Patents and the other IPRs in use

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Abstract

Statistics on how intellectual property rights (IPRs) are used provide important information on R&D outputs, technology trade and the role of IPRs protection on innovation. This paper uses statistical data of Japan to evaluate the importance of such information. In particular, it illustrates the importance of such statistics on the use of IPRs by analyzing the following issues:

(1) How much of the patents owned by a firm are used internally and how much does licensing contribute to the use?
(2) How important are the patents relative to the other IPRs in technology exchange?
(3) How significantly is the strength of IPRs protection reflected in licensing contracts?

Key words: patents, intellectual property rights, licensing
JEL classification: O34, L14, F23

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I. Introduction

Statistics on how intellectual property rights (IPRs) are used provide important information on R&D outputs, technology trade, and on the role of IPRs protection on innovation. First, firms do not use many of their IPRs for various reasons. Thus, the mere number of patent applications/grants, for an example, can give misleading information on the output of R&D, even if such number is adjusted for its technological quality. Statistics on the utilization of IPRs may be very important to evaluate R&D outputs. Second, technology can be shared among firms unlike tangible goods, even though it faces high transaction costs. Statistics on licensing is expected to provide important clues on barriers of technology trade and the role of IPRs facilitating such trade. Third, information on licensing terms would provide important clues of the effect of IPR policy.

Despite of such importance, there is not much empirical studies on licensing are scarce, although there are important exceptions such as Taylor and Silberston (1973), Caves, Crookell and Killing (1983), Davidson and McFeridge (1984), Anand and Khanna (2000) and Arora, Fosfuri and Gambardella (2001). This paper illustrates the importance of the statistics on IPRs in use by analyzing the following issues, based on Japanese statistics:

(1) How much of the patents owned by a firm are used internally and how much does licensing contribute to the use?

(2) How important are the patents relative to the other IPRs in technology exchange?

(3) How significantly is the strength of IPRs protection reflected in licensing

II. Ownership and Use of IPRs

One of the most basic questions is how much of the IPRs owned by a firm are used. The Survey (the Basic Survey of Japanese Business Structure and Activities) [i] by the METI gives some evidence. As shown in Figure 1, only 36.1 % of the patents owned are used by manufacturing firms, including those which are licensed out. The utility models and designs are more used (43.3% and 50.8% respectively), presumably because they are granted in later stage of innovation.

(Figure 1)

Figure 1 also shows that the utilization rates are not much affected even if the use is limited to internal use (i.e. excluding IPRs used only through licensing). Without licensing, 34.7% of patents are used and with licensing 36.1% of patents are used. This indicates that licensing increases the utilization rate only marginally in terms of the number of patents (1.3% point for the manufacturing sector as a whole). Since the IPRs of a firm are complementary to the other assets owned by the firm, it may not be surprising that the patents which can only be used through licensing are very small in numbers. The same point applies to utility models and designs. 42 % and 43.3% of utility models are used without licensing and with licensing respectively. 49.9% and 50.8% of designs are used without licensing and with licensing respectively. Thus, the impact of licensing seems to be larger for patents than the other rights.

There exists significant variation across industries in the extent that

the patents owned by firms are used, as shown in Table 1. Light manufacturing industry tends to have higher rate of utilization (for an example, 53% of textile industry) and machinery industry tends to have low rate of utilization (for an example, 35.6% for electrical machinery industry). The variation is also large for utility and designs.

(Table 1)

The recent survey by The Japanese Patent Office[ii] suggests the utilization rate varies significantly across firms in the same industry and between domestic patents and foreign patents. Smaller firms have higher rate of utilization and domestic patents are more used than foreign patents (see Figure 2). As for domestic patents, 45% of the patents owned are used by small and medium firms, compared to 27% by all firms. For all firms, 27% of domestic patents are used while 15% of foreign patents are used.

(Figure 2)

These empirical evidences confirm the view that the information of IPRs maintained may not provide adequate information on the value of R&D, since many IPRs are not used. It also calls for research on the causes of such variation. The low utilization of IPRs is not necessarily inefficient, since it may just indicate that R&D investment is vigorous enough not to lose the opportunities which are marginally profitable. Thus, low utilization of patents by a larger firm may just indicate its appropriability advantage. On the other hand, it may indeed reflect inefficiency in the R&D or IPR management at a firm level or at the system level such as defensive patenting. Analyzing the utilization rate would provide useful information

on what motivations firms obtain IPRs, and therefore the role of IPRs protection.

III. Structure of IPRs and royalty terms in technology import contracts

III.1 Structure of IPRs in the technology import contracts

In this section we review the structure of IPRs specified in technology import contracts of Japan, and how they have evolved and how they are related to royalty terms[iii]. The survey we use is very comprehensive, based on the reporting system which was compulsory[iv].

First, let us look at the short overview of the evolution of such contracts. The number of technology import contracts was mostly from 2,000 to 3,000 contracts annually, during the period from 1971 to 1998 (see Figure 3). The number of contracts dropped sharply in 1998, due to the reduction of reporting requirements[v]. There has been a significant change in the composition of technologies which are imported. Most importantly, the share of software technology has increased significantly over time. It accounted for only less than 10% in 1981, but for about a half in 1990s. The change of the aggregate picture of contract characteristics over time has also been closely related to this structural change.

(Figure 3)

Table 2 shows the structure of intellectual property rights (IPRs) specified in the licensing contracts over the last two decades. Know-how is most frequently specified in the contracts. Close to 50% of the contracts specified only know-how in these periods in terms of the number of contracts[vi] . More than 70% of the contracts specified know-how as one of

IPRs in 1995-98. Thus, although it is often pointed out that know-how is difficult to trade due to information asymmetry[vii], it is often traded, without being accompanied with patents.

Trademark has become more often specified. The frequency of the contracts with only trademarks increased significantly from 5.9% in 1981-84 to 19.4% in 1995-98. 32.4% of the contracts covered trademark in the period of 1995-98. Patents have become less specified, although this is entirely due to the structural change in the composition of imported technologies. The frequency of the contracts with only patents declined from 11.7 % in 1981-84 to 9.0% in 1995-98. 24.0 % of the contracts specified patents in the 1995-98 period.

