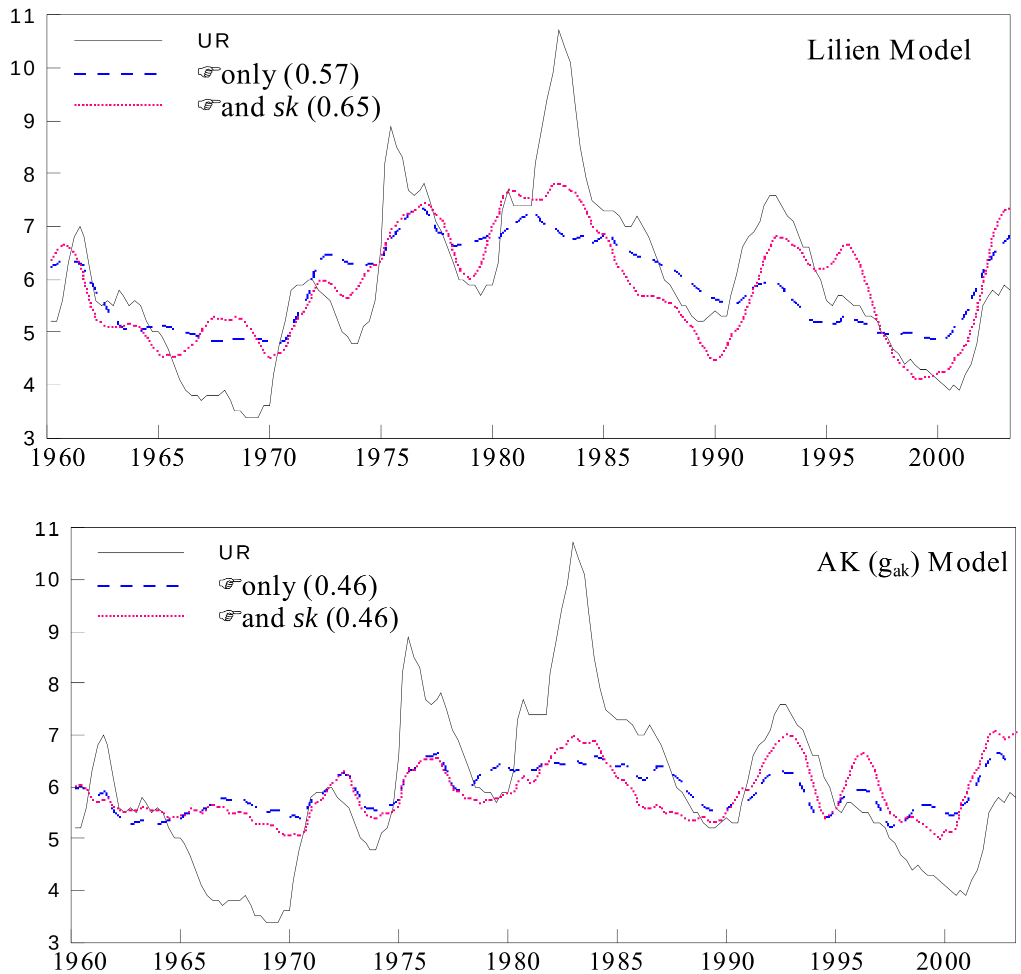
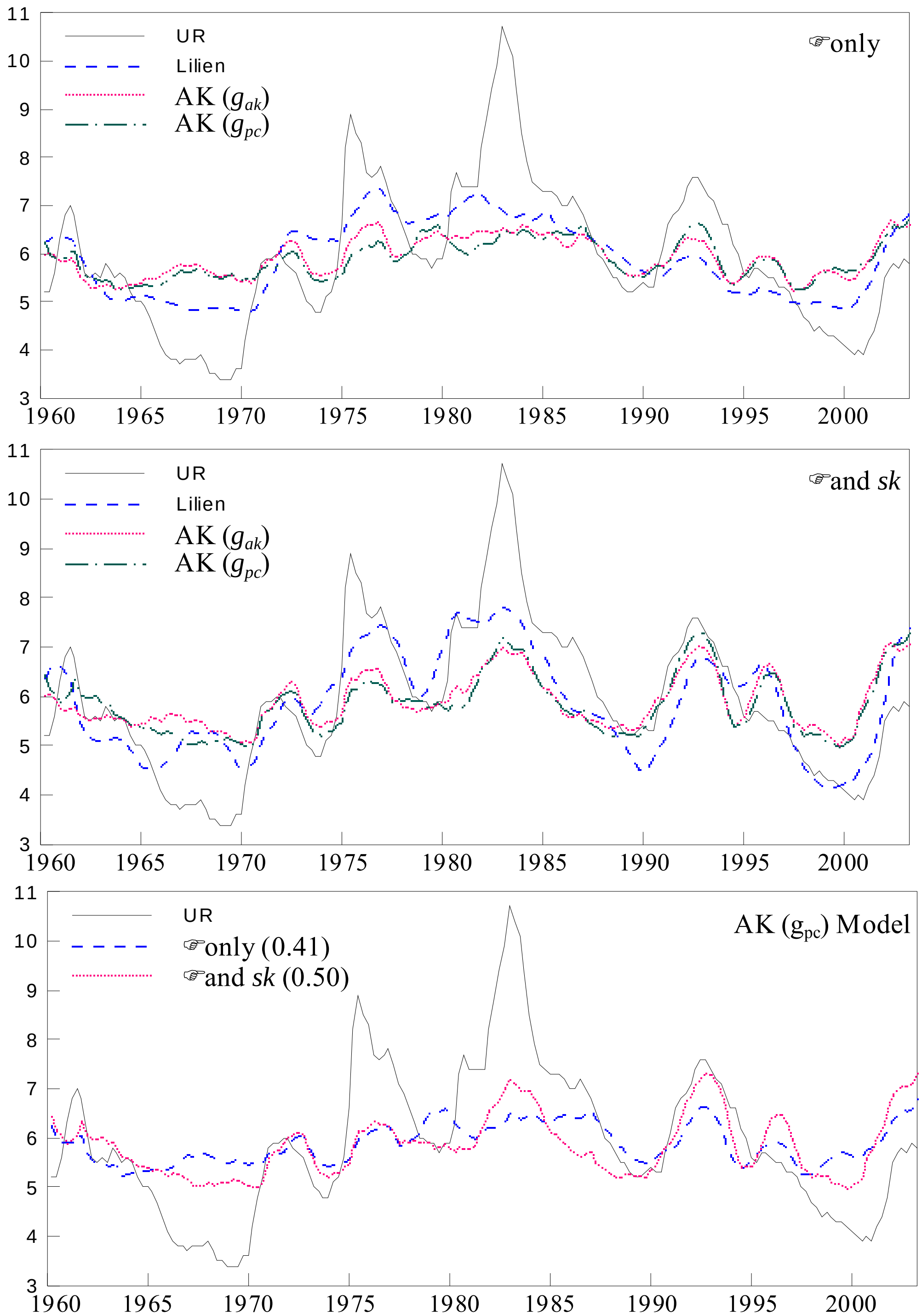


Figure 3b. Natural Rates of Unemployment Comparison of Models



Appendix

Nonlinear Least Squares Estimation of Equations with an Unobservable Variable Consider a system of linear regression equations

$$y_j = X\beta_j + g\gamma_j + \varepsilon_j, \qquad j = 1, 2, \cdots, n \tag{A.1}$$

where X is a $T \times K$ matrix of K observable regressors and g is a $T \times 1$ vector of an unobservable regressor. Since regressors are common to all equations, the seemingly unrelated regression estimators of parameters are identical to the least squares estimator of each equation if g is observable. Let $Y = (y_1, y_2, \cdots, y_n)$, $B = (\beta_1, \beta_2, \cdots, \beta_n)$, and $E = (\varepsilon_1, \varepsilon_2, \cdots, \varepsilon_n)$. Let $\hat{B}$ and $\hat{E}$ be least squares estimators of B and E subject to restrictions $\gamma_j = 0$. That is,

$$\hat{B} = (X'X)^{-1}X'Y, \qquad \hat{E} = [I - X(X'X)^{-1}X']Y \equiv QY$$

We write (A.1) for all equations as

$$y = (I_n \otimes X)\beta + (\gamma \otimes I_T)g + \varepsilon = Z_1\beta + Z_2 g + \varepsilon \tag{A.2}$$

where $y = vec(Y)$, $\beta = vec(B)$, $\varepsilon = vec(E)$ and $\gamma = (\gamma_1, \gamma_2, \cdots, \gamma_n)'$. We wish to estimate parameters β and γ and the unobservable regressor g by minimizing the sum of squared residuals subject to the identifying normalization restriction $\gamma'\gamma = 1$.

$$\min_{\beta,\gamma,g} (y - Z_1\beta - Z_2 g)'(y - Z_1\beta - Z_2 g)$$
$$s.t. \;\; \gamma'\gamma = 1$$

The estimator of β is given by

$$\tilde{\beta} = (Z_1'Z_1)^{-1}Z_1'(y - Z_2 g) = \hat{\beta} - [\gamma \otimes (X'X)^{-1}X']g \tag{A.3}$$

where $\hat{\beta} = vec(\hat{B})$. It is easy to show that the normal equations for g are given by $(Z_2^{'} A_1 Z_2) g = Z_2^{'} A_1 y$, where $A_1 = I - Z_1 (Z_1^{'} Z_1)^{-1} Z_1^{'}$. It is straightforward to show $A_1 = I_n \otimes Q$, and $Z_2^{'} A_1 Z_2 = \gamma' \gamma \otimes Q = Q$ due to the restriction $\gamma' \gamma = 1$. Therefore, the normal equations for g can be written as

$$Qg = (\gamma' \otimes Q) y \qquad \text{(A.4)}$$

Though the linear system in (A.4) does not have the unique solution for g because Q is singular, it is a consistent system and has a solution

$$\tilde{g} = Q^{-} (\gamma' \otimes Q) y + (I_T - Q^{-} Q) g_0 \qquad \text{(A.5)}$$

where Q^{-} is the generalized inverse of Q and g_0 is any real vector. It is well known that the generalized inverse of an idempotent matrix is itself. Therefore, we can write (A.5) as

$$\tilde{g} = Q(\gamma' \otimes Q) y + (I_T - Q) g_0 = (\gamma' \otimes Q) y + (I_T - Q) g_0 \qquad \text{(A.6)}$$

Substituting $\tilde{g}$ into (A.3), we can show by using the relationship $X'Q = 0$ that

$$\tilde{\beta} = \hat{\beta} - [\gamma \otimes (X'X)^{-1} X'] g_0 \qquad \text{(A.7)}$$

Substitution of (A.6) and (A.7) into (A.2) gives

$$\begin{aligned} \tilde{\varepsilon} &= y - Z_1 \tilde{\beta} - Z_2 \tilde{g} \\ &= y - [I_n \otimes (I_T - Q)] y + [\gamma \otimes (I_T - Q)] g_0 - [\gamma\gamma' \otimes Q] y - [\gamma \otimes (I_T - Q)] g_0 \qquad \text{(A.8)} \\ &= (I_n \otimes Q) y - [\gamma\gamma' \otimes Q] y \end{aligned}$$

This in turn gives

$$\tilde{\varepsilon}'\tilde{\varepsilon} = y'(I_n \otimes Q)y - [y'(\gamma \otimes Q)][(\gamma' \otimes Q)y] = y'(I_n \otimes Q)y - \gamma'\hat{E}'\hat{E}\gamma$$

where the last equality is due to the relationship

$$(\gamma' \otimes Q)y = (\gamma' \otimes Q)vec(Y) = vec(QY\gamma) = \hat{E}\gamma$$

Minimization of $\tilde{\varepsilon}'\tilde{\varepsilon}$ with respect to γ subject to the normalization restriction $\gamma'\gamma = 1$ is thus equivalent to maximization of $\gamma'\hat{E}'\hat{E}\gamma$ subject to $\gamma'\gamma = 1$. From the Lagrange equation

$$\mathrm{L} = \gamma'\hat{E}'\hat{E}\gamma + \lambda(1 - \gamma'\gamma)$$

We can derive the first order condition

$$\hat{E}'\hat{E}\tilde{\gamma} - \lambda\tilde{\gamma} = (\hat{E}'\hat{E} - \lambda I)\tilde{\gamma} = 0$$

Thus, $\tilde{\gamma}$ is the normalized characteristic vector of $\hat{E}'\hat{E}$ corresponding to its largest characteristic root λ because the first order condition indicates $\lambda = \tilde{\gamma}'\hat{E}'\hat{E}\tilde{\gamma}$. Substitution of $\tilde{\gamma}$ into (A.6)-(A.8) gives the estimators

$$\tilde{g} = (\tilde{\gamma}' \otimes Q)y + (I_T - Q)g_0 = \hat{E}\tilde{\gamma} + X(X'X)^{-1}g_0$$
$$\tilde{\beta} = \hat{\beta} - [\tilde{\gamma} \otimes X(X'X)^{-1}]g_0$$
$$\tilde{\varepsilon} = (I_n \otimes Q)y - (\tilde{\gamma}'\tilde{\gamma} \otimes Q)y = vec(\hat{E}) - vec(\hat{E}\tilde{\gamma}\tilde{\gamma}')$$

If we choose $g_0 = 0$, $\tilde{g}$ is the first principal component of OLS residuals $\hat{E}$ and the estimator of $\tilde{\beta}$ is the OLS estimator with restriction $\gamma = 0$. Note that the residual estimator does not depend on the choice of g_0, and it can be written in a matrix form as $\tilde{E} = \hat{E} - \hat{E}\tilde{\gamma}\tilde{\gamma}'$.

