Determinants and Influences of Patenting Activities in Korean Manufacturing

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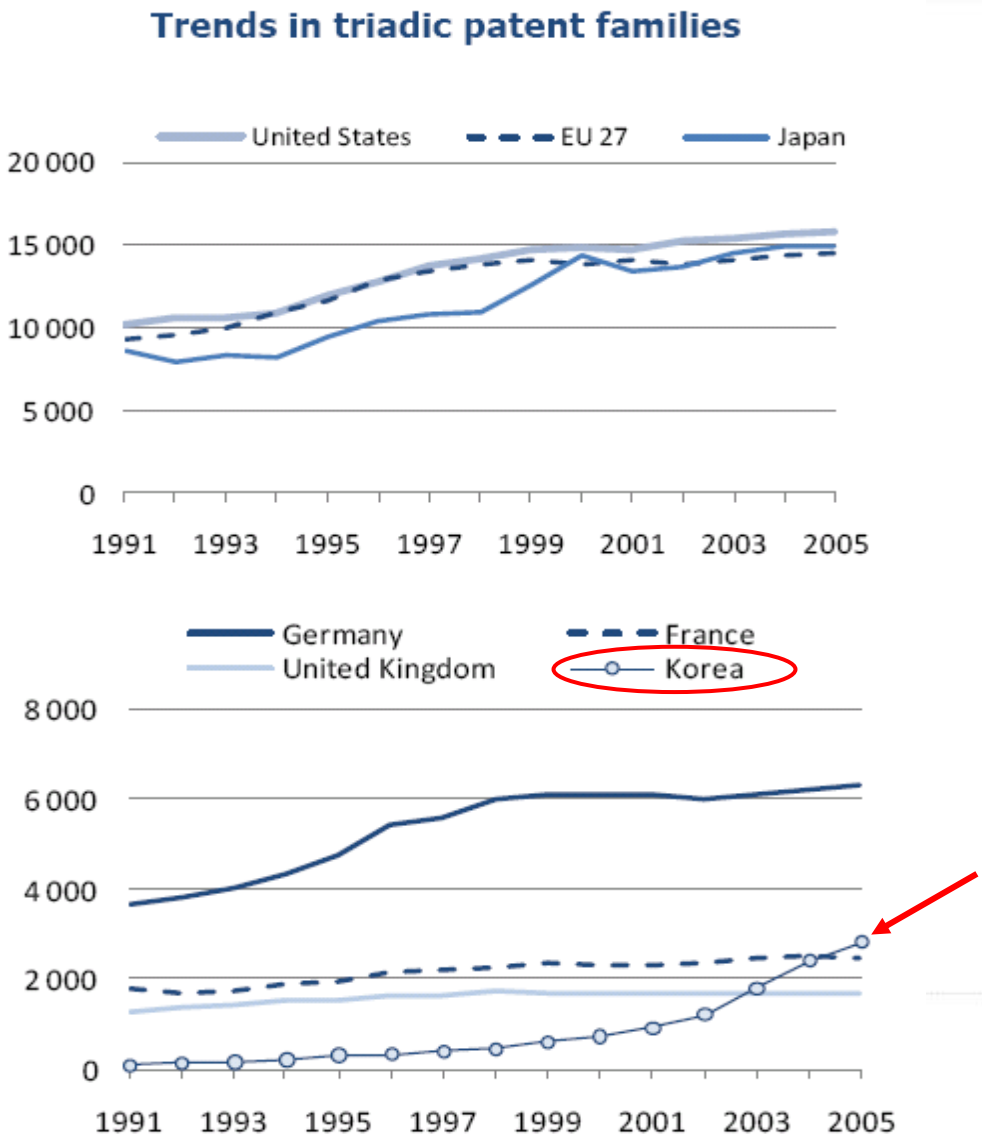
Part-01

Background and Motivation

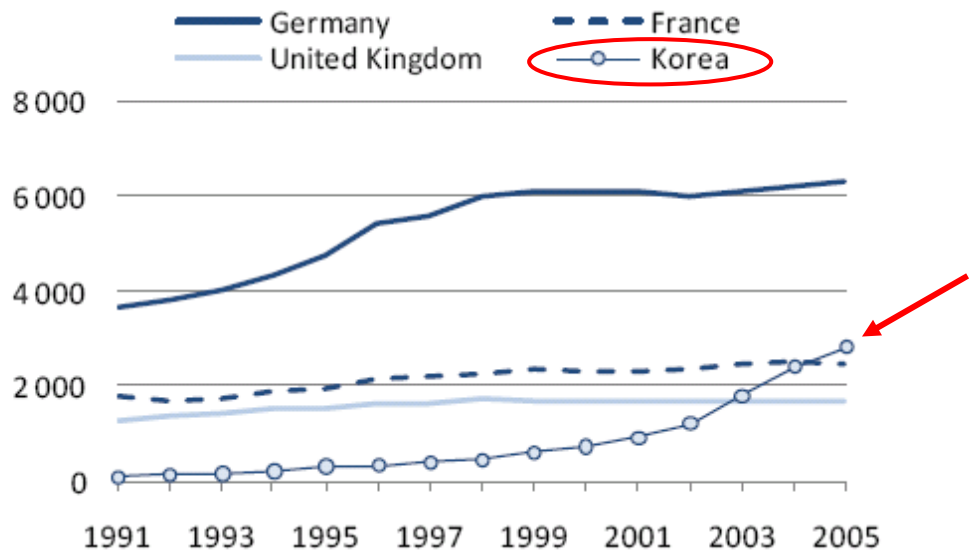
Related findings from OECD

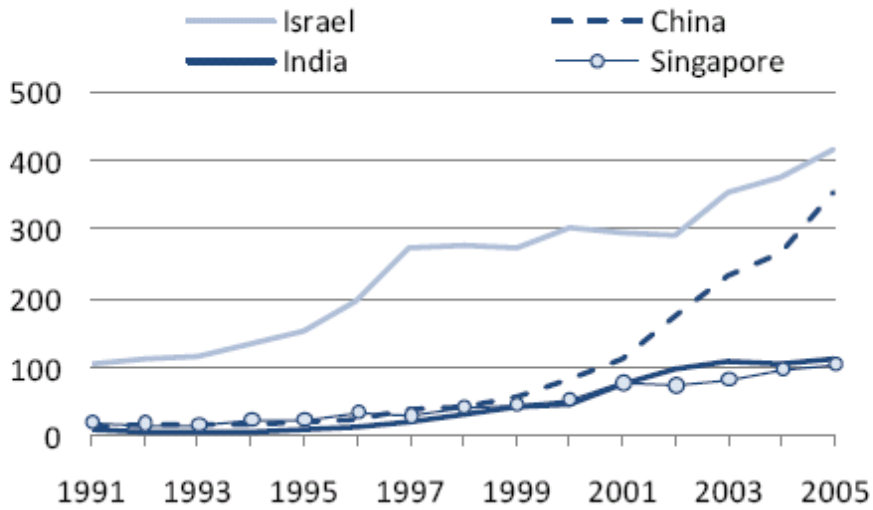
(*2008 Compendium of Patent Statistics*)



Related findings from OECD

(*2008 Compendium of Patent Statistics*)





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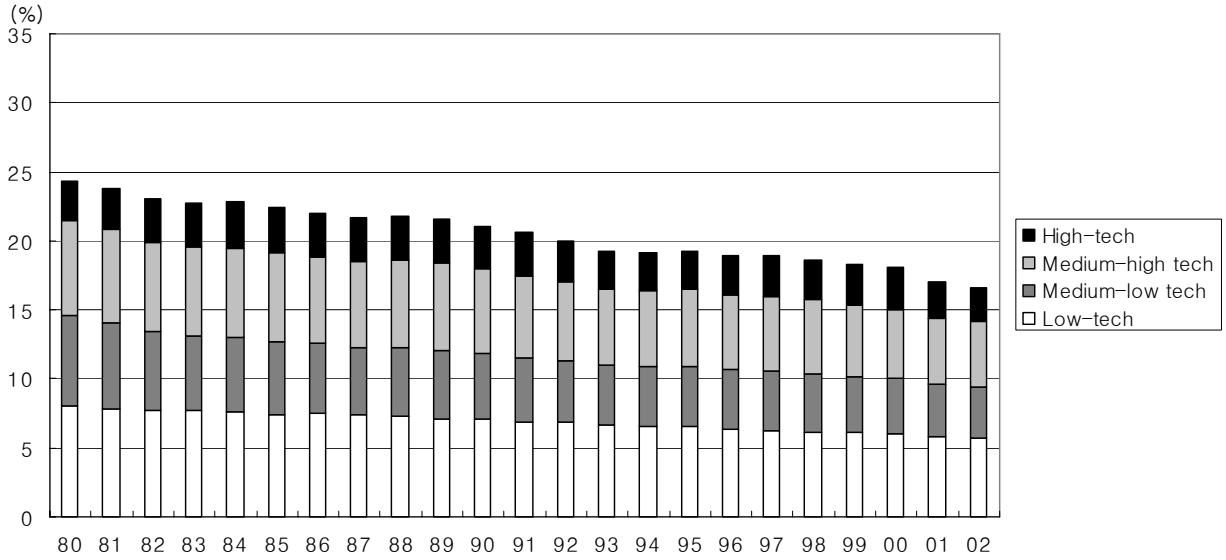
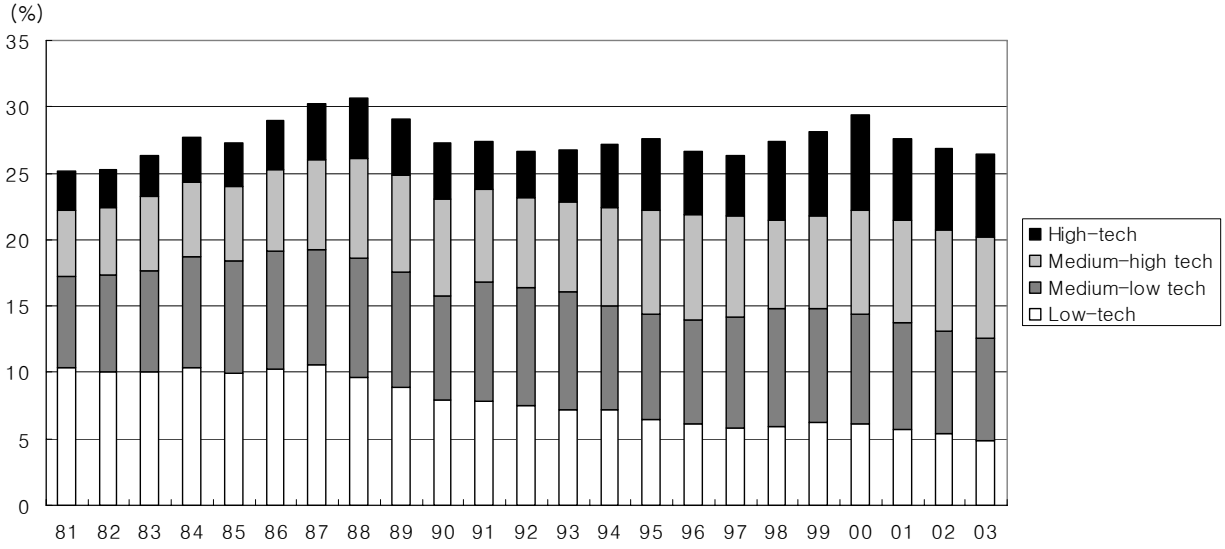
Trend in value-added share of manufacturing industry (by technology level)

G7



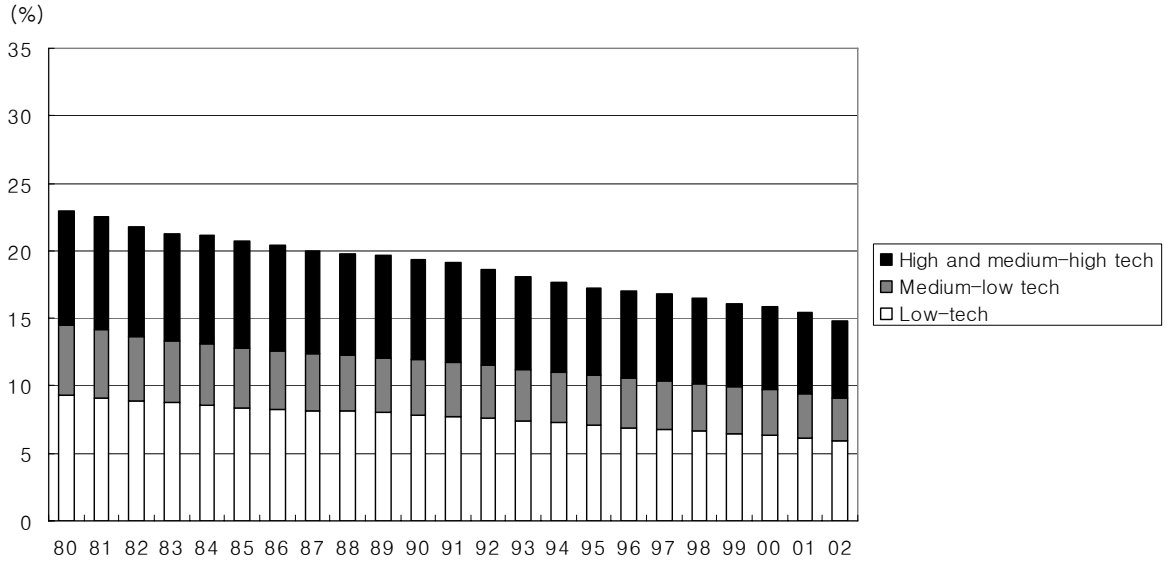
Korea



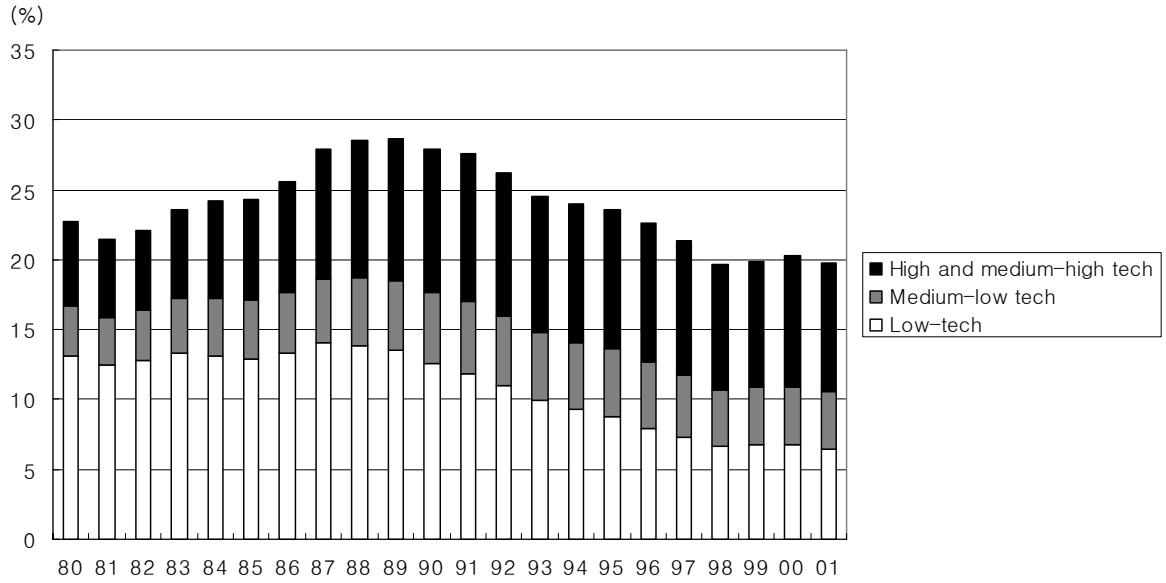
Source: *OECD STAN Indicators database, 2005*

