

Intellectual Property Rights and Technological Catch-up in Korea

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Outline and reference

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Part I:

Evolution of the IPR Regimes and Catch-up in Korea

Part II:

The Impacts of IPRs on Firm-Level Catch-up

Background Studies

- Kim, Y., Keun Lee, W.G. Park & K. Choo, 2012,
“Appropriate Intellectual Property Protection and Economic
Growth in Countries at Different Levels of Development,”
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- Keun Lee, 2010,
"IPR and Technological Catch-Up in Korea",
In *IPRs, Development, and Catch-up*,
eds. H. Odagiri, A. Goto, A. Sunami, R. Nelson,
Oxford U Press



The Economics of Intellectual Property in the Republic of Korea

Korean Catch-up vs. Other Countries

Number of Patent Applications in the US by countries

Country	1980	1981	1985	1988	1990	1993	1995	1998	2000	2002	2003
Korea	33	64	129	295	775	1,624	2,820	5,452	5,705	7,937	10,411
Taiwan	367	394	760	1,246	2,035	2,874	4,054	7,412	9,046	12,488	13,786
China	7	10	24	122	111	135	144	181	469	888	1,034
average of 9 MICs	23	31	26	23	30	34	40	60	91	88	105
MIC (Middle Income Countries)											
Argentina	56	55	39	32	56	56	65	119	137	95	125
Brazil	53	66	78	71	88	105	115	165	220	243	259
Chile	8	11	7	4	13	11	10	17	24	38	33
Costa Rica	6		5	3	4	8	7	13	16	8	11
Malaysia	5	5	8	6	11	20	30	41	104	142	237
Mexico	77	99	81	74	76	82	99	141	190	157	185
Turkey	3	2	11	7	6	3	6	16	28	36	28
Uruguay	2	3	2	4	5	8	6	1	4	8	11
Thailand	1	5	5	4	8	15	21	26	92	61	60
TOTAL	104,329	106,413	117,006	139,825	164,558	174,743	212,377	243,062	295,926	334,445	342,441

Evolution of Korean IP regime in its Catch-up : 4 stages

Stage 1: The Early Catch-up Efforts : From the 1960s to the mid 1970s

- No foreign IPR in Korea ← very low inflow of foreign technology , no interest of foreigners in applying for IPRs in Korea

Stage 2: Beginning of Catch-up: From the mid 1970s to the mid 1980s

- Foreign dominance ← with growth of technology market in Korea, slight role of FDI
- Foreign share : 70% on average

Stage 3: Rapid Catch-up: From the mid 1980s to the mid 1990s

- Korean catch-up ← led by big businesses with their own in-house R&D centers
- Share of domestic inventors rose rapidly, esp. the corporate patents (from 1986)
- More US patents filed by Korean in the US

Stage 4: After Catch-up: From the mid 1990s to present

- Korean dominance: its share rose to 62.4% in 1999
- Large share of corporate patent which is more than 90%, the high concentration of *chaebols*

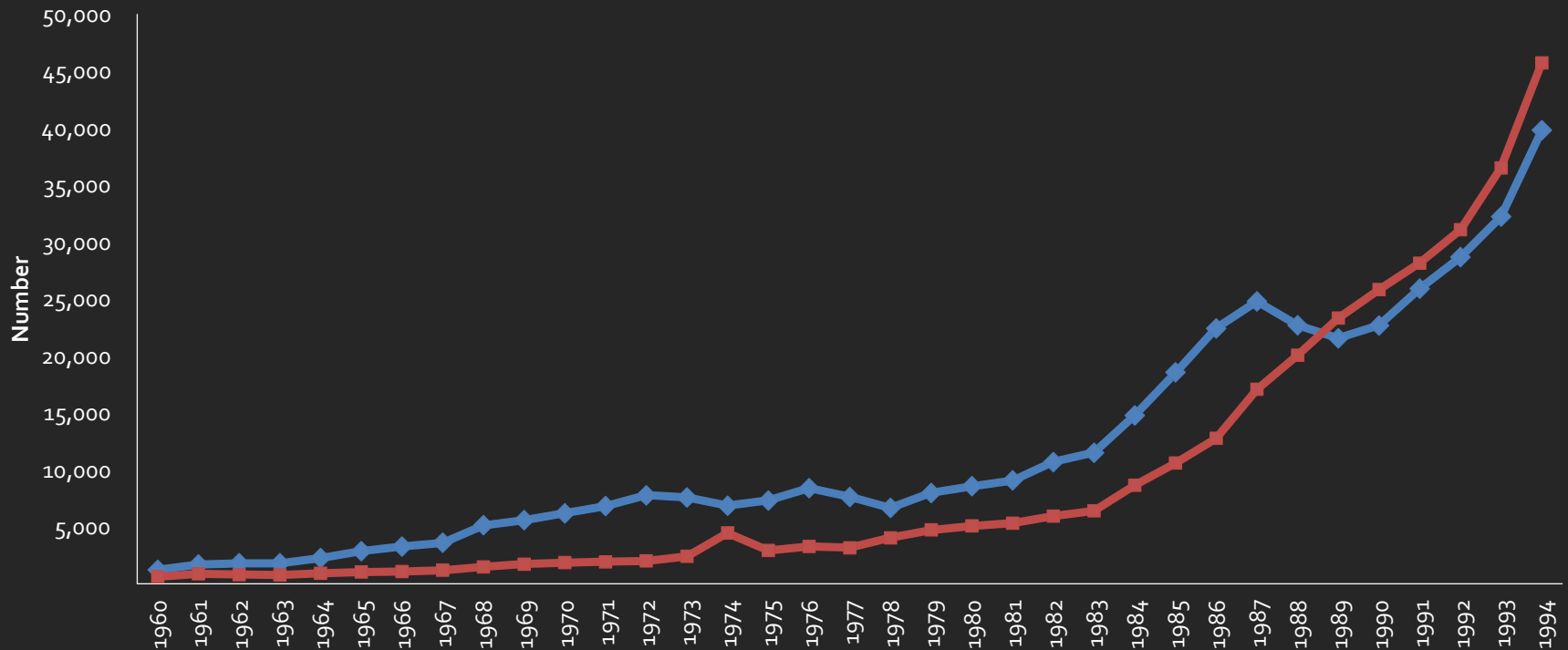
Fact 1

Utility patents vs. Invention patents

- Early days of catch-up: petit (utility) patents > regular (invention) patents
- Later stage of catch-up: petit patents < regular patents

Utility vs. invention patent

— 2) Utility Patents — 2) Invention Patents



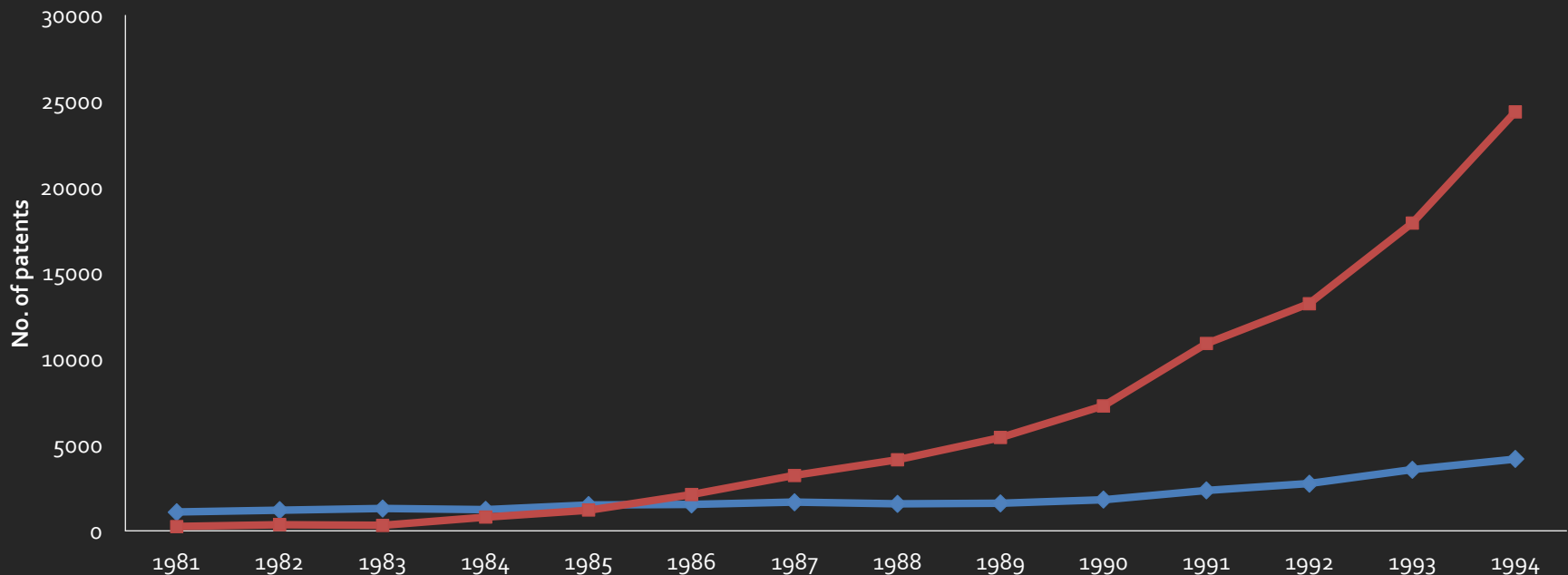
Fact 2

Individual vs. corporate patents among Korean-residents patents

- Early days of catch-up: individual patents > corporate patents
- Later stage of catch-up: individual patents < corporate patents