(Table 2)

There exists significant heterogeneity in the importance of each intellectual property rights specified in the contracts across industry. Patents are more important in R&D intensive industry, with a major exception of computer industry. Figure 4 shows the frequency of patents in the licensing contracts in the most R&D intensive eleven sectors for the two periods: from 1981 to 1986 and from 1995 to 1998. As shown in this figure, patents were specified for more than 40% of the contracts in 8 out of 11 sectors for 1995-98 period and they became more important in 8 out of 11 sectors between the two periods. The frequency increased from 6.9 % to 9.6% in computer industry and from 47.6% to 69.2% in pharmaceutical industry. Figure 5 compares the changes of the frequencies of patents in licensing contracts with respect to software and hardware technologies (all

technologies excluding software and trademark). This shows the sharply rising tendency of software patents, beginning in 1996.

(Figure 4 and 5)

III.2 Contract characteristics

Let us turn to the changes of contract characteristics in both price and non-price conditions over the last two decades (see Table 3). Table 3 shows the average of these conditions for all contracts in the columns I and the simple average of the values of 48 industries in the columns II. The latter average controls the structural change of industry in terms of the number of contracts due to its fixed weight. In terms of the first average, 94.5% of the contracts are onerous, and 62.2% of the contracts have royalty provisions, 26.5% of the royalty contracts have high royalty rates (8% or more of sales) and 61.3% of the contracts have initial payment provisions.

(Table 3)

The average price of imported technology seems to have increased during these two decades, although its extent is not large once we control the change of the composition of imported technologies. The share of high royalty contracts increased significantly from 13.4 % of the period of 1981-84 to 26.5% of the period of 1995-98. However, the increase is much less substantial, once we control the structural change. It increased only from 13.4% of the period of 1981-84 to 14.8% of the period of 1995-98, according to the second average. The share of the contracts with initial payments and the share of onerous contracts also increased from 57.6% to 60.4% and from 93.3% to 95.9% respectively according to the second average.

As for non-price conditions (exclusive territorial provisions (or monopoly provisions), and cross-licensing), the share of the contracts with monopoly rights and the share of cross-licensing provision increased slightly. It declined from 51.0% of the period of 1981-1984 to 29.4% in the most recent period in the total average, and declined from 52.0% to 41.6% according to the second average. Cross-licensing became more prevalent according to the second average.

III.3 Licensing conditions in two high-tech sectors

Let us take a closer look at the developments of licensing conditions in the most R&D intensive two sectors: pharmaceutical industry and computer industries. Figure 6 and 7 show the changes over time of eight characteristics of licensing contracts in terms of the proportion in the total industry contracts: onerous contract, initial payments, high royalty contracts (the contracts with 8% or more royalty rates in all royalty contracts), exclusive marketing rights, cross-licensing, patents, trademarks, and know-how. The proportions of high royalty contracts are twice more frequent in the computer industry than in pharmaceutical industries. The monopoly marketing rights are significantly less frequent in the computer industry. Know-how is most frequently traded in the computer industry, while patents are also very important in the pharmaceutical industry.

(Figure 6 and 7)

When we look at the changes over time, the price of technology in the pharmaceutical industry became more expensive: in particular, the proportion of contracts with high royalty rates increased significantly. As for

the structure of IPR, patents became more important over time, while trademarks became less important. In contrast, there are no clear signs for the appreciation of price in the computer industry. This is so despite of the fact that patents have become more important in this industry, as seen in the above subsection.

IV. Determinants of royalty terms

Royalty terms would be the good indicators of the strength of IPR protection. Royalty terms would become more expensive with stronger IPR protection, due both to smaller vertical competition between a licensor and a licensee and to smaller horizontal competition for a licensee. That is, stronger protection of IPRs shifts the threat point in favor of a licensor, since it makes inventing-around difficult and expensive. In addition, it makes imitation more difficult, so that the infringement by a third party is reduced. Both of these changes increase the payment for the technology[viii].

Royalty terms depend not only the level of protection of IPRs, but also on the effects of IPRs on appropriability, quality of technology, the other contract provisions such as exclusivity and cross-licensing provision and the other factor such as research opportunities in each sector. For an example, the presence of exclusivity provision shows the existence of ex-ante competition among licensees, so that it would positively affect royalty. Cross-licensing in the context of technology import implies that part of the payment is made by technology, but it may also indicate that the technology introduced is of high quality, since the patentee of a pioneer patent often requires the grant-back of derivative technologies. We need to take into

account these factors to access the effects of policy change. We implemented such estimations, based on the above panel data. We divide the 20 year time period into the following four periods: the first period is from 1981 to 1984, the second period is 1985, 1986 and 1989, the third period is from 1990 to 1994 and the fourth period is from 1995 to 1998. We introduce 31 industry dummies to control industry-level fixed effects, which may cover research opportunities, demand growth and market structure.

The results are shown in Table 4. It shows that an exclusivity provision (*monopoly*) and trademark licensing (relative to know-how licensing, *br*) are accompanied with more high royalty contracts. It also shows that a cross-licensing provision (*cr*) and the increase of R&D intensity (*rds*) of the technology importing industry tended to be associated with high royalty contracts. Moreover, after controlling these factors, the share of high royalty contracts increased significantly in the latter part of 1990s in those industries for which intellectual property rights are important in terms of appropriability or R&D intensity and the restriction of sales territory to Japan is frequently imposed in the contracts (*propd*). They seem to reflect the impact of stronger IPR policy of Japan since the middle part of 1990s[ix].

(Table 4)

VI Conclusions

This paper illustrated the importance of statistics on the use of IPRs as complementary to the statistics on IPRs owned by firms. Using Japanese statistical data on the use of IPRs, we illustrated its importance by demonstrating the following,

(1) A large portion of the patents and the other IPRs owned by a firm are not used. Licensing does not significantly increase the proportion of the IPRs used.

(2) There exist significant variation among industries and firms in the extent of the utilization of the IPRs owned.

(3) According to the statistics on the technology import, know-how is extensively traded, even in a stand alone manner. There exist significant variations in the structure of IPRs in licensing across industries. Patents have become more important as R&D intensity increase.

(4) The share of high royalty contracts increased significantly in 1980s and 1990s in Japan, which, however, mainly reflected the change of the composition of imported technologies, especially the increasing share of software licenses. An exclusivity provision, trademark licensing (relative to know-how licensing), a cross-licensing provision and the increase of R&D intensity of the industry tended to be associated with high royalty contracts. After controlling these factors, the share of high royalty contracts increased significantly in the latter part of 1990s in those industries for which intellectual property rights are important.