Trend in employment share of manufacturing industry (by technology level)

G7

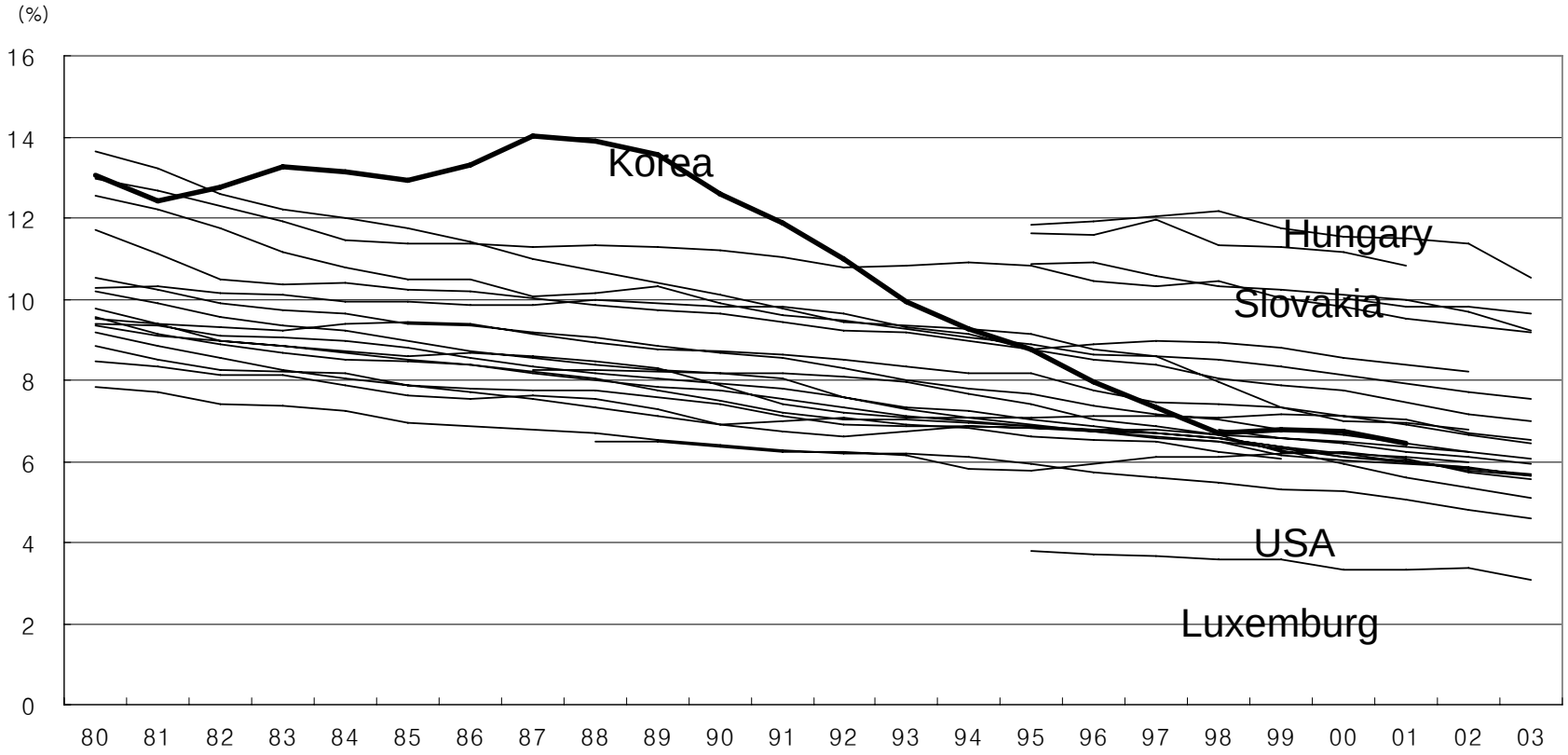


Korea



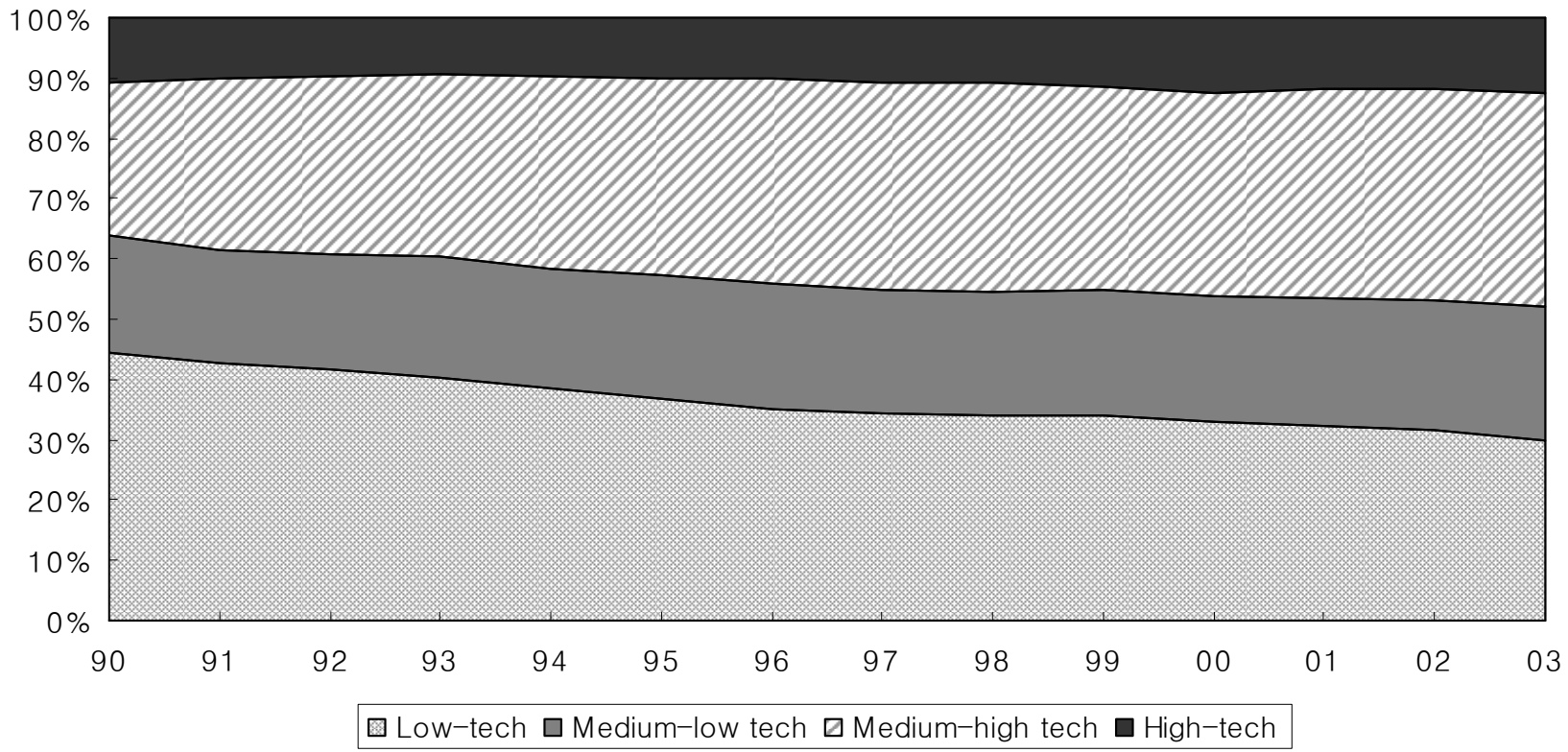
Source: *OECD STAN Indicators database, 2005*

Trend in employment share of OECD countries by sector: Low-tech manufacturing industry



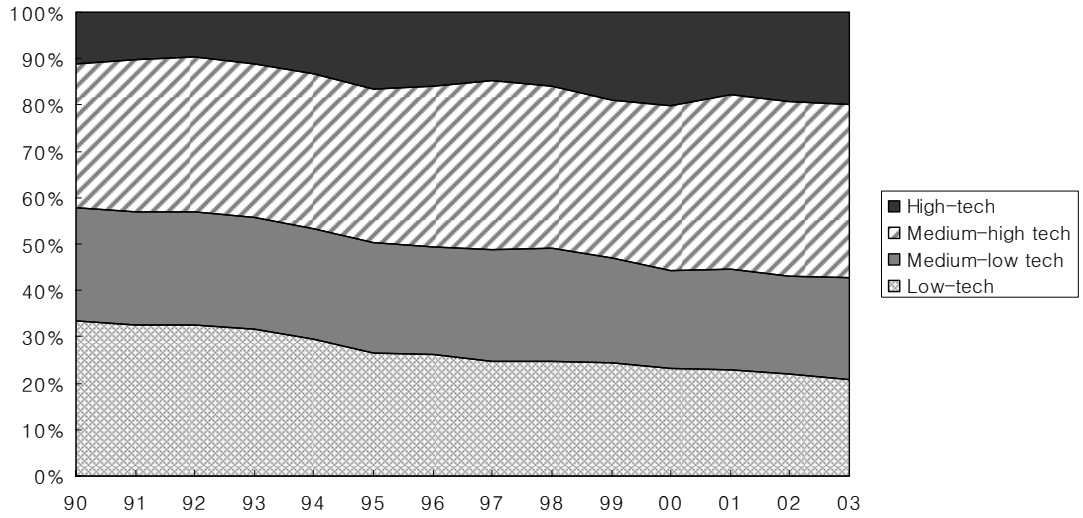
Source: *OECD STAN Indicators database, 2005*

Employment share of industries within manufacturing industry (by technology level)

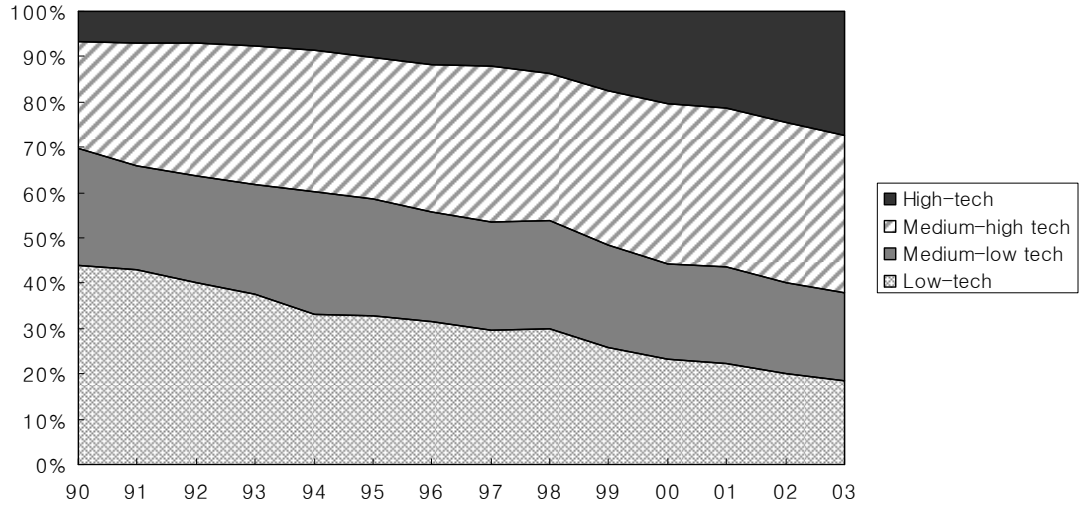


Author's calculation based on the micro-data of
Annual Survey on Mining and Manufacturing, National Statistics Office

Value-added share of industries within manufacturing industry (by technology level)



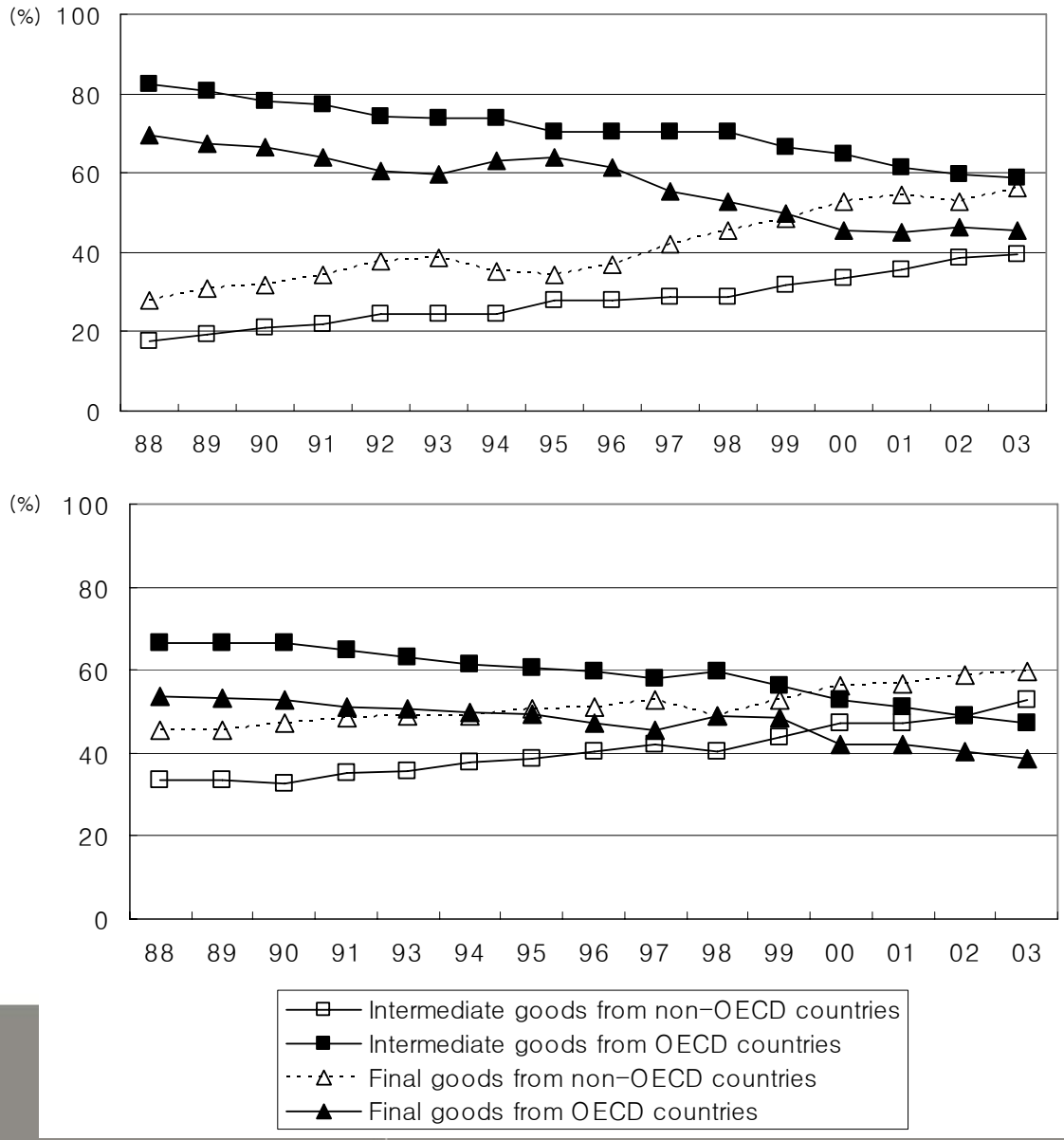
Nominal Value-added



Real Value-added

Author's calculation based on the micro-data of *Annual Survey on Mining and Manufacturing*, National Statistics Office

