16 Panel Data Analysis of Patent Infringement Suits: Quantitative Analysis of Changes in the Finding of Infringement, Following the Enforcement of the Act for Establishment of the Intellectual Property High Court(*)

Research Fellow: Takahiro Yuzuki

The patent system operates across almost the entire world, under the respective national law of each country (e.g. in Japan, the Patent Act) and under an international treaty, the Paris Convention for the Protection of Industrial Property. Article 4bis of the Paris Convention sets forth the rule of independence of patents in different countries. This rule should be taken into consideration when conducting analysis because it brings about difference in terms of the conditions for patent lawsuits from country to country, and in particular, disclosure on the data of litigation costs between Japan and the United States. Lanjouw and Lerner (2001) and Lanjouw and Schankerman (2001, 2004) are the preceding empirical studies, focusing on the incentive for filing patent lawsuits in the United States. In these preceding studies, the variable for costs is set as a factor that is known to the parties to the suit beforehand. This is consistent with the litigation procedure in the United States, but it cannot be applied to analysis of the situation in Japan without adjustment. The present study takes note of the fact that the revision to the Patent Act in 2004 has drastically changed the form of proceedings in patent infringement suits. It attempts to make quantitative analysis, focusing particularly on the decision-making behavior of judges when rendering final judgments on patent infringement suits.

Ⅰ Introduction

The patent system in Japan is designed for the dissemination of research and development and results thereof and for the promotion of innovation. This is reflected in Article 1 of the Patent Act which clearly stipulates, "The purpose of this Act is, through promoting the protection and the utilization of inventions, to encourage inventions, and thereby to contribute to the development of industry." Viewed from a global perspective, the patent system operates across almost the entire world, under the respective national law of each country and under an international treaty, the Paris Convention for the Protection of Industrial Property. Article 4bis of the Paris Convention sets forth the rule of independence of patents in different countries. In the context of the present study, this rule has significance in that the extent affected by a dispute that arises in relation to a patent applied for and granted in each country is limited within that country, and that in economic analysis on disputes relating to patent registrations, consideration should be given to the fact that conditions for patent lawsuits differ from country to country. In connection with the latter point, for the purpose of making comparative analysis on litigation costs between Japan and the United States, it is necessary to set a cost condition for Japan as similar to that seen in the United States where, unlike in Japan, the data of the total litigation costs is disclosed. In the present study, a cost condition is set based on the objective calculation standards. From a legislative perspective, the present study focuses on the following legal reforms: the revision to the Patent Act in 1986 (Sakakibara and Branstetter, 2001), the revision to the Patent Act in 2004, and the enactment of the Act for Establishment of the Intellectual Property High Court.

Lanjouw and Lerner (2001) and Lanjouw and Schankerman (2001, 2004) are the notable preceding studies addressing the incentive structure for inducing patentees to file suits under the US patent system. Scotchmer (2003, ch7, pp203-204) presents an outstanding survey on the empirical analysis of cross-section data in

(*) This is an English translation of the summary of the report published under the Industrial Property Research Promotion Project FY2010 entrusted by the Japan Patent Office. IIP is entirely responsible for any errors in expression or description of the translation. When any ambiguity is found in the English translation, the original Japanese text shall be prevailing.

connection with the series of studies conducted by those predecessors. Bessen and Meurer (2005) make empirical analysis concerning patent infringement suits and litigation costs. The major findings obtained in these preceding studies are as follows.

1. Looking at the probability of being involved in infringement suits, patents held by smaller patentees are more likely to be involved than those held by larger patentees. Smaller patentees have to bear a relatively large burden of litigation costs as compared to larger patentees.
2. As for patents involved in infringement suits, the "number of patent claims" and the "number of forward citations" are larger and the "number of backward citations" is smaller than the average.
3. By business field, patent infringement suits increased in pharmaceuticals, biotechnology, computers, and other electronics. In these fields, the rate of litigation has always been high and the ratio of the number of patents involved in infringement suits to the total number of patents granted has increased.
4. The difference in litigation costs between business fields mainly arises from the difference in the rate of litigation. No significant difference is found in terms of the settlement rate or the outcome of litigation.

From the viewpoint of industrial organization, patent infringement suits reflect an aspect of disputes over market competition. It is often the case that companies facing competition in research and product markets, venture capitals, and individuals engaged in research and development infringe one another's patent rights, and they sometimes bring their disputes to court. Following the procedure under the US Patent Act, for example, they have to make a choice, upon applying for a preliminary injunction, to venture to file a plenary suit, spending a huge amount of money, or to reach a settlement with the other party while preparing for filing a suit. Empirical analysis on their decision-making behavior when facing legal disputes — which is affected by the characteristics of intellectual property rights as assets, characteristics of holders of such rights, and industrial structures — gives good implications as to the mutual strategic relationships between companies.