Appendix

We used the following specification in order to examine how the royalty terms are related to the contract characteristics based on industry-level panel data.

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

$$+ \beta_7(initial)_{i,t} + \beta_8(propd)_{i,t} + \eta_i + \varepsilon_{i,t} \qquad (1)$$

In the above specification, i denotes the sector and t the time period. The variable η_i is unspecified fixed effects and $\varepsilon_{i,t}$ is a random term. The dependent variable $(price)_{i,t}$ is the price of technology. We use the share of the licensing contracts with the royalty rate of 8% or more in all royalty based contracts (*price*), to measure the price level of imported technology.

The first independent variable (*rds*) is the R&D intensity of domestic industry: the R&D expenditure of each industry divided by its sales. The second independent variable (*monopoly*) is the share of the contracts with exclusive right. The third, fourth and fifth independent variables indicate the structure of intellectual property rights (IPRs) specified in contracts. The variables *br*, *pat* and *kh* respectively denote the share of the contracts with trade-mark, patents and know-how. Considering the possibility of collinearity[x], we also estimate equations by dropping one of the variables (kh). The sixth independent variable (*cr*) is the share of the contracts with a cross licensing provision. The seventh independent variable (*initial*) is the share of the contracts with initial payment.

The last independent variable (*propd*) is a dummy variable

representing the effect of stronger IPR policy of Japan since the middle part of the 1990s. As a benchmark estimation, we use a time dummy *variable (Time4)* , which takes a value 1 for the last period, as one of the dummies. The effects of stronger IPR would differ across sectors, which have two sources: the effect of IPR on appropriability of R&D for a given market and the territorial focus of licensing contracts on the Japanese market. As for the indicator of the appropriability, we use two variables. One indicator is the index of appropriability of patent protection (*hapr, which have values of either 0, 1 or 2*), which we assigned, based on the survey results of Goto and Nagata (1996) and Cohen, Nelson and Walsh (2000). The second indicator is R&D intensity of each sector, since stronger protection of IPR (larger α) has a larger effect on royalty in R&D intensive industry as shown in equations.

The effects of stronger IPR protection would also depend upon the territorial scope of licensing contracts. If licensing covers only the Japanese market, its term is more strongly influenced by the IPR protection in Japan. We use the average percentage of licensing with its territorial scope restricted to Japan from 1990 to 1991 (*mrkj)* as an indicator of the territorial focus of the contract. The appropriability (or R&D intensity) indicator and the focus of the territorial scope are likely to affect the royalty rate in a multiplicative manner, so that we use the following variables ($haprmrkd = hapr \times mrkj \times time4$ and $rdsmrkd = rds \times mrkj \times time4$).

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[i] This is a census survey on the manufacturing and distribution firms (with some additional sectors covered), excluding small firms.

[ii] The Japanese Patent Office recently conducted a survey of intellectual property related activities, in order to address this question among others. It covers firms and individuals which made 3 or more patent applications, 2 or more utility models applications, 4 or more design applications or 3 or more trademark applications. 41.1 % of the 16,093 entities responded to the survey. (http://www.iip.or.jp/chizai_toukei.html).

[iii] The following two sections heavily depend on Nagaoka (2003).

[iv] The licensing contracts data set is from the annual issues on status of technology imports and technology-related imports compiled by the Science and Technology Agency (now by the National Institute for Science and Technology Policy). The tables with detailed industrial classification (39 industries) are available for the period from 1981 to 1998, except for the years of 1987 and 1988. It has compiled this report based on compulsory reporting requirements by the "Foreign Exchange and Foreign Trade Control Law" (hereinafter referred to as the "Foreign Exchange Control Law").

[v] The reporting requirement was narrowed down to the contracts with total payments more that 30 million Yen.

[vi] Know-how is likely to become less important relative to patents in terms of economic value than these numbers suggest, since know-how is less specified in the contracts which firms disclosed as important contracts for their business in corporate disclosure documents (see Nagaoka (2002)).

[vii] See Arrow (1962) for a seminal discussion.

[viii] However, there is a theoretical possibility that stronger protection of IPRs shifts the threat point in favor of a licensee. As discussed by Schankerman and Scotchmer(1999), larger damage for infringement can induce a licensee to switch its conduct from the strategy of infringement (and payment of damage) to that of non-infringement when it faces refusal of license.

[ix] IPR protection has become significantly strengthened in Japan since the middle of 1990s. The major developments include the following. The possibility of compulsory licensing was significantly restricted, based on the Japan and US governmental agreement in 1994. The scope of patent protection to software has been extended through several steps. The TRIPS agreement became effective in 1995. The doctrine of equivalent was established in the Supreme Court decision in 1998 (the lower court decision in 1994).

[x] If each contract has only one type of IPR (i.e only one of patent, trademark and know-how), the sum of *br*, *pat* and *kh* is unity. As shown in Table 2, 80% of the contracts have only one type of IPR.

Figure 1 IPRs in use (Japanese manufacturing, 1999)

