“Pro-patent” policy in Japan and international technology trade

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Outline of my presentation

- IPR policy of Japan in recent years
- Economic effects

-Technology import → The focus of this paper

- Domestic and foreign Applications for patents
- R&D
- Competition

I. Stronger IPR protection in Japan

1. Expansion of the patentable subject matter
2. Tighter conditions on compulsory licensing of a blocking patent
3. Higher damage for infringement
4. Doctrine of equivalents

Expansion of the patentable subject matter

- Definition of invention: utilization of natural law
- Computer program was not patentable until 1993, unless it was combined with hardware.
- It became patentable in 1997, when recorded in a computer-readable storage medium.
- It became fully patentable in 2000 (affirmed in 2002 patent law amendment).

Restriction of compulsory licensing

- Three provisions: failure to work (article 83), blocking patent (article 92) and public interest (article 93)
- No case of government direct interventions, but 23 applications which were later privately settled
- US-Japan Agreement in 1994

  Article 92 will be invoked only for the purpose of correcting anticompetitive conduct or for the public or non-commercial use

Higher damage for infringement

- Low damage award in Japan

  Difficulty in establishing damage due infringement→ frequent use of royalty award

  "Value to be *ordinarily* received" for licensing → low royalty award

  cf. the other factors: the economic understanding by the courts of marginal cost, low profit rate of Japanese firms in recent decades, no punitive damage in Japan

- The 1998 Patent Law Amendment

  - the amount of damages due to infringement can be estimated, based on the sales made by the infringer and on the profit rate of the patentee.

  - "Value to be received"

  - Criminal sanctions also became harsher under the amendment.

Doctrine of equivalents

- It is rare for an infringing firm to use the invention of the patentee in the same manner.
- Supreme court decision in 1998

  "Equivalence" should be determined based on the technologies available when the infringement takes place not when the patent is granted.
- 15 cases for which equivalence were recognized by the courts in the total140 litigations involving the issue of equivalence from 1998 to 2003

II. Effects of “Pro patent” policy

- Focus on licensing conditions

  -Royalty reflects solely the value of technology

  -60% of the technology import contracts have the provision restricting the sales to the Japanese market.
- Theoretical proposition to be confirmed

  Stronger IPR protection increases royalty rates since it shifts the threat point in favor of a licensor and improves the profitability of licensee given licensing.

III. Overview of licensing contracts for technology import

- The number of technology import contracts
- contract characteristics
- Intellectual property rights specified in the contracts
- the frequency of patents in the licensing contracts in the most R&D intensive eleven sectors

