Preliminary draft: Comments are welcome

Entry Regulation and Industries' Performance in Korea

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1. 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, 2003).[1] Regression results both at the country level

[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).

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 (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.

2. 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] 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.

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.
- *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.

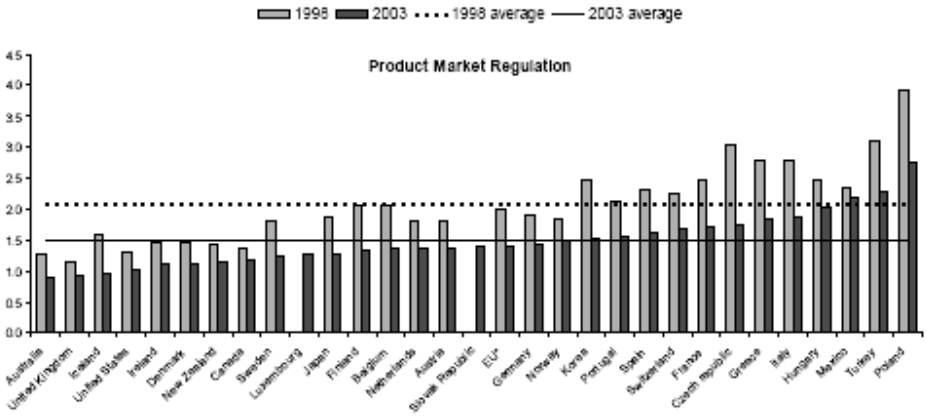
3) Barriers to trade and investment (outward-oriented policies)

- *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

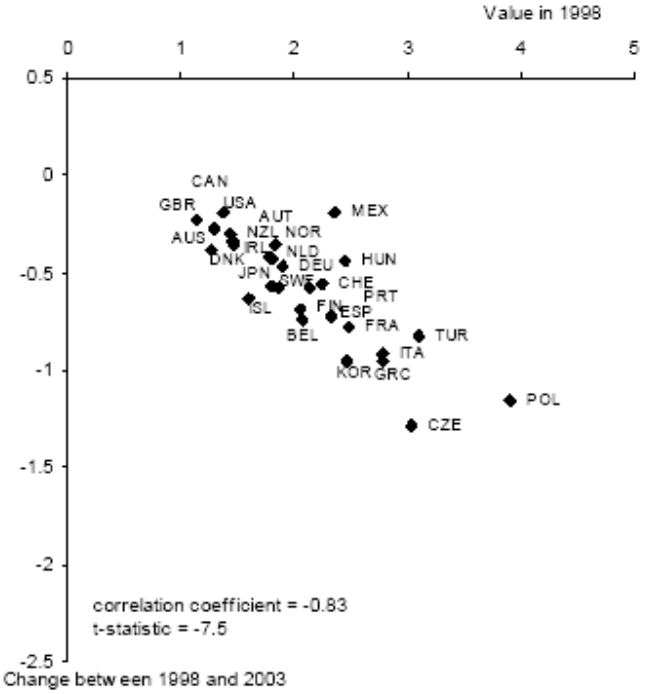
regulation (PMR) has become more homogeneous reflecting a degree of convergence, i.e., countries with relatively restrictive PMR in 1998 showing more progress over the period 1998-2003 (See Figure 2). Third, cross-country correlations between different aspects of PMR remain substantial. In other words, 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