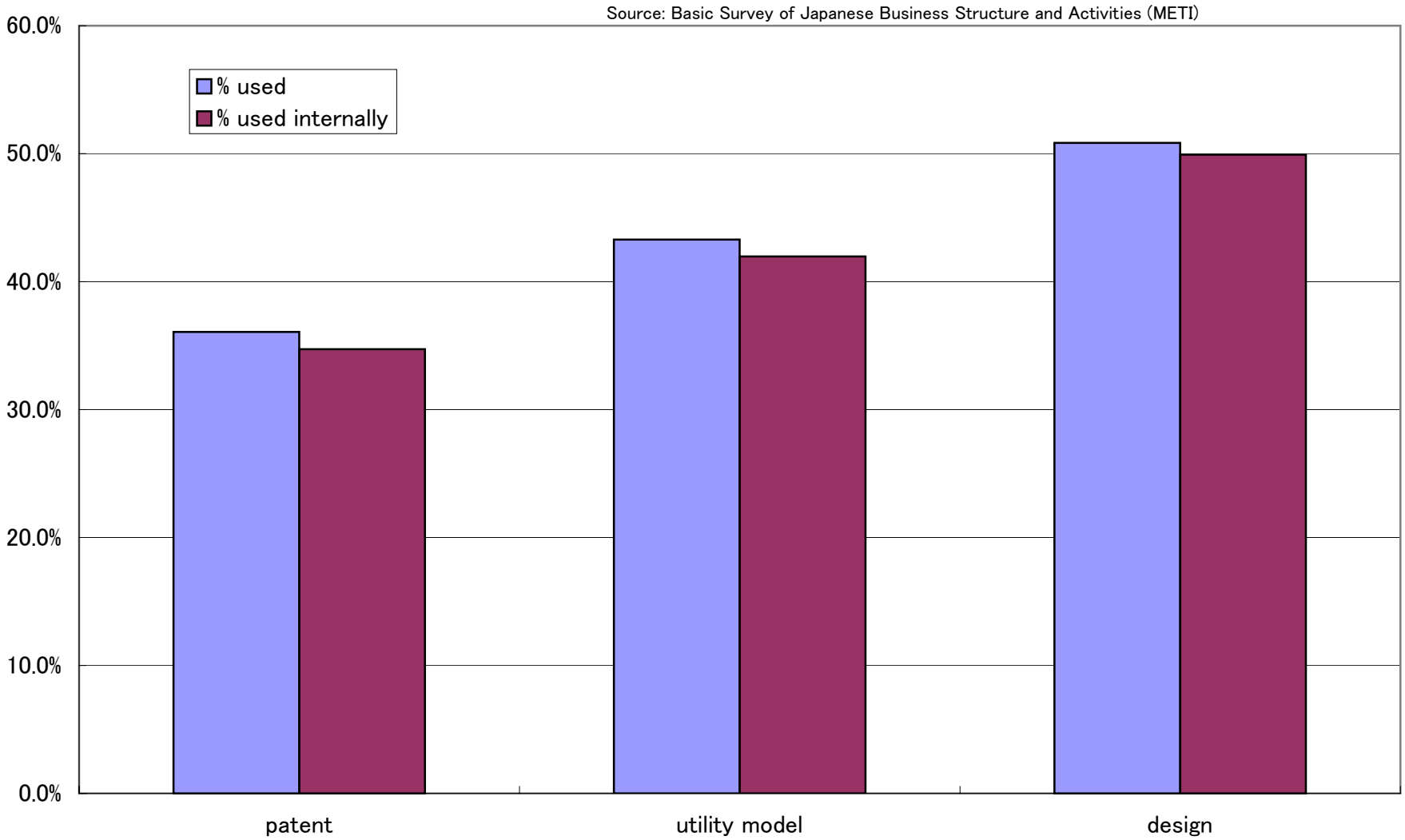


Figure2　IPRs in use (by firm size and by markets,2001)

Source: Results of the Survey of intellectual property related activities (JPO)