Trend in import share of final and intermediate goods by region



Korea

Japan

Source: Pain (2006)

Background and Motivation

- Recent surge in patenting activities in Korea
- Globalization and structural changes in Korean manufacturing
- Rapid industrialization and economic development in Korea
- KIPO’s new policy measures for public R&D and patenting
- Access to various micro-data

Part-02

Measuring Impacts of IP Policy on Patenting

KIPO's new policy measures (since 2005)

- **Patent trends survey**
  - At the stage of planning multi-year public R&D projects
  - 10-80 million KRW, for 3-6 months
- **Prior art search**
  - At the stage of selecting short-term R&D projects
  - 1-2 million KRW, for 3-7 days

Patent Applications Regression 1 (2000-2006, pooling)

Explanatory variables	I	II	III	IV
(Budget A + Budget B) t	0.08098*** (12.56)			
(Budget A + Budget B) t-1	0.05450*** (5.52)			
(Budget A) t		0.07866*** (7.98)		
(Budget A) t -1		0.05666*** (3.06)		
(Budget B) t			0.08275*** (12.26)	
(Budget B) t -1			0.05750*** (5.52)	
(Budget C) t				0.08214*** (11.19)
(Budget C) t-1				0.07662*** (9.99)
(Budget C) t-2				0.06303*** (7.98)
(Budget C) t-3				0.06328*** (7.20)

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Patent Applications Regression 1 (2000-2006, pooling)

Explanatory variables	I	II	III	IV
Year dummy	Included	Included	Included	Included
Class dummy	Included	Included	Included	Included
Number of observations	4050	4050	4050	4050
R-sq	0.38536	0.36351	0.38287	0.42638

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Patent Applications Regression 2 (2000-2008, pooling)

Explanatory variables	I	II	III
(Budget A + Budget B) t -1	0.09253*** (18.17)		
(Budget A + Budget B) t-2	0.04726*** (7.79)		
(Budget A + Budget B) t-3	0.02846 *** (3.28)		
(Budget A) t -1		0.08224*** (11.50)	
(Budget A) t -2		0.04693*** (5.29)	
(Budget A) t -3		0.03463* (1.94)	
(Budget B) t -1			0.09579*** (18.00)
(Budget B) t -2			0.04787*** (7.57)
(Budget B) t -3			0.03388*** (3.84)

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Patent Applications Regression 2 (2000-2008, pooling)

Explanatory variables	I	II	III
Year dummy	Included	Included	Included
Class dummy	Included	Included	Included
Number of observations	5796	5796	5796
R-sq	0.41812	0.38227	0.41560

Hetero-scadasticity robust *t*-ratios are in parentheses. ***,**,* significant at 1%, 5%, 10% level, respectively.

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Patent Applications Regression 3 (2000-2008, fixed effect)

Explanatory variables	I	II	III
(Budget A + Budget B) t -1	0.02429*** (15.50)		
(Budget A + Budget B) t-2	0.01099*** (5.65)		
(Budget A + Budget B) t-3	0.00363 (1.18)		
(Budget A) t -1		0.02560*** (9.10)	
(Budget A) t -2		0.01473 *** (4.64)	
(Budget A) t -3		0.00331 (0.53)	
(Budget B) t -1			0.02482*** (15.28)
(Budget B) t -2			0.01066*** (5.26)
(Budget B) t -3			0.00540 (1.64)

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Patent Applications Regression 3 (2000-2008, fixed effect)

Explanatory variables	I	II	III
Number of observations	5796	5796	5796
R-sq	0.09461	0.03529	0.08546

Hetero-scadasticity robust *t*-ratios are in parentheses. ***,**,* significant at 1%, 5%, 10% level, respectively.

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Patent Applications Regression 4 (2000-2008, random effect)

Explanatory variables	I	II	III
(Budget A + Budget B) t -1	0.025591*** (15.13)		
(Budget A + Budget B) t-2	0.01146*** (5.61)		
(Budget A + Budget B) t-3	0.00405 (1.35)		
(Budget A) t -1		0.02656*** (9.47)	
(Budget A) t -2		0.01534*** (4.90)	
(Budget A) t -3		0.00367 (0.62)	
(Budget B) t -1			0.02627*** (14.88)
(Budget B) t -2			0.01122*** (5.21)
(Budget B) t -3			0.00592* (1.86)

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Patent Applications Regression 4 (2000-2008, random effect)

Explanatory variables	I	II	III
Number of observations	5796	5796	5796

Hetero-scadasticity robust *t*-ratios are in parentheses. ***,**,* significant at 1%, 5%, 10% level, respectively.

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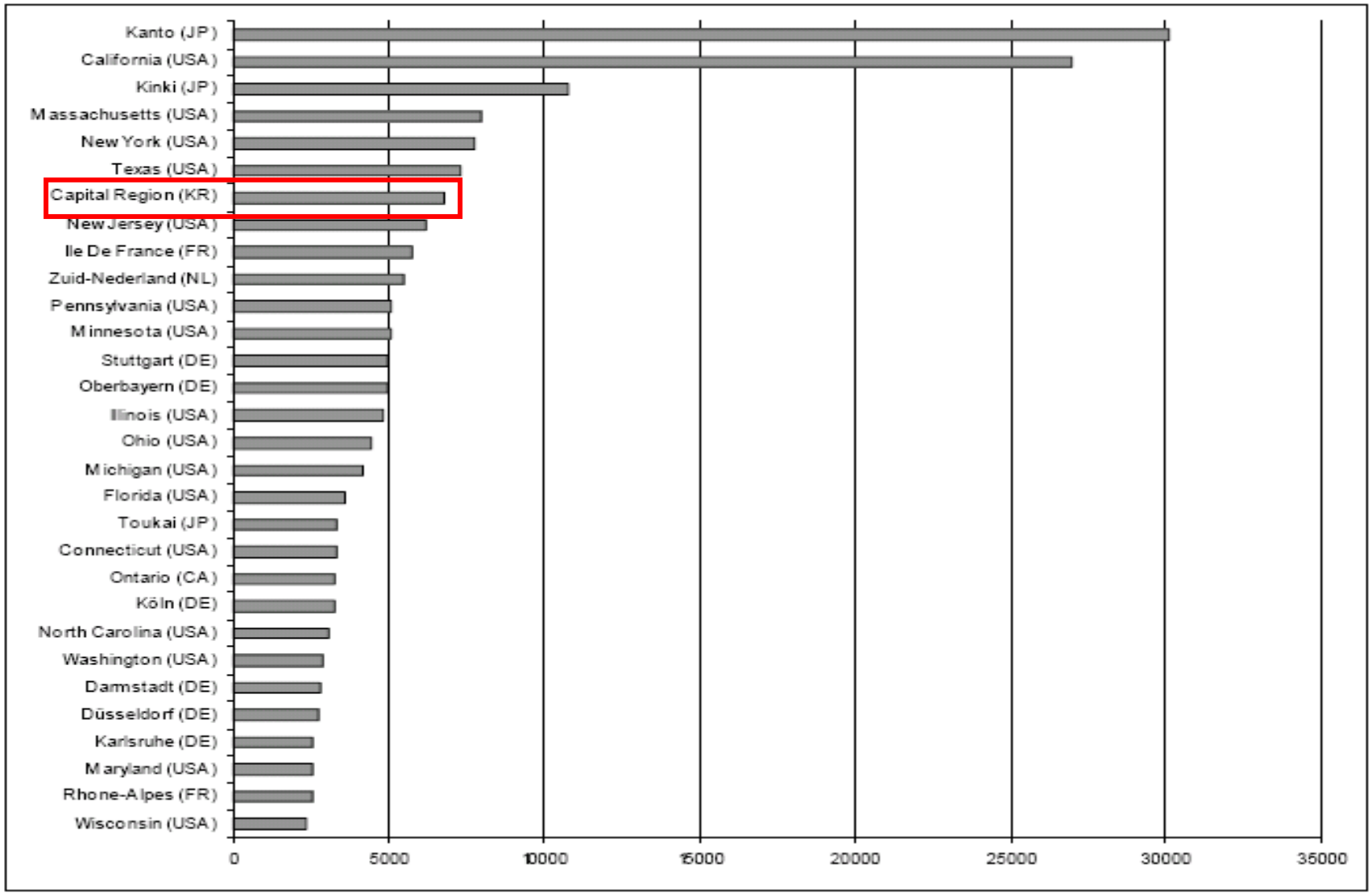
Part-03 | Intellectual Property and Infrastructure

Geography of Inventive Activities in OECD Regions

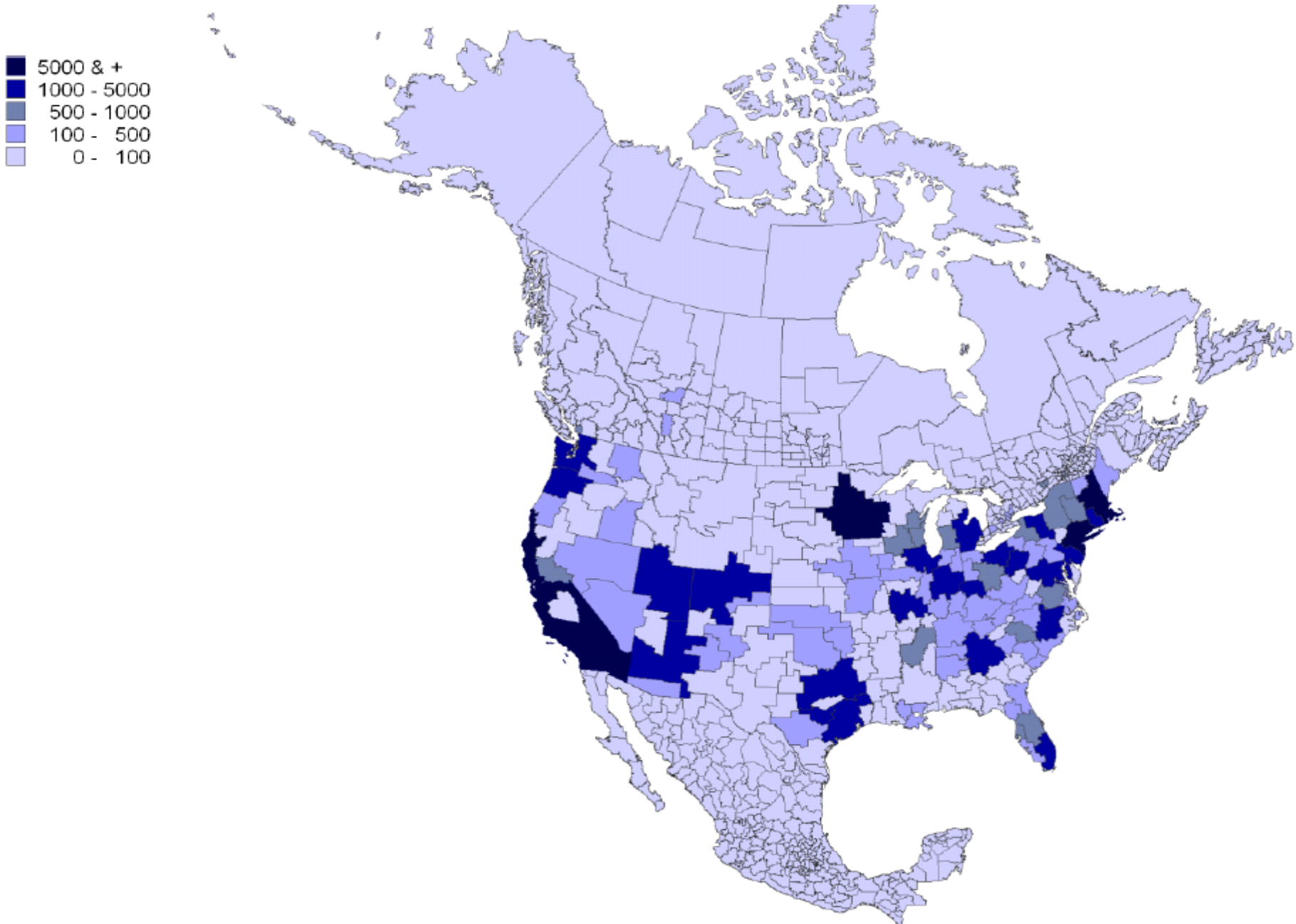
(*Stefano Usai, OECD STI WORKING PAPER 2008*)

Figure 5. PCT, Top performance (30 regions), 2002-2004



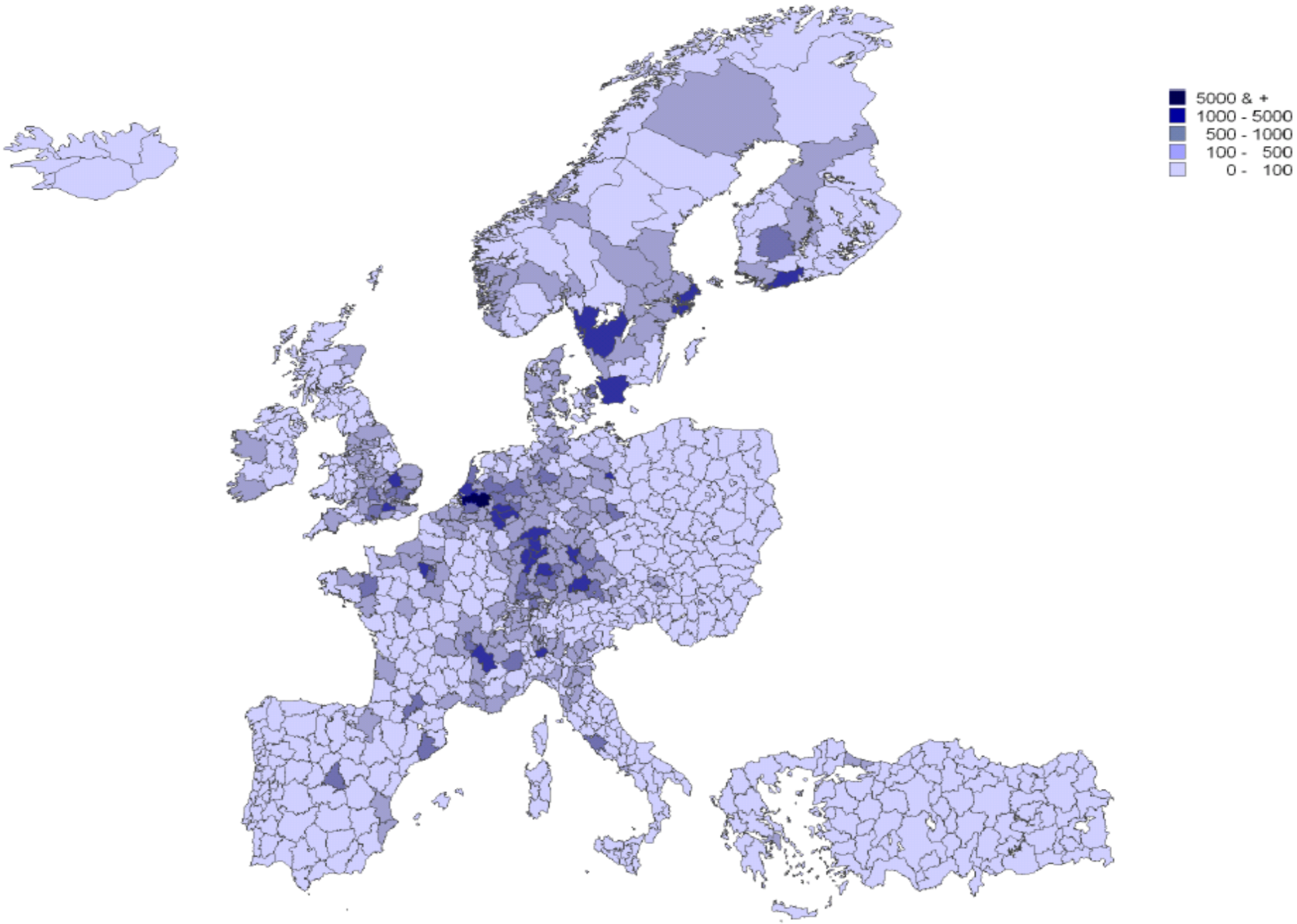
Number of patent applications filed under the PCT, 2003-2005