Individual vs. corporate patents among Korean-residents patent

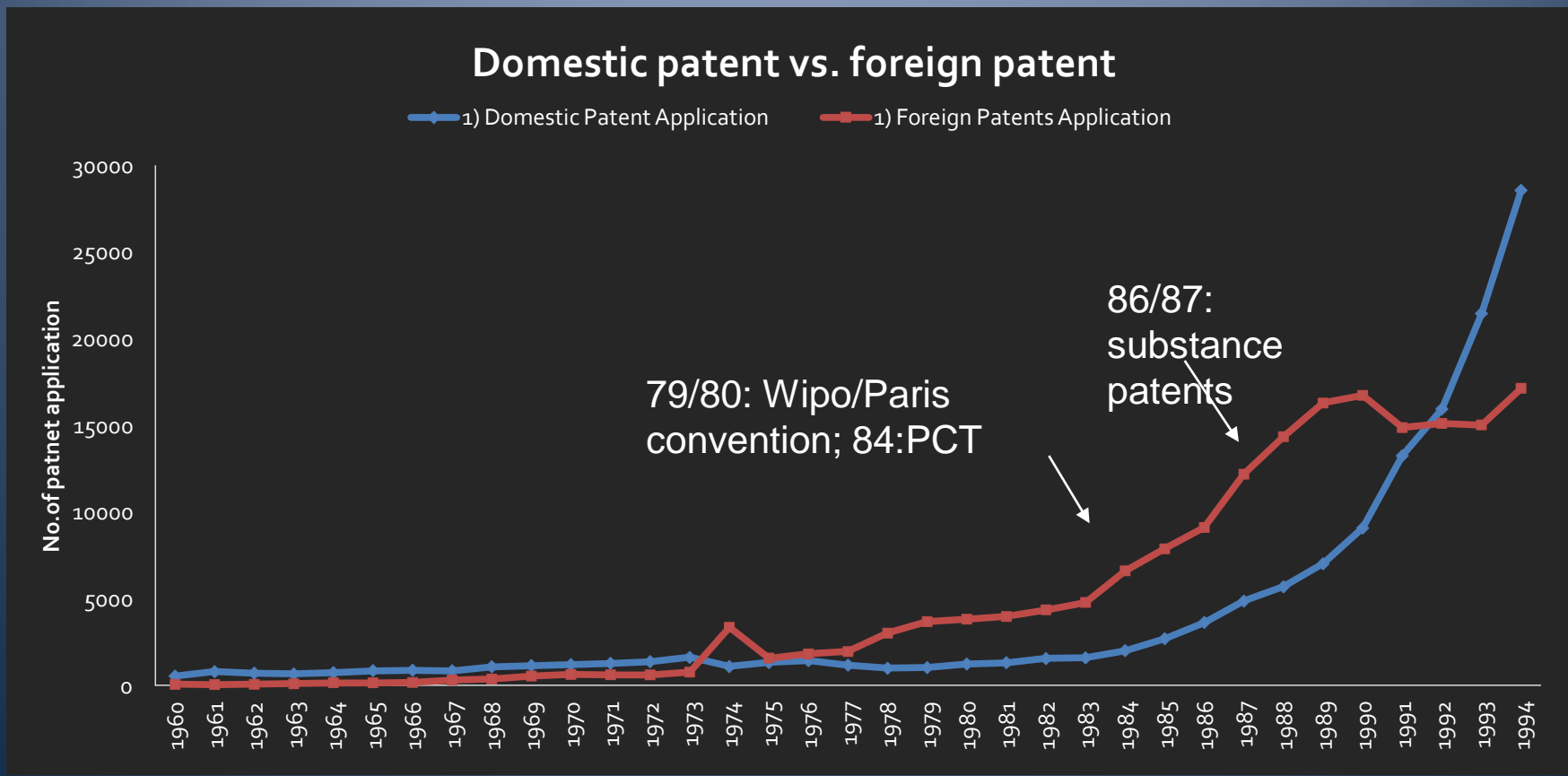
—◆— 3) Individual (Korean) —■— 3) Corporate (Korean)



Fact 3

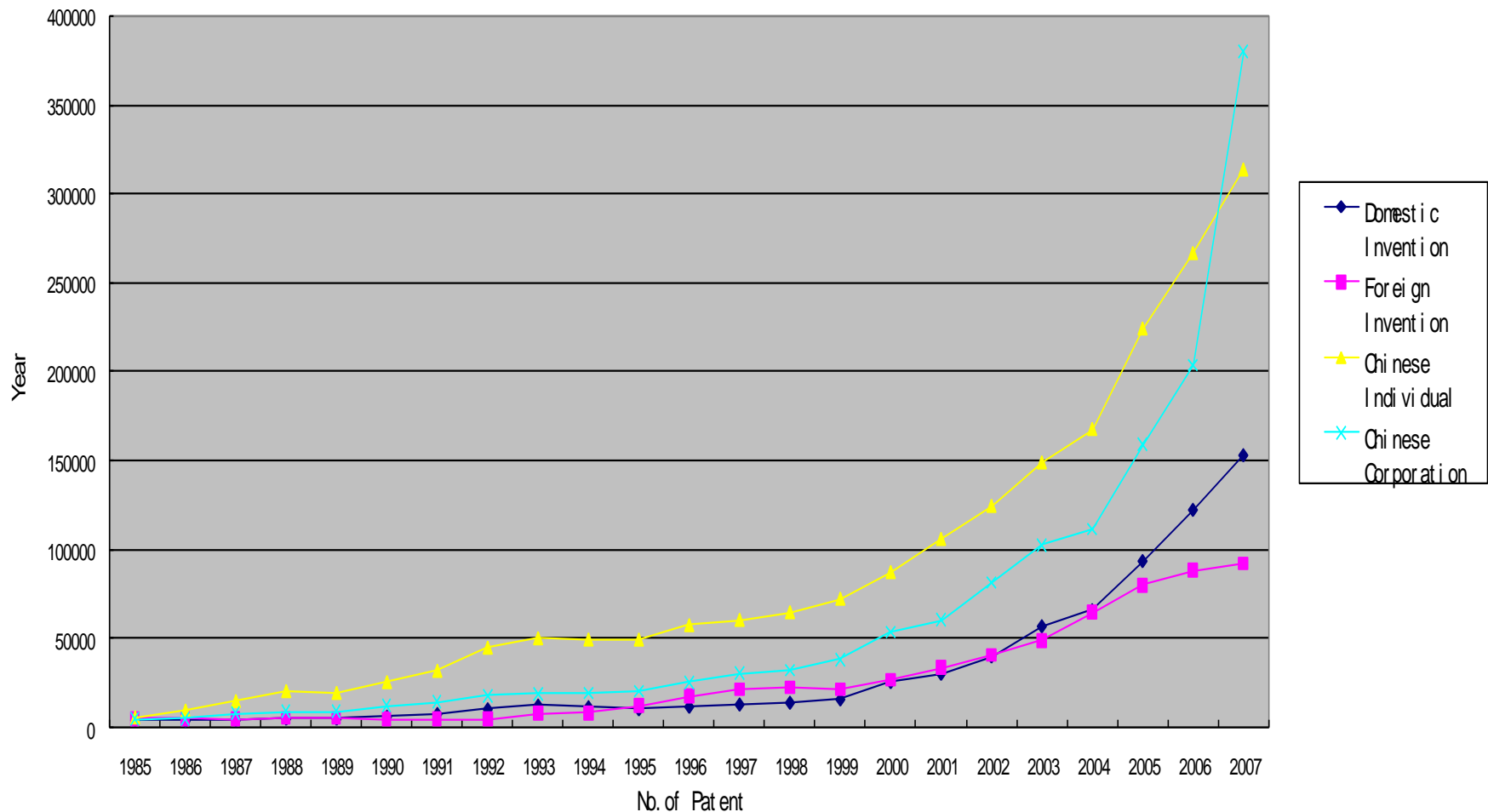
Domestic patents vs. foreign patents

- Early days of catch-up: domestic patents > foreign patents
- Mid stage of catch-up: domestic patents < foreign patents
- Later stage of catch-up: domestic patents > foreign patents



Similar Catch-up in China? Yes!