Abraham and Katz estimates the unobservable non-monetary aggregate effects by the weighted means of least squares residuals $\hat{\eta}_{tj}$ which is estimated from regression equations

$$y_{tj} = X_t\beta_j + \eta_{tj}, \qquad t = 1,2,\cdots,T, \quad j = 1,2,\cdots,n$$

This procedure implicitly assumes time varying means of η_{tj} and we can write explicitly as

$$y_{tj} = X_t\beta_j + g_t + \varepsilon_{tj}, \qquad t = 1,2,\cdots,T, \quad j = 1,2,\cdots,n$$

where g_t is the mean of η_{tj} in period *t* and it represents the non-monetary aggregate effect. This system of equations is same as (A.1) with restrictions $\gamma_j = 1$ for all j. Let γ be an n-dimensional vector of ones. Then, the normal equations for g become $(Z_2' A_1 Z_2) = nQg = Z_2' A_1 y$ because $(Z_2' A_1 Z_2) = \gamma'\gamma \otimes Q = nQ$. Therefore, the estimator of g in (A.6) becomes

$$\tilde{g} = \frac{1}{n}[(\gamma'\otimes Q)y + (I_T - Q)g_0] = \frac{1}{n}\sum_{j=1}^{n}\hat{\varepsilon}_j - \frac{1}{n}(I_T - Q)g_0$$

where $\hat{\varepsilon}_j$ is the least squares residual vector of the regression equation of industry *j*, $y_j = X\beta_j + \varepsilon_j$. If we choose $g_0 = 0$, this estimator becomes

$$\tilde{g} = \frac{1}{n}\sum_{j=1}^{n} Qy_j = \frac{1}{n}\sum_{j=1}^{n}\hat{\varepsilon}_j$$

which is similar to the Abraham-Katz estimator except for the weights.

The Abraham-Katz estimator uses employment share weights w_{tj} in the place of the uniform weights 1/n. Their weighting system will arise in our derivation if the number of firms varies across industries. We may capture the differences in the number of firms by assigning weights n_{tj}/n_t to the dependent variable y_j and replace y_j with $(n_{tj}/n_t)y_j$. Then the estimator of g becomes

$$\tilde{g} = \frac{1}{n}\sum_{j=1}^{n} Q\left(\frac{n_{tj}}{n_t}y_j\right) = \frac{1}{n}\sum_{j=1}^{n} w_{tj}\hat{\varepsilon}_j$$

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Comments on "Measurements of Sectoral Shifts: Dispersion and Skewness"

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The paper tests the sectoral shift hypothesis. Dispersion alone is not sufficient for measurement of sectoral shift. Skewness of the sectoral shocks can improve the measurement. The empirical results suggest that the lack of support in Abraham and Katz study is due to i) the omission of the skewness measure, and ii) their use of dispersion of the innovation terms in serially correlated sectoral shocks (ut) instead of the dispersion of the sectoral shocks themselves (εt). The difference in natural rate of unemployment across models lies in the difference in the structure of equation.

This is a very rich paper. It contains detailed discussion on the topic and careful treatment of econometrics. Results are quite interesting and it provides a clue about the puzzle in Abraham and Krueger. I initially had several questions about the paper, but I have already clarified my questions with the authors. However, I still have one question in the paper which is not clear to me; "Why there is an increased importance of the skewness in 1980s?". The authors do not investigate this finding further, and I understand that this question might be beyond the scope of the paper. Thus, I recommend "Publish as is submitted". However, the editor of the journal can take this question seriously and ask the authors to investigate this further. I will leave this matter to the editor's discretion.

CHAPTER 6-2

Entry Regulation and Industries' Performance in Korea

by
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I. Introduction

It is widely recognized that improving the quality of government regulations and of the regulatory management system is an integral element of improving business environment. As a matter of fact, improving business environment through regulatory reforms has been pursued as a major objective of the governments both in advanced and developing economies (OECD, 2002; World Bank, 2005).

Economic regulation (e.g., regulation of pricing, entry and exit) would deprive consumers of the benefits from price competition. Market distorting regulations would also create allocative inefficiencies by making prices deviate from marginal costs. Even though regulation could benefit protected firms by insulating them from market competition, it would also restrict their operations and thus create dynamic inefficiencies as indicated by low productivity growth, slow technological innovation, and the poor quality of management (Winston, 1993). In fact, the United States and many other OECD countries have made considerable progress in regulatory reform in some sectors during the last two decades. Available evidence suggests that progress in regulatory reform has been beneficial for efficiency and consumer welfare (Winston, 1998; Gonenc *et al*., 2001). In addition, evidence from OECD countries suggest that regulatory reforms lowering entry barriers spur investment and growth (Alesina, Ardgana, Nicoletti, and Schiantarelli, 2005).[1] Regression results both at the country level and at the sectoral level by Conway (2005) also suggest that anti-competitive product market regulation has a strong negative effects on ICT (information & communication technology) investment.

The experience of regulatory reform for the past several decades has provided researchers with good opportunities for estimating productivity gains from enhanced competition. Based on cost function regressions using an unbalanced panel of 293 observations from 24 airlines over the period 1971-86, Baltagi *et al.* (1995) concluded that, despite the slowdown of productivity growth in the 1980s, deregulation did appear to have stimulated technical change due to more efficient route structures. Gort and Sung

[1] For a further review of empirical evidence on static and dynamic gains from regulatory reform mainly in OECD countries, see Ahn (2002) and Nicoletti and Scarpetta (2003).

(1999) compared the performance (in terms of both productivity and cost) of AT&T Long Lines, operating in an increasingly competitive markets, with that of eight local telephone monopolies. Over the 1985-91 period, TFP growth rate of AT&T Long Lines was substantially higher than that of the regional companies.

International comparisons in various ways also point to productivity-enhancing effects of regulatory reform. Caves *et al*. (1981) observed substantial differences in productivity growth of the railroad industry between the United States and Canada (0.6% vs. 1.7% during 1956-63, and 0.1% vs. 4.0% during 1963-74) and they attributed the differences to the regulatory environment in the United States (Joskow and Rose, 1989). Marín (1998) included 10 European flag carriers in addition to 9 US companies and estimated a stochastic production frontier to measure technical efficiency. According to his results, the introduction of liberalisation in the form of bilateral agreement with the US has brought about a short run reduction in efficiency that is expected to be followed by long run efficiency improvements. Possible reasons for this short run efficiency loss include: *i*) Firms may decide to use more productive inputs which require some time before being efficiently utilised; and *ii*) Re-organisation of their output cannot be immediately followed by adjustments in their input requirement.

As was emphasized by Winston (1998), progress in regulatory reform is sometimes stalled or even reversed when it fails to produce sufficient immediate benefits. Unfortunately, however, it usually takes a long time for the affected producers and consumers to adjust to the new competitive environment and to fully experience gains from the regulatory reform. Moreover, benefits of regulatory reform are not evenly distributed among producers and consumers (Joskow and Rose, 1989). Therefore, it is difficult but very important to examine how the long-run benefits of regulatory reform are achieved and distributed.

And yet, due to various difficulties coming from analytical tractability and data availability, empirical studies usually focus on particular comparative static effects of regulatory reform such as price, profit, and wage changes. Arguably, sum of such static gains would represent only a lower bound of gains from regulatory reform, since firms will continue to innovate in ways they would not have under regulation (Winston, 1993). The existing evidence on the effects of regulatory reform on innovation includes anecdotes, case studies, and an increasing number of econometric studies (Joskow and Rose, 1989).

For better understanding the effects of regulatory reform which is very likely to involve changes in firm dynamics (i.e., entry and exit, growth and decline of firms), one needs to delve into micro data. Olley and Pakes (1996) analysed the productivity dynamics in the telecommunications equipment industry in the United States using the 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 productivity. Their findings also suggested that competitive selection process via entry and exit facilitated this reallocation.

Evidence supporting the importance of firm dynamics and selection effects in aggregate productivity is found in other countries as well. In the United Kingdom, compositional changes due to firm dynamics (i.e., expansion and shrink, entry and exit of firms) accounted for 50% of labour productivity growth and 90% of total factor productivity growth in the total manufacturing sector over 1980-1992 (Disney *et al*., 2000). In the Netherlands, one third of aggregate labour productivity growth over the period 1980-1991 was explained by the net entry effect alone (Bartelsman *et al*., 1995).

Taking advantage of rich information from Korean micro-data, this paper explores links between regulatory reform and economic performance. More specifically, this paper first asks whether reducing entry regulation would facilitate firm dynamics, and then, asks whether firm dynamics would contribute to job creation and productivity growth. This paper consists of five sections. Section 2 is an overview of regulation in OECD countries, focused on OECD regulatory indicators of product market regulation (PMR). From Section 3, we look into Korean micro-data more closely. Section 3 investigates the links between entry regulation and the industry-level firm dynamics measures. It is found in Section 3 that industries with less entry regulation tend to have more active firm dynamics. Section 4 shows that plants in industries with more active firm dynamics tend to create more jobs and to achieve faster productivity growth. Section 5 summarizes and concludes the paper.

II. Regulation in OECD Countries

Conway, Janod, and Nicoletti (2005) analysed recent trends in product market regulation (PMR) in OECD countries, using OECD PMR indicators which provide a snapshot of regulation for the whole economy for two points in time (1998 and 2003).[2] OECD has developed a comprehensive PMR indicators system covering three areas: 1) state control, 2) barriers to entrepreneurship, and 3) barriers to trade and investment. These three areas cover both inward-oriented policies and outward-oriented policies. They consist of total 16 low-level indicators as follows (Conway *et al*., 2005).

1) State control (inward-oriented policies)

Scope of public enterprises: this indicator measures the pervasiveness of state ownership across business sectors as the proportion of sectors in which the state has an equity stake in at least one firm.

Size of public enterprise: reflects the overall size of state-owned enterprises relative to the size of the economy.

Direct control over business enterprises: measures the existence of government special voting rights in privately-owned firms, constraints on the sale of state-owned equity stakes, and the extent to which legislative bodies control the strategic choices of public enterprises.

Price controls: reflects the extent of price controls in specific sectors.

2) Barriers to entrepreneurship (inward-oriented policies)

Use of command and control regulation: indicates the extent to which government uses coercive (as opposed to incentive-based) regulation in general and in specific service sectors.