North America



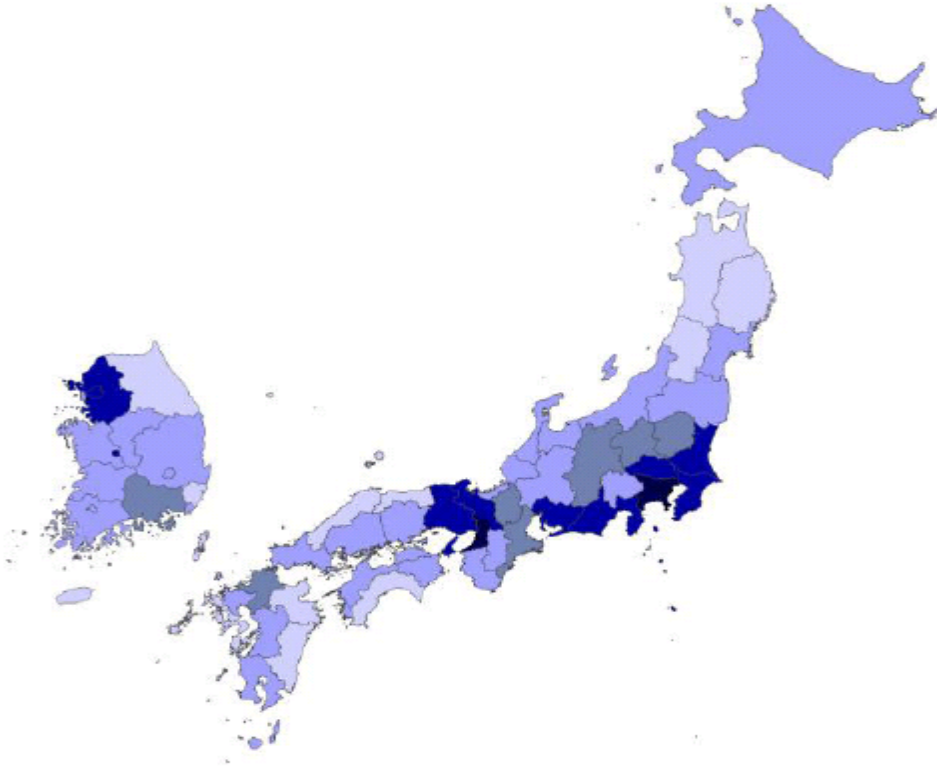
Number of patent applications filed under the PCT, 2003-2005

Europe

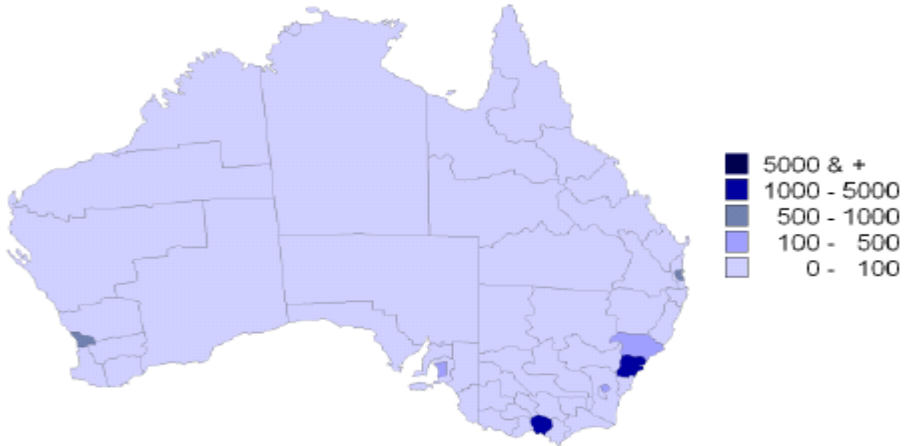


Number of patents filed under the PCT, 2003-2005

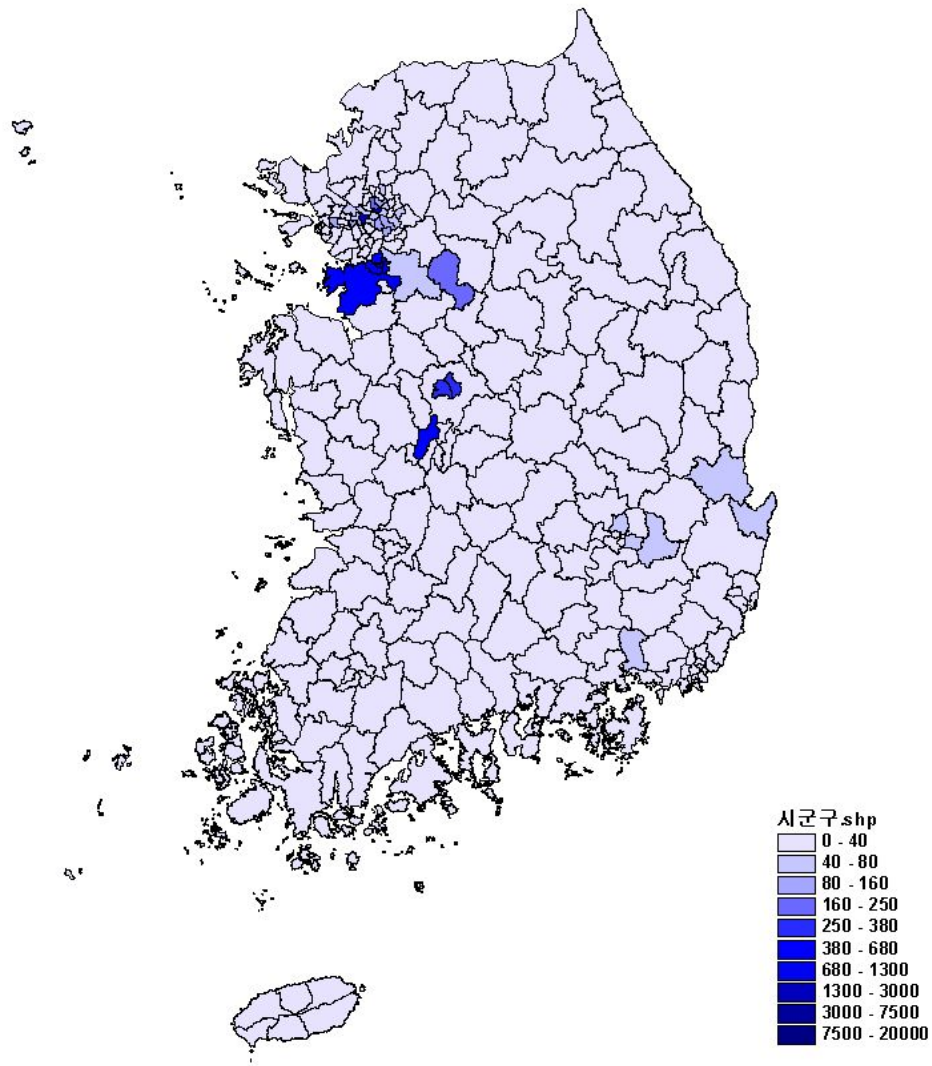
Japan and Korea



Australia



내국거주출원인_분율가산
(1990)



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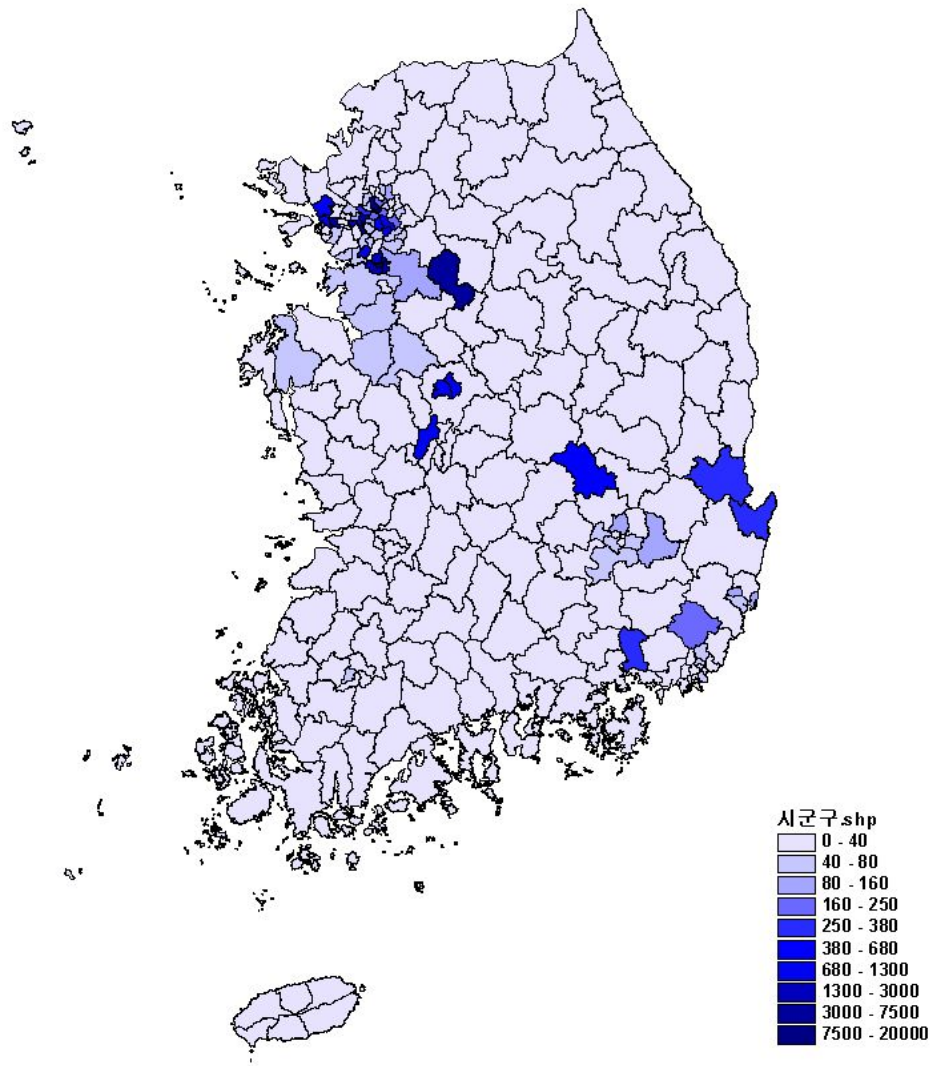
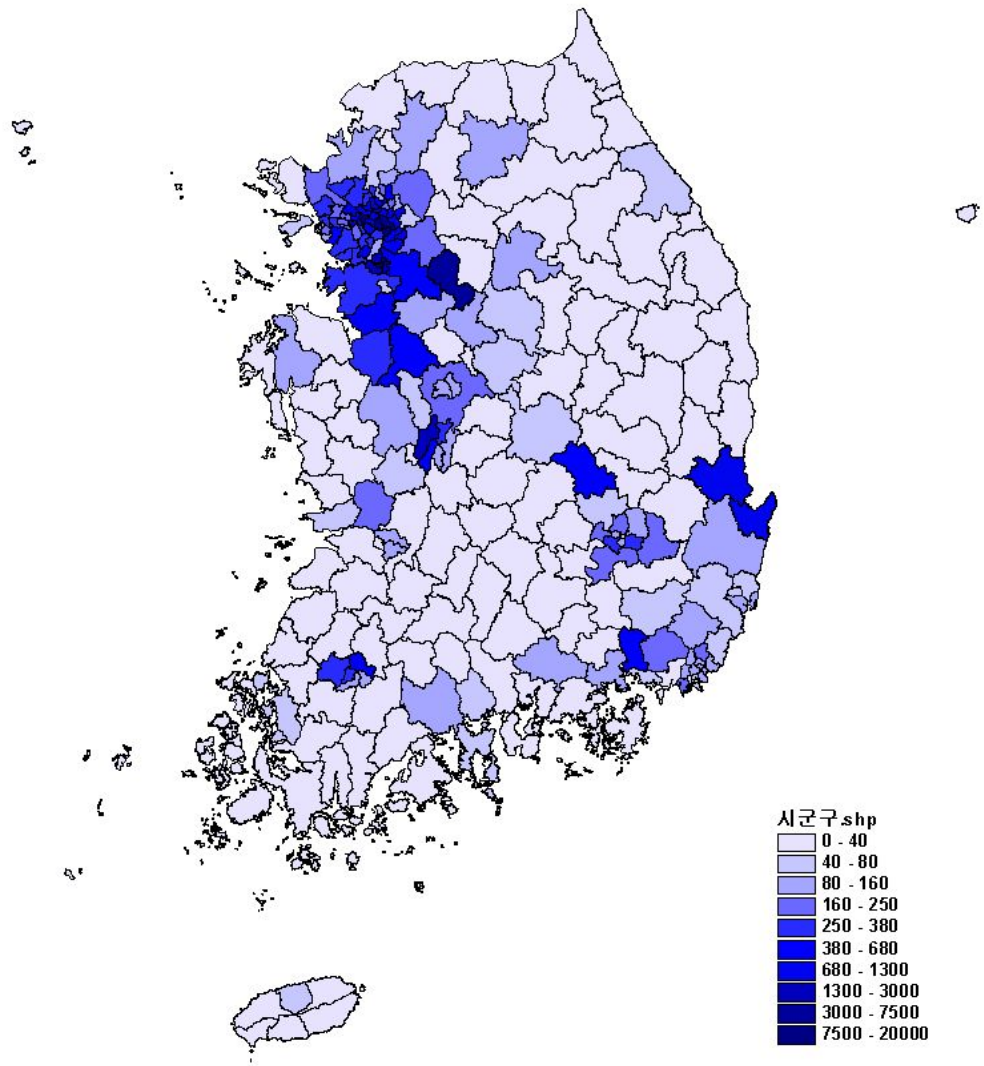
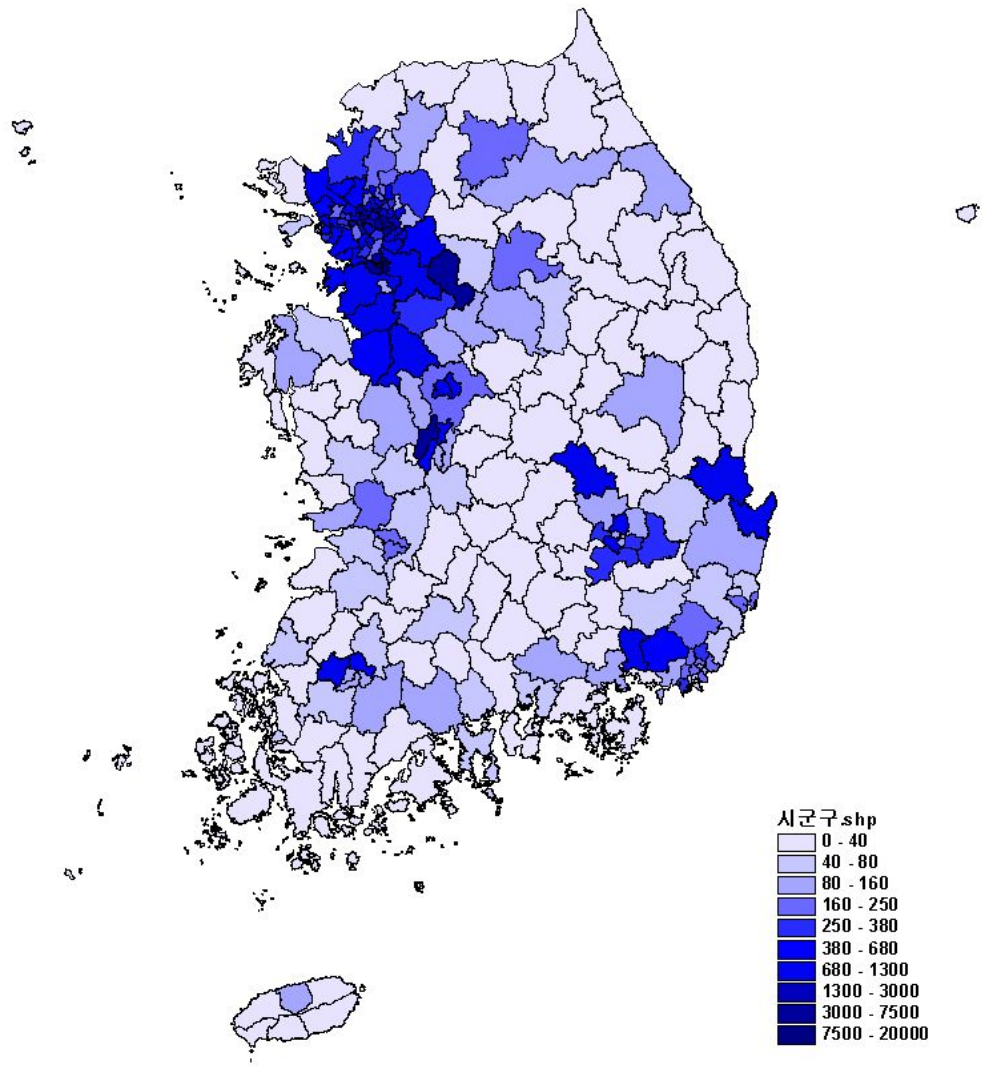
(1995)