In the early stage of the present study, a data set was compiled as a tool for making a broad statistical analysis on patent infringement suits in Japan. The data sets compiled by the United States Patent and Trademark Office (USPTO) enable us to easily extract a bulk amount of data related to disputes and lawsuits required for empirical analysis. In particular, abundant data is available with regard to patent disputes in the United States, because Section 290 of the US Patent Act requires that the court give notice to the USTPO, without condition, when a warning is issued or a preliminary injunction is applied for against patent infringement. On the other hand, Japanese courts do not have such a database on patent disputes that stores sufficient data for making empirical analysis. To overcome this obstacle, the present study uses a combination of the IIP Patent Database, developed by Goto and Motohashi (2007), and the data set of final judgments in patent infringement cases, made public by Japanese courts.

Under the existing laws and operation thereof, there is a limit to the data on litigation in Japan available for research purposes. The micro data on patent infringement cases currently accessible through Japanese courts is limited to data as of the time when civil suits processed under the Patent Act come to an end with final judgments. Meanwhile, in the United States, case records on all patent lawsuits are provided from federal and state courts to the USPTO pursuant to Section 290 of the US Patent Act. Among such data, Lanjouw and Lerner (2001) and Lanjouw and Schankerman (2001, 2004) extract data on applications for preliminary injunctions, used as warnings against infringements. As Japan does not have a similar law or procedure, such data has not been compiled into a uniform data set. This makes it impossible for us to estimate the probability of litigation as it has been done in the preceding studies in the United States. The present study takes a different approach, supposing a patent dispute as a kind of *game*, and focusing on the final phase of the game, that is, a final court judgment rendered in a patent lawsuit, and on the causes of the patentee's victory or defeat. In this respect, it applies the distribution function, presented by Hylton (2006), with respect to the process leading up to litigation in the case where the plaintiff and the defendant are under informational asymmetry and have different preferences and variances to the winning of the case.

In the process of comparison with Lanjouw and Schankerman (2001, 2004), an empirical study on warnings (preliminary injunctions) against patent infringements in the United States, the present study adopts the data of final and

binding judgments on patent infringement suits, which is available in Japan, due to the difference in patent statistics between the two countries. During the observation period, from 1988 to 2010, the Patent Act of Japan went through two major revisions. The present study divides the dataset into the portions before and after the introduction of the Intellectual Property High Court, with the objective of finding any impact of the 2004 revision from the data.

Ⅱ Outline of Patent Infringement Suit

In principle, the procedural flow of a patent infringement suit in Japan is governed by the Code of Civil Procedure. The parties who participate in an infringement suit are (i) the patentee and (ii) the alleged infringer. As an independent third player, (iii) judges also take part.

At time point 0, the patentee becomes aware that his/her patent has been infringed. Against the alleged infringer, the patentee first takes measures that he/she can take before filing a plenary suit, such as issuing a warning letter or applying for a provisional disposition. At this point, the alleged infringer makes a choice to accept or refuse a settlement offer. If the alleged infringer chooses settlement, the case is over. If he/she refuses, the patentee brings the case to court.

At time point 1, the patentee files a suit with a district court, paying a fee for petition in civil litigation. The judges of the district court make a choice to recommend settlement or render a judgment. If both the patentee and the alleged infringer choose settlement and accept the terms of settlement, the case is over. If the judges choose to render a judgment, the patentee and the alleged infringer respectively makes a choice to accept the judgment or appeal to a high court.

At time point 2, either the patentee or the alleged infringer, who has chosen to appeal, files an appeal, paying a fee for petition in civil litigation. The judges of the high court make a choice to recommend settlement or render a judgment. If both the patentee and the alleged infringer choose settlement and accept the terms of settlement, the case is over. If the judges choose to render a judgment, the patentee and the alleged infringer respectively make a choice to accept the judgment or appeal to the Supreme Court.

At time point 3, either the patentee or the alleged infringer, who has chosen to appeal, files a final appeal, paying a fee for petition in civil litigation. The judges of the Supreme Court make a choice to recommend settlement or render a judgment. Whichever the judges choose, the case is over.

The present study excludes proceedings of cases remanded by high courts or the Supreme Court, and only assumes a one-way procedural flow moving from lower courts to higher courts.

Ⅲ Economic Model of Patent Infringement Suits

Condition 1: If the participants choose settlement, the judgment in prior instance is deemed to have become final and binding.