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[2] In addition to the PMR indicators which summarize economy-wide regulation, OECD also has developed two sectoral indicators as follows (Conway, 2005)

- The indicators of regulation in specific service sectors: These indicators include professional services, retail, and banking sectors and cover entry and operational restrictions for selected years.
- The indicators of regulatory reform (REGREF): The REGREF indicators have time-series information for 21 OECD countries for each year from 1975 to 2003, covering 7 non-manufacturing sectors: airlines, telecommunications, electricity, gas, post, rail, and road freight.

Licenses and permits systems: reflects the use of 'one-stop shops' and 'silence is consent' rules for getting information on and issuing licenses and permits.

Communication and simplification of rules and procedures: reflects aspects of government's communication strategy and efforts to reduce and simplify the administrative burden of interacting with government.

Administrative burdens for corporations: measures the administrative burdens on the creation of corporations.

Administrative burdens for sole proprietors: measures the administrative burdens on the creation of sole proprietor firms.

Sector-specific administrative burdens: reflects administrative burdens in the road transport and retail distribution sectors.

Legal barriers: measures the scope of explicit legal limitations on the number of competitors allowed in a wide range of business sectors.

Antitrust exemptions: measures the scope of exemptions to competition law for public enterprises.

3) Barriers to trade and investment (outward-oriented policies)

Ownership barriers: reflects legal restrictions on foreign acquisition of equity in public and private firms and in the tele-communications and airlines sectors.

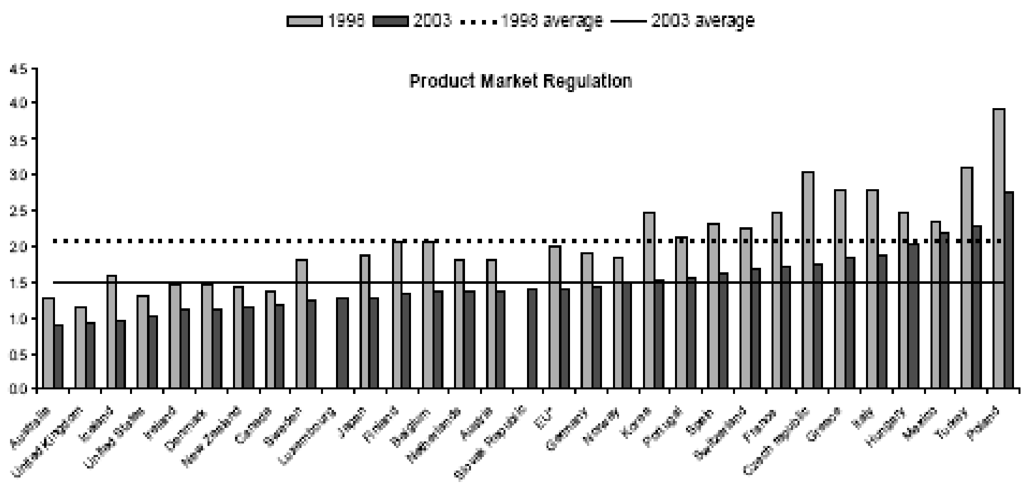
Tariffs: reflects the (simple) average of most-favoured-nation tariffs.

Discriminatory procedures: reflects the extent of discrimination against foreign firms at the procedural level.

Regulatory barriers: reflects other barriers to international trade (e.g. international harmonisation, mutual recognition agreements).

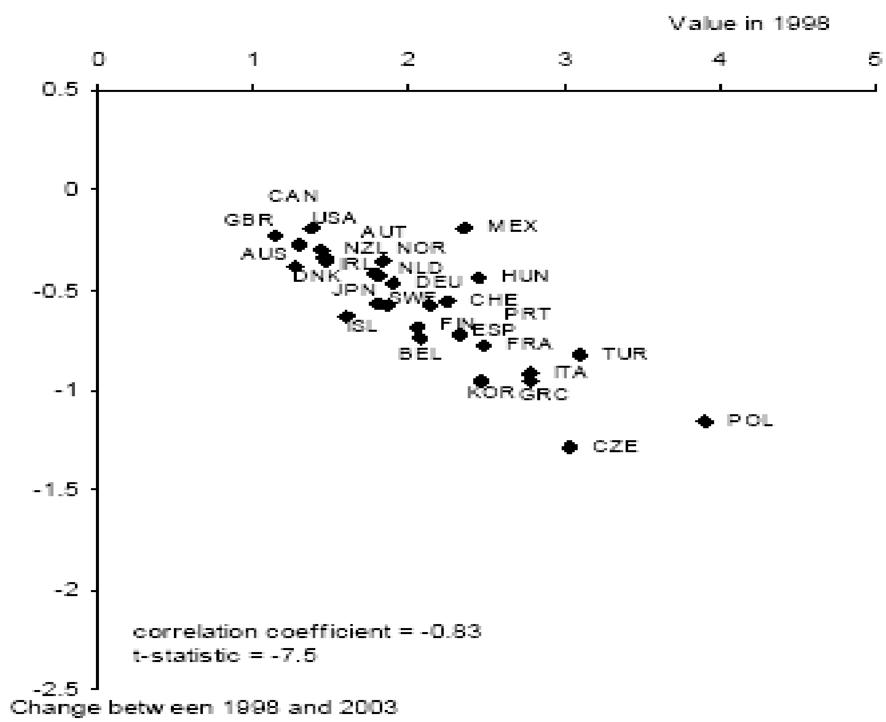
The scale of the PMR indicators is 0 to 6, reflecting increasing restrictiveness of regulatory provisions. Conway *et al*., (2005) compared PMR indicators for OECD countries as of 1998 and 2003, and drew following conclusions. First, changes in PMR indicators confirm a broad improvement coming from recent regulatory forms in OECD countries (See Figure 1). Second, product market regulation (PMR) has become more homogeneous reflecting a degree of convergence, i.e., countries with relatively restrictive PMR in 1998 showing more progress over the period 1998-2003 (See Figure 2). Third, cross-country correlations between different aspects of PMR remain substantial. In other words, a country having restrictive product market regulation (PMR) in inward-oriented policies tend to be also restrictive in outward-oriented policies and in factor market regulation such as employment protection legislation (EPL) (See Figure 3 and Figure 4). Judging from findings of Conway *et al*., (2005), Korea seems to have made substantial imrpovement in reducing PMR during the period 1998-2003, which exceeds average improvement in OECD countries. But, Korea is still far from the group of countries with most favorable business environment, such as Australia, Iceland, United States, and Ireland (See Figure 1).

Figure 1. Product Market Regulation (PMR) Indicators in 1998 and 2003



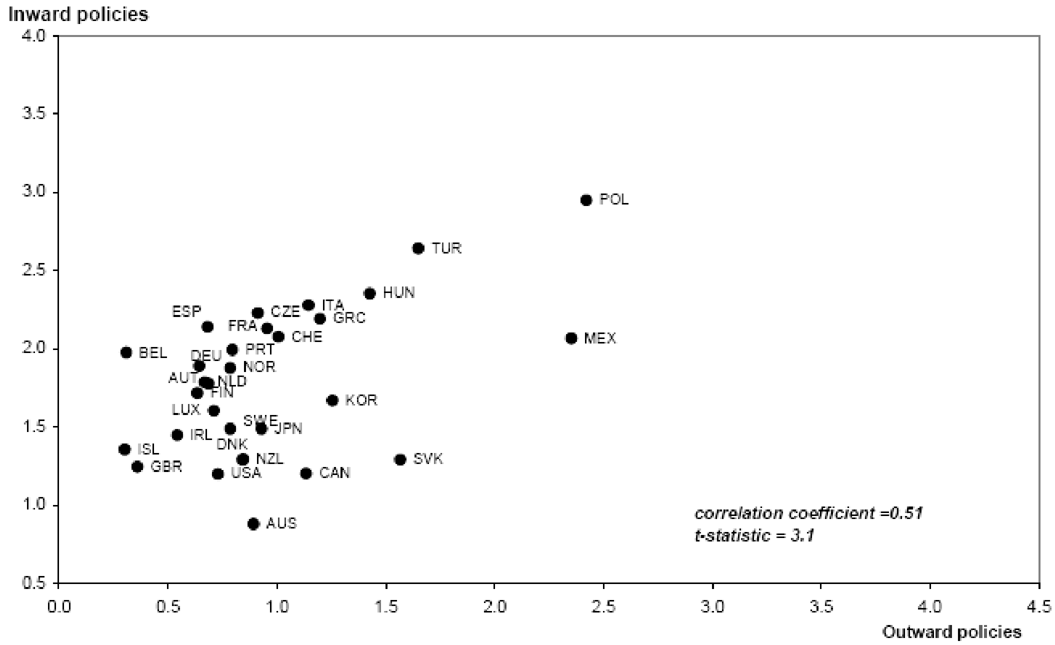
Source: Conway et al. (2005)

Figure 2. Tendency of Convergence in PMR Indicators during 1998-2003



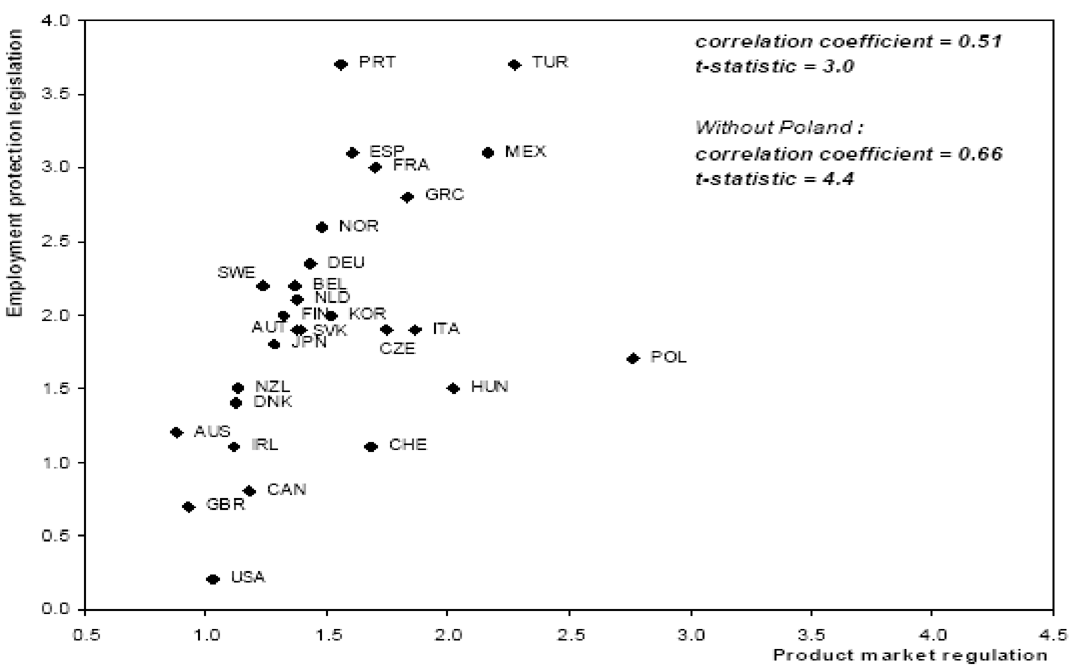
Source: Conway et al. (2005)

Figure 3. Correlation between Inward and Outward-Oriented Policies ('03)



Source: Conway et al. (2005)

Figure 4. Correlation between PMR and EPL Indicators ('03)



Source: Conway et al. (2005)

III. Entry Regulation and Firm Dynamics in Korea

The main goal of this paper is to explore empirical relations between entry regulation, firm dynamics, and economic performance using manufacturing micro-data in Korea. Section 3 investigates links between entry regulation and firm dynamics in Korea, mainly focused on 23 manufacturing sectors at the KSIC 2-digit industry-level. Regulation is far more prevalent at the non-manufacturing sectors in OECD countries, while regulatory barriers are much lower and being reduced persistently in manufacturing sectors (Maher, 2005). However, as micro-data in service industries are yet to be obtained, this paper will focus mainly on analyzing manufacturing micro-data that are already available.