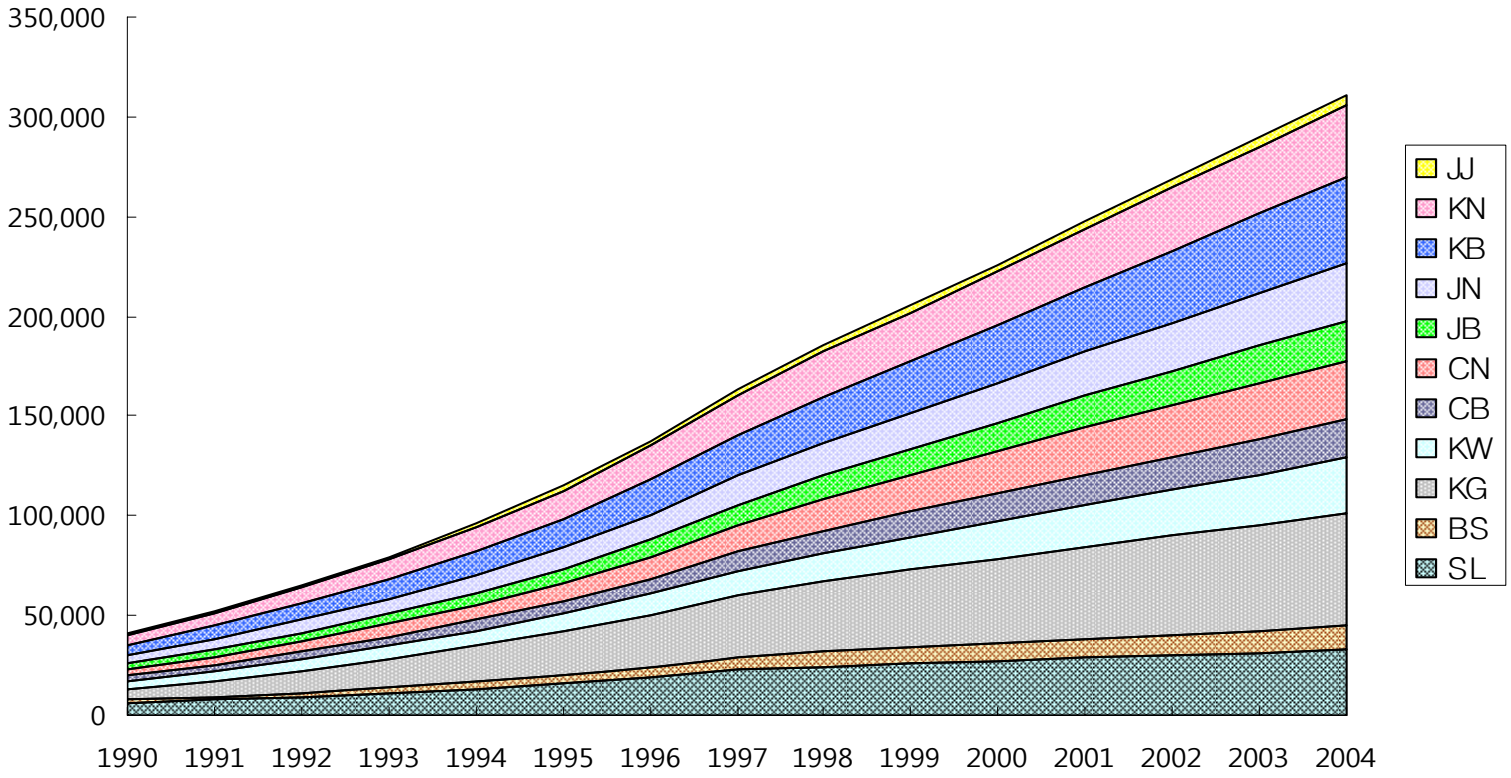
내국거주출원인_분율가산
(2000)



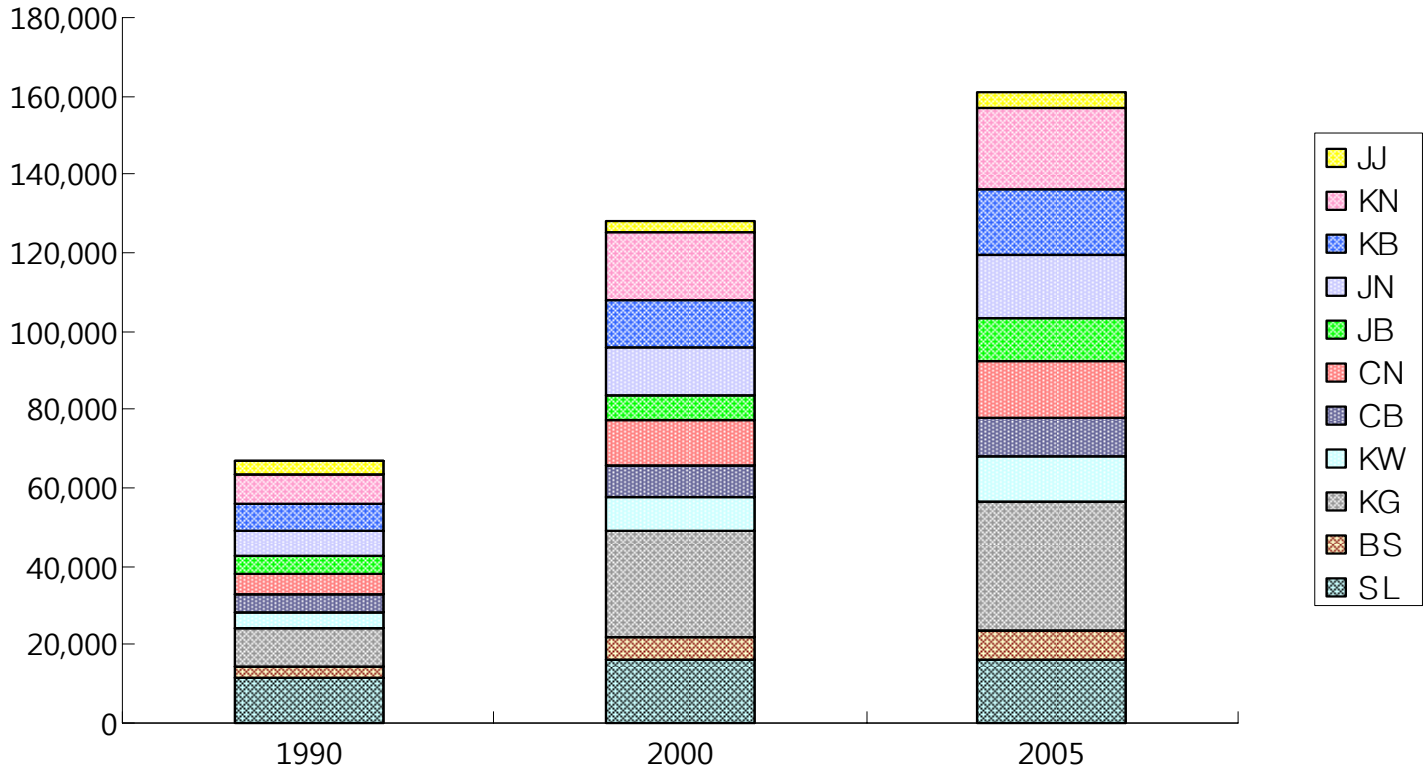
내국거주출원인_분율가산
(2005)



(Million KW, 2000 fixed price)



(km, 2-lane equivalent)



Part-04

Infrastructure, Innovation, and Productivity Growth

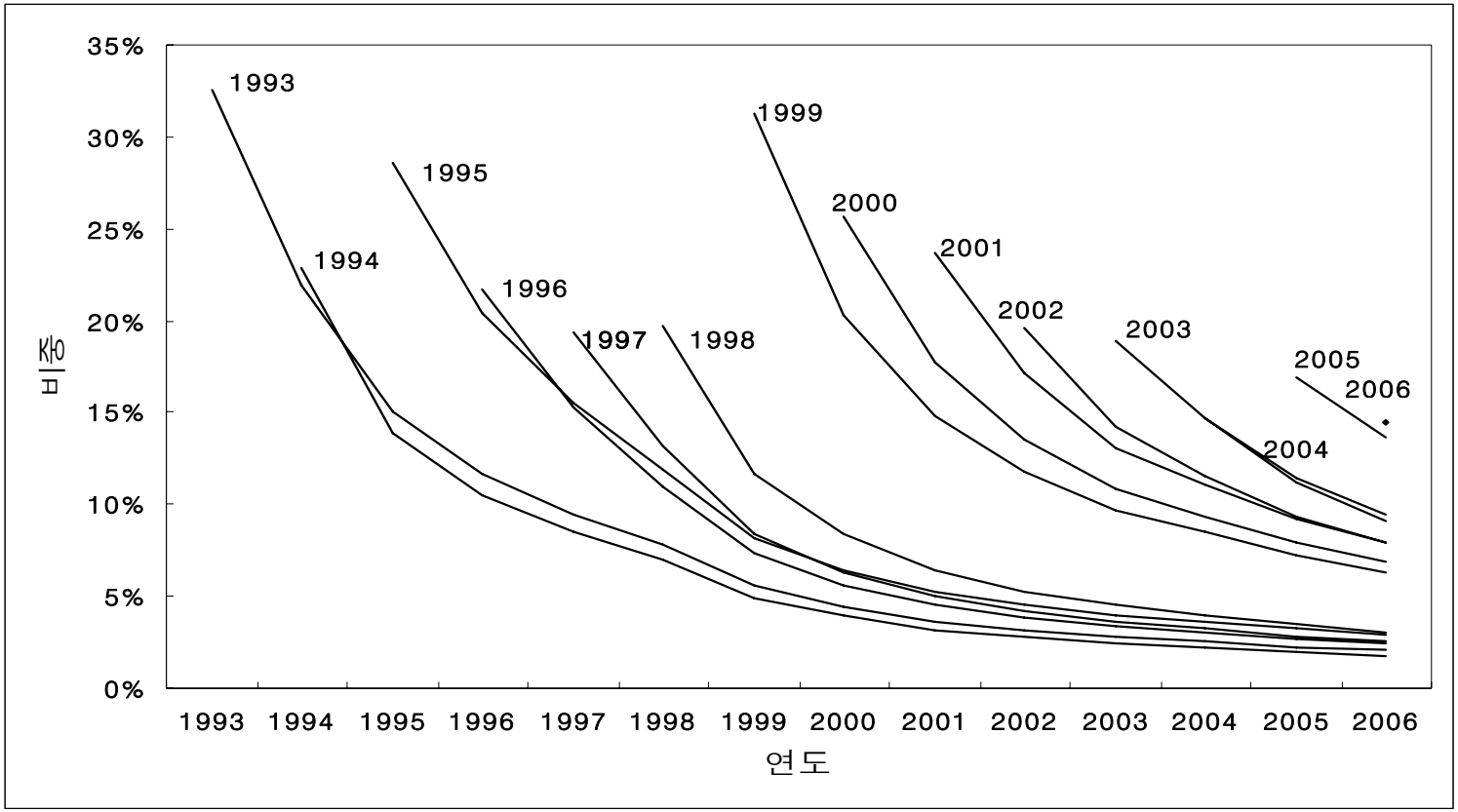
Establishment Micro Data in Korea

Mining and Manufacturing Survey

- *Mining and Manufacturing Survey* is conducted annually by the Korea National Statistical Office.
- *Survey* covers all plants with five or more employees in the mining and manufacturing industries
- *Survey* contains plant-level information on output, inputs, and a variety of additional items, including the plant ID, the regional code, and the industry code assigned to each plant based on its major product.