Number of Patent Application in China



Importance of the mid to late 1980s in Korea

Mid 80s: 1) Korean firms started to establish in-house R&D, given their price competitiveness being challenged by next-tier exporters and rising domestic wages

2) surpassed R&D/GDP ratio 1%, share of private R&D 50%

3) beginning of rapid rise of firm patents > indiv. Patents

4) first time (post-war) had trade surplus in the late 80s.

These (capa. Building) happened just before or together with the sudden rise of IPR protection level in 1986/87

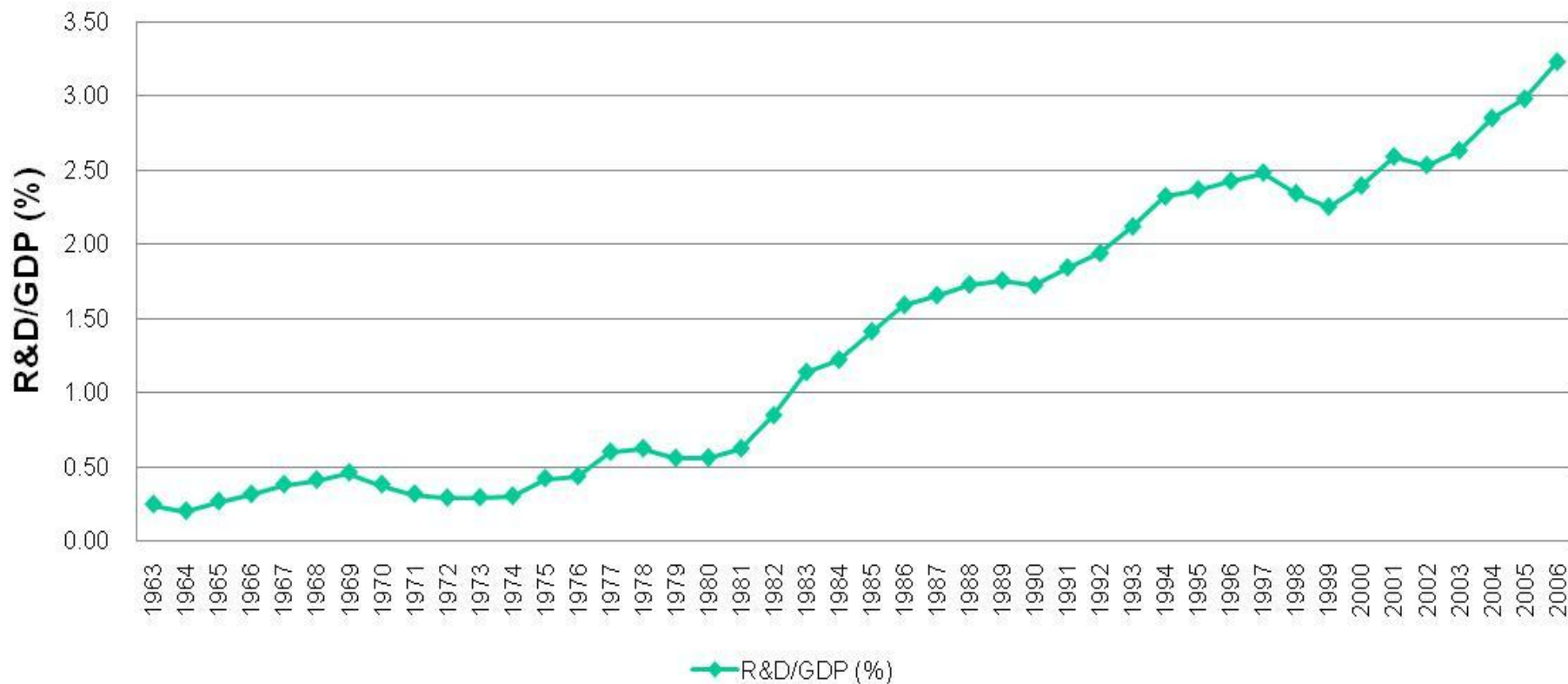
-> higher IPRs had impacts in Korea

Before the late 80s, Korean firms was not interested in IPR issues.

(b/c relied on imported machinery and equipment to do business

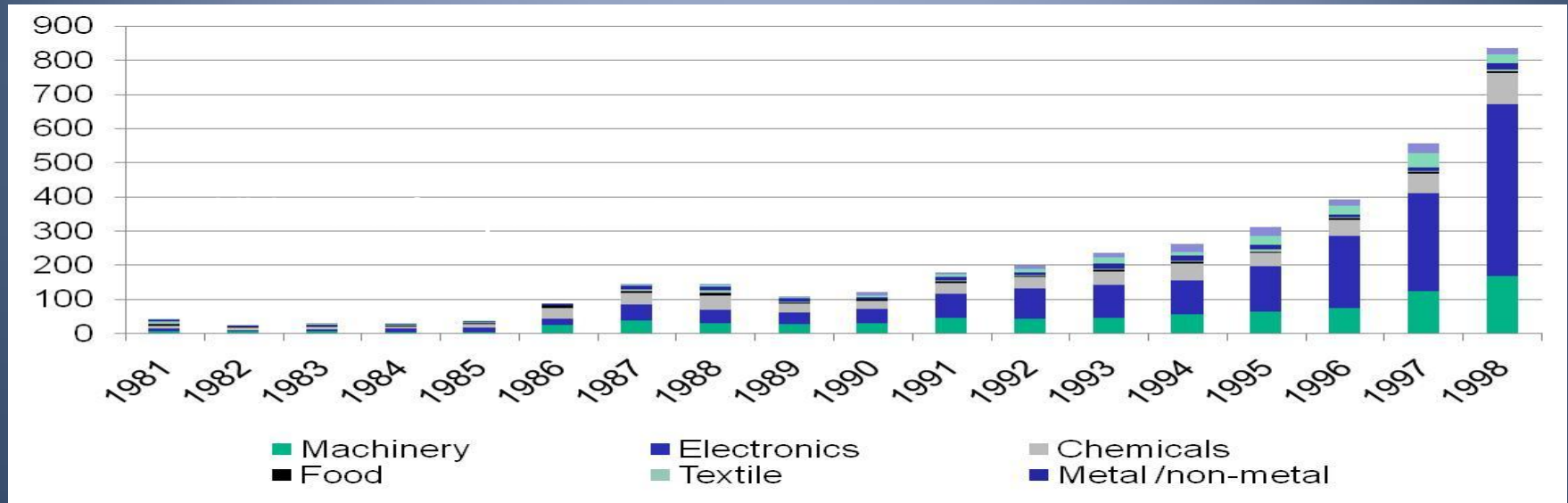
R&D took off since the Mid-80s (due to in-house R&D)

R&D Intensity (1963-2006)