For entry regulation, Kim (2002) calculated several measures of entry regulation in each industry as of year 1992 and year 2001. For firm dynamics, I calculated entry and exit rates for each industry each year from 1991 to 2003, using the plant-level micro-data of the *Annual Report on Mining and Manufacturing Survey* by the National Statistical Office of Korea. Plant-level employment growth and TFP growth, which are necessary for analyses in Section 4, are also calculated using the same data.

3.1. Entry Regulation Indicators

Kim (1994, 2002) has tabulated the actual types of legal entry regulations in Korean industries as of 1992 and 2001 for each of 1,195 industries at the KSIC 5-digit level. Legal entry regulations consist of the following 8 types: state monopoly, designation, permit, license, approval, authorization, registration, and report. Kim (2002) categorized state monopoly, designation, permit, license, approval, and authorization as strong types of regulation, and, registration and report as weak types.

Table 1. Changes in Entry Regulations by Type (1992 - 2001)

2001 / 1992	State Monopoly	Designa-tion	Permit	License	Approval	Authori-zation	Registr-ation	Report	abolished	TOTAL
State monopoly	**20**		1							21
Designa-tion		**5**	1		1		1		2	10
Permit			**101**				34	55	30	220
Licence				**33**			37		1	71
Approval			1		**16**		1	1	7	26
Authori-zation								2	2	4
Registra-tion			2				**73**	9	65	149
Report							2	**21**	17	40
not existing in 1992			6		2		1	1		10
TOTAL	20	5	112	33	19	0	149	89	124	**551**

Source: Kim (2002)

Table 1 shows a transition matrix for changes in entry regulations from 1991 to 2002. Total 541 (= 551 – 10) regulations existed in 1991. Over the period from 1991 to 2002, 10 new entry regulations appeared and 124 entry regulations were abolished. As a result, total 427 (= 551 – 124) regulations remained by the end of 2002. Among 220 sectors where entry permit was required in 1991, for example, total 89 sectors came to have weak types of regulation such as registration (in 34 sectors) and report (in 55 sectors) while regulations of entry permit were abolished in 30 sectors. But, it is not always the case that strong entry regulations were abolished or replaced by weak regulations. Among 149 sectors where registration was required in 1991, such regulation was abolished in 65 sectors but a stronger form (entry permit) was introduced in 2 sectors.

Table 2. Entry Regulations in the Whole Industry (By Number of Sectors)

		Number of KSIC 5-digit industries (A)	1992		2001		Changes	
CODE	INDUSTRY		# of industries with entry regulation (B)	% (C=B/A)	# of industries with entry regulation (D)	% (E=D/A)	# of industries with entry regulation (D-B)	% (E-C)
A	AGRICULTURE AND FORESTRY	32	13	40.6	6	18.8	-7	-21.9
B	FISHING	9	7	77.8	7	77.8	0	0.0
C	MINING AND QUARRYING	27	26	96.3	26	96.3	0	0.0
D	MANUFACTURING	585	188	32.1	115	19.7	-73	-12.5
E	ELECTRICITY, GAS AND WATER SUPPLY	6	4	66.7	4	66.7	0	0.0
F	CONSTRUCTION	40	39	97.5	39	97.5	0	0.0
G	WHOLESALE AND RETAIL TRADE	168	57	33.9	40	23.8	-17	-10.1
H	HOTELS AND RESTAURANTS	22	20	90.9	19	86.4	-1	-4.5
I	TRANSPORT, POST AND TELECOMMUNICATIONS	61	45	73.8	40	65.6	-5	-8.2
J	FINANCIAL INSTITUTIONS AND INSURANCE	30	21	70.0	23	76.7	2	6.7
K	REAL ESTATE, RENTING AND BUSINESS SERVIC	83	41	49.4	32	38.6	-9	-10.8
L	PUBLIC ADMINISTRATION AND DEFENCE	15	15	100.0	15	100.0	0	0.0
M	EDUCATION	14	11	78.6	12	85.7	1	7.1
N	HEALTH AND SOCIAL WORK	20	15	75.0	16	80.0	1	5.0
O	OTHER COMMUNITY AND PERSONAL SERVICES	80	37	46.3	31	38.8	-6	-7.5
P	PRIVATE HOUSEHOLDS WITH EMPLOYED PERSO	1	0	0.0	0	0.0	0	0.0
Q	EXTRA-TERRITORIAL ORGANIZATIONS AND BOD	2	2	100.0	2	100.0	0	0.0
	TOTAL	**1,195**	**541**	**45.3**	**427**	**35.7**	**-114**	**-9.5**

Source: Kim (2002)

Table 2 shows the economy-wide distribution of entry regulations in 1992 and 2001. Over the two observation years, 1992 and 2001, the number of sectors under entry regulation decreased from 545 down to 427. The share of sectors with entry regulation (by the number of sectors) declined substantially, from 45.3% to 35.7%.

The whole industry consists of 1,195 KSIC 5-digit industries, and 585 industries belong to manufacturing. Out of those 585 sectors in manufacturing, total 188 sectors (32.1%) used to have entry regulations in 1991. But, the number of sectors with entry regulations decreased to 115 (i.e., 19.7% of 585 sectors in manufacturing). As Table 2 shows, there was a substantial reduction in entry regulations in manufacturing where the share of sectors with entry regulations was alreay relatively low. In contrast to manufacturing, the number of sectors with entry regulations did not decrease but even increased in highly regulated industries such as utilities, construction, finance & insurance, education, and health & social work.

Henceforth, we will focus on entry regulations in the manufacturing sector.

Table 3. Entry Regulations in Manufacturing (By Number of Sectors)

Industry (KSIC 2-digit)		Number of KSIC 5-digit industries (A)	1992		2001		Changes	
			# of industries with entry regulation (B)	% (C=B/A)	# of industries with entry regulation (D)	% (E=D/A)	# of industries with entry regulation (D-B)	% (E-C)
15	Food Products and Beverages	72	62	*86.1*	62	*86.1*	0	*0.0*
16	Tabacco Products	2	1	*50.0*	1	*50.0*	0	*0.0*
17	Textiles	38	1	*2.6*	0	*0.0*	-1	*-2.6*
18	Sewn Wearing Apparel and Fur Articles	16	0	*0.0*	0	*0.0*	0	*0.0*
19	Leather, Luggage and Footwear	16	1	*6.3*	0	*0.0*	-1	*-6.3*
20	Wood and Products of Wood and Cork	21	5	*23.8*	0	*0.0*	-5	*-23.8*
21	Pulp, Paper and Paper Products	21	2	*9.5*	1	*4.8*	-1	*-4.8*
22	Publishing and Printing	16	10	*62.5*	10	*62.5*	0	*0.0*
23	Coke, Refined Petroleum Products and Fuel	5	5	*100.0*	5	*100.0*	0	*0.0*
24	Chemicals and Chemical Products	49	18	*36.7*	16	*32.7*	-2	*-4.1*
25	Rubber and Plastic Products	25	1	*4.0*	0	*0.0*	-1	*-4.0*
26	Other Non-metallic Mineral Products	43	10	*23.3*	3	*7.0*	-7	*-16.3*
27	Basic Metals	32	0	*0.0*	0	*0.0*	0	*0.0*
28	Fabricated Metal Products	36	6	*16.7*	2	*5.6*	-4	*-11.1*
29	Other Machinery and Equipment	56	29	*51.8*	3	*5.4*	-26	*-46.4*
30	Computers and Office Machinery	8	3	*37.5*	0	*0.0*	-3	*-37.5*
31	Electrical Machinery and Apparatuses	22	13	*59.1*	0	*0.0*	-13	*-59.1*
32	Electronic Components and Telecom Equipme	10	3	*30.0*	0	*0.0*	-3	*-30.0*
33	Medical, Precision and Optical Instrument	24	13	*54.2*	11	*45.8*	-2	*-8.3*
34	Motor Vehicles, Trailers and Semitrailers	7	0	*0.0*	0	*0.0*	0	*0.0*
35	Other Transport Equipment	18	3	*16.7*	0	*0.0*	-3	*-16.7*
36	Furniture and Articles n.e.c.	43	2	*4.7*	1	*2.3*	-1	*-2.3*
37	Recycling	5	0	*0.0*	0	*0.0*	0	*0.0*
TOTAL		**585**	**188**	***32.1***	**115**	***19.7***	**-73**	***-12.5***

Source: Kim (2002)

Table 4. Entry Regulations in Manufacturing (By Production of Sectors)

	Industry	1991 Production of industries (A)	1991 Production of industries with entry regulation (B)	1991 % (C=B/A)	2000 Production of industries (D)	2000 Production of industries with entry regulation (E)	2000 % (F=E/D)	Changes % (G=F-C)
15	Food Products and Beverages	17,165,127	16,538,625	96.4	35,093,720	30,200,392	86.1	-10.3
16	Tabacco Products	2,974,982	2,731,629	91.8	3,695,553	3,186,547	86.2	-5.6
17	Textiles	14,312,117	48,912	0.3	26,033,439	0	0.0	-0.3
18	Sewn Wearing Apparel and Fur Articles	5,921,649	0	0.0	9,457,700	0	0.0	0.0
19	Leather, Luggage and Footwear	6,642,851	1,714,986	25.8	5,507,506	0	0.0	-25.8
20	Wood and Products of Wood and Cork	2,150,883	1,863,921	86.7	3,171,060	0	0.0	-86.7
21	Pulp, Paper and Paper Products	5,193,334	1,142,630	22.0	13,410,379	281,933	2.1	-19.9
22	Publishing and Printing	3,190,461	2,915,241	91.4	9,803,929	8,719,676	88.9	-2.4
23	Coke, Refined Petroleum Products and Fuel	9,521,810	9,521,810	100.0	40,038,973	40,038,973	100.0	0.0
24	Chemicals and Chemical Products	19,522,861	5,550,923	28.4	56,014,909	12,426,363	22.2	-6.2
25	Rubber and Plastic Products	8,893,617	218,123	2.5	21,464,626	0	0.0	-2.5
26	Other Non-metallic Mineral Products	11,147,334	1,531,079	13.7	16,974,163	763,161	4.5	-9.2
27	Basic Metals	18,168,098	0	0.0	44,527,747	0	0.0	0.0
28	Fabricated Metal Products	8,574,139	2,116,420	24.7	20,306,140	516,507	2.5	-22.1
29	Other Machinery and Equipment	16,354,154	11,473,913	70.2	42,413,933	3,242,338	7.6	-62.5
30	Computers and Office Machinery	1,485,854	215,228	14.5	26,348,597	0	0.0	-14.5
31	Electrical Machinery and Apparatuses	6,587,394	4,685,685	71.1	21,594,787	0	0.0	-71.1
32	Electronic Components and Telecom Equipm	19,640,609	12,865,090	65.5	79,414,018	0	0.0	-65.5
33	Medical, Precision and Optical Instrument	2,054,848	880,793	42.9	5,132,385	2,465,542	48.0	5.2
34	Motor Vehicles, Trailers and Semitrailers	17,745,997	0	0.0	53,578,437	0	0.0	0.0
35	Other Transport Equipment	5,630,912	440,669	7.8	18,383,561	0	0.0	-7.8
36	Furniture and Articles n.e.c.	5,065,943	48,195	1.0	8,378,225	35,614	0.4	-0.5
37	Recycling	32,600	0	0.0	891,355	0	0.0	0.0
	TOTAL	**207,977,574**	**76,503,872**	**36.8**	**561,635,142**	**101,877,046**	**18.1**	**-18.6**

Source: Kim (2002)

Table 3 and Table 4 are for the distribution of entry regulations in 23 manufactruing sectors (at KSIC 2-digit level). Table 3 is based on the number of the regulated sectors, and Table 4 is based on the amount of production in the regulated sectors. From Table 3 and Table 4, we obtain two kinds of indicators for the degree of entry regulation in each sector. The one is calculated as the ratio of the number of regulated sectors to the number of all sectors in each of 23 industries. They are reported in Column C and Column F of Table 3. The other is the ratio of the amount of production of regulated sectors to the total amound of production in each of 23 industries. They are reported in Column C and Column F of Table 4. These two ratios indicate the degree of entry regulation in each industry and will be used as measures of entry regulation in the following analyses.