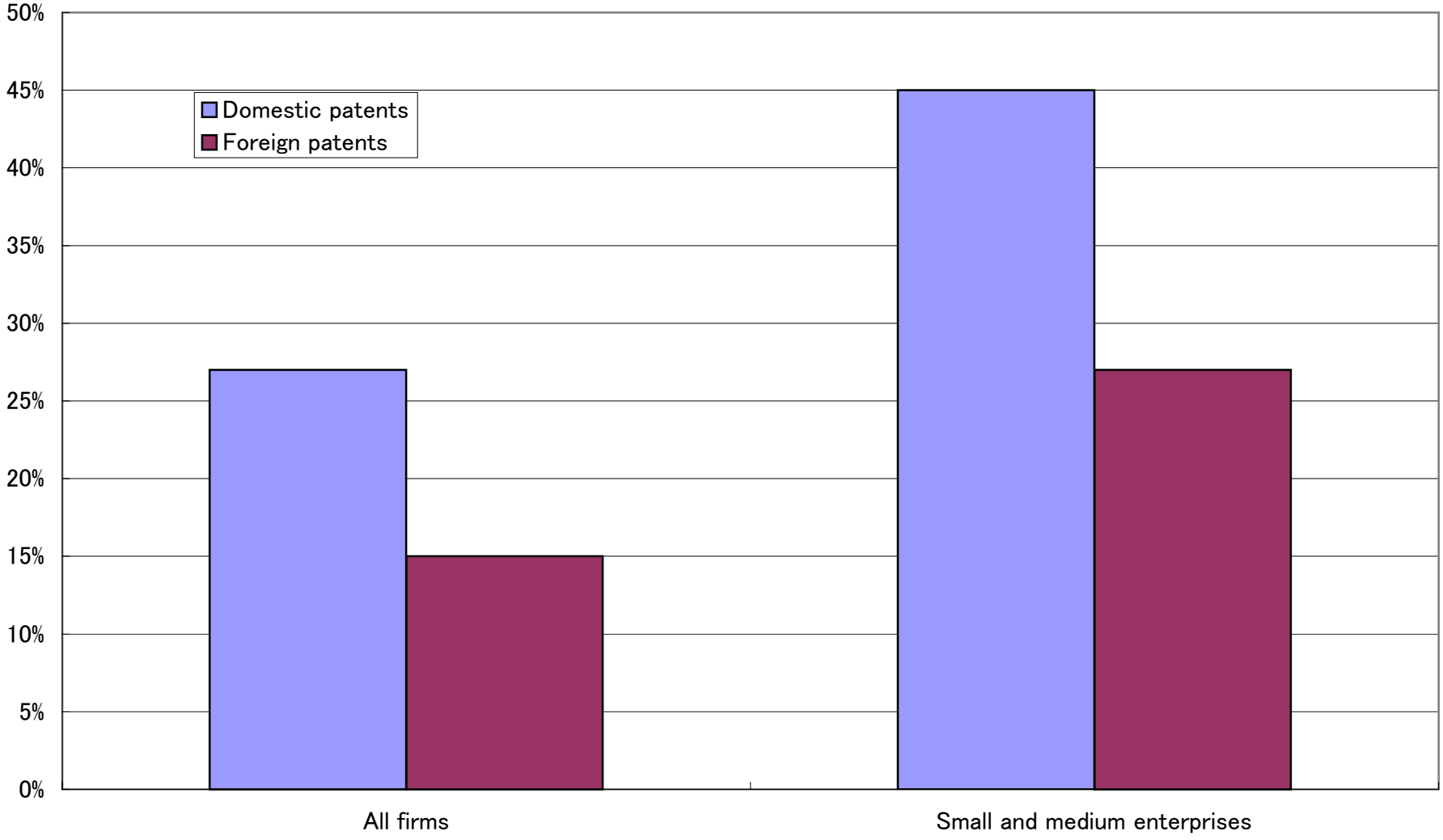


Figure3 Number of technology import contracts

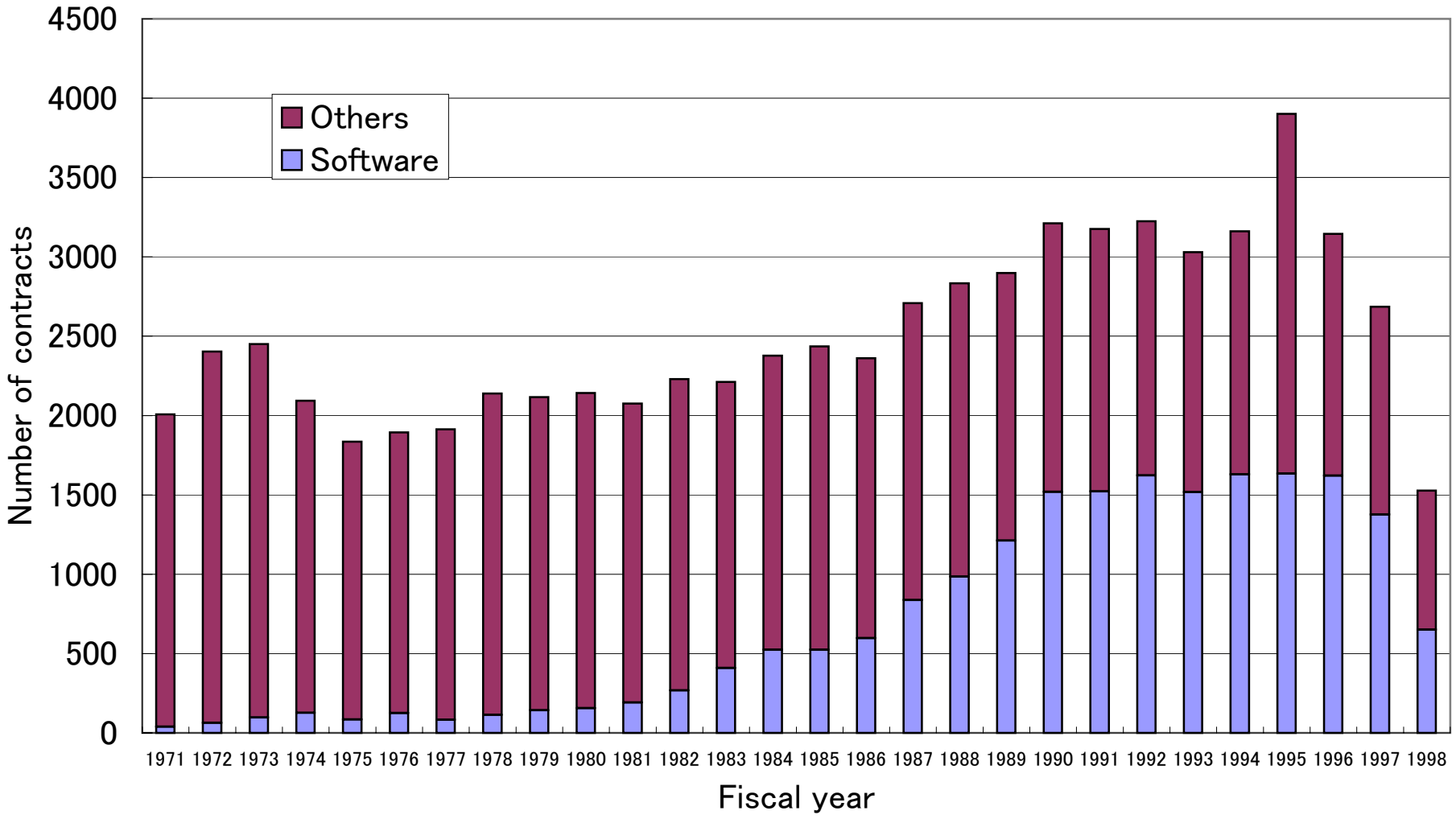