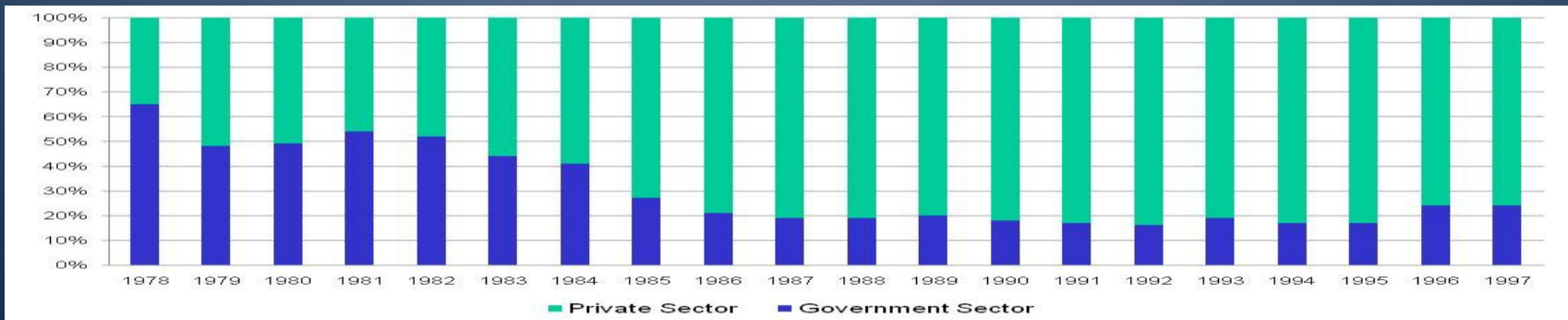


Increase of in-house R&D labs by firms and private R&D

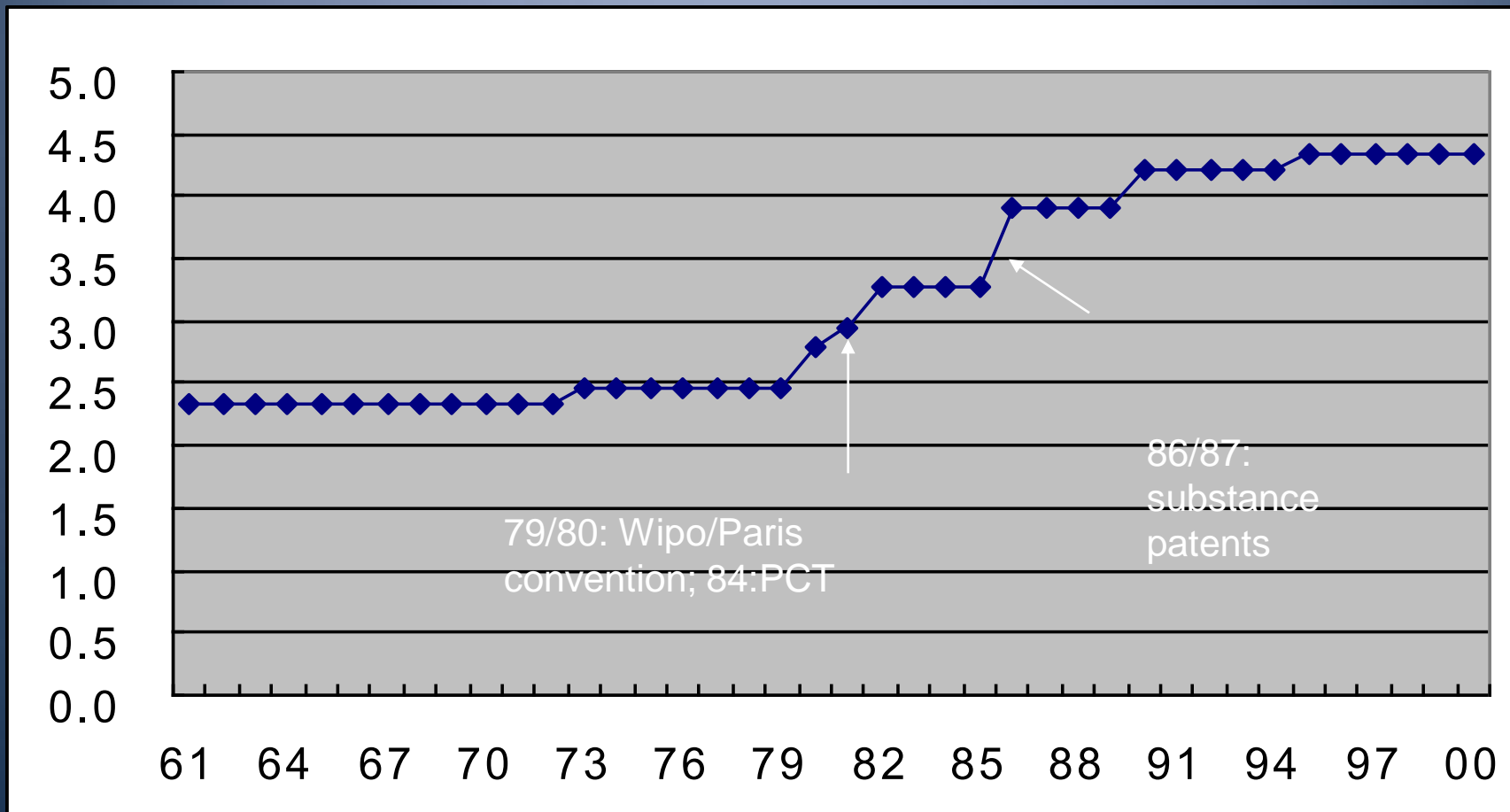
1) no of in-house R&D labs in firms (tax exemptions)



2) Share of Private vs Public R&D in Korea:



Experiment or the Event: the sudden rise in the level and scope of the IPR protection in Korea in the mid to late 1980s



Patent Protection and Innovation:

Time-series Analysis in Korea: Patents = f (R&D, IPR index)

Table 3: Impacts of Patent Rights Index on the Changes in Patent Applications: Time Series

Dependent Variable: $\Delta(\log \text{ of no. of patent application})$		
	(1)	(2)
$\Delta(\log \text{ of } RD)$	0.494 (1.93)*	0.543 (2.26)**
$\Delta(\log \text{ of } GDP)$	1.034 (1.13)	0.216 (0.38)
IPR dummy 2 (1973-1979)	-0.093 (-0.89)	
IPR dummy 3 (1980-1985)	0.076 (0.72)	
IPR dummy 4 (1986-1989)	0.209 (2.51)**	
IPR dummy 5 (1990-1994)	0.141 (1.78)*	
IPR dummy 6 (1995-2001)	0.241 (1.59)	
High IPR dummy (1986-2001)		0.132 (2.22)**
Constant	-0.271 (-1.37)	-0.106 (-1.09)
Adjusted R^2	0.184	0.224
F value	2.194	4.562
Observations	36	36

Note: White-Sandwich standard errors are used.

Result:

Positive influence of IPR on the technology changes began to be positively significant since 1986

Firm-level Impact of IPRs

- *IPRs =*
 - *serious barriers for catch-up*
 - *or a strong pressure for upgrading for catch-up?*
- *Diverse or heterogeneous responses and IPR strategies by the late-comer firms, depending upon their level or stages of capabilities.*
- Case studies of large, middle and small-sized companies in Korea and draw lessons from them

Case 1. Large firms'

Samsung Electronics vs. Texas Instruments Inc. (1986)

Texas Instruments Inc., a holder of patents for a “solid circuit” filed in 1958 , filed a lawsuit against Samsung, who refused to renew licensing with TI.

→ ITC ruling: Put a ban on Samsung's export to the US

→ Samsung : settled with TI by a new agreement (more than \$1 billion

c.f.) 7 Japanese firm: settled by cross-license contracts: \$138 million in total

A key case to urge Korean firms Samsung to strengthen IP strategy

⇒ Reevaluation of size and function of IPR team.