Table 5. Entry Regulations by Strength (By Number of Sectors)

KSIC	industry	1992			2001			change		
		Strong Form	Weak Form	Total	Strong Form	Weak Form	Total	Strong Form	Weak Form	Total
15	Food Products and Beverages	62	0	62	21	41	62	−41	41	0
16	Tabacco Products	1	0	1	1	0	1	0	0	0
17	Textiles	1	0	1	0	0	0	−1	0	−1
18	Sewn Wearing Apparel and Fur Articles	0	0	0	0	0	0	0	0	0
19	Leather, Luggage and Footwear	0	1	1	0	0	0	0	−1	−1
20	Wood and Products of Wood and Cork	0	5	5	0	0	0	0	−5	−5
21	Pulp, Paper and Paper Products	0	2	2	0	1	1	0	−1	−1
22	Publishing and Printing	0	10	10	0	10	10	0	0	0
23	Coke, Refined Petroleum Products and Fuel	3	2	5	0	5	5	−3	3	0
24	Chemicals and Chemical Products	16	2	18	8	8	16	−8	6	−2
25	Rubber and Plastic Products	0	1	1	0	0	0	0	−1	−1
26	Other Non-metallic Mineral Products	2	8	10	1	2	3	−1	−6	−7
27	Basic Metals	0	0	0	0	0	0	0	0	0
28	Fabricated Metal Products	5	1	6	2	0	2	−3	−1	−4
29	Other Machinery and Equipment	5	24	29	3	0	3	−2	−24	−26
30	Computers and Office Machinery	0	3	3	0	0	0	0	−3	−3
31	Electrical Machinery and Apparatuses	0	13	13	0	0	0	0	−13	−13
32	Electronic Components and Telecom. Equipment	2	1	3	0	0	0	−2	−1	−3
33	Medical, Precision and Optical Instrument	5	8	13	5	6	11	0	−2	−2
34	Motor Vehicles, Trailers and Semitrailers	0	0	0	0	0	0	0	0	0
35	Other Transport Equipment	0	3	3	0	0	0	0	−3	−3
36	Furniture and Articles n.e.c.	1	1	2	1	0	1	0	−1	−1
37	Recycling	0	0	0	0	0	0	0	0	0
	Total	103	85	**188**	42	73	**115**	−61	−12	**−73**

Source: Kim (2002)

Table 5 shows sectoral distribution of entry regulations with the strong form (state monopoly, designation, permit, license, approval, and authorization) and the weak form (registration and report). In 1992, total 62 out of 72 sectors in food & beverage industry had entry regulations in the strong form. Table 5 shows that 41 sectors out of those 62 sectors with strong entry regulations switched from strong to weak regulations by 2001. As a result, food & beverage industry had 21 sectors with strong entry regulations and 41 with weak entry regulations. By calculating the ratios of the nubmer of sectors with strong [weak] regulations to the nuber of total sectors in each industry, we can get strong [weak] form entry regulation indicators.

3.2. Firm Dynamics in Korean Manufacturing

Recent empirical studies exploring determinants of aggregate productivity growth based on micro-data have found large and persistent differences in productivity levels across firms/plants even within the same sector. Moreover, a substantial portion of aggregate productivity growth is attributable to resource reallocation across such heterogeneous firms/plants, from shrinking/exiting low productive firms to expanding/entering high productive firms. The importance of such firm dynamics (i.e., expansion and contraction of existing firms as well as entry and exit of firms) in aggregate productivity growth is being recognised in the growing body of empirical research in many countries.[3]

Characteristics of firm dynamics can be summarised by statistics such as entry rate, survival rate, hazard rate, growth rate, etc. The most easily obtainable statistics are entry, exit, and turnover rates.

The *entry rate* (or start-up rate) is typically calculated as the number of entrants during a certain period divided by the total number of firms in the sector. Occasionally, production or employment is used as a measure of the share of entrants.

The *exit rate* is typically calculated as the number of exiting firms during a certain period divided by the total number of firms in the sector. The analogous production-weighted [employment-weighted] exit rate is calculated by dividing the production [employment] of exiting firms by total (sectoral) production [employment].

The *turnover rate* is the sum of entry rate and exit rate in a given sector over a given period.

By tracing a cohort(s) of firms that entered at the same period, one can also calculate survival rate and hazard rate.

The *survival rate* is the share of surviving firms in a given year as a percentage of the total number of entrants in the beginning year (i.e. share of survivors in a cohort).

The *hazard rate* is the share of exiting firms in a given year as a percentage of the total number of survivors as of the previous year (i.e. it represents continuing firm's conditional probability of failure).

[3] Findings from those empirical studies were reviewed by Geroski (1995), OECD (1998, Ch.4), Caves (1998), Foster et al. (1998), Bartelsman and Doms (2000), Haltiwanger (2000), and Ahn (2001), among others.

Table 6. Entry and Exit Rates (By Number of Plants)

(%)

KSIC	industry	1992		2001	
		Entry Rate	Exit Rate	Entry Rate	Exit Rate
15	Food Products and Beverages	14.05	10.97	17.94	9.06
16	Tabacco Products	0.00	20.00	8.33	0.00
17	Textiles	15.21	15.73	18.40	12.62
18	Sewn Wearing Apparel and Fur Articles	18.96	19.31	20.20	15.70
19	Leather, Luggage and Footwear	18.45	22.45	17.47	18.87
20	Wood and Products of Wood and Cork	14.39	14.83	19.11	12.60
21	Pulp, Paper and Paper Products	14.32	15.42	16.82	10.16
22	Publishing and Printing	17.61	18.99	22.77	10.51
23	Coke, Refined Petroleum Products and Fuel	5.48	8.22	10.64	2.13
24	Chemicals and Chemical Products	14.93	10.39	15.13	7.76
25	Rubber and Plastic Products	15.07	14.72	16.55	10.02
26	Other Non-metallic Mineral Products	14.11	15.75	15.33	8.33
27	Basic Metals	15.55	15.03	15.16	5.91
28	Fabricated Metal Products	19.73	15.03	20.17	10.87
29	Other Machinery and Equipment	19.56	14.58	18.77	10.17
30	Computers and Office Machinery	21.21	17.93	19.89	12.43
31	Electrical Machinery and Apparatuses	20.23	15.31	17.37	9.73
32	Electronic Components and Telecom. Equipment	15.61	14.27	21.33	10.95
33	Medical, Precision and Optical Instrument	16.44	15.11	21.36	10.38
34	Motor Vehicles, Trailers and Semitrailers	18.17	12.83	18.72	7.75
35	Other Transport Equipment	17.24	12.32	23.29	9.67
36	Furniture and Articles n.e.c.	16.35	18.31	22.86	14.47
37	Recycling	31.65	15.19	29.43	15.31
	Average	16.27	15.33	18.57	10.23

Source: Author's calculation based on micro-data from National Statistical Office of Korea

From the plant-level micro-data of the *Annual Report on Mining and Manufacturing Survey* by the National Statistical Office, annual entry and exit rates can be calculated for 23 manufacturing industries (at KSIC 2-digit level) for each year from 1991 to 2003. Table 6 reports annual entry and exit rates (based on number of plants) for those 23 industries in 1992 and 2001, when entry regulation indicators are also available.

Following figures (Figure 6, Figure 7, and Figure 8) show share (by number of plants) of entry cohorts, survival rates for each entry cohort, and hazard rates for each cohort, respectively, over the period from 1994 to 2003. The peak in Figure 8 reflects the impact of East Asian financial crisis.

Figure 6. Share of Each Entry Cohort (By Number of Plants)

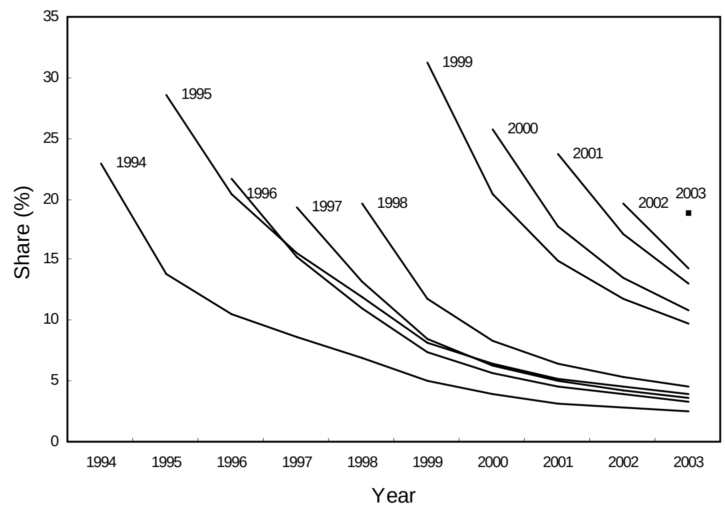
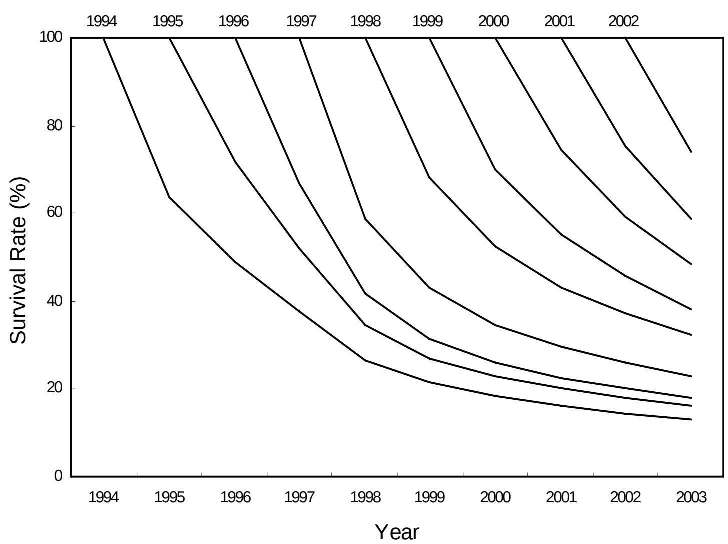
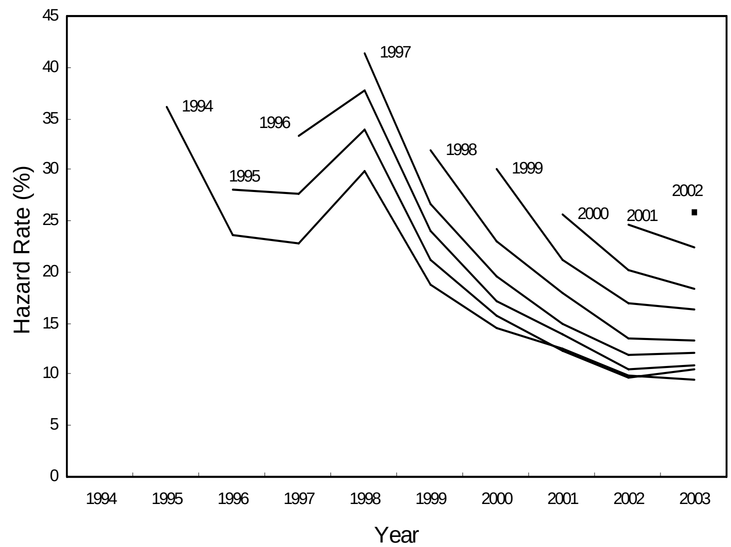


Figure 7. Survival Rate for Each Entry Cohort (By Number of Plants)



Source: Author's calculation based on micro-data from National Statistical Office of Korea

Figure 8. Hazard Rate for Each Entry Cohort (By Number of Plants)



Source: Author's calculation based on micro-data from National Statistical Office of Korea

3.3. Entry Regulations and Firm Dynamics

Now we are ready to investigate empirical links between entry regulation and firm dynamics, using aforementioned entry regulation indicators and firm dynamics statistics. Findings of Olley and Pakes (1996) from their analyses on the productivity dynamics in the telecommunications equipment industry in the United States suggest that aggregate productivity increased sharply after two rounds of deregulation. According to their study, the productivity growth that followed regulatory change is largely due to a reallocation of capital from less productive plants to more productive ones rather than due to an increase in average productivity. Their findings also suggested that competitive selection process via entry and exit facilitated this reallocation. Findings of this paper also suggest that entry regulation has detrimental influences on productivity growth by hamperinig firm dynamics. After exploring links between entry regulation and firm dynamics in this sub-section, we will examine links between firm dynamics and productivity growth in Section 4.