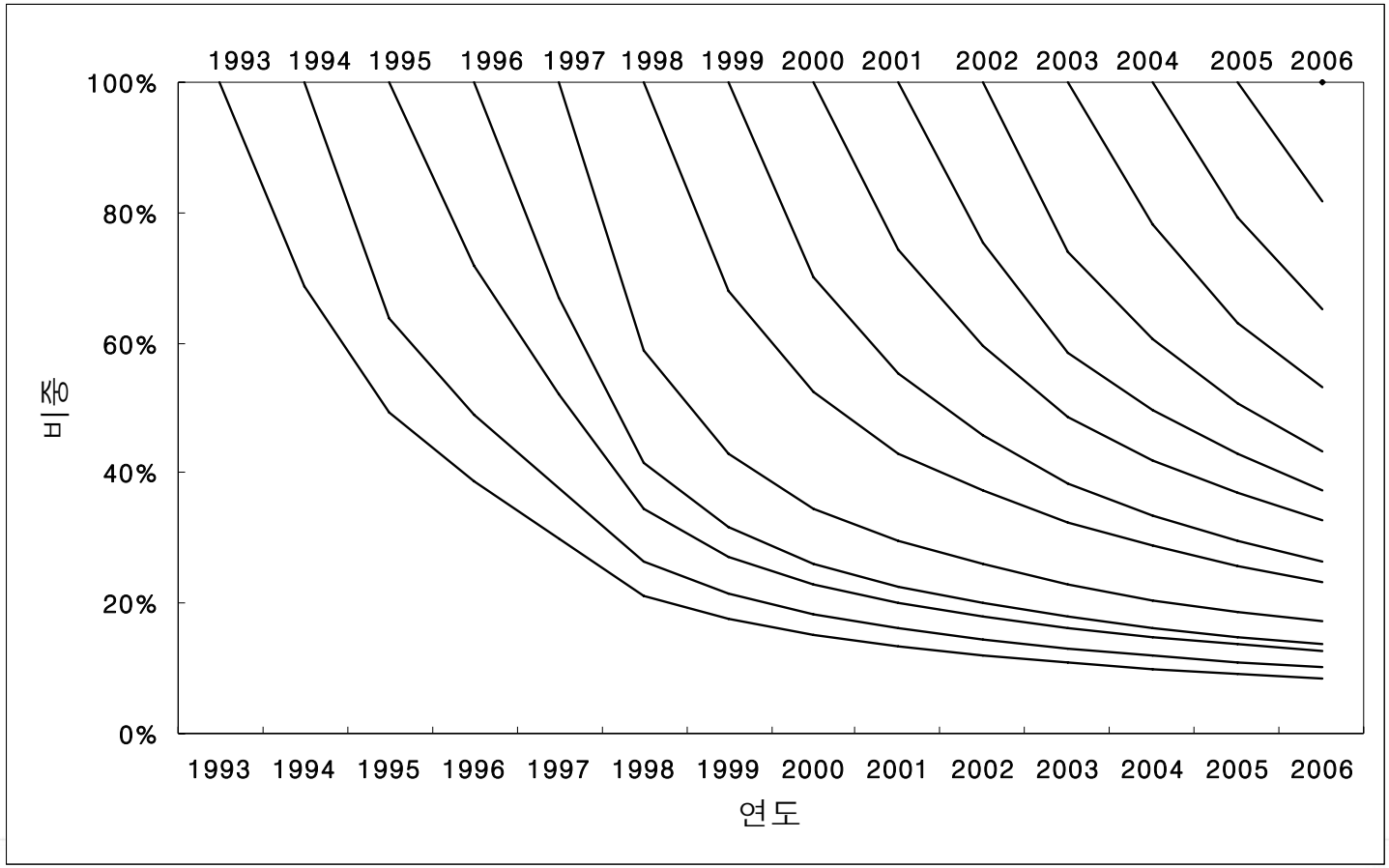
Firm Dynamics in Korean Manufacturing

Share of Entry Cohorts (by # of establishments)



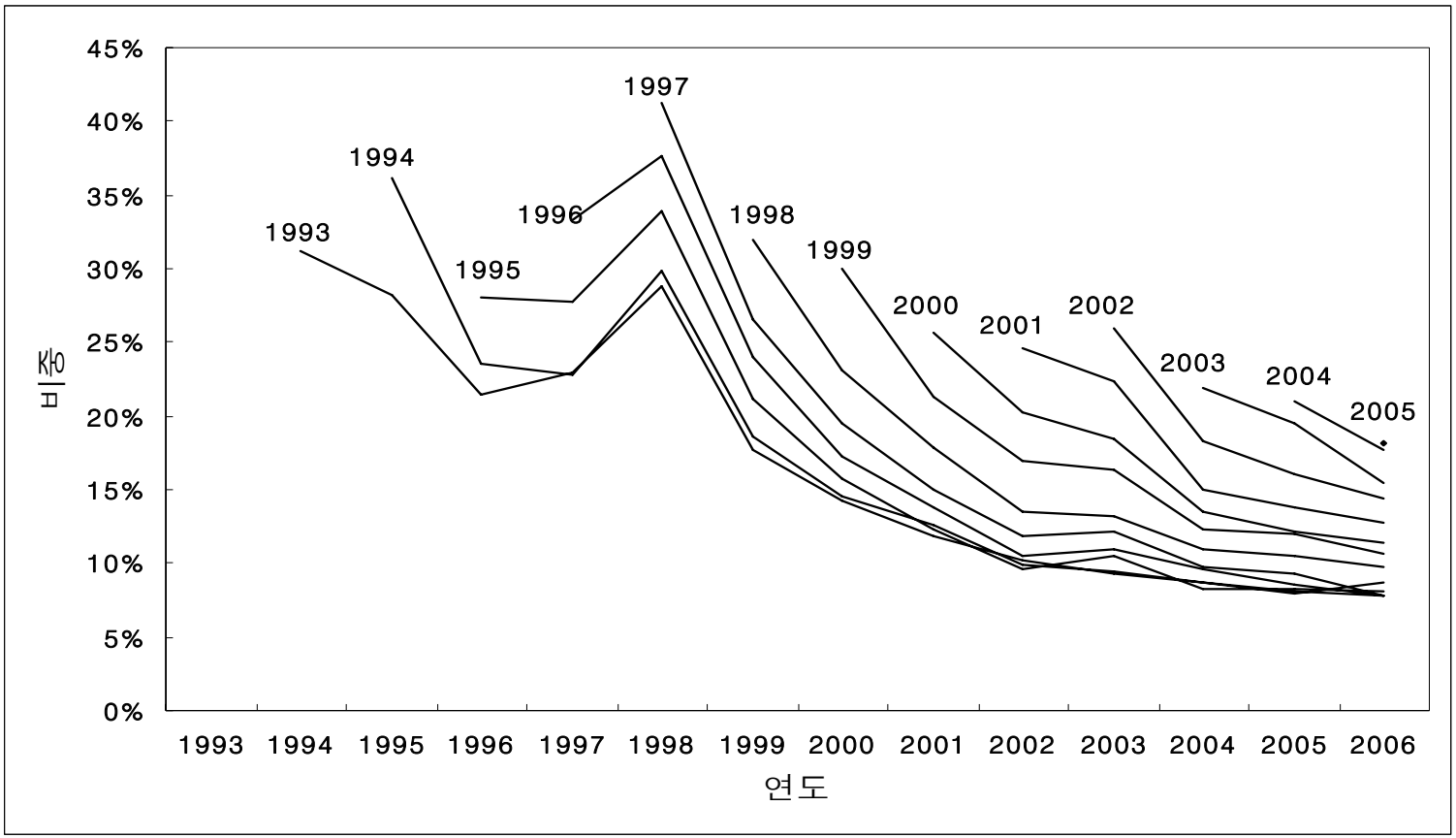
Firm Dynamics in Korean Manufacturing

Survival Rate of Entry Cohorts



Firm Dynamics in Korean Manufacturing

Hazard Rate of Entry Cohorts



자료: 통계청 광공업통계조사 미시데이터

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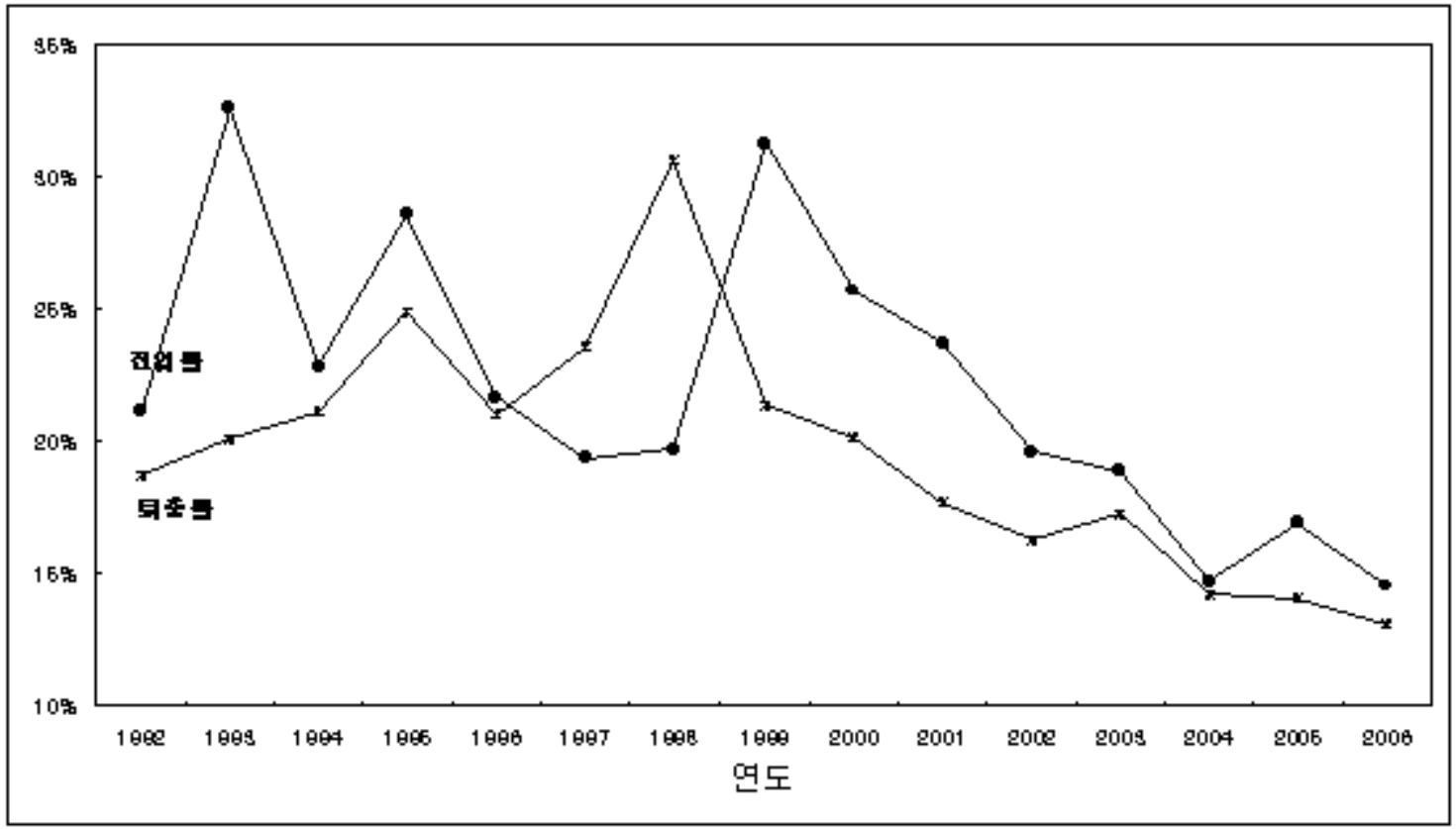
Firm Dynamics in Korean Manufacturing

Entry and Exit Rates of Manufacturing Plants (by number)



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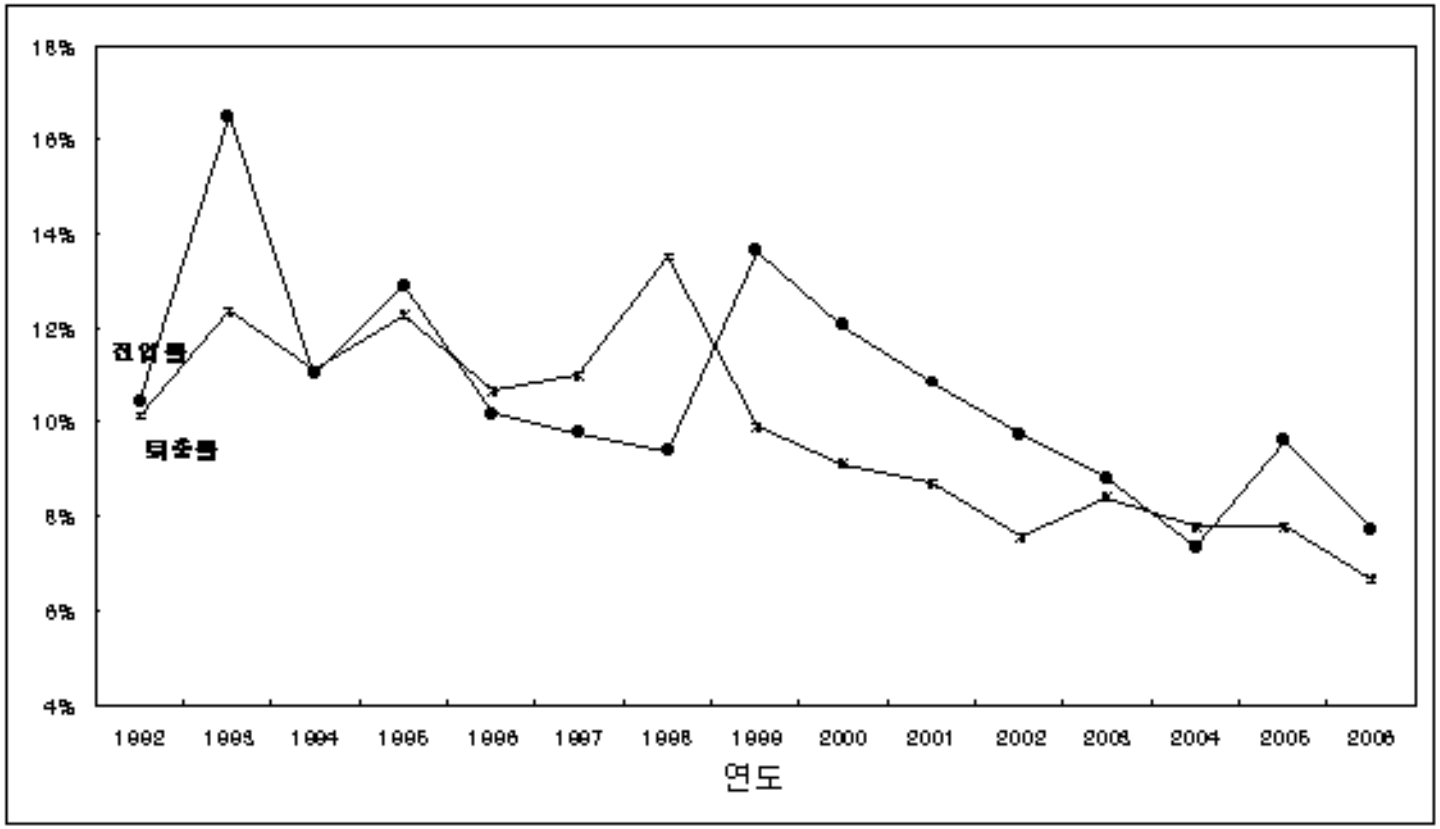
Firm Dynamics in Korean Manufacturing

Entry and Exit Rates of Manufacturing Plants (by employment)



Plant-Level Total Factor Productivity

- Multilateral Index Approach

$$\ln TFP_{it} = (\ln Y_{it} - \overline{\ln Y_t}) + \sum_{\tau=2}^{t} (\overline{\ln Y_\tau} - \overline{\ln Y_{\tau-1}})$$

$$- \left\{ \sum_{n=1}^{N} \frac{1}{2} (S_{nit} + \overline{S_{nt}})(\ln X_{nit} - \overline{\ln X_{nt}}) + \sum_{\tau=2}^{t} \sum_{n=1}^{N} \frac{1}{2} (\overline{S_{n\tau}} + \overline{S_{n\tau-1}})(\overline{\ln X_{n\tau}} - \overline{\ln X_{n\tau-1}}) \right\}$$

$$\ln TFP_t = \sum_{f}^{n} \theta_{f,t} \ln TFP_{f,t}$$

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TFP Growth Decomposition

- **TFP Growth** $lnTFP_t - lnTFP_{t-\tau}$
- **Within Effect** $\sum_{f \in S} \theta_{f,t-\tau} \Delta \ln TFP_{f,t}$
- **Between Effect** $\sum_{f \in S} \Delta \theta_{f,t} (\ln TFP_{f,t-\tau} - \overline{\ln TFP_{t-\tau}})$
- **Covariance Effect** $\sum_{f \in S} \Delta \theta_{f,t} \Delta \ln TFP_{f,t}$
- **Entry Effect** $\sum_{f \in N} \theta_{f,t} (\ln TFP_{f,t} - \overline{\ln TFP_{t-\tau}})$
- **Exit Effect** $\sum_{f \in X} \theta_{f,t-\tau} (\overline{\ln TFP_{t-\tau}} - \ln TFP_{f,t-\tau})$