Figure 1　Number of technology import contracts

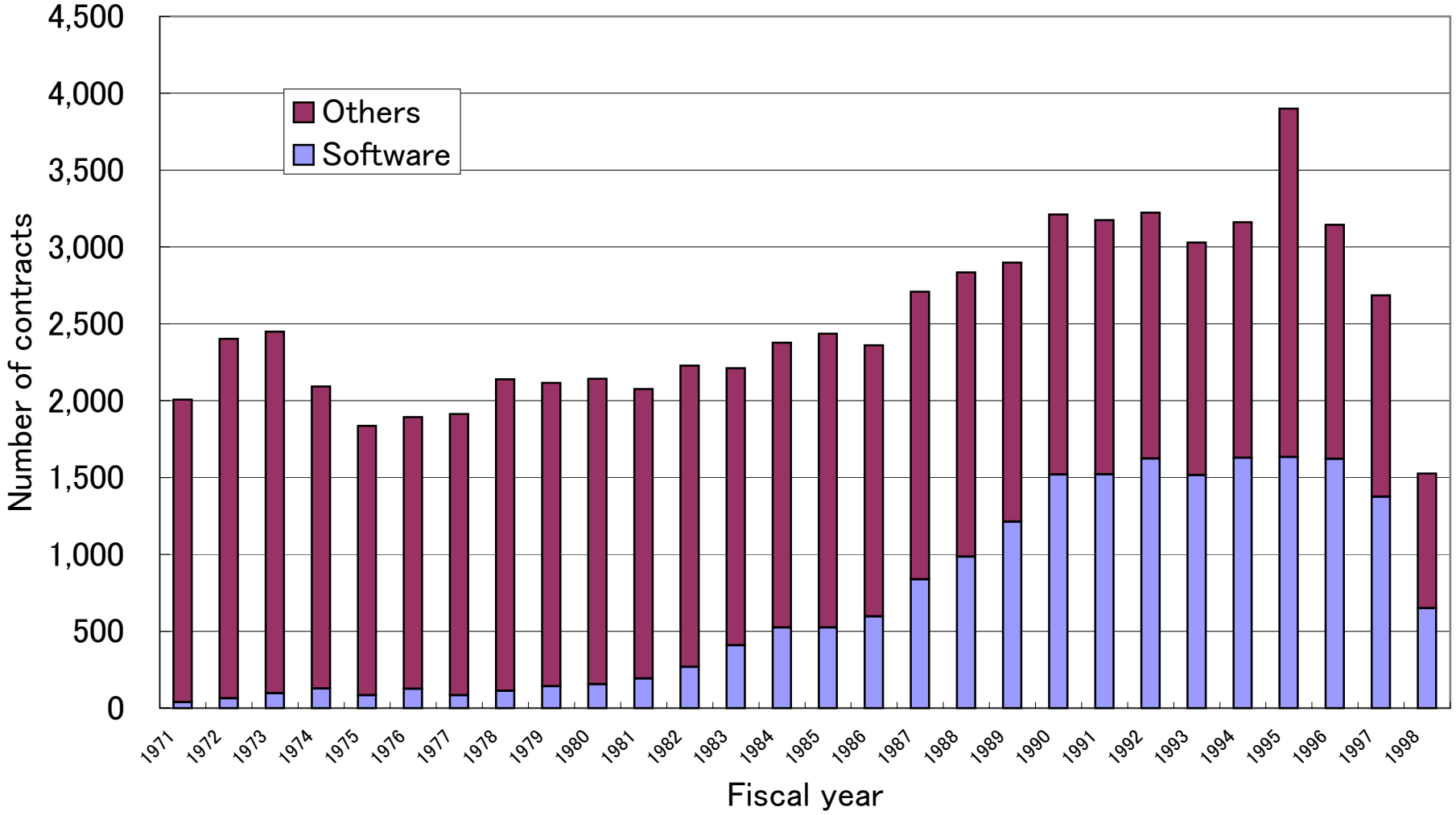


Table 1　Contract characteristics over time

The proportion in the contracts (%)		I: Average of all contracts				II. Average of 48 industry averages			
		81–84	85,86,89	90–94	95–98	81–84	85,86,89	90–94	95–98
price	Onerous contracts	94.0	94.5	94.2	94.5	93.3	92.6	93.9	95.9
	Royalty contracts	68.7	50.3	56.0	62.2	73.3	63.4	70.1	71.9
	High royalty contracts	13.4	14.9	23.7	26.5	13.4	11.0	17.5	14.8
	Initial payments	58.2	70.6	69.6	61.3	57.6	66.1	63.2	60.4
non–price	Monopoly rights	51.0	44.1	36.7	29.4	52.0	48.7	45.8	41.6
	Coss license	4.0	3.5	2.7	4.1	4.4	4.7	4.1	5.6

Note:　% of high royalty contracts are with respect to the royalty contracts, not with respect to all contracts.

Table 2　Structure of IPRs over time

The proportion in the contracts (%)	I: Average of all contracts				II. Simple average of industry values			
	81-84	85,86,89	90-94	95-98	81-84	85,86,89	90-94	95-98
Only patents	11.71%	10.38%	8.15%	9.01%	14.35%	15.50%	12.46%	15.42%
With patents	36.47%	33.89%	24.30%	23.96%	41.08%	44.04%	44.23%	43.06%
Only trademark	5.90%	9.01%	12.01%	19.44%	6.80%	11.25%	19.95%	17.69%
With trademark	24.20%	21.49%	21.01%	32.39%	23.61%	25.87%	31.04%	38.51%
Only knowhow	48.78%	52.84%	59.20%	48.71%	41.66%	36.20%	32.09%	28.96%
With knowhow	69.34%	73.05%	90.04%	70.97%	72.42%	73.06%	74.02%	60.36%