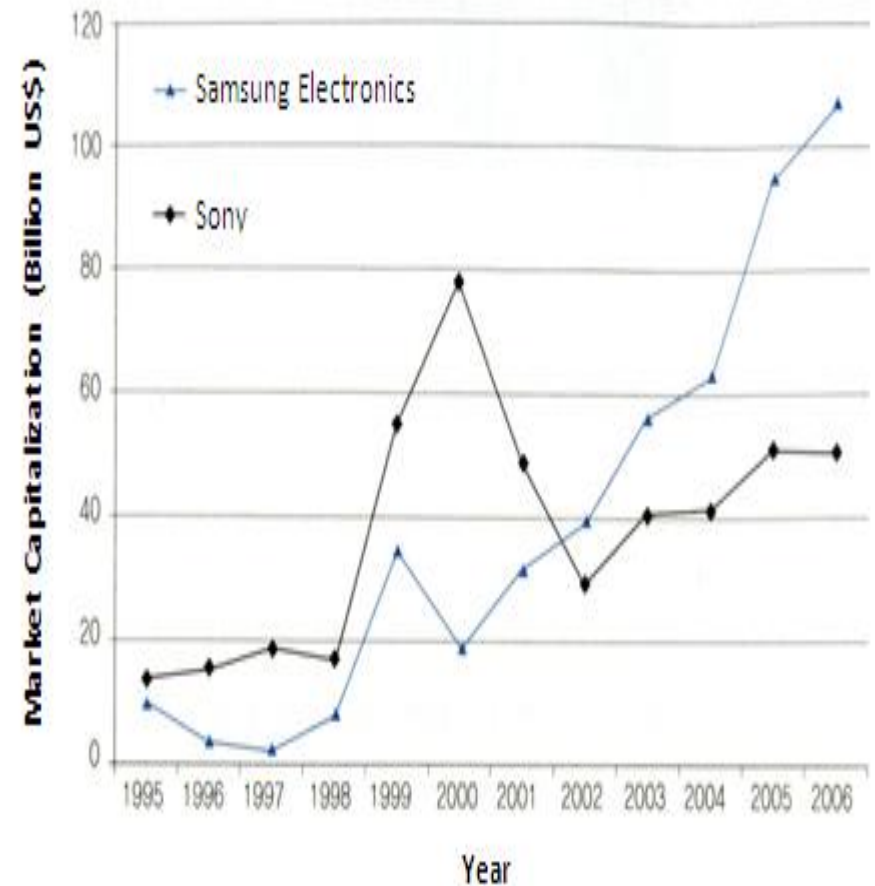
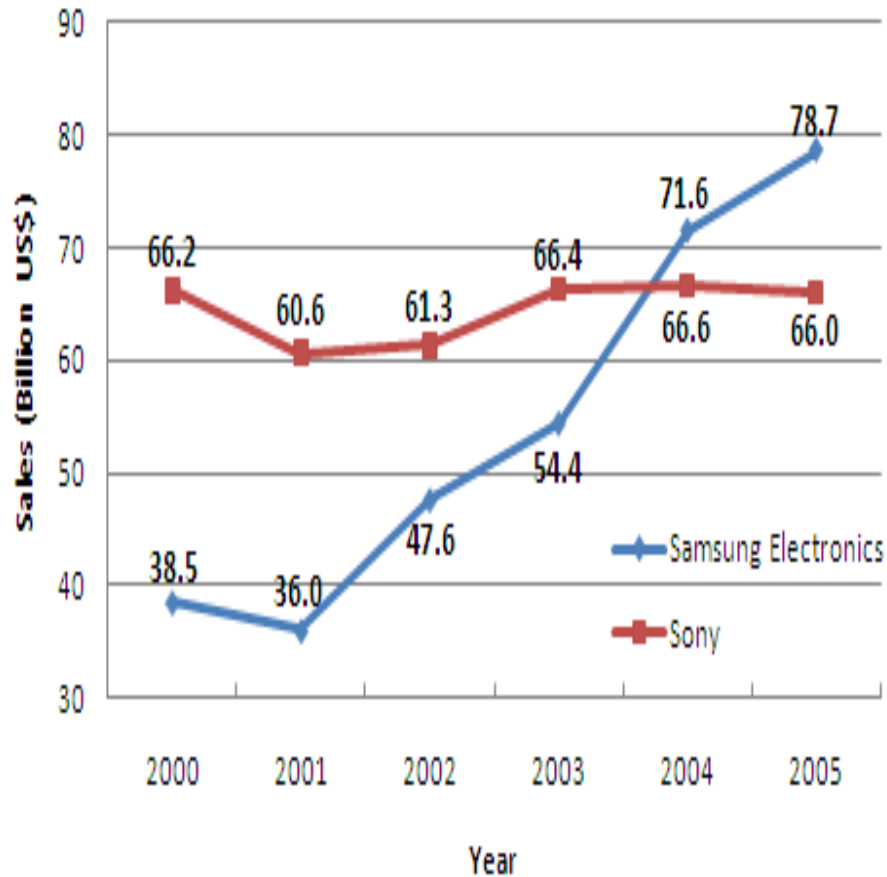
The 90s, Samsung upgraded their patent management division into IPR center ; Under the direct control of CTO, they established IPR strategy group.

Recently, a decentralization of patent management organizational structure.

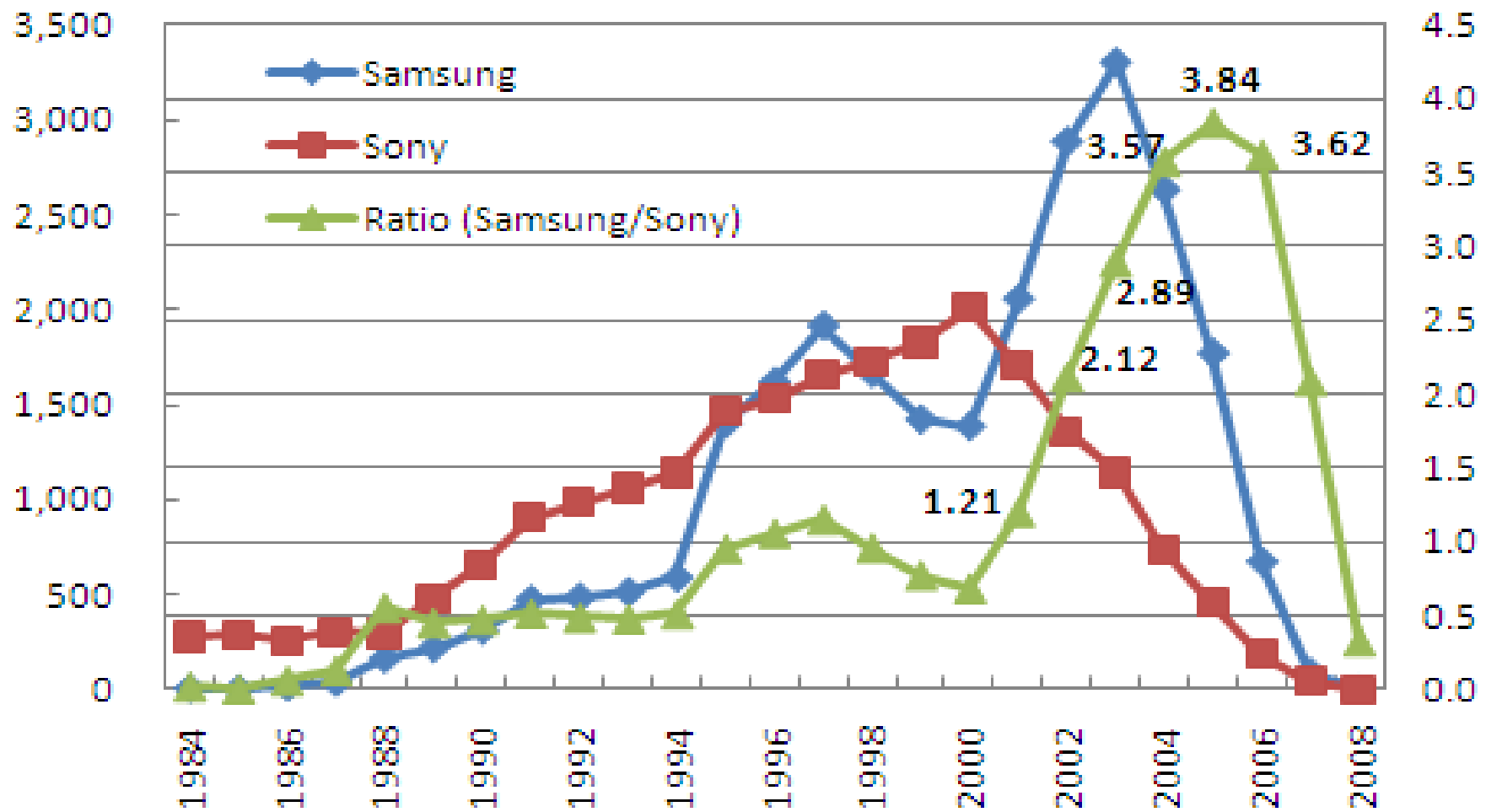
Currently, about 200 working in the patent management division.

→ Now , they have grown enough to use cross licensing as their strategy.