Table 7. Correlation of Entry Regulation and Firm Dynamics (I)

	Entry Rate (# of plants)	Entry Rate (production)	Entry Rate (employment)	Entry Regulation Indicator (# of industry)	Entry Regulation Indicator (strong form)	Entry Regulation Indicator (weak form)	Entry Regulation Indicator (production)
Entry Rate (# of plants)	1.0000						
Entry Rate (production)	0.7310 **	1.0000					
Entry Rate (employment)	0.8167 **	0.9453 **	1.0000				
Entry Regulation Indicator (# of industry)	-0.2944 **	-0.1953 *	-0.2434 **	1.0000			
Entry Regulation Indicator (strong form)	-0.4232 **	-0.2314 **	-0.2752 **	0.6382 **	1.0000		
Entry Regulation Indicator (weak form)	-0.0387	-0.0658	-0.0927	0.7806 **	0.0170	1.0000	
Entry Regulation Indicator (production)	-0.3128 **	-0.1380	-0.1816 *	0.9122 **	0.6112 **	0.6885 **	1.0000

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

Correlations between 3 indicators of entry rate and 4 indicators of entry regulation are reported in Table 7-1. First, it is obvious that 3 different entry rate indicators are very highly correlated with one another (ranging from 73.1% to 94.5%). Second, 4 different indicators of entry regulation are also show significantly positive correlations (ranging from 63.8% to 91.2%) except that the strong form entry regulation indicator and the weak form entry regulation are not corellated with each other. Last but not least, an entry regulation indicator and an entry rate indicator typically have negatively correlation, implying that more regulated industries tend to have less entry. Correlation between the simple unweighted entry rate and the strong form entry regulation indicator is –42.3%. But, weak types of entry regulation such as registration or report requirements appear to have little impacts on entry. If entry regulation tends to have negative effects on entry rate, will it have any effects on exit rate? Table 8 on the next page will give some hints for answering this question.

Table 8. Correlation of Entry Regulation and Firm Dynamics (II)

	Entry Rate (# of plants)	Exit Rate (# of plants)	Entry Regulation Indicator (# of industry)	Entry Regulation Indicator (strong form)	Entry Regulation Indicator (weak form)	Entry Regulation Indicator (production)	Non-Production to Production Worker Ratio (by industry)	Capital to Labor Ratio (by industry)
Entry Rate (# of plants)	1.0000							
Exit Rate (# of plants)	0.0582	1.0000						
Entry Regulation Indicator (# of industry)	-0.2944 **	-0.2509 **	1.0000					
Entry Regulation Indicator (strong form)	-0.4232 **	-0.1749 *	0.6382 **	1.0000				
Entry Regulation Indicator (weak form)	-0.0387	-0.1839 *	0.7806 **	0.0170	1.0000			
Entry Regulation Indicator (production)	-0.3128 **	-0.2096 *	0.9122 **	0.6112 **	0.6885 **	1.0000		
Non-Production to Production Worker Ratio (by industry)	0.0919	-0.1451	0.3616 **	-0.0563	0.5152 **	0.2920 **	1.0000	
Capital to Labor Ratio (by industry)	-0.3527 **	-0.1957 *	0.4353 **	0.0802	0.5002 **	0.3149 **	0.2298 **	1.0000

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

Table 8 includes the simple unweighted exit rate as well as non-production to production. First, it shows that the entry rate and the exit rate have little correlation. Second, the exit rate is negatively correlated with entry regulation indicators (ranging from –17.5% to –25.1%). Finally, the capital to labor ratio is negatively correlated with the entry rate (–35.3%) and with the exit rate (–19.6%), confirming the broadly-accepted view that capital intensity deters both entry and exit. Table 7 and Table 8 provide quite useful information on the links between entry regulation and firm dynamics. But, such information has limited value in the sense that simple correlation does not control for the third factors which could affect both entry regulation and firm dynamics. Following regression analyses are needed to treat this problem.

Table 9. Regressions for Entry Rate

Entry Rates (# of plants)	I	II	III	IV
Average Employment	-0.00048 ***	-0.00039 ***	-0.00052 ***	-0.00046 ***
	(-7.43)	(-5.69)	(-7.96)	(-6.79)
Non-Production to Production Worker Ratio (by industry)	0.05367 ***	0.03451 *	0.03053	0.05105 **
	(2.65)	(1.92)	(1.38)	(2.56)
Capital to Labor Ratio (by industry)	-0.00010 **	-0.00015 ***	-0.00015 ***	-0.00012 ***
	(-2.22)	(-3.81)	(-3.01)	(-2.85)
Entry Regulation Indicator (# of Industry)	-0.03956 **			
	(-2.60)			
Entry Regulation Indicator (strong form)		-0.08473 ***		
		(-4.03)		
Entry Regulation Indicator (weak form)			0.00409	
			(0.19)	
Entry Regulation Indicator (production)				-0.03007 **
				(-2.52)
Intercept	0.18962 ***	0.19119 ***	0.18914 ***	0.18913 ***
	(16.21)	(16.89)	(15.76)	(16.15)
Year Dummy	Yes	Yes	Yes	Yes
Number of Obs.	138	138	138	138
R^2	0.61396	0.63945	0.59372	0.61286

The values in parentheses are heteroskedasticity-robust t-statistics
***: Significant at the 1% level.
**: Significant at the 5% level.
*: Significant at the 10% level.

The results of regressions examining the determinants of the entry rate are summarized in Table 9. The independent variable is the simple unweighted entry rate. The explanatory variables are average employment size, non-production to production worker ratio, capital to labor ratio and one out of four different entry regulation indicators. Year dummies need to be added to control for economy-wide shocks such as business-cycle effects.

All the variables are obtained at the level of KSIC 2-digit industries, which means that we have only 23 sectoral observations for one year. As discussed before, entry regulation indicators are available only for two observation years, 1992 and 2001. Then, we have only 46 observations, which seems quite small. To overcome this problem, we make an assumption that the entry regulations remain unchanged within the 3-years window centering around the observation year 1992 and 2001. Under this assumption, we can use total 6 years' observations (1991, 1992, 1993, 2000, 2001, and 2002). The number of observations is now 138 (= 23 x 6).

It is a widely accepted view that economies of scale make an entry barrier. New entrants are typically smaller than incumbents'. If there exist scale effects, then, it would be more difficult to enter an industry where the existing firms' average size is larger. This conjecture is confirmed by the regression results in Table 9. The coefficient for average employment size is always negative and significant. A high degree of capital intensity is often regarded as another strong candidate to be an entry barrier. New entrants cannot afford to buy a large amount of capital goods, and hence, cannot easily enter a sector with high capital intensity. Indeed, the coefficient for capital to labor ratio is always siginificantly negative in Table 9.

Interestingly, the coefficient for the non-production to production worker ratio turns out to be negative and sometimes significant. A plausible conjecture is that skill-intensive industries are rather favorable to entrants while capital-intensive industries or indusries with scale effects are not. Entry regulation indicators, except for the case of the weak form entry regulations, have significantly negative coefficients (ranging from –3.0% to –8.5%). A reasonalbe conclusion obtained from Table 9 is that entry regulation (especially strong form regulation) tends to make entry rate lower.

It is not surprising to see that regulations restricting entry actually make entry rate lower. But, it does not look trivial whether entry regulations would raise or reduce exit rate. According to the results of regressions in Table 10, it appears that entry regulations tend to have negative effects on exit rate (with a varying degree of statistical significance). All in all, we can conclude that entry regulations tend to restrict firm dynamics including both entry and exit.

Table 10. Regressions for Exit Rate

Exit Rates (# of plants)	I	II	III	IV
Average Employment	0.00007	0.00012 *	0.00001	0.00009
	(1.08)	(1.72)	(0.13)	(1.33)
Non-Production to Production Worker Ratio (by industry)	0.00477	-0.01750	-0.00520	0.00056
	(0.24)	(-0.96)	(-0.24)	(0.03)
Capital to Labor Ratio (by industry)	-0.00002	-0.00007 *	-0.00003	-0.00004
	(-0.39)	(-1.82)	(-0.73)	(-1.02)
Entry Regulation Indicator (# of Industry)	-0.04449 ***			
	(-2.99)			
Entry Regulation Indicator (strong form)		-0.06317 ***		
		(-2.97)		
Entry Regulation Indicator (weak form)			-0.02690	
			(-1.24)	
Entry Regulation Indicator (production)				-0.03176
				(-2.72)
Intercept	0.08550 ***	0.08647 ***	0.08461 ***	0.08496
	(7.48)	(7.56)	(7.20)	(7.39)
Year Dummy	Yes	Yes	Yes	Yes
Number of Obs.	138	138	138	138
R^2	0.18169	0.18111	0.13501	0.17222

The values in parentheses are heteroskedasticity-robust t-statistics
***: Significant at the 1% level.
**: Significant at the 5% level.
*: Significant at the 10% level.

IV. Influences of Firm Dynamics on Economic Performance

Empirical findings in Section 3 can be summarized as follows. First, last decade witnessed a substantial progress in reducing entry regulations, but the speed of progress varied a lot from industry to industry. Second, in the form of firm dynamics, inputs and outputs are constant reallocated from more efficient entering or growing firms to less efficient declining or dying firms. Third, entry regulations have negative effects on firm dynamics by deterring entry and exit. In other words, firm dynamics would be facilitated by regulatory reforms reducing entry regulations. This section aims to shed more light on the links between firm dynamics and economic performance. More specifically, this section will utilize both industry-level and plant-level data to detect influences of entry and exit on economic performance in terms of job creation and productivity growth.

4.1. Evidence from Industry-level Performance

This sub-section continues to rely on industry-level data hired in Sub-section 3-3, where regression analyses are based on industry-level observations for 23 manufacturing sectors over 6 years. Both employment growth and output growth are considered in evaluating performance. To mitigate potential simultaneity problem in interpreting the regression results, both annual growth rates and 3-year average growth rates are considered as independent variables. Regression results indicate that entry makes positive and significant contribution to employment growth and output growth, while impacts of exit turn out to be mostly insignificant with mixed signs (See Table 11 through Table 18).

Table 11. Entry and Employment Growth (I)

The values in parentheses are heteroskedasticity-robust t-statistics

Annual Employment Growth Rates	I	II	III
Non-Production to Production Worker Ratio (by industry)	0.05293	0.07670 **	0.07175 *
	(1.40)	(2.03)	(1.93)
Capital to Labor Ratio (by industry)	0.00005	-0.00001	0.00004
	(0.55)	(-0.09)	(0.44)
Entry Rates (# of plants)	0.45424 ***		
	(3.21)		
Entry Rate (production)		0.32118 **	
		(2.25)	
Entry Rate (employment)			0.44861 ***
			(3.05)
Intercept	-0.13736 ***	-0.08848 ***	-0.10801 ***
	(-4.57)	(-3.78)	(-4.33)
Year Dummy	Yes	Yes	Yes
Number of Obs.	138	138	138
R^2	0.29538	0.26772	0.29040

***: Significant at the 1% level.
**: Significant at the 5% level.
*: Significant at the 10% level.

Table 12. Entry and Employment Growth (II)

3-year Average Annual Emplyment Growth Rates	I	II	III
Non-Production to Production Worker Ratio (by industry)	0.09601 **	0.13034 ***	0.12021 ***
	(2.15)	(3.07)	(2.83)
Capital to Labor Ratio (by industry)	0.00006	-0.00001	0.00003
	(0.50)	(-0.10)	(0.27)
Entry Rates (# of plants)	0.34822 ***		
	(2.89)		
Entry Rate (production)		0.34750 ***	
		(2.97)	
Entry Rate (employment)			0.38343 ***
			(3.08)
Intercept	-0.08102 ***	-0.05459 ***	-0.06508 ***
	(-3.21)	(-2.65)	(-2.99)
Year Dummy	Yes	Yes	Yes
Number of Obs.	92	92	92
R^2	0.24511	0.24879	0.25404

The values in parentheses are heteroskedasticity-robust t-statistics
***: Significant at the 1% level.
**: Significant at the 5% level.
*: Significant at the 10% level.