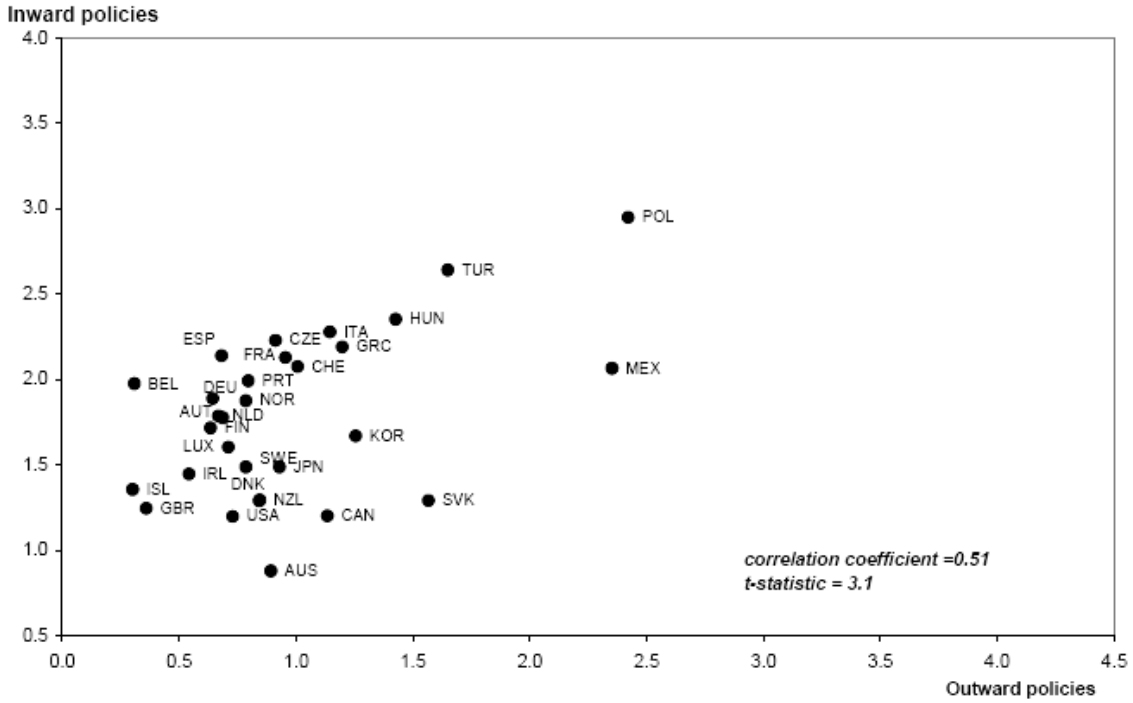
Source: Conway *et al.* (2005)

Figure 2. Tendency of Convergence in PMR Indicators during 1998-2003



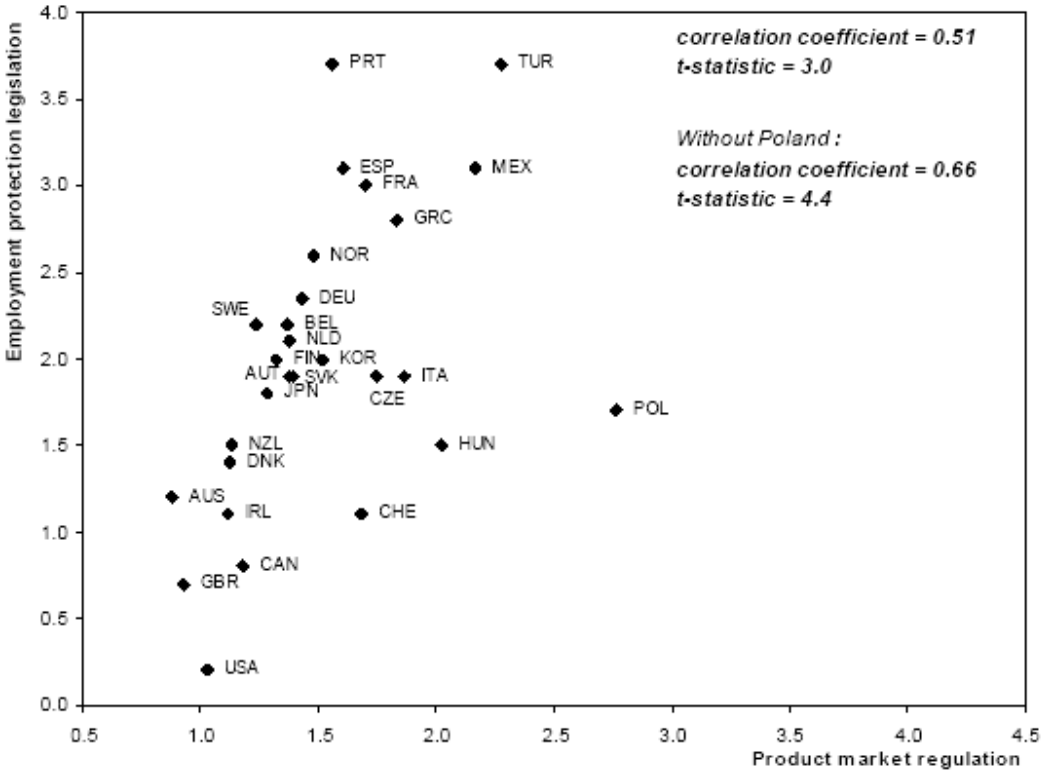
Source: Conway *et al.* (2005)