Figure 2　Frequency of patents in licensing contracts in R&D intensive industry

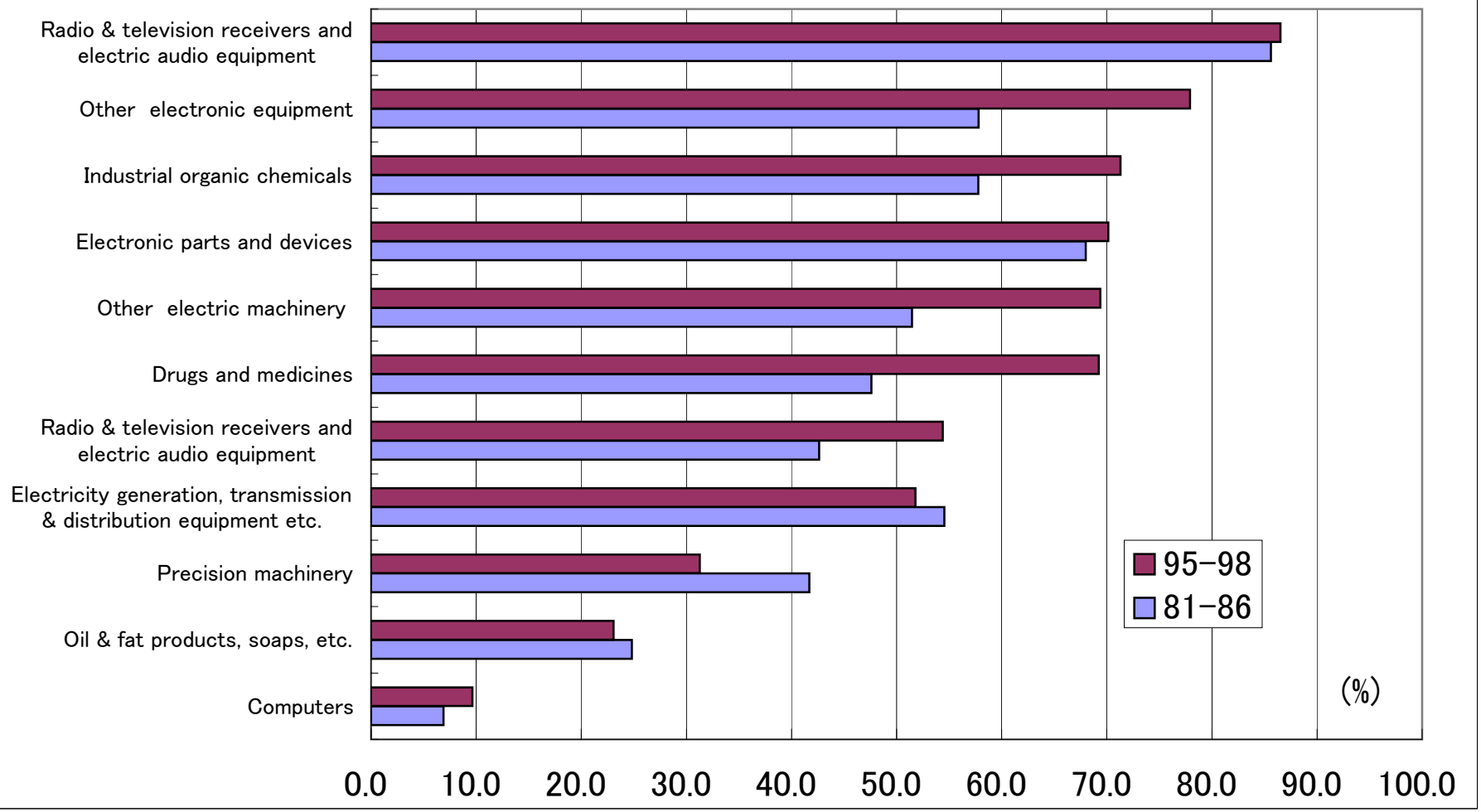
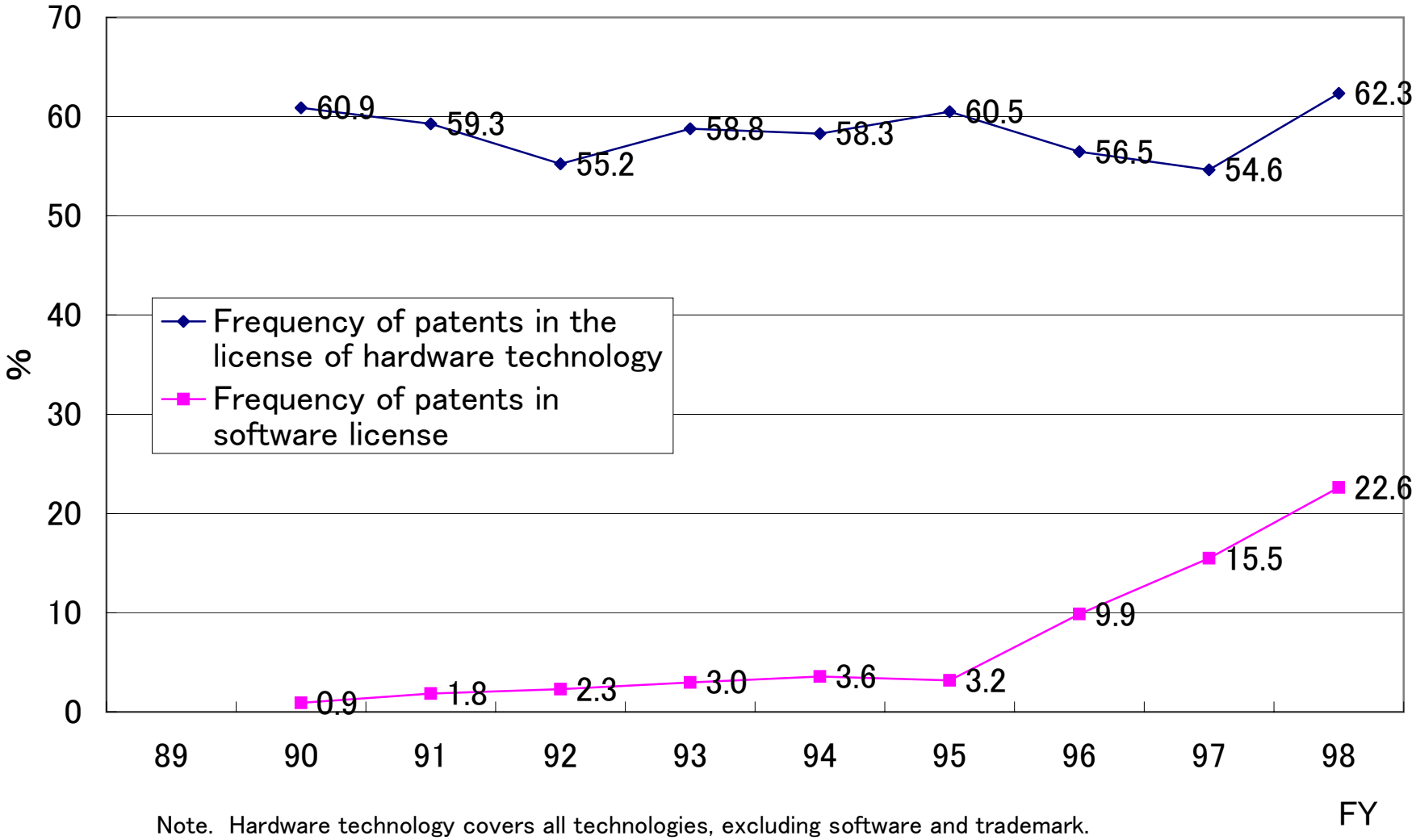