Table 13. Entry and Output Growth (I)

Annual Production Growth Rates	I	II	III
Non-Production to Production Worker Ratio (by industry)	-0.06398	0.02365	0.00513
	(-0.79)	(0.29)	(0.06)
Capital to Labor Ratio (by industry)	0.00030	0.00016	0.00029
	(1.65)	(0.90)	(1.64)
Entry Rates (# of plants)	1.71892 ***		
	(5.66)		
Entry Rate (production)		1.53595 ***	
		(4.98)	
Entry Rate (employment)			1.82675 ***
			(5.85)
Intercept	-0.16176 **	0.00464	-0.06168
	(-2.51)	(0.09)	(-1.16)
Year Dummy	Yes	Yes	Yes
Number of Obs.	138	138	138
R^2	0.33096	0.29977	0.34017

The values in parentheses are heteroskedasticity-robust t-statistics
***: Significant at the 1% level.
**: Significant at the 5% level.
*: Significant at the 10% level.

Table 14. Entry and Output Growth (II)

3-year Average Annual Production Growth Rates	I	II	III
Non-Production to Production Worker Ratio (by industry)	-0.08426	0.07325	0.02130
	(-0.78)	(0.74)	(0.22)
Capital to Labor Ratio (by industry)	0.00054 *	0.00025	0.00047 *
	(1.95)	(1.01)	(1.89)
Entry Rates (# of plants)	1.61063 ***		
	(5.56)		
Entry Rate (production)		1.68278 ***	
		(6.13)	
Entry Rate (employment)			1.92767 ***
			(6.80)
Intercept	-0.07723	0.04073	-0.01560
	(-1.27)	(0.84)	(-0.31)
Year Dummy	Yes	Yes	Yes
Number of Obs.	92	92	92
R^2	0.37831	0.41229	0.45130

The values in parentheses are heteroskedasticity-robust t-statistics
***: Significant at the 1% level.
**: Significant at the 5% level.
*: Significant at the 10% level.

Table 15. Exit and Employment Growth (I)

Annual Employment Growth Rates	I	II	III
Non-Production to Production Worker Ratio (by industry)	0.07357 *	0.07156 *	0.05759
	(1.92)	(1.82)	(1.49)
Capital to Labor Ratio (by industry)	-0.00009	-0.00008	-0.00011
	(-1.12)	(-1.05)	(-1.44)
Exit Rates (# of plants)	-0.27393		
	(-1.51)		
Exit Rates (production)		-0.18722	
		(-0.84)	
Exit Rates (employment)			-0.52119 **
			(-2.41)
Intercept	-0.04614 *	-0.05959 **	-0.03619
	(-1.70)	(-2.35)	(-1.40)
Year Dummy	Yes	Yes	Yes
Number of Obs.	138	138	138
R^2	0.25224	0.24326	0.27191

The values in parentheses are heteroskedasticity-robust t-statistics
***: Significant at the 1% level.
**: Significant at the 5% level.
*: Significant at the 10% level.

Table 16. Exit and Employment Growth (II)

3-year Average Annual Emplyment Growth Rates	I	II	III
Non-Production to Production Worker Ratio (by industry)	0.13857 ***	0.13579 ***	0.11809 **
	(3.07)	(2.97)	(2.57)
Capital to Labor Ratio (by industry)	-0.00011	-0.00011	-0.00013
	(-1.04)	(-1.06)	(-1.27)
Exit Rates (# of plants)	0.05501		
	(0.32)		
Exit Rates (production)		-0.00447	
		(-0.02)	
Exit Rates (employment)			-0.26345
			(-1.36)
Intercept	-0.04026	-0.03471	-0.01542
	(-1.53)	(-1.48)	(-0.62)
Year Dummy	Yes	Yes	Yes
Number of Obs.	92	92	92
R^2	0.17176	0.17078	0.18845

The values in parentheses are heteroskedasticity-robust t-statistics
***: Significant at the 1% level.
**: Significant at the 5% level.
*: Significant at the 10% level.

Table 17. Exit and Output Growth (I)

Annual Production Growth Rates	I	II	III
Non-Production to Production Worker Ratio (by industry)	0.03763	0.07430	0.04360
	(0.42)	(0.83)	(0.48)
Capital to Labor Ratio (by industry)	-0.00014	-0.00008	-0.00013
	(-0.75)	(-0.43)	(-0.69)
Exit Rates (# of plants)	0.14024		
	(0.33)		
Exit Rates (production)		0.98798 *	
		(1.95)	
Exit Rates (employment)			0.21294
			(0.42)
Intercept	0.08152	0.03946	0.07990
	(1.29)	(0.68)	(1.31)
Year Dummy	Yes	Yes	Yes
Number of Obs.	138	138	138
R^2	0.16575	0.18887	0.16617

The values in parentheses are heteroskedasticity-robust t-statistics
***: Significant at the 1% level.
**: Significant at the 5% level.
*: Significant at the 10% level.

Table 18. Exit and Output Growth (II)

3-year Average Annual Production Growth Rates	I	II	III
Non-Production to Production Worker Ratio (by industry)	0.12900	0.15649	0.12908
	(1.07)	(1.30)	(1.04)
Capital to Labor Ratio (by industry)	-0.00021	-0.00017	-0.00021
	(-0.75)	(-0.60)	(-0.74)
Exit Rates (# of plants)	0.61214		
	(1.33)		
Exit Rates (production)		0.95522 *	
		(1.97)	
Exit Rates (employment)			0.41313
			(0.79)
Intercept	0.07702	0.07682	0.10497
	(1.10)	(1.25)	(1.56)
Year Dummy	Yes	Yes	Yes
Number of Obs.	92	92	92
R^2	0.16993	0.18972	0.15875

The values in parentheses are heteroskedasticity-robust t-statistics
***: Significant at the 1% level.
**: Significant at the 5% level.
*: Significant at the 10% level.

4.2. Evidence from Industry-level Performance

In this new sub-section, we start to utilize plant-level data more intensively. The Korea National Statistical Office conducts *Mining and Manufacturing Survey* annually. The survey covers all plants with five or more employees in mining and manufacturing industries and contains plant-level information on output, input, and a variety of additional information including the 5-digit Korean Standard Industry Classification (KSIC) code assigned to each plant based on its major product. Variables such as plant-level employment growth, capital-labor ratio, non-production- to production-worker ratio, labor productivity, and total factor productivity were calculated at plant-level based on information from this *Survey*.

The regression equation for the empoyment growth is:

$$\sqrt[\frac{1}{3}]{\frac{L_{i,t+3}}{L_{i,t}}} - 1 = \alpha_0 + \alpha_{Plant} \cdot X_{i,t} + \alpha_{Industry} \cdot Y_{j,t} + \alpha_{Dt} \cdot D_t + \alpha_{Dj} \cdot D_j + \varepsilon_{i,t}$$

where the left-hand-side variable is the 3-year average employment growth rate in terms of the number of workers at plant *i* from year *t* to year (*t* +3).

The regression equation for the TFP growth is:

$$\frac{\ln TFP_{i,t+3} - \ln TFP_{i,t}}{3} = \beta_0 + \beta_{Plant} \cdot X_{i,t} + \beta_{Industry} \cdot Y_{j,t} + \beta_{Dt} \cdot D_t + \beta_{Dj} \cdot D_j + \varepsilon_{i,t}$$

where the left-hand-side variable is the 3-year average log growth rate of total factor productivity (TFP) at plant *i* from year *t* to year (*t* +3).

Following Good, Nadiri, and Sickles (1999), Aw, Chen, and Roberts (2001), , Hahn (2004), and Ahn, Fukao, and Kwon (2004), plant-level total factor productivity (TFP) is estimated by the chained-multilateral index number approach. 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 output, input, and productivity level of each plant in each year is measured relative to the hypothetical plant 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 plant *i* at time *t* is measured in the following way.

where Y, X, S, and *TFP* denote output, input, input share, *TFP* level, respectively

$$\ln TFP_{it} = (\ln Y_{it} - \overline{\ln Y_t}) + \sum_{\tau=2}^{t} (\overline{\ln Y_\tau} - \overline{\ln Y_{\tau-1}})$$
$$- \left\{ \sum_{n=1}^{N} \frac{1}{2} (S_{nit} + \overline{S_{nt}})(\ln X_{nit} - \overline{\ln X_{nt}}) + \sum_{\tau=2}^{t} \sum_{n=1}^{N} \frac{1}{2} (\overline{S_{n\tau}} + \overline{S_{n\tau-1}})(\overline{\ln X_{n\tau}} - \overline{\ln X_{n\tau-1}}) \right\}$$

and symbols with upper bar are corresponding measures for hypothetical firms. The subscripts t and n are indices for time and inputs, respectively. Here, capital, labor, energy and real intermediate inputs were considered as factor inputs.

Table 19 and Table 20 report the results of regressions for the employment growth and for the TFP growth. Coefficents have correct signs for most plant-and industry-level variables. In particular, both entry and exit rates of a certain sector have positive effects on the TFP growth of individual plants belongin to that sector, while only entry rates have positive sector on the plant-level employment growth. Regression results of this sub-section reconfirm that enhanced firm dynamics (which can be facilitated by reducing entry regulations or some other regulations) would have positive effects on employment growth and productivity growth.

All in all, evidence from both industry-level and at plant-level anayses seems to confirm the same point: Relaxing entry regulation would facilitate firm dynamics and enhance productivity growth.

V. Summary and Conclusion

[To be added]

Table 19. Firm Dynamics and Employment Growth

3-year Average(overlapped) Annual Employment Growth Rates $(L_{i,t+3}/L_{i,t})$^(1/3)-1	I (Total)	II (Total)	III (Employment < 300)	IV (Employment < 300)	V (Employment ≥ 300)	VI (Employment ≥ 300)
(Sales growth)$_{i,t}$	0.23472 ***	0.23438 ***	0.22665 ***	0.22631 ***	0.39134 ***	0.39133 ***
	(64.35)	(64.25)	(66.07)	(65.96)	(15.64)	(15.64)
(Non-production worker share)$_{i,t}$	0.00263 ***	0.00259 ***	0.00328 ***	0.00322 ***	-0.00277 *	-0.00277 *
	(6.12)	(6.03)	(6.85)	(6.77)	(-1.68)	(-1.67)
(Capital-labor ratio)$_{i,t}$	0.00016 ***	0.00016 ***	0.00017 ***	0.00017 ***	0.00003 ***	0.00003 ***
	(4.18)	(4.19)	(3.51)	(3.52)	(2.91)	(2.90)
(R&D intensity)$_{i,t}$	-0.00150	-0.00153	-0.00135	-0.00138	0.01158	0.01134
	(-0.40)	(-0.40)	(-0.37)	(-0.38)	(0.15)	(0.15)
(Export intensity)$_{i,t}$	0.01238	0.01242	0.01187	0.01190	0.01418	0.01417
	(1.61)	(1.61)	(1.57)	(1.57)	(1.33)	(1.33)
ln(Number of workders)$_{i,t}$	-0.03110 ***	-0.03123 ***	-0.03680 ***	-0.03692 ***	-0.09529 ***	-0.09531 ***
	(-48.97)	(-49.32)	(-61.23)	(-61.61)	(-16.15)	(-16.15)
(Non-production worker share)$_{j,t}$	0.01312 ***	0.01116 ***	0.01102 ***	0.00907 ***	-0.01182	-0.01220
	(6.27)	(5.32)	(5.32)	(4.36)	(-0.38)	(-0.39)
(Capital-labor ratio)$_{i,t}$	-0.00002 **	-0.00003 ***	-0.00002 *	-0.00003 **	-0.00004	-0.00004
	(-2.15)	(-2.78)	(-1.88)	(-2.53)	(-0.81)	(-0.82)
(R&D intensity)$_{j,t}$	0.22787 ***	0.22223 ***	0.22411 ***	0.21843 ***	0.91296 ***	0.91287 ***
	(5.00)	(4.88)	(4.95)	(4.83)	(2.63)	(2.63)
(Export intensity)$_{j,t}$	-0.00988 ***	-0.01313 ***	-0.00996 ***	-0.01321 ***	-0.03379	-0.03428
	(-2.87)	(-3.78)	(-2.96)	(-3.89)	(-1.26)	(-1.27)
(Import penetration ratio)$_{j,t}$	-0.00190	-0.00292	0.00075	-0.00032	-0.10852 ***	-0.10841 ***
	(-0.51)	(-0.79)	(0.20)	(-0.09)	(-3.40)	(-3.39)
(Entry rate)$_{j,t}$	0.04532 ***	0.03919 ***	0.04268 ***	0.03657 ***	-0.01628	-0.01711
	(3.77)	(3.25)	(3.54)	(3.02)	(-0.21)	(-0.22)
(Exit rate)$_{j,t}$		-0.15851 ***		-0.15929 ***		-0.01938
		(-12.40)		(-12.54)		(-0.18)
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Industry Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Number of Observations	266,525	266,524	262,700	262,699	3,825	3,825
R^2	0.31261	0.31305	0.31027	0.31072	0.72748	0.72749

The values in parentheses are heteroskedasticity-robust t-statistics

***: Significant at the 1% level.

**: Significant at the 5% level.

*: Significant at the 10% level.