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Decomposition of TFP growth rate of manufacturing industry

1.1 Period before Financial Crisis: 1990-1995 (annual average growth rate)

Industry	**Within effect**	Between effect	Covariance effect	**Total effect among stayers**	Entry effect	Exit effect	Switch-in effect	Switch-out effect	**Net-entry effect**	**Industry total**	Average share	Change in share
	a	b	c	**d=a+b+c**	e	f	g	h	**i=e+f+g+h**	**j=d+i**		
High-tech	**0.37%**	-0.12%	0.41%	**0.66%**	0.20%	-0.08%	0.05%	-0.05%	**0.12%**	**0.79%**	8.82%	4.21%
Medium-high tech	**0.69%**	-0.32%	0.30%	**0.67%**	0.44%	-0.22%	0.36%	-0.13%	**0.46%**	**1.13%**	27.31%	7.13%
Medium-low tech	**0.22%**	-0.48%	0.58%	**0.32%**	0.19%	-0.22%	0.11%	-0.17%	**-0.08%**	**0.23%**	25.82%	0.14%
Low-tech	**-0.34%**	-0.50%	1.12%	**0.28%**	0.93%	-1.08%	0.05%	-0.09%	**-0.18%**	**0.10%**	38.05%	-11.48%
Weighted average of all industries	**0.94%**	-1.42%	2.41%	**1.93%**	1.77%	-1.60%	0.58%	-0.44%	**0.31%**	**2.25%**		
Share of each effect in industry's TFP growth	**42.00%**	-63.10%	107.12%	**86.02%**	78.67%	-70.99%	25.72%	-19.42%	**13.98%**	**100.0%**		

Decomposition of TFP growth rate of manufacturing industry

1.2 Period including Financial Crisis: 1995-1999 (annual average growth rate)

Industry	**Within effect**	Between effect	Covariance effect	**Total effect among stayers**	Entry effect	Exit effect	Switch-in effect	Switch-out effect	**Net-entry effect**	**Industry total**	Average share	Change in share
	a	b	c	**d=a+b+c**	e	f	g	h	**i=e+f+g+h**	**j=d+i**		
High-tech	**0.14%**	-0.35%	0.59%	**0.38%**	0.36%	-0.05%	0.81%	-0.12%	**1.01%**	**1.39%**	14.29%	6.72%
Medium-high tech	**-0.02%**	-0.33%	0.93%	**0.59%**	0.38%	-0.22%	0.24%	-0.05%	**0.35%**	**0.94%**	32.74%	3.73%
Medium-low tech	**-0.98%**	-0.19%	0.78%	**-0.39%**	0.13%	-0.26%	0.18%	-0.08%	**-0.03%**	**-0.41%**	24.39%	-3.00%
Low-tech	**-1.03%**	-0.37%	1.35%	**-0.04%**	0.35%	-0.61%	0.12%	-0.07%	**-0.21%**	**-0.25%**	28.58%	-7.46%
Weighted average of all industries	**-1.88%**	**-1.23%**	**3.65%**	**0.54%**	**1.23%**	**-1.15%**	**1.35%**	**-0.32%**	**1.12%**	**1.66%**		
Share of each effect in industry's TFP growth	**-112.98%**	-74.22%	219.93%	**32.72%**	73.86%	-69.04%	81.46%	-19.00%	**67.28%**	**100.0%**		

Decomposition of TFP growth rate of manufacturing industry

1.3 Period after Financial Crisis: 1999-2003 (annual average growth rate)

Industry	**Within effect**	Between effect	Covariance effect	**Total effect among stayers**	Entry effect	Exit effect	Switch-in effect	Switch-out effect	**Net-entry effect**	**Industry total**	Average share	Change in share
	a	b	c	**d=a+b+c**	e	f	g	h	**i=e+f+g+h**	**j=d+i**		
High-tech	**2.48%**	0.07%	0.17%	**2.71%**	0.61%	-0.14%	0.19%	-0.07%	**0.59%**	**3.29%**	22.82%	10.34%
Medium-high tech	**1.42%**	-0.75%	1.16%	**1.83%**	0.40%	-0.15%	0.17%	-0.06%	**0.35%**	**2.18%**	34.84%	0.48%
Medium-low tech	**0.32%**	-0.43%	0.59%	**0.48%**	0.27%	-0.11%	0.10%	-0.10%	**0.16%**	**0.64%**	21.20%	-3.38%
Low-tech	**-0.96%**	-0.65%	1.12%	**-0.50%**	0.49%	-0.30%	0.09%	-0.11%	**0.17%**	**-0.33%**	21.13%	-7.44%
Weighted average of all industries	**3.25%**	**-1.77%**	**3.04%**	**4.52%**	**1.77%**	**-0.71%**	**0.56%**	**-0.35%**	**1.27%**	**5.78%**		
Share of each effect in industry's TFP growth	**56.25%**	-30.68%	52.55%	**78.12%**	30.53%	-12.28%	9.63%	-6.01%	**21.88%**	**100.0%**		

Regression for Plant-Level TFP Growth

$$\frac{\ln TFP_{i,t+3} - \ln TFP_{i,t}}{3} = \beta_0 + \beta_{Plant} \cdot X_{i,t} + \beta_{Industry} \cdot Y_{j,t} + \beta_{Dt} \cdot D_t + \beta_{Dj} \cdot D_j + \varepsilon_{i,t}$$

TFP Growth Regression 1 (Firm Dynamics)

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)
$(\text{Non-production worker share})_{i,t}$	0.00558 ***	0.00562 ***	0.00632 ***	0.00636 ***	0.00004	0.00005
	(10.34)	(10.34)	(11.23)	(11.21)	(0.07)	(0.09)
$(\text{Capital-labor ratio})_{i,t}$	-0.00005 ***	-0.00005 ***	-0.00005 ***	-0.00005 ***	-0.00004 ***	-0.00004 ***
	(-8.99)	(-8.98)	(-7.43)	(-7.41)	(-5.22)	(-5.20)
$(\text{R\&D intensity})_{i,t}$	0.00016	0.00018	0.00016	0.00018	-0.03331	-0.03434
	(0.35)	(0.39)	(0.36)	(0.40)	(-0.96)	(-0.98)
$(\text{Export intensity}_{)i,t}$	0.00042	0.00036	0.00167	0.00161	-0.01054	-0.01055
	(0.34)	(0.29)	(1.31)	(1.26)	(-1.46)	(-1.46)
$\ln(\text{Number of workders})_{i,t}$	0.00764 ***	0.00771 ***	0.00706 ***	0.00713 ***	0.00726 ***	0.00725 ***
	(32.29)	(32.59)	(27.11)	(27.37)	(4.25)	(4.24)
$(\text{Non-production worker share})_{j,t}$	0.01921 ***	0.02033 ***	0.01845 ***	0.01959 ***	0.00092	-0.00012
	(10.48)	(11.07)	(9.72)	(10.30)	(0.07)	(-0.01)
$(\text{Capital-labor ratio})_{i,t}$	0.00002 ***	0.00002 ***	0.00002 ***	0.00002 ***	0.00001	0.00001
	(3.72)	(4.34)	(3.78)	(4.43)	(0.26)	(0.25)
$(\text{R\&D intensity})_{j,t}$	0.31034 ***	0.31419 ***	0.30630 ***	0.31025 ***	0.64897 ***	0.64758 ***
	(9.34)	(9.45)	(9.05)	(9.17)	(3.80)	(3.79)
$(\text{Export intensity})_{j,t}$	-0.00894 ***	-0.00713 ***	-0.00756 ***	-0.00571 **	-0.06415 ***	-0.06547 ***
	(-3.81)	(-3.03)	(-3.18)	(-2.40)	(-4.10)	(-4.15)
$(\text{Import penetration ratio})_{j,t}$	0.01964 ***	0.02019 ***	0.01938 ***	0.01999 ***	0.05134 **	0.05193 **
	(6.99)	(7.18)	(6.84)	(7.05)	(2.15)	(2.17)
$(\text{Entry rate})_{j,t}$	0.07149 ***	0.07405 ***	0.07179 ***	0.07439 ***	0.09267 *	0.09138 *
	(7.50)	(7.76)	(7.39)	(7.66)	(1.88)	(1.85)
$(\text{Exit rate})_{j,t}$		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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TFP Growth Regression 2 (R&D and Road Stock)

$\{\ln(TFP)_{i,t+3} - \ln(TFP)_{i,t}\}/3$	I	II	III	IV
ln(TFP)i, t	-0.23483*** (-268.95)	-0.23537*** (-267.35)	-0.23475*** (-268.80)	-0.23582*** (-267.31)
Non-production to production worker ratio (by plant)	0.00540*** (10.57)	0.00543*** (10.55)	0.00543*** (10.58)	0.00552*** (10.54)
Capital Labor Ratio (by plant)	-0.00005*** (-8.60)	-0.00005*** (-8.58)	-0.00005*** (-8.57)	-0.00005*** (-8.48)
R&D Intensity (by plant)	0.00014 (0.31)	0.00013 (0.27)	0.00016 (0.34)	0.00015 (0.32)
Export Intensity (by plant)	-0.00137 (-1.08)	-0.00137 (-1.08)	-0.00148 (-1.17)	-0.00162 (-1.28)
ln (Number of workers)	0.00613*** (25.57)	0.00625*** (26.02)	0.00617*** (25.73)	0.00648*** (27.00)
Non-production to production worker ratio (by industry)	0.01426*** (8.84)	0.01470*** (9.08)	0.01460*** (9.05)	0.01607*** (9.87)
Capital Labor Ratio (by industry)	0.00005*** (12.40)	0.00006*** (14.01)	0.00006*** (13.85)	0.00008*** (18.74)
R&D Intensity (by industry)	0.20076*** (7.36)	0.16367*** (5.89)	0.22754*** (8.26)	0.18268*** (6.59)
Export Intensity (by industry)	0.01547*** (8.80)	0.01592*** (9.05)	0.01429*** (8.11)	0.01364*** (7.75)

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TFP Growth Regression 2 (R&D and Road Stock)

$\{\ln(TFP)_{i,t+3} - \ln(TFP)_{i,t}\}/3$	I	II	III	IV
Import penetration (by industry)	0.02200*** (11.97)	0.02364*** (12.77)	0.02071*** (11.19)	0.02255*** (12.17)
Entry rate (by industry)		0.03158*** (7.27)		0.06999*** (12.90)
Exit rate (by industry)			0.03209*** (6.72)	0.07683*** (12.87)
ln (Road Stock) (by region)	**0.01971*** (55.12)**	**0.01981*** (55.41)**	**0.01980*** (55.21)**	**0.02013*** (55.96)**
Number of observation	204,040	204,040	204,040	204,040
R-sq	0.40243	0.40260	0.40257	0.40314

Hetero-scadasticity robust *t*-ratios are in parentheses. ***,**,* significant at 1%, 5%, 10% level, respectively.

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TFP Growth Regression 3 (R&D and Road Stock)

$\{\ln(TFP)_{i,t+3} - \ln(TFP)_{i,t}\}/3$	I (L < 50)	II (50 ≤ L <150)	III (150 ≤ L < 300)	IV (L ≥ 300)
ln(TFP)i, t	-0.24415*** (-240.61)	-0.20801*** (-68.38)	-0.20236*** (-32.72)	-0.17902*** (-23.19)
Non-production to production worker ratio (by plant)	0.00874*** (15.15)	0.00432*** (5.82)	0.00132 (0.97)	0.00075 (1.36)
Capital Labor Ratio (by plant)	-0.00012*** (-7.42)	9.753e-06 (1.14)	-1.950e-06 (-0.15)	-0.00003*** (-4.55)
R&D Intensity (by plant)	0.00007 (0.15)	0.01565 (1.43)	0.02679 (0.95)	-0.04388 (-1.08)
Export Intensity (by plant)	0.00012 (0.08)	-0.00069 (-0.28)	-0.00788* (-1.69)	-0.00947 (-1.27)
ln (Number of workers)	0.00177*** (4.55)	0.00440*** (3.62)	0.00269 (1.05)	0.00309* (1.80)
Non-production to production worker ratio (by industry)	0.00934*** (5.03)	0.02967*** (6.41)	0.02496*** (4.54)	0.01112 (1.62)
Capital Labor Ratio (by industry)	0.00009*** (17.95)	0.00007*** (6.78)	0.00002 (0.97)	0.00005** (2.27)
R&D Intensity (by industry)	0.13053*** (4.12)	0.52895*** (7.01)	0.46873*** (3.73)	0.71269*** (4.95)
Export Intensity (by industry)	0.01785*** (9.20)	-0.00078 (-0.15)	-0.00148 (-0.14)	-0.02739** (-2.12)

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TFP Growth Regression 3 (R&D and Road Stock)

$\{\ln(TFP)_{i,t+3} - \ln(TFP)_{i,t}\}/3$	I (L < 50)	II (50 ≤ L <150)	III (150 ≤ L < 300)	IV (L ≥ 300)
Import penetration (by industry)	0.02636*** (12.84)	0.00656 (1.27)	0.02384** (2.28)	-0.00002 (0.00)
Entry rate (by industry)	0.10624*** (18.02)	-0.03535** (-2.19)	-0.22749*** (-7.91)	-0.15425*** (-3.98)
Exit rate (by Industry)	0.11546*** (17.87)	-0.02680 (-1.59)	-0.23885*** (-7.48)	-0.14704*** (-3.02)
ln (Road Stock) (by region)	**0.02042*** **(52.19)**	**0.01848*** **(17.77)**	**0.01804*** **(8.50)**	**0.02302*** **(7.65)**
Number of observation	173,923	21,944	5,116	3,057
R-sq	0.41302	0.37006	0.37109	0.30847

Hetero-scadasticity robust *t*-ratios are in parentheses. ***,**,* significant at 1%, 5%, 10% level, respectively.