Figure 3 Frequency of patents in licensing contracts



Note. Hardware technology covers all technologies, excluding software and trademark.

IV. **Theoretical framework**

- A licensor (X) and a licensee (Y)

Nash bargaining framework

Threat point for such negotiation by (Π^X, Π^Y_M)

Profits given licensing: (Π^X_D, Π^Y_D)

R payment

$$R = \theta\{(\Pi^X_D + \Pi^Y_D) - (\Pi^X_M + \Pi^Y_M)\}$$

If the licensor X does not use its technology in the market of the licensee

- $R = \theta(\Pi^{Y}_{D} - \Pi^{Y}_{M})$ (6)
- $\Pi^{Y}_{D,N}$ the profit of Y with no imitation

  γ the probability of third party imitation

  $\Pi^{Y}_{D} = (1 - \gamma)\,\Pi^{Y}_{D,N}$ (7)
- In case Y cannot obtain a license, he can still realize some profit by doing its own R&D

  $\Pi^{Y}_{M} = (1 - \delta)\,\Pi^{Y}_{D} - \alpha RD^{X}$ (8)
- $R = \theta\{\delta(1 - \gamma)\,\Pi^{Y}_{D,N} + \alpha RD^{X}\}$ (9)

- *R* is high when the licensed technology enables the licensee to realize high profit
- If the technology to be licensed requires a large R&D expenditure for being invented around, the royalty rate would be high
- *R* would increase with stronger IPR protection, due both to smaller vertical competition (i.e. δ and α are large) and to smaller horizontal competition (γ is low)

Determinants of θ

- ex-ante competition among licensees increases the royalty

  All surplus belongs to the licensor $\rightarrow$ θ =1

  A good indicator of ex-ante competition is exclusivity provision
- Competition among licensors reduces the royalty. $\rightarrow$ In the extreme, θ =0

V. Framework of estimation

$$(price)_{i,t} = \alpha + \beta_1 (rds)_{i,t} + \beta_2 (monopoly)_{i,t} + \beta_3 (br)_{i,t} + \beta_4 (pat)_{i,t} + \beta_5 (kh)_{i,t} + \beta_6 (cr)_{i,t}$$

$$+ \beta_7 (initial)_{i,t} + \beta_8 (propd)_{i,t} + \eta_i + \varepsilon_{i,t}$$

- $(price)_{i,t}$ is the price of technology. We use the share of the licensing contracts with the royalty rate of 8% or more
- $(rds)_{i,t}$ is the R&D intensity of domestic industry
- $(monopoly)_{i,t}$ is the share of the contracts with exclusive right

- the structure of intellectual property rights (IPRs)$_{i,t}$: *br*, *pat* and *kh* respectively denote the share of the contracts with trade-mark, patents and knowhow
- $(cr)_{i,t}$ is the share of the contracts with a cross licensing provision
- $(initial)_{i,t}$ is the share of the contracts with initial payment
- $(propd)_{i,t}$ is a dummy variable representing the effect of stronger IPR policy of Japan since the middle part of the 1990s

  - *(Time4)* : a time dummy *variable*
  - *haprd*: *hapr* (the index of appropriability of patent protection*, which have values of either 0, 1 or 2,* based on the survey results of Goto and Nagata (1996) and Cohen, Walsh and Nelson (2000)) × *Time4*
  - *haprmarkd*: *mrkj* (the average percentage of licensing with its territorial scope restricted to Japan from 1990 to 1991*)* × *haprd*

We also use R&D intensity of each sector (*rds*) instead of *hapr*.

Control variables and estimation method

- 32 industries $\rightarrow$31 industry dummies control product market competition, demand growth etc.
- four periods: 1981-1984, 1985, 1986 and 1989, 1990-1994 and 1995-1998 $\rightarrow$ 3 time dummies control macroeconomic conditions and common economy wide changes
- GLS estimation

  average values

VI. Estimation results (I)

- As expected,

-*rds significantly positive*

-*monopoly* positive but not significant

- Structure of IPRs

-*br significantly positive*

-pat & kh positive but less significant

- *cr significantly positive*

Estimation results (II)

- "Pro patent" dummies

  positive and significant

  the interaction term is more significant

→Royalty increased more in the industry for which patent is important and territorial restriction is important

- Uncontrolled estimation

  negative coefficient of patent

  negative coefficient of cross licensing

Table 3　Estimation results (Ppanel estimates, Fixed effects GLS estimation)
Number of obs　=　128 ,　Number of groups　=　32,　***: significant at 1%, **: significant at 5%, and * significant at 10%