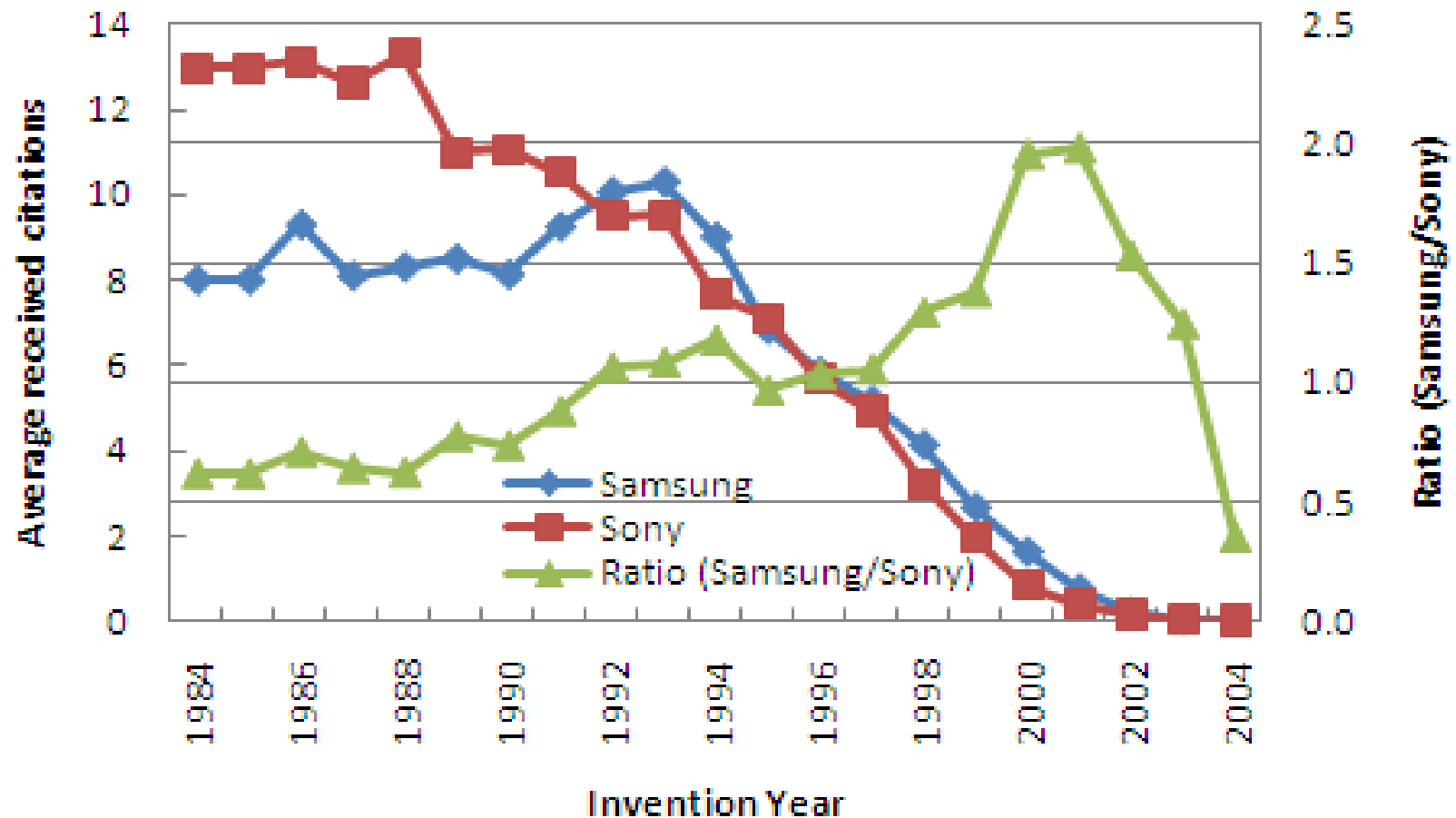
Catch-up of Samsung with SONY in mid 2000s in Sales and Market Value (Joo & Lee 2010)



- Samsung Caught up with Sony in mid 90s in Patents, 10 year before catch-up in sales or market values
 - Until mid 80s : less than 10% of SONY



Patent Quality catch-up in the mid 90s (average No. of being cited)



Case 2 .Large firms

LG Electronics' Acquisition of Zenith (1995)

Lesson from the CDMA royalty case with Qualcomm:

- The Korean consortium led by Samsung and LG vs. Qualcomm (owner of the source technology in CDMA)
- Had to pay the 5% of all sales , as a royalty to Qualcomm

Any changes in IPR strategy?:

M&A, an alternative to secure raw technologies for Catch-up

- LG acquired Zenith which holds digital broadcasting patent in 1995 at 0.36 billion US D.
- LG would keep royalties coming to Zenith
 - 5 USD per a digital TV as royalty
- Acquiring technologically superior foreign firms is a shortcut to obtain raw technologies.

Case .Mid-sized firms: diverse compromising ways of getting access to foreign IPRs **rDNA Hepatitis B Vaccine Development in Korea**

A major health issue: hepatitis B infection & high price of imported vaccine
(2 firms used to be independent with old plasma-derived vaccines; with licensing)

The Korean strategy: to get access to foreign know how for vaccine production and to establish prod. facilities before product patents allowed in 1987 in Korea

Foreign knowledge access mode has changed from licensing in plasma vaccine to a Joint Venture in the case of rDNA vaccine.

LG Chem, a newcomer, established in-house R&D program and JV with a US biotechnology firm, Chiron Corp.

Green Cross, an incumbent, obtained patented technology from a German biotech company- RheinBiotech, allowing a controlling stake in return

CJ co. failed initially with independent strategy;

→ Success of rDNA vaccines development in the mid-90s, not significantly inhibited by existing IP , but with price (JV).

Case. IPRs as a serious barrier to small firms

Sunstar company and Joosung Engineering Co.

Case of Sunstar company

Sunstar company newly entered the market in 1997 with computer-controlled automatic embroidery machine

→ Japanese Tokai filed a lawsuit against Sunstar in 1998;

cleared the charge by presenting the technology has already been in use before Tokai adopted it for its products
succeed in obtaining 35% of the market share; now one of the top firms.

case : Joosung Engineering Company

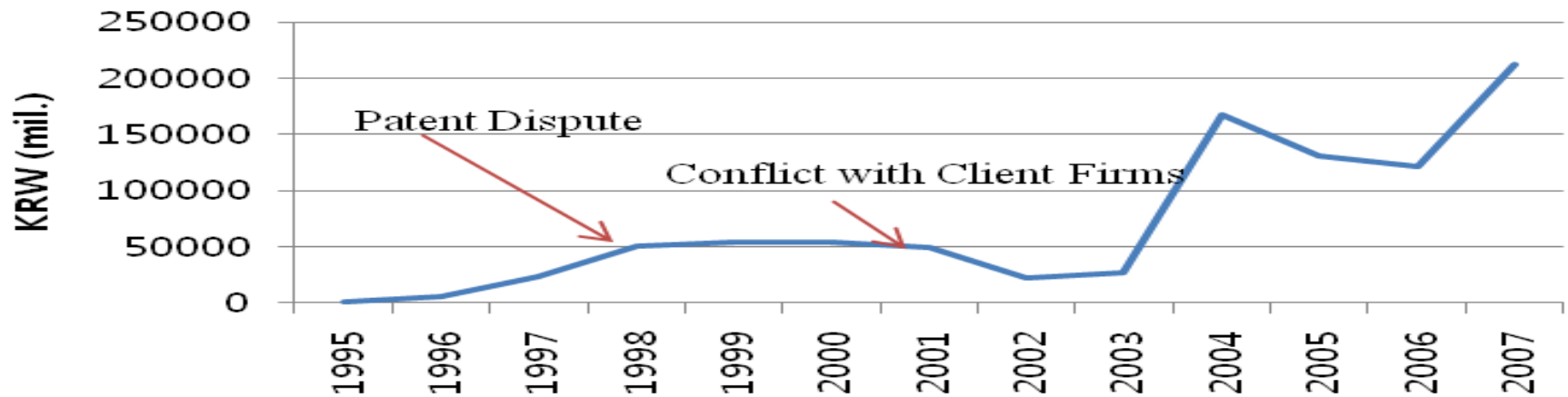
Joosung, a manufacturer of equipment for semiconductors and LCDs such as those used in CVD machines.

- AMAT (Applied Material Inc.) filed a lawsuit against Joosung for patent violations in Korea & in Taiwan for provisional disposition.