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)

3. 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)

CODE	INDUSTRY	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)
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 SERVICE	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			2000			Changes
		Production of industries (A)	Production of industries with entry regulation (B)	% (C=B/A)	Production of industries (D)	Production of industries with entry regulation (E)	% (F=E/D)	% (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. Equipme	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)

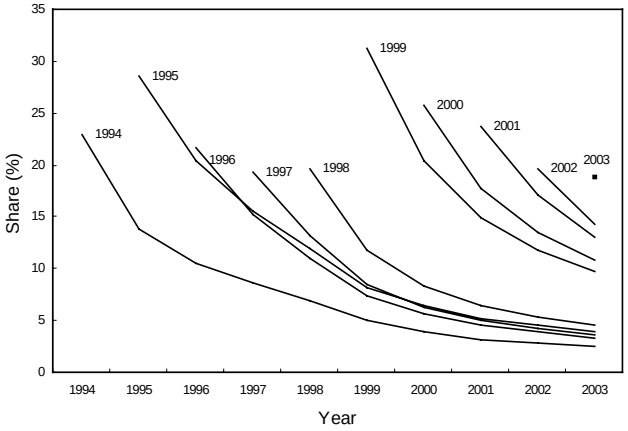
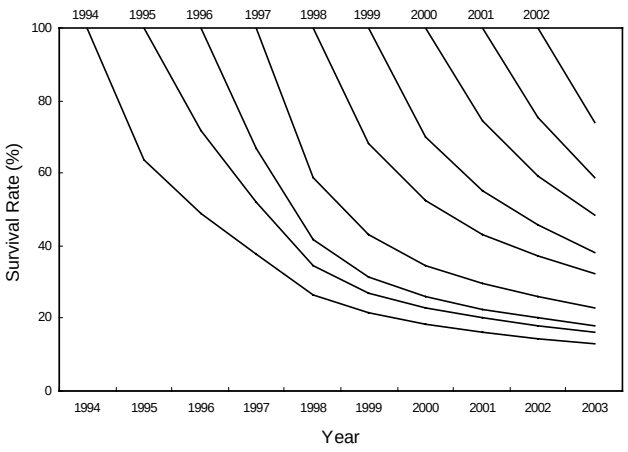
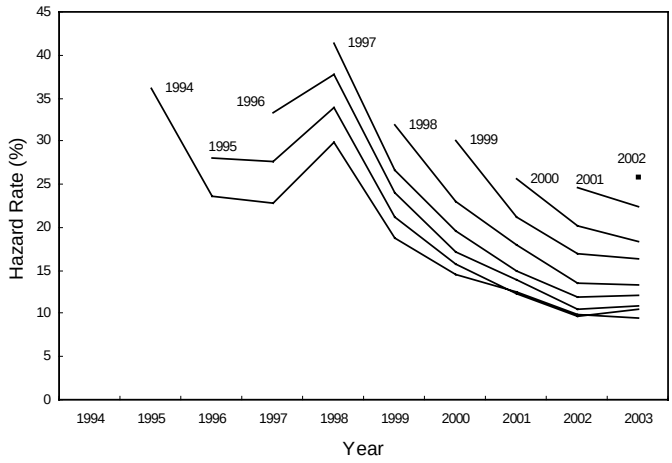


Figure 7. Survival Rate for Each Entry Cohort (By Number of Plants)



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 withing 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.

4. 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)

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

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 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.

5. 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$_{j,t}$	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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[To be completed]

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