Figure 4　Frequency of patents in licensing contracts in R&D intensive industry

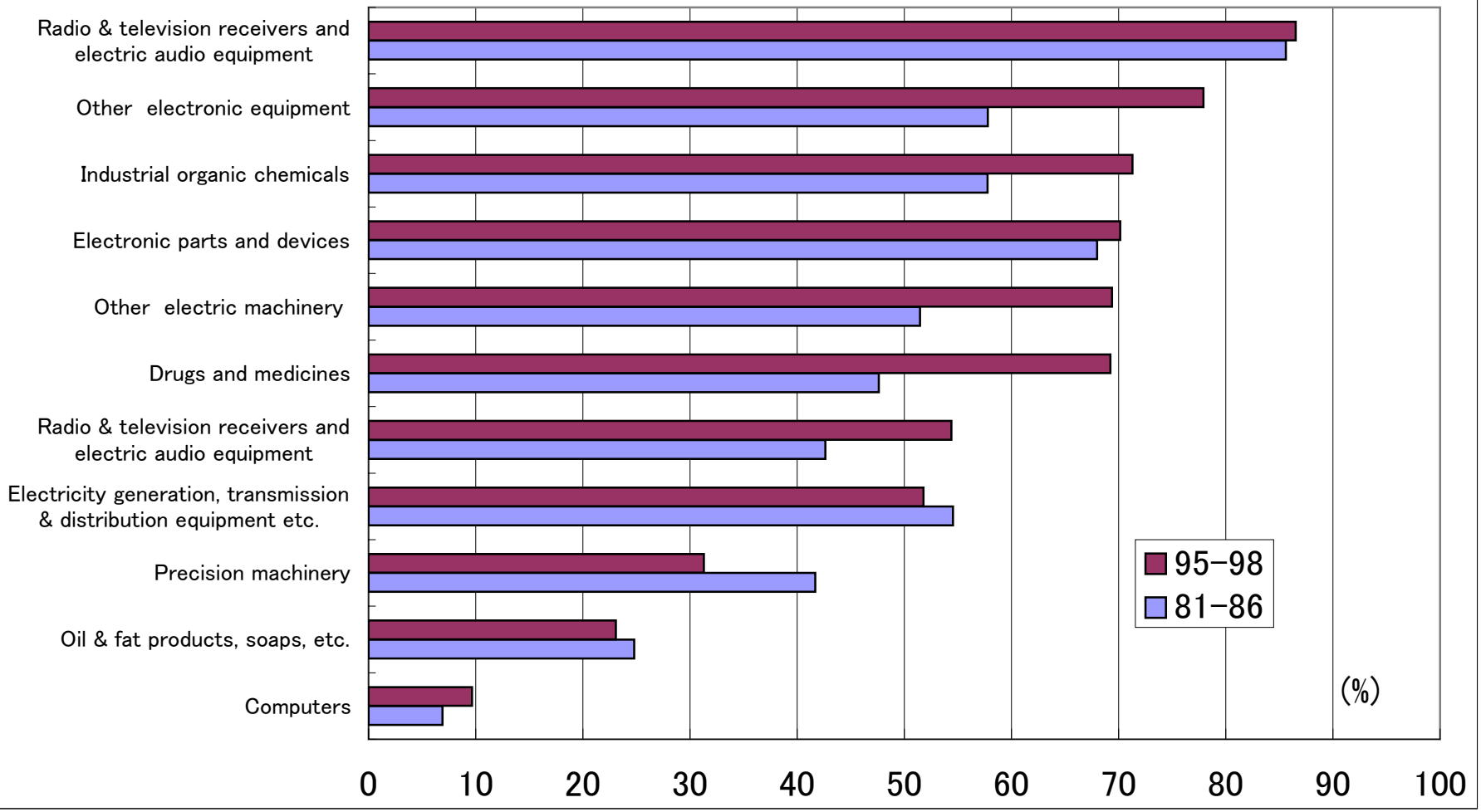
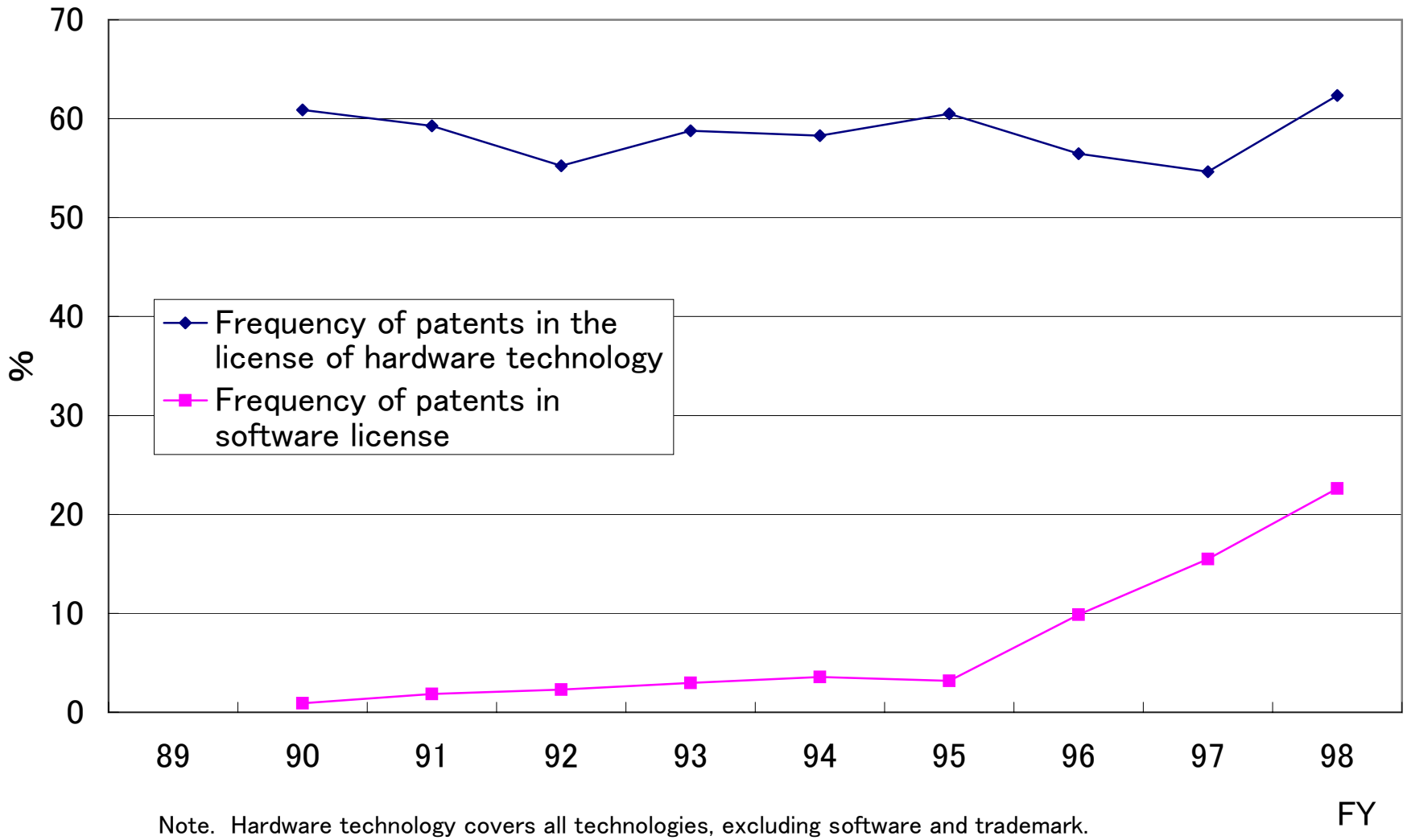