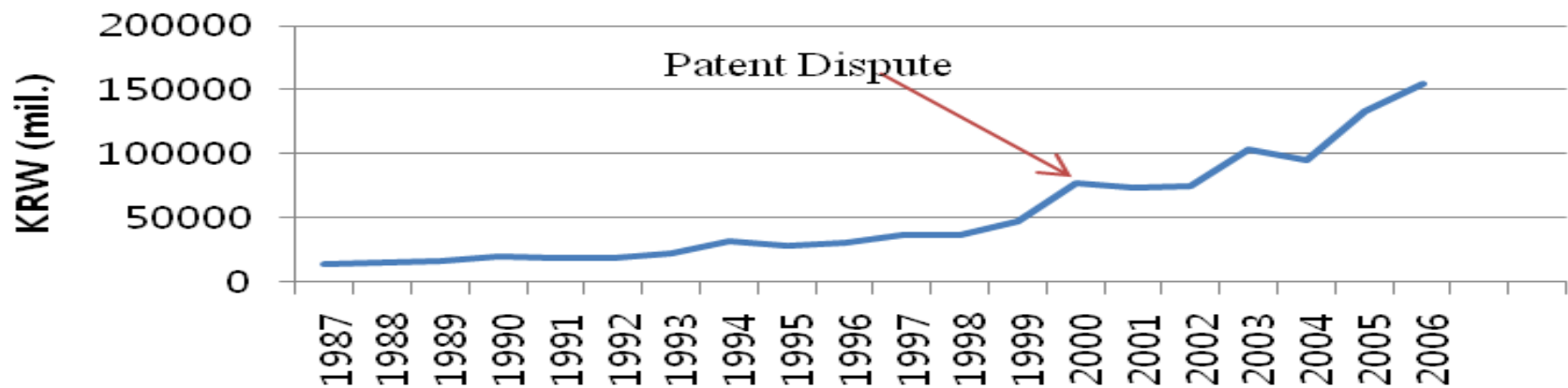
→ A year long litigation; Joosung being cleared of all the charges.

→ Damage of its negative image as a “patent robber” in Taiwan market.

Jusung Engineering



Sunstar



Case . IPRs as a serious barrier to small firms

IPR related lawsuits by the incumbents

← A serious barrier to catch-up of small firms

Potential damages:

- Prohibitive patent license fees & marketing channels can be lost
- Huge concern with patent infringement lawsuits especially during the stage when they are starting to develop a technology

Ex) semiconductor equipment firms : “IPR-related legal dispute (64.3%)” is regarded as a biggest obstacle

→ Due to lack of IPR department or personnel, they face very high risks.

Role of Government help in IPRs Dispute of the SMEs?

- 1) A direct sharing of costs of legal IPR disputes by the SMEs:
 - eg) commercial insurance against IPR lawsuits ;
government pays 70% or more of the premium with the maximum amount set,
- 2) Service to conduct pre-marketing/exporting investigation of possibility of legal disputes when the SMEs go for exporting to some countries.
- 3) Ex-post measure included the package consulting for the SMEs who faced the IPR lawsuits with foreign entities;
 - in 2009, 42 SMEs resorted to this service and got the help in the forms of analysis of legal documents and involved patents, exploring solutions such as licensing, patent pools, countervailing patents, counter claims, and going through with the legal processes.
- 4) A public-private consortium fund, the so-called “patent angel,” was created to purchase, manage, license, and sell various types of IPRs and help the SMEs ;
 - SMEs joined this fund either as a fee-based membership or as a equity holder;
 - a patent umbrella for the SMEs exposed to the possible claims by the patent trolls.

Summary: Impact of the IPR on firm-level

- Dubious role for catch-up:
=> serious barriers? or strong pressure for upgrading?
- Diverse challenges and responses by the size of firms
 - Large firms: quick learners in the face of new challenges → emerged as the powerful holders using cross-licensing & M&A
 - Mid-sized firms: adopted compromising ways such as JV → avoided potential IP obstacles and succeed to develop vaccine
 - Small firms: high risk of devastating damages by the incumbent firms -> need for gov't help

Role of Utility model (petit patent):

**“Appropriate Intellectual Property Protection
and Economic Growth in Countries
at Different Levels of Development”**

by

Kim, et al (Research Policy 2012)

- ⇒ For LDCs, UM matters more than patent rights
then DCs, the opposite situation
- ⇒ Earlier UM leading to Patents in later periods

Utility Models vs. Patents

Utility Models	Patents
Second-tier protection for minor inventions; The inventive step required is small; a practical or functional advantage over existing prior art	Granted for inventions that are novel, non-obvious, and have industrial applicability
Processes or methods of production are typically excluded	Cover products and processes,
Typically 6 – 10 years duration of protection	20 years duration from the date of application
Less expensive to apply for and do not require substantive examination	Undergo substantive examination, and are costly to obtain (filing fees, search and examination fees, attorney costs, and translation fees, where applicable)

Countries w and w/o utility model system

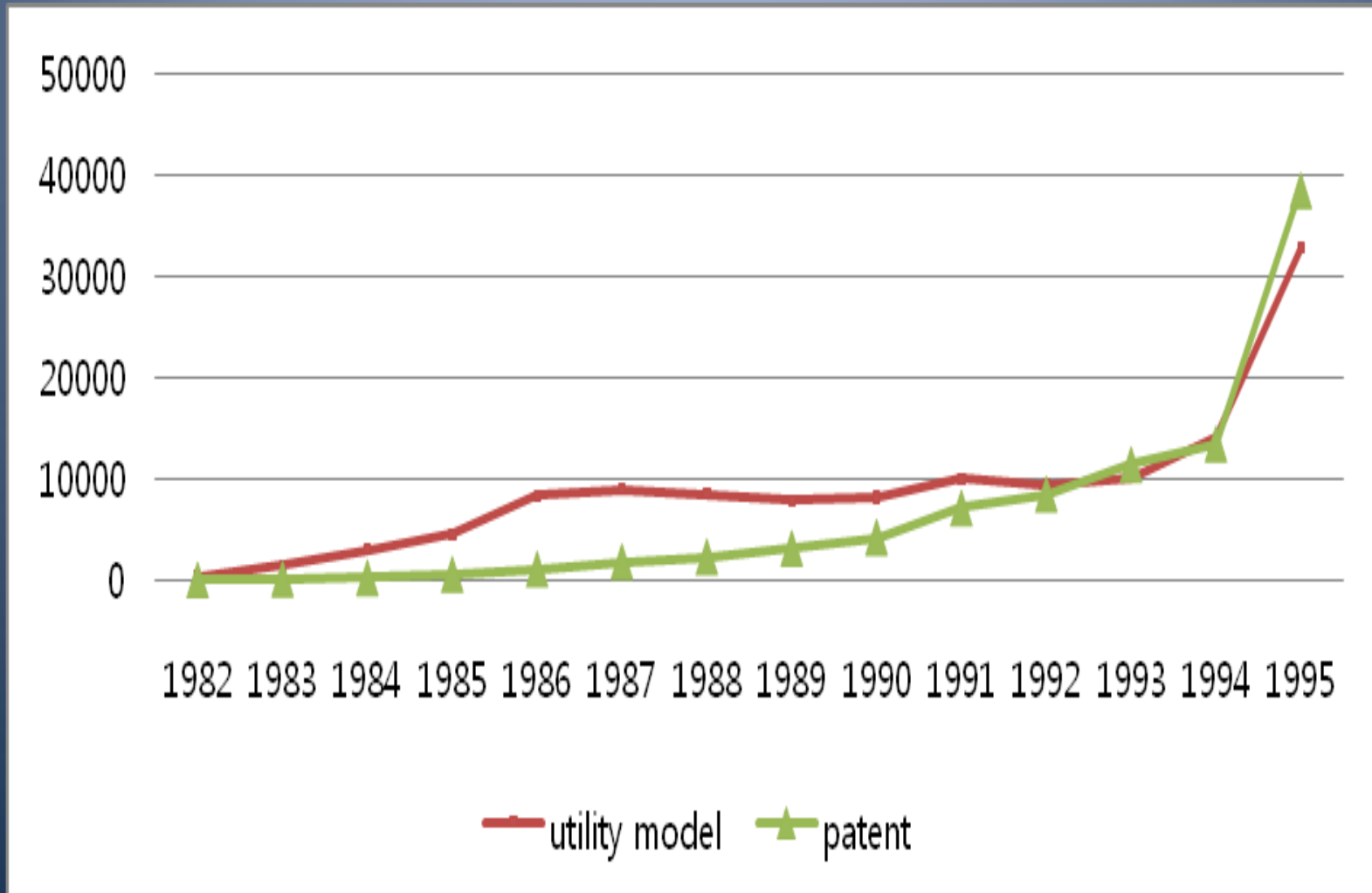
Appendix 1: List of countries with and without a utility model system (as of year 2000)