Independent variables		Estimation 1			Estimation 2			Estimation 3			Estimation 4			Estimation 5		
		Dependent variable (price)			Dependent variable (price)			Dependent variable (price)			Dependent variable (price)			Dependent variable (price)		
		Coef.	Std. Err.		Coef.	Std. Err.		Coef.	Std. Err.		Coef.	Std. Err.		Coef.	Std. Err.	
rds		6.703	0.914	***	6.215	0.913	***	6.464	0.945	***	6.140	0.901	***	5.915	0.937	**
monopoly		0.078	0.037	**	0.056	0.038		0.075	0.042	*	0.051	0.040		0.071	0.039	***
br		0.132	0.050	***	0.134	0.047	***	0.155	0.050	***	0.117	0.049	**	0.129	0.045	
pat		0.088	0.054		0.065	0.051		0.082	0.054		0.062	0.054		0.044	0.049	
kh		0.014	0.050		0.028	0.049		0.037	0.049		0.020	0.050		−0.008	0.042	
cr		0.418	0.174	**	0.424	0.170	**	0.449	0.172	***	0.403	0.174	**	0.443	0.168	***
initial		−0.062	0.044		−0.078	0.043	*	−0.057	0.047		−0.095	0.045	**			
poprd	haprd							−3.402	3.036		2.947	1.417	**			
	haprmrkd				5.919	1.686	***	9.947	3.913	**				5.525	1.709	***
industry dummies		Yes			Yes			Yes			Yes			Yes		
time dummies		Yes			Yes			Yes			Yes			Yes		
Log likelihood		−347.13			−344.09			−343.49			−345.72			−345.04		

Independent variables		Estimation 6		
		Dependent variable (price)		
		Coef.	Std. Err.	
rds		2.398	0.364	***
monopoly		0.078	0.035	**
br		0.066	0.058	
pat		−0.146	0.046	***
kh		0.031	0.057	
cr		−0.083	0.129	
initial		0.018	0.053	
poprd	haprd			
	haprmrkd	8.797	2.168	***
industry dummies		No		
time dummies		No		
Log likelihood		−420.52		

Independent variables		Estimation 7			Estimation 8			Estimation 9		
		Dependent variable (price)			Dependent variable (price)			Dependent variable (price)		
		Coef.	Std. Err.		Coef.	Std. Err.		Coef.	Std. Err.	
rds		5.576	1.001	***	5.805	1.080	***	5.920	1.055	***
monopoly		0.055	0.037		0.069	0.040	*	0.059	0.041	
br		0.125	0.046	***	0.143	0.053	***	0.102	0.055	*
pat		0.072	0.051		0.081	0.052		0.077	0.054	
kh		0.034	0.048		0.045	0.051		0.005	0.052	
cr		0.342	0.175	*	0.370	0.179	**	0.356	0.181	**
initial		−0.082	0.043	*	−0.068	0.047		−0.094	0.048	**
poprd	rdsd				−0.440	0.520		0.615	0.434	
	rdsmrkd	2.131	0.694	***	2.544	0.861	***			
industry dummies		Yes			Yes			Yes		
time dummies		Yes			Yes			Yes		
Log likelihood		−343.31			−346.78			−343.23		

Table A-1 Industry composition of technology import contracts (%)

	81-84	85,86,89	90-94	94-98
Total number of contracts	8,895	7,695	15,800	11,258
Clothing and textile products	11.7%	8.0%	5.3%	12.6%
Drugs and medicines	3.2%	3.9%	3.3%	2.8%
Other chemicals	5.8%	5.0%	2.8%	2.1%
General machinery and tools	18.8%	12.6%	8.0%	7.3%
Transportation equipment	3.7%	3.9%	2.1%	1.8%
Computers	17.4%	32.9%	53.0%	46.7%
Other electric/electronics machinery	11.7%	11.8%	11.6%	13.4%
Precision machinery	2.9%	2.5%	2.3%	1.7%
Others	24.8%	19.5%	11.7%	11.6%

Table A-2 Industry characterristics of licensing (average of the four periods) ,%