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TFP Growth Regression 4 (R&D and Patenting)

Explanatory variables	I	II	III	IV
ln(TFP)i, t	-0.18667*** (-405.88)	-0.18668*** (-405.93)	-0.18667*** (-405.88)	-0.18667*** (-405.88)
Non-production to production worker ratio (by plant)	0.01310*** (32.45)	0.01314*** (32.55)	0.01310*** (32.45)	0.01310*** (32.45)
R&D Intensity (by plant)	0.00428*** (3.02)	0.00430*** (3.03)	-0.01915*** (-1.14)	0.00184*** (0.53)
Export Intensity (by plant)	0.00424*** (3.06)	0.00430*** (3.10)	0.00425*** (3.06)	0.00424*** (3.06)
ln(Number of workers)	0.00849*** (25.36)	0.00843*** (25.19)	0.00849*** (25.37)	0.00849*** (25.36)
Non-production to production worker ratio (by industry)	0.02745*** (10.73)	0.02741*** (10.71)	0.02745*** (10.73)	0.02746*** (10.73)
Capital Labor Ratio (by industry)	0.00031*** (46.88)	0.00031*** (46.74)	0.00031*** (46.88)	0.00031*** (46.88)
R&D Intensity (by industry)	1.80791*** (37.99)	0.58761*** (2.74)	1.80738*** (37.98)	1.80630*** (37.92)
Export Intensity (by industry)	0.00676** (2.40)	0.00499** (1.76)	0.00673* (2.39)	0.00676** (2.40)

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TFP Growth Regression 4 (R&D and Patenting)

Explanatory variables	I	II	III	IV
ln(Number of Patent Applications) (by industry)	0.01129*** (39.32)	0.01060*** (34.17)	0.01128*** (39.28)	0.01129*** (39.32)
Industry R&D × Industry Patenting		0.14671*** (5.83)		
Plant R&D × Industry Patenting			0.00299 (1.40)	
Plant R&D × Industry R&D				0.12390 (0.77)
Year dummy	included	included	included	included
Number of observations	438,624	438,624	438,624	438,624
R-sq	0.28544	0.28549	0.28544	0.28544

Hetero-scadasticity robust *t*-ratios are in parentheses. ***,**,* significant at 1%, 5%, 10% level, respectively.

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TFP Growth Regression 5 (R&D and Patenting, HT & MHT)

Explanatory variables	I	II	III	IV
ln(TFP)i, t	-0.20220*** (-252.64)	-0.20214*** (-253.22)	-0.20219*** (-252.63)	-0.20219*** (-252.61)
Non-production to production worker ratio (by plant)	0.01041*** (13.93)	0.01072*** (14.39)	0.01038*** (13.89)	0.01039 (13.91)
R&D Intensity (by plant)	0.00188 (1.32)	0.00189 (1.33)	-0.07194*** (-3.54)	-0.00572 (-1.54)
Export Intensity (by plant)	0.00082 (0.28)	0.00121 (0.42)	0.00083 (0.29)	0.00082 (0.28)
ln(Number of workers)	0.00173*** (3.15)	0.00137** (2.49)	0.00173*** (3.15)	0.00173*** (3.14)
Non-production to production worker ratio (by industry)	-0.09555*** (-17.01)	-0.08694*** (-15.49)	-0.09534*** (-16.97)	-0.09545*** (-16.99)
Capital Labor Ratio (by industry)	0.00085*** (8.04)	0.00007*** (7.02)	0.00009*** (8.05)	0.00009*** (8.04)
R&D Intensity (by industry)	0.49597*** (7.55)	-12.29331*** (-26.07)	0.49521*** (7.54)	0.49032 (7.46)
Export Intensity (by industry)	0.00767*** (10.43)	0.03310*** (6.70)	0.06651*** (13.87)	0.06659*** (13.88)

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TFP Growth Regression 5 (R&D and Patenting, HT & MHT)

Explanatory variables	I	II	III	IV
ln(Number of Patent Applications) (by industry)	0.00767*** (10.43)	-0.01230*** (-11.89)	0.00755*** (10.26)	0.00767*** (10.42)
Industry R&D × Industry Patenting		1.48937*** (27.39)		
Plant R&D × Industry Patenting			0.00932*** (3.64)	
Plant R&D × Industry R&D				0.37283*** (2.21)
Year dummy	included	included	included	included
Number of observations	143,340	143,340	143,340	143,340
R-sq	0.32206	0.32558	0.32212	0.32208

Hetero-scadasticity robust *t*-ratios are in parentheses. ***,**,* significant at 1%, 5%, 10% level, respectively.

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TFP Growth Regression 6 (Infrastructure and Patenting)

특허활동의 생산성 제고효과 분석결과 (지역변수 포함)

변수	IX	X	XI	XII
ln(TFP)i, t	-0.23906*** (-274.15)	-0.23618*** (-271.01)	-0.24042*** (-275.08)	-0.24021*** (-274.54)
업체별 비생산직 종사자 비율	0.00499*** (10.01)	0.00524*** (10.30)	0.00500*** (9.97)	0.00498*** (9.95)
업체별 자본장비율	-0.0005*** (-8.50)	-0.00005*** (-9.20)	-0.0004*** (-8.09)	-0.00042*** (-8.01)
업체별 R&D 집약도	-0.0003 (-0.07)	0.00006 (0.15)	0.0002 (0.04)	-0.00001*** (-0.02)
업체별 수출집약도	-0.00063 (-0.51)	-0.00073 (-0.59)	-0.00098 (-0.19)	-0.00097 (-0.78)
업체 규모	0.00813*** (34.70)	0.00743*** (31.60)	0.00860*** (36.71)	0.008574*** (36.62)
산업별 비생산직 종사자 비율	0.01459*** (8.99)	0.01713*** (10.50)	0.01394*** (8.57)	0.01394*** (8.57)
산업별 자본장비율	0.00004*** (9.12)	0.0002*** (4.64)	0.00004*** (10.72)	0.00004*** (10.54)
산업별 R&D 집약도	0.29792*** (11.67)	0.30741*** (11.98)	0.33433*** (13.09)	0.32692*** (12.80)
산업별 수출집약도	0.01674*** (9.00)	0.01970*** (10.56)	0.01620*** (8.72)	0.01688*** (9.09)
지역별 특허출원	0.00540*** (39.91)		0.00824*** (45.96)	-0.10267*** (-4.52)
지역별 도로스톡		0.00372*** (8.81)	-0.01349*** (-24.16)	-0.02614*** (-15.78)
지역별 특허출원 × 지역별 도로스톡				0.00187*** (8.20)
연도더미	포함	포함	포함	포함
관측치수	206,485	206,485	206,485	206,485
결정계수	0.42683	0.42236	0.42848	0.42867

주: ( )안은 이분산성을 감안한 t-비율. ***,**,*는 각각 1%, 5%, 10% 수준에서 유의함을 나타냄.

Het ely.

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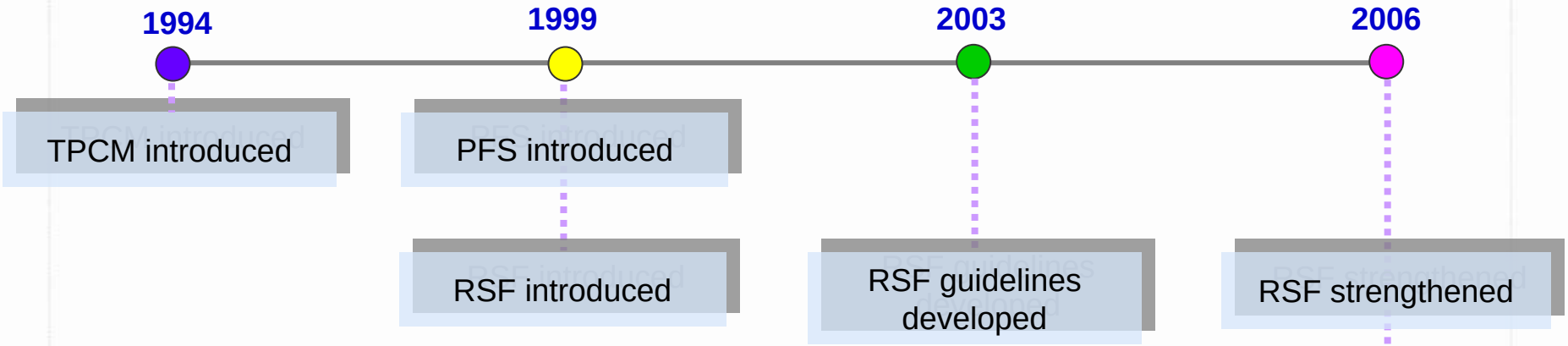
Part-05 | Related Issues for Researchers and Policymakers

Public Investment Management in Korea

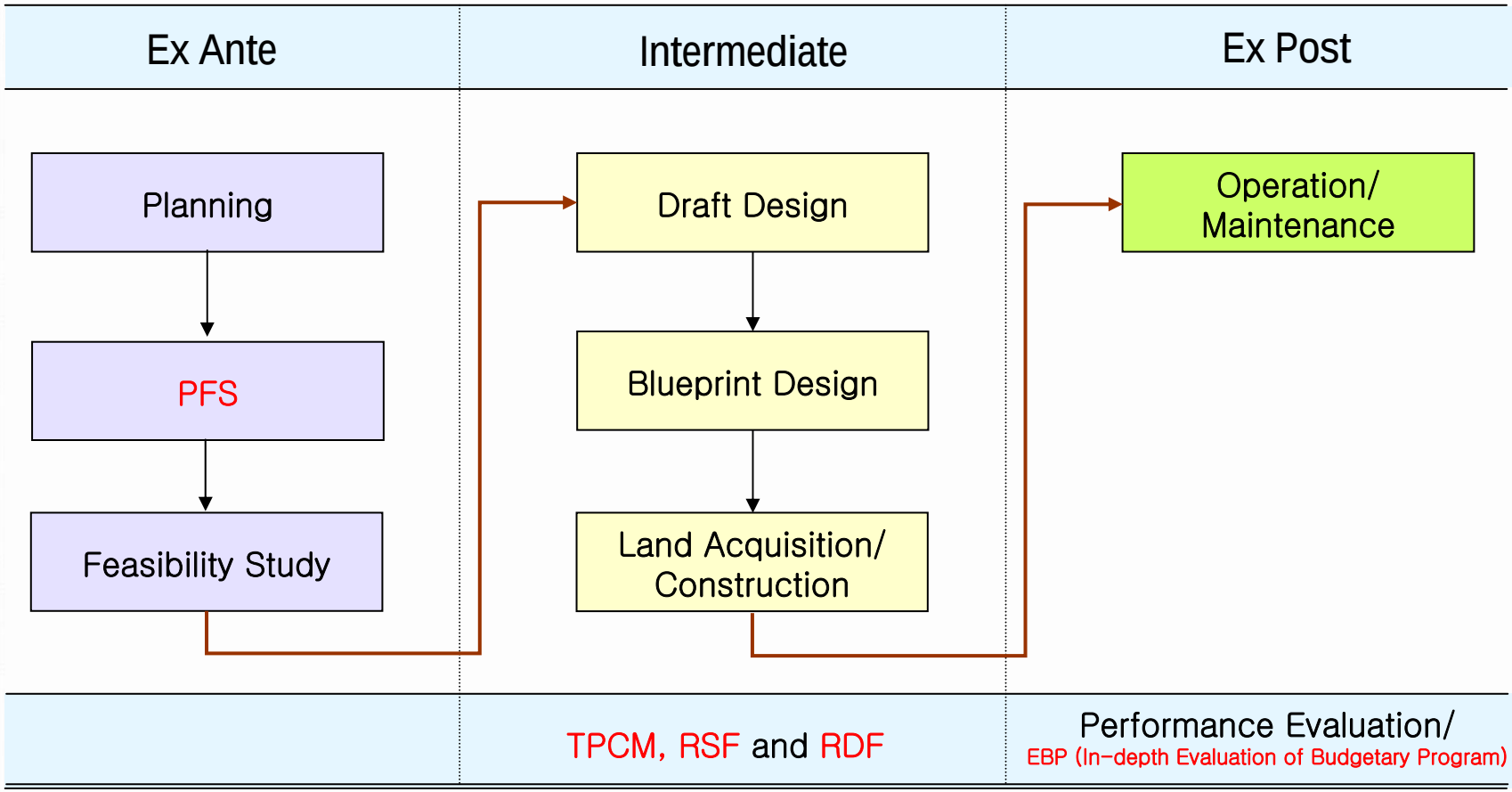
New Initiatives of Public Investment Management



- ✓ **TPCM (Total Project Cost Management)**
- ✓ **PFS (Preliminary Feasibility Study)**
- ✓ **RSF (Re-assessment Study of Feasibility)**
- ✓ **RDF (Re-assessment of Demand Forecast)**

Public Investment Management in Korea

Implementation Process of Public Investment



* Evaluation works in RED characters are owned by budget ministry (i.e., Ministry of Strategy and Finance).

Public Investment Management in Korea

What is a Preliminary Feasibility Study (PFS)?

- Short and brief evaluation of a project to produce information for budgetary decision
  - Owned by the Ministry of Strategy and Finance (MOSF)
  - Managed by PIMAC
- Meaning of “PRELIMINARY” is two-folded:
  - Provisional; and
  - Preceding a (detailed) feasibility study
- The National Finance Act of 2006 provides the legal framework of PFS.

Public Investment Management in Korea

Coverage of PFS?

- All new large-scale projects with total costs amounting to 50 billion Won ($50 million USD) or more are subject to PFS.
  - Before the NF Act, PFS was centered on infrastructure projects.
  - PFS has expanded to non-infrastructure (e.g. R&D, welfare) programs.
- Local government and PPP (Public-Private Partnership) projects are also subject to PFS if central government subsidy exceeds 30 billion Won.
- The following types of projects are exempted from PFS:
  - Typical building projects such as government offices and correctional institutions
  - Legally required facilities such as sewage and waste treatment facility
  - Rehabilitating projects and restoration from natural disaster
  - Military facilities and projects related with national security

Preliminary Feasibility Study (PFS)

Flowchart of PFS

Project proposal

Background study

- Review of statement of purpose
- Collect socio-economic, geographic, and technical data
- Brainstorming (Other Alternatives)
- PFS issues raised

Economic analysis

- Demand analysis
- Cost estimation
- Benefit estimation
- Cost-benefit analysis
- Sensitivity analysis
- Financial analysis

Policy analysis

- Consistency with higher-level plan and policy directions
- Project risk (financing and environmental impacts)
- Project-specific evaluation item

Balanced regional development analysis

- Regional backwardness index analysis
- Regional economic impacts

Analytic Hierarchy Process

- Overall feasibility
- Prioritization
- Financing and policy suggestion

Public Investment Management in Korea

Number of PFS by Sector (1999~2008)

Unit: number

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	Sum
Road	11	11	20	9	11	24	11	27	30	12	166
Railway	2	7	14	8	7	13	6	10	4	2	73
Seaport	1	5	1	2	3	1	2	5	1	4	25
Culture & tourism	3	2	5	2	5	2	1	5	1	3	29
Water resources	1	1	0	5	5	3	3	1	1	2	22
Others	1	4	1	4	2	12	7	4	8	15	58
Sum	19	30	41	30	33	55	30	52	45	38	373

Public Investment Management in Korea

Proportion of Feasible Projects by Sector (1999~2008)

Unit: %, number

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total Projects (A)	Feasible Projects (B)	(B)/(A)
Road	45.5	27.3	30.0	33.3	72.7	87.5	36.4	63.0	63.3	75.0	166	95	57.2
Railway	50.0	57.1	35.7	75.0	71.4	53.8	83.3	40.0	25.0	100.0	73	40	54.8
Seaport	100.0	80.0	100.0	50.0	100.0	100.0	100.0	40.0	100.0	100.0	25	19	76.0
Culture & Tourism	100.0	0.0	40.0	0.0	0.0	100.0	100.0	40.0	0.0	100.0	29	13	44.8
Water Resources	100.0	100.0	0.0	0.0	60.0	66.7	66.7	100.0	100.0	50.0	22	12	54.5
Others	100.0	75.0	0.07	75.0	50.0	66.7	71.4	50.0	50.0	46.7	58	35	60.3
Average	63.2	50.0	34.1	43.3	60.6	74.5	63.3	53.8	57.8	68.4	373	214	57.4

- The allocation of 86.7 trillion Won for 157 non-feasible projects (i.e., 49% of 177 trillion Won for total 373 projects) had been prevented through PFS.

Thank you!

Korea's Leading Think Tank KDI