High income countries with IPR system (GDP per capita > 10,000 PPP constant 2000 int. \$)		Mid & Low income countries with IPR system (GDP per capita ≤ 10,000 PPP constant 2000 int. \$)	
With utility model system	Without utility model system	With utility model system	Without utility model system
Country	Country	Country	Country
Argentina	Cyprus	Angola	Burundi
Australia	Great Britain (UK)	Burkina Faso	Bangladesh
Austria	Iceland	Bulgaria	Ethiopia
Belgium	Israel	Bolivia	Fiji
Canada	Luxembourg	Brazil	Grenada
Switzerland	Malta	Botswana	Guyana
Czech Republic	Norway	Chile	India
Germany	New Zealand	China	Iran, Islamic Rep.
Denmark	Saudi Arabia	Cameroon	Jamaica
Spain	Singapore	Central African Republic	Jordan
Finland	Sweden	Congo, Rep.	Sri Lanka
France	United States	Colombia	Madagascar
Greece		Costa Rica	Malawi
Hong Kong, China		Algeria	Nigeria
Hungary		Ecuador	Nicaragua
Ireland		Egypt, Arab Rep.	Nepal
Italy		Gabon	Pakistan
Japan		Ghana	Papua New Guinea
Korea, Rep.		Guatemala	Paraguay
Netherlands		Honduras	Sudan
Portugal		Haiti	Sierra Leone
Slovak Republic		Indonesia	Tunisia
Taiwan		Morocco	Tanzania
		Mexico	Uganda
		Mali	South Africa
		Mauritania	Congo, Dem. Rep.
		Malaysia	Zambia
		Niger	Zimbabwe
		Panama	
		Peru	
		Philippines	
		Romania	
		Russian Federation	
		Rwanda	
		Senegal	
		El Salvador	
		Syrian Arab Republic	
		Togo	
		Thailand	
		Turkey	
		Ukraine	
		Uruguay	
		Venezuela, RB	
		Vietnam	

Cross-country panel analysis

- Per capita GDP growth on:
- Patent Right index and cross terms with a low/middle income country dummy
- utility model dummy for countries that adopted the UM system and its cross term with a low/mid income country dummy
- => Patent rights not significant for lower income groups; while UM country dummy, positive and significant for lower group.

Utility Models versus Patents of Top 10 Patent Applicants (as of 1995)



- **H: Impact of utility models on firm performance**

Firm growth during the early period is positively linked with minor inventions (utility models) and with patents during the later period.

$$\begin{aligned}
 (3) \ln(\text{sales}_{it}) - \ln(\text{sales}_{it-1}) = & \phi_0 + \phi_1 \ln(\text{sales}_{it-1}) + \phi_2 \ln(\text{patent}_{it-1}) + \phi_3 \ln(\text{utility model}_{it-1}) \\
 & + \phi_4 \ln(\text{investment rate}_{it-1}) + \phi_5 \ln(\text{employees}_{it-1}) + \phi_6 \ln(\text{firm age}_{it}) \\
 & + \phi_i + \phi_j + \phi_t + v_{it}
 \end{aligned}$$

- *Sales growth* A proxy for firm performance
- *Patent and utility model* The number of firm patent applications and utility model applications respectively
- *Investment rate* The change in a firm's fixed assets as a percentage of total assets
- *Employees* The firm's labor force
- *Firm Age* The difference between the current year and the founding year of the firm
- ϕ_i denotes fixed effect; ϕ_t denotes time effect (i.e., 1970-1995 year dummies); ϕ_j denotes industry dummies for 21 industries

- For the whole period: patent dominates utility models
- Before 1986, utility models → Positive ,
- After 1986, patents → positive

Table 6: Impacts of utility models and patents on firm performance

Dependent variable: (Annual Sales Growth Rate) _{it}									
-----System GMM-----									
	=====	Full sample	=====	=====	1970-1986	=====	=====	1987-1995	=====
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(Log of sales) _{it-1}	-0.168*** (-5.883)	-0.149*** (-6.366)	-0.131*** (-5.666)	-0.168*** (-3.881)	-0.182*** (-4.170)	-0.113** (-2.281)	-0.207*** (-8.887)	-0.233*** (-7.857)	-0.217*** (-7.350)
(log of utility model) _{it-1}	0.00934 (0.874)		0.0184** (2.511)	0.0473** (2.141)		0.0418** (1.966)	0.00456 (0.448)		0.0253** (2.408)
(log of patent) _{it-1}	0.0250** (2.435)	0.0405*** (5.231)		-0.0192 (-0.987)	0.001 (0.069)		0.0529*** (4.958)	0.0397*** (3.600)	
(log of investment) _{it-1}	0.0461*** (6.093)	0.0661*** (7.299)	0.0607*** (7.073)	0.0163 (1.072)	0.0325* (1.890)	0.026 (1.093)	0.0371*** (5.375)	0.0714*** (7.257)	0.0677*** (7.158)
(log of employees) _{it-1}	0.153*** (4.355)	0.134*** (4.561)	0.124*** (4.198)	0.112** (2.468)	0.140*** (2.772)	0.101 (1.562)	0.168*** (6.134)	0.228*** (6.013)	0.222*** (6.118)
(log of firm age) _{it-1}	-0.0431*** (-3.564)	-0.0400*** (-3.587)	-0.0451*** (-3.615)	-0.00369 (-0.162)	(0.003) (-0.0947)	-0.0456** (-2.146)	-0.0339** (-2.188)	-0.0530*** (-3.118)	-0.0597*** (-3.475)
Constant	2.216*** (6.934)	1.971*** (7.498)	1.732*** (6.573)	7.784 (1.463)	11.600 (1.628)	12.700 (0.672)	2.795*** (9.687)	2.936*** (8.491)	2.708*** (7.677)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Hansen	0.67	0.390	0.350	0.54	0.880	0.840	0.28	0.160	0.11
AR2	0.795	0.791	0.829	0.625	0.830	0.505	0.583	0.137	0.151
Observations	14359	14359	14359	3034	3034	3034	11325	11325	11325
Number of firms	1717	1717	1717	861	861	861	1708	1708	1708

Also, earlier UM leading to patents at Later Period:
 → Learning effects

Table 5: Impact of patents and utility models on new knowledge generation

	Dependent variable : (Log of patent application) _t		
	(1)	System GMM (2)	(3)
(log of patent application) _{t-1}		0.721*** (15.390)	0.539*** (21.690)
(log of patent application) _{t-2}		0.159*** (3.979)	0.258*** (12.560)
(log of utility model application) _{t-5}			0.0841** (2.329)
(log of utility model application) _{t-6}			0.0397* (1.865)
(log of R&D expenditure) _{t-1}	0.0414*** (2.850)	0.0204* (1.859)	0.0165** (1.974)
(log of R&D expenditure) _{t-2}	0.0294* (1.694)	0.00103 (0.269)	0.00338 (0.935)
Firm size dummy(1-50 employees)	0.0358 (0.499)	-0.00659 (-0.215)	0.0057 (0.125)
Firm size dummy(50-300 employees)	0.116 (1.359)	0.0165 (0.461)	0.0437 (0.871)
Firm size dummy(300- 1000 employees)	0.781*** (5.800)	0.208*** (4.213)	0.266*** (4.655)
Constant	-1.065*** (-3.277)	-0.283*** (-3.014)	(0.186) (-1.459)
Year dummy	Yes	Yes	Yes
Industry dummy	Yes	Yes	Yes
Observations	9903	9903	9903
Number of firms	1464	1464	1464
AR2	0.288	0.156	0.206
Hansen	0.22	0.72	0.770

Note) (1) *** p<0.01, ** p<0.05, * p<0.1, t-statistics are in parentheses. Year dummy: 1970-1995, industry dummy: 21 industries are included, utility model: number of utility models application, patent: number of patent application, investment rates: investment ratio to assets, R&D expenditure: constant 1995 Korean one thousand Won

Merci!

Thank you!!!

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