Code	Industry	High royalty contracts	Onerous contracts	initial	territorial restriction to Japan	R&D intensity	Appropriability index	sample
		price	*notfree*	*initial*	*mrkj*	*rds*	hapr	
4	Construction	8.6	100.0	66.3	88.1%	0.48	0	*
11	Food and tobacco	4.8	89.3	41.2	81.7%	0.87	1	*
12	Textiles	17.0	96.6	28.3	78.2%	1.50	1	*
14	Outer garments	8.9	98.6	27.0	82.3%	1.50	0	*
15	Other clothing textile products	14.1	99.2	11.8	96.8%	1.50	0	*
16	Sawing/planing mill products, wood products and furniture	5.2	96.8	46.8	85.0%			
17	Pulp and paper	17.6	93.8	53.0	81.3%	0.79	0	*
22	Industrial organic chemicals	5.2	90.1	74.7	42.5%	3.50	1	*
24	Oil & fat products, soaps, etc.	10.6	91.6	51.0	77.8%	3.76	2	*
25	Drugs and medicines	24.1	87.6	72.4	56.5%	7.35	2	*
26	Other chemicals	16.0	86.2	49.4	60.7%	4.14	1	*
31	Rubber products	13.3	94.1	42.4	40.0%	3.03	1	*
32	Tanned leather, leather products and fur skins	15.8	99.2	16.8	90.4%			
33	Ceramics	14.4	93.6	68.1	50.0%	2.43	1	*
35	Non-ferrous metals and products	7.9	89.1	78.7	43.8%	1.98	1	*
36	Fabricated metal products	8.4	95.6	65.1	49.3%	1.44	1	*
41	Boilers and engines	5.3	94.3	89.7	87.0%	2.92	1	*
42	Agricultural, construction and mining machinery and equipment	8.6	98.7	64.0	25.0%	2.92	1	*
43	Metal working machinery	6.4	95.6	70.8	43.1%	2.92	1	*
45	Special industrial machinery	17.1	97.2	65.7	32.0%	2.92	1	*
47	Pumps, compressors and blowers	5.4	97.1	64.5	33.3%	2.92	1	*
48	Prime mover	2.3	95.8	61.2	24.2%	2.92	1	*
49	Chemical machinery and equipment	13.2	98.2	76.1	55.9%	2.92	1	*
50	Other general industry machinery	9.5	99.0	75.8	42.9%	2.92	1	*
51	Other machinery	11.6	92.8	72.4	36.2%	2.92	0	*
52	Transportation equipment	12.1	96.7	72.1	52.9%	3.23	1	*
53	Precision machinery	25.0	94.1	58.6	43.4%	4.99	1	*
61	Electricity generation, transmission & distribution equipment and industrial electrical machinery, equipment & supplies	12.6	93.1	70.6	37.8%	5.21	1	*
64	Wired and radio communication equipment	9.1	92.2	82.9	15.2%	5.61	0	*
65	Radio & television receivers and electric audio equipment	3.0	90.2	63.1	8.3%	5.61	1	*
68	Computers	62.8	95.7	78.2	71.9%	5.61	2	*
69	Other electronic equipment	10.5	92.9	76.7	10.7%	5.61	0	*
70	Electronic parts and devices	8.0	88.9	75.3	12.5%	5.61	1	*
71	Other electric machinery	3.7	94.0	78.8	17.6%	5.61	0	*
81	Precious metal products, costume jewelry, etc.	25.9	94.0	16.8	68.2%			
82	Leisure activity equipment	19.2	93.4	40.6	66.7%			
83	Plastic products	5.7	89.7	65.9	52.2%			
84	Manufacturing industries not classified elsewhere	27.9	94.8	44.3	88.2%			
90	Other industries	12.6	96.8	62.8	100.0%			

Note. The proportion of the contracts with the territorial restriction to Japan (mrkj) is based on the contracts in 90 and 91.

Table A-3 Summary Statistics

		Mean							
	N of ob	*price*	*initial*	*rds*	*monopoly*	*br*	*pat*	*kh*	*cr*
1981-84	32	12.17	58.76	2.60	52.97	11.22	39.52	80.82	5.19
1985,86,89	32	10.37	69.60	3.33	50.28	14.82	43.29	75.61	4.62
1990-94	32	12.97	63.82	3.73	47.35	24.53	43.85	69.35	4.18
1995-98	32	14.10	61.01	3.79	38.78	26.51	43.77	68.58	5.84

		Standard deviation							
	No of ob	*price*	*initial*	*rds*	*monopoly*	*br*	*pat*	*kh*	*cr*
1981-84	32	11.22	14.77	1.41	22.70	8.01	20.45	13.85	5.85
1985,86,89	32	10.10	15.74	1.73	21.32	12.11	20.58	15.08	4.53
1990-94	32	13.41	19.97	1.92	21.70	26.05	22.93	24.78	5.14
1995-98	32	13.07	25.79	1.89	23.11	25.19	25.70	24.33	5.07