Table 20. Firm Dynamics and TFP Growth

3-year Average(overlapped) Annual TFP Growth Rates $\{\ln(TFP)_{i,t+3}-\ln(TFP)_{i,t}\}/3$	I (Total)	II (Total)	III (Employment < 300)	IV (Employment < 300)	V (Employment ≥ 300)	VI (Employment ≥ 300)
$\ln(TFP)_{i,t}$	-0.24383 ***	-0.24376 ***	-0.24466 ***	-0.24459 ***	-0.20992 ***	-0.21001 ***
	(-275.69)	(-275.61)	(-272.87)	(-272.81)	(-26.43)	(-26.46)
(Non-production worker share)$_{i,t}$	0.00558 ***	0.00562 ***	0.00632 ***	0.00636 ***	0.00004	0.00005
	(10.34)	(10.34)	(11.23)	(11.21)	(0.07)	(0.09)
(Capital-labor ratio)$_{i,t}$	-0.00005 ***	-0.00005 ***	-0.00005 ***	-0.00005 ***	-0.00004 ***	-0.00004 ***
	(-8.99)	(-8.98)	(-7.43)	(-7.41)	(-5.22)	(-5.20)
(R&D intensity)$_{i,t}$	0.00016	0.00018	0.00016	0.00018	-0.03331	-0.03434
	(0.35)	(0.39)	(0.36)	(0.40)	(-0.96)	(-0.98)
(Export intensity)$_{i,t}$	0.00042	0.00036	0.00167	0.00161	-0.01054	-0.01055
	(0.34)	(0.29)	(1.31)	(1.26)	(-1.46)	(-1.46)
ln(Number of workders)$_{i,t}$	0.00764 ***	0.00771 ***	0.00706 ***	0.00713 ***	0.00726 ***	0.00725 ***
	(32.29)	(32.59)	(27.11)	(27.37)	(4.25)	(4.24)
(Non-production worker share)$_{j,t}$	0.01921 ***	0.02033 ***	0.01845 ***	0.01959 ***	0.00092	-0.00012
	(10.48)	(11.07)	(9.72)	(10.30)	(0.07)	(-0.01)
(Capital-labor ratio)$_{i,t}$	0.00002 ***	0.00002 ***	0.00002 ***	0.00002 ***	0.00001	0.00001
	(3.72)	(4.34)	(3.78)	(4.43)	(0.26)	(0.25)
(R&D intensity)$_{j,t}$	0.31034 ***	0.31419 ***	0.30630 ***	0.31025 ***	0.64897 ***	0.64758 ***
	(9.34)	(9.45)	(9.05)	(9.17)	(3.80)	(3.79)
(Export intensity)$_{j,t}$	-0.00894 ***	-0.00713 ***	-0.00756 ***	-0.00571 **	-0.06415 ***	-0.06547 ***
	(-3.81)	(-3.03)	(-3.18)	(-2.40)	(-4.10)	(-4.15)
(Import penetration ratio)$_{j,t}$	0.01964 ***	0.02019 ***	0.01938 ***	0.01999 ***	0.05134 **	0.05193 **
	(6.99)	(7.18)	(6.84)	(7.05)	(2.15)	(2.17)
(Entry rate)$_{j,t}$	0.07149 ***	0.07405 ***	0.07179 ***	0.07439 ***	0.09267 *	0.09138 *
	(7.50)	(7.76)	(7.39)	(7.66)	(1.88)	(1.85)
(Exit rate)$_{j,t}$		0.09192 ***		0.09489 ***		-0.04577
		(8.52)		(8.67)		(-0.70)
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Industry Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Number of Observations	203,936	203,935	200,878	200,877	3,058	3,058
R^2	0.43413	0.43436	0.43536	0.43561	0.38465	0.38476

The values in parentheses are heteroskedasticity-robust t-statistics

***: Significant at the 1% level.

**: Significant at the 5% level.

*: Significant at the 10% level.

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Comments on "Entry Regulation and Industries' Performance in Korea"

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This paper empirically examines the relationship between entry regulation and performance of industries and plants, utilizing plant-level data on Korean manufacturing sector. Most economists would agree that entry is one crucial aspect of the competitive process of creative destruction, which is a core element of the development of a capitalist economy. However, there are not many empirical studies, especially on Korea, which examine whether barriers to entry did in fact inhibit this competitive process and did harm to the performance of industries. In this regard, I think this paper is taking a step toward the right direction to better understand the role of entry regulation in economic performance.

I have four comments on this paper. First, although this paper is ultimately aimed at examining whether entry regulation leads to poor outcome in terms of growth of employment, output, and TFP, this paper presents no empirical results on this aspect. In fact, this paper takes a little detour and approaches this question in two steps. In the first step, this paper examines the relationship between industry-level entry regulation measures and entry rates. In the second step, this paper tries to establish more active firm dynamics or, in other words, faster reallocation of resources from exiting toward entering plants is associated with better economic performance. However, why not directly test whether entry regulation is associated with poor economic performance? I think there is no binding constraint on data which precludes directly testing the hypothesis the author has in mind.

My second comment is on the second step of this paper. In a statistical sense, higher entry rate is very likely to be associated with higher output and TFP growth and more job creation. Specifically, industries with faster technological progress might have better growth prospects *and* higher entry rates. If this is the case, endogeneity of entry rates in various regressions have to be taken care of. The author tries to mitigate this problem by using three-year average dependent variables, but IV estimation would be more appropriate procedure. Even if the author obtained similar results using IV estimation, the results might be hard to interpret. Do we have a theoretical background for presuming that more active firm dynamics lead to better economic performance in a *causal* sense? That is, do faster plant turnovers always lead to better economic performance? If there is a sunk cost of entry, which is always considered in related theoretical models and the presence of which is confirmed by many empirical studies, faster plant turnovers do not necessarily lead to better outcome. To summarize, showing positive relationship between various performance variables and entry rates might be interesting by itself, but is not very much relevant to the main argument of the paper. What is worth examining is this paper is whether the variations of industry entry rates associated with variations of entry regulation measures could explain divergent performances of industries or plants.

My third comment is on the regression methodology. The author has a industry-level entry regulation measure covering 23 manufacturing industries for two years. So the total number of observations would be 46. This is not a large number but the degrees of freedom in most regressions would be more than 40. Nevertheless, the observations are artificially created in almost all regressions relying on rather unusual assumptions, which will introduce biases in the coefficient estimates. I don't know how the author could justify this procedure.

Here is my final comment. The period covered in this study is when the influence of newly developing economies, such as China, on the Korean economy has become larger. For example, the shift from labor intensive toward capital or skill intensive industries might well have been facilitated by the rise of China. Moreover, the structural change is likely to have involved different patterns of entry and exit across industries. In this regard, it might be helpful to consider as a control variable the effect of competition with low wage countries on entry/exit behavior and employment and output growth.

[1] Eichengreen, Rhee and Tong (2004) and Eichengreen and Tong (2005) argue that economic growth in China has had a positive effect on high income countries and on countries that produce and export capital goods, components and technology and a negative effect on low-income countries and countries that produce and export consumer goods. In this paper we show that it has had both a positive and a negative effect on the Korean economy.

[2] For this purpose we regroup trade data using the International Standard Industrial Classification (ISIC). The four technology groups are thus comprised of the following ISIC3 groups: 15~22, 36, and 37 for the low technology group; 23, 25~28 and 351for the medium-low technology group; 24 (excluding 2423), 29, 31, 34, and 35 (excluding 351and 353) for the medium-high technology group; and 353, 2423, 30, 32, and 33 for the high technology group. The non-manufacturing group consists of 01~14.

[3] Rodrik (2006) argues that although foreign investment has played a key role in upgrading industries in China the government's industrial policy of fostering domestic capabilities has also contributed to China's rapid increase in high tech exports. Gaulier, Lemoine and Ünal-Kesenci (2005) also make a similar point when they attribute changes in the commodity and geographic pattern of China's trade to its selective trade policy.

[4] This distinction was attributed to C.H. Kwan in Abe (2004).

[5] The export intensity index of country A with respect to country B is the ratio of B's share of A's total exports to B's share of world total imports. If it is greater than 1, B's share of A's exports is bigger than B's share of world imports, suggesting closer economic ties between the two. An increasing value of the index would suggest growing integration of the two economies through trade. The import intensity index is similarly calculated and would have the same implication.

[6] Jones (2001) defines international fragmentation of production processes as an activity that separates previously integrated production processes at one location into various component sub-processes across national boundaries. Obviously, international fragmentation does not have to undertaken only by a multinational corporation, as a firm may "outsource" parts production to an independent firm in another country.

[7] This integrative effect at the level of corporate organizations is well documented in a study of international production networks in Asia by Borrus, Ernst and Haggard (2000).

[8] According to an article published in *The International Herald Tribune* (2/9/06), "Made in China's Labels Don't Tell Whole Story," Samsung Electronics of Korea has established 23 factories in China employing 50,000 workers while closing down its last computer notebook factory in Korea.

[9] Kim and Lee (2003) found that for the large firms the market access is the most important reason for investing in China whereas for SMEs it is the low-cost labor that is the most important reason for investing in China. They also report that Korea's FDI in China in 1993-97 was concentrated in the coastal areas and the areas with a high concentration of ethnic Koreans such as Jilin, Heilongjiang, and Liaoning provinces. These three provinces received a significant amount of investment from SMEs in Korea but a negligible amount from other countries. Kim and Lee attribute this difference to the importance of a common language and common culture in reducing transactions cost of overseas investment for SMEs.

[10] This survey results are consistent with the result of an econometric study (Fung, Iizaka, and Paker, 2002) that shows that FDI from Hong Kong and Taiwan tend to use China as a platform to manufacture labor-intensive goods and export them to industrialized countries.

[11] Ahn *et al*. (2005) show in an econometric study based on manufacturing micro-data from 1990 to 2003 that Korea's FDI led to a decrease in exports from Korea's low-tech and medium low-tech industries; that an industry with a high growth rate of FDI tends to experience a high growth rate in employment; and that an industry with a high share of FDI in China tends to have a slow rate of growth in employment.

[12] The years 2001-03 are chosen to minimize the negative effect of the Asian financial crisis of 1997-98 on employment and the subsequent rapid recovery in employment in Korea.

[13] Lee (2001) made a proposal for creating a regional economic cooperation body for China, Japan and Korea—the Council for Northeast Asian Economic Cooperation. According to him, such a body would perform useful functions such as strengthening the voice of the three countries in the international arena and pave the way to future formal economic integration in the region.