Figure 5 Frequency of patents in licensing contracts



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

Figure 6 Licensing conditions in pharmaceutical industry

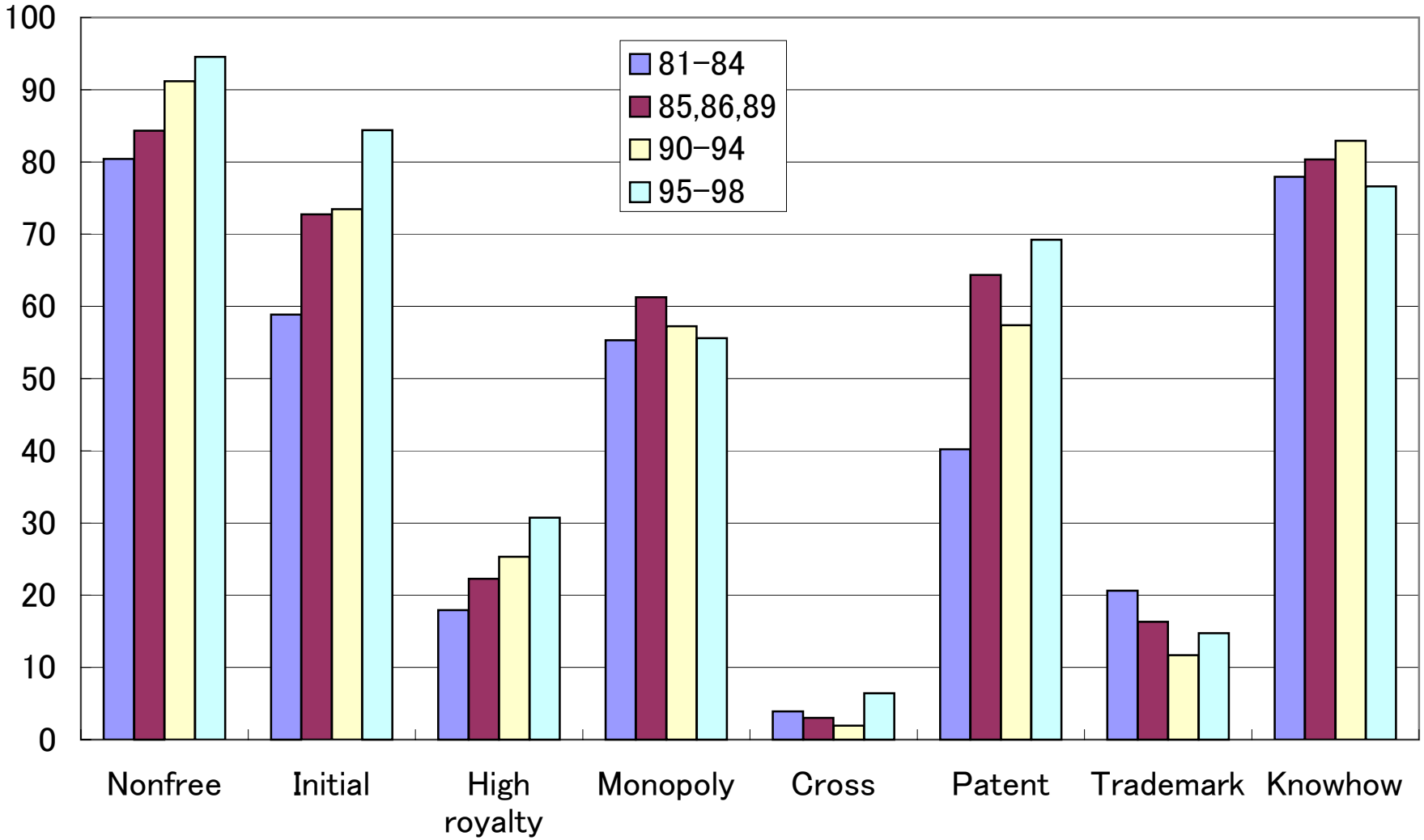


Figure 7 Licensing conditions in computer industry

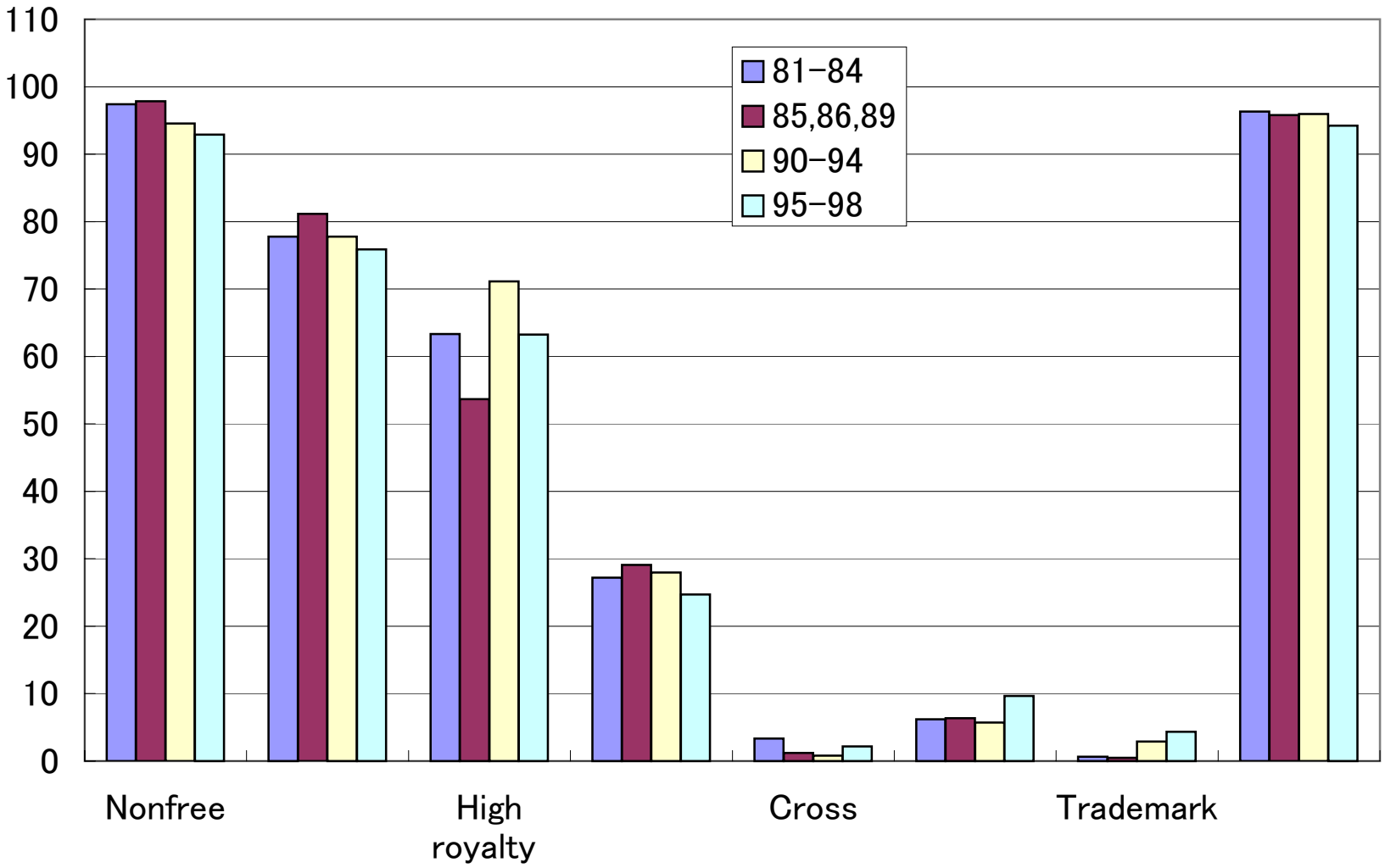


Table 1 No. of owned IPRs and its use (1999)

	Internal use + licensing						Internal use		
	patent		utility model		design		patent	utility mode	design
	Numbers owned	% used	Numbers owned	% used	Numbers owned	% used	% used	% used	% used
Manufacturing	703,132	36.1%	190,471	43.3%	141,459	50.8%	34.7%	42.0%	49.9%
Foods*	9,403	39.6%	1,263	48.8%	2,399	69.4%	38.1%	47.8%	66.9%
Textile*	1,990	52.6%	1,158	52.4%	1,334	83.4%	51.0%	51.6%	15.3%
Timber and wooden products	709	44.4%	468	49.1%	316	53.8%	39.6%	44.4%	47.2%
Furniture and fixtures	1,154	50.5%	2,378	55.6%	3,767	50.6%	49.4%	52.3%	50.5%
Pulp, paper and wooden products	4,170	35.8%	1,366	46.9%	597	69.0%	35.1%	45.7%	68.8%
Publishing and printing	3,918	36.2%	2,092	31.0%	977	42.9%	35.4%	30.5%	33.7%
Chemical products	90,961	35.8%	6,933	44.9%	8,465	63.8%	33.8%	42.8%	62.7%
Petroleum and coal products	2,163	32.9%	117	67.5%	45	62.2%	30.3%	60.7%	60.0%
Plastic products	11,764	31.7%	5,572	49.6%	8,633	60.6%	29.8%	46.1%	59.5%
Rubber products	7,671	51.6%	1,529	40.7%	2,136	59.6%	50.5%	39.0%	58.1%
Leather, fur skins and miscellaneous leather products	5	60.0%	20	30.0%	37	51.4%	60.0%	30.0%	51.4%
Ceramic, stone and clay products	8,763	43.6%	4,875	38.2%	5,736	43.1%	42.6%	37.6%	42.9%
Iron and steel	26,337	34.4%	3,043	43.9%	2,853	56.0%	32.3%	42.0%	55.3%
Non-ferrous metals	17,772	32.2%	5,215	32.6%	4,541	39.7%	30.6%	30.9%	37.9%
Metal products	14,991	39.9%	10,636	49.6%	13,345	53.4%	38.7%	47.9%	53.0%
General machinery	108,810	35.5%	40,048	45.5%	13,351	53.1%	34.4%	44.5%	52.7%
Electrical machinery	299,691	35.6%	49,301	43.6%	51,189	42.1%	34.3%	41.7%	41.1%
Transportation equipment	71,510	33.9%	44,486	38.3%	11,694	59.7%	32.8%	37.7%	59.3%
Precision instruments	13,436	42.4%	6,162	46.3%	3,519	67.5%	41.9%	45.8%	66.9%
Miscellaneous manufacturing products	7,934	54.5%	3,989	50.0%	6,525	50.3%	54.1%	49.5%	49.0%
Max		60.0%		67.5%		83.4%	60.0%	60.7%	68.8%
Min		31.7%		30.0%		39.7%	29.8%	30.0%	15.3%
Sdv		8.3%		8.6%		10.7%	8.7%	7.5%	12.6%

(source) Basic Survey of Japanese Business Structure and Activities

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%

Table 3　Contract characteristics 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
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 4 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)		
		31 Industry dummies			31 Industry dummies			31 Industry dummies			31 Industry dummies			31 Industry dummies		
		Coef.	Std. Err.		Coef.	Std. Err.		Coef.	Std. Err.		Coef.	Std. Err.		Coef.	Std. Err.	
rds		2.107	0.667	***	1.752	0.622	***	1.799	0.645	***	1.727	0.610	***	1.264	0.644	**
monopoly		0.107	0.040	***	0.099	0.035	***	0.100	0.035	***	0.101	0.036	***	0.105	0.038	***
br		0.052	0.052		0.068	0.049		0.081	0.051		0.065	0.031	**	0.071	0.046	
pat		0.033	0.058		0.030	0.055		0.036	0.055		0.027	0.050		0.015	0.053	
kh		−0.004	0.053		0.005	0.049		0.016	0.051					−0.027	0.044	
cr		0.501	0.191	***	0.472	0.178	***	0.503	0.182	***	0.517	0.172	***	0.486	0.174	***
initial		−0.106	0.044	**	−0.090	0.042	**	−0.085	0.042	**	−0.080	0.039	**			
propd	*time4*	1.670	1.048													
	haprd							−1.570	2.043							
	haprmrkd				5.882	1.591	***	8.461	3.607	**	5.783	1.577	***	6.492	1.618	***
Log likelihood		−358.79			−353.96			−353.79			−352.67			−353.11		

Independent variables		Estimation 6			Estimation 7			Estimation 8			Estimation 9		
		Dependent variable (price)			Dependent variable (price)			Dependent variable (price)			Dependent variable (price)		
		31 Industry dummies			31 Industry dummies			31 Industry dummies			31 Industry dummies		
		Coef.	Std. Err.		Coef.	Std. Err.		Coef.	Std. Err.		Coef.	Std. Err.	
rds		1.420	0.621	**	1.480	0.622	**	1.402	0.614	**	0.826	0.661	
monopoly		0.116	0.034	***	0.118	0.034	***	0.113	0.035	***	0.120	0.036	***
br		0.065	0.049		0.088	0.051	*	0.063	0.029	**	0.069	0.045	
pat		0.047	0.054		0.054	0.054		0.045	0.049		0.033	0.052	
kh		0.002	0.049		0.025	0.052					−0.028	0.043	
cr		0.329	0.184	*	0.366	0.185	**	0.379	0.179	**	0.324	0.178	*
initial		−0.087	0.041	**	−0.082	0.041	**	−0.080	0.038	**			
propd	*time4*												
	rdsd				−0.458	0.375							
	rdsmrkd	1.922	0.469	***	2.834	0.883	***	1.838	0.469	***	2.174	0.508	***
Log likelihood		−351.58			−351.62			−351.15			−355.02		