Condition 2: Judges of all courts have the same function regarding the finding of infringement, with an observable factor X, and private information possessed by each judge ε, which cannot be observed from outside.

Under these two conditions, and using the model presented by Hylton (2006), an attempt is made to build an estimation model on a patent infringement suit, in which the plaintiff and the defendant often have asymmetric information. In a patent infringement suit, in general, the information held by the plaintiff, who is the patentee, and that held by the defendant, who is the alleged infringer, are asymmetric. The present study assumes such informational asymmetry, and the difference between the parties in terms of their preference and variance in relation to the winning of the case.

Following Hylton (2006), a model of litigation is set as follows.

Ω_p, Ω_d are random variables indicating whether the plaintiff (p) or the defendant (d), respectively, prefers to file a suit to obtain a final judgment. They have two choices, file a suit or reach a settlement.

$\mathrm{Pr}_p, \mathrm{Pr}_d$ are factors that can be observed by both the plaintiff and the defendants, whereas ε_p , ε_d denote their private information that cannot be observed by the other party. J refers to the monetary value determined by a judgment, and Cost refers to the total litigation costs incurred by the plaintiff and the defendant, respectively (the fee for petition, mentioned later, is an amount calculated based on publicly available information). The conditions under which the plaintiff or the defendant prefers litigation to settlement are as follows.

$$\left(\mathrm{Pr}_p - \mathrm{Pr}_d\right) J > Cost \tag{10}$$

$$\mathrm{Pr}_p = E\left[\mathrm{Pr}_p \middle| \Omega_p\right] + \varepsilon_p, E\left[\varepsilon_p \middle| \Omega_p\right] = 0 \tag{11}$$

$$\mathrm{Pr}_d = E\left[\mathrm{Pr}_d \middle| \Omega_d\right] + \varepsilon_d, E\left[\varepsilon_d \middle| \Omega_d\right] = 0 \tag{12}$$

Suppose the plaintiff and the defendant have different preferences and asymmetric information.

$$\frac{df}{dv} = \varphi\left(\frac{\frac{J}{C} - v}{\sqrt{\sigma_p^2 + \sigma_d^2 - 2\rho}}\right) \tag{21}$$

ψ denotes a probability distribution function of standard normal distribution. The shape of the probability distribution function differs between the plaintiff and the defendant due to the assumed difference in their preferences and variances. When they have different variances, they are more likely to prefer litigation to settlement in patent disputes (Schankerman and Scotchmer 2001).

Since the distribution function to be estimated (21) is a normal distribution, a multinomial probit model is selected as an estimation model (Amemiya 1975).

Ⅳ Estimation and Consideration

1 Data Description

The data applied in the present empirical analysis is cited from three data sets: (i) the IIP Patent Database, developed by Goto and Motohashi (2007); (ii) patent gazettes; and (iii) final judgments on patent infringement suits, made public by courts. The observation period is from May 22, 1988, to December 31, 2010.

The latter part of this period, which covers the 2004 revision to the Patent Act, the enactment of the Act for Establishment of the Intellectual Property High Court, and the 2010 revision to the Patent Act, is set as a separate observation period. It runs from April 21, 2005, to December 31, 2010. The data set corresponding to this recent period includes 277 patent infringement suits that ended with final judgments by courts. Among them, 147 suits were ended with judgments in first instance, 121 with judgments in second instance, and 9 with judgments by the Supreme Court.

(1) Numbers of forward citations and backward citations

Patent gazettes contain academic papers, patents, and other documents cited by the patent office in the examination process to determine the novelty and inventive step of the invention for which a patent is sought. Hall et al. (2005) and other empirical studies inquiring into patents and economic activities suggest some relevance between citations and innovation.

There are two indicators of citations. *Backward citation* refers to a patent citing earlier patent gazettes and academic papers. A patent gazette discloses the past patents and academic papers cited by the patent. The number of backward citations of a patent is fixed at the time when the patent is registered at the patent office. This is an operable variable because it is the patent applicant that selects and cites documents in the patent. *Forward citation* refers to a patent being cited in later patent gazettes. The number of forward citations of a patent is fixed at the time when the patent expires or when the duration of the patent is determined by a final and binding judgment in a patent infringement suit.

In the present study, the number of backward citations is counted based on patent gazettes, and the number of forward citations is counted based on the IIP Patent Database, developed by Goto and Motohashi (2007).

(2) Patent claims

A patent claim is a statement that describes the technical scope where a patent is protected. Since the legal revision in 1988, which introduced the revised multiple claim system, a number of patents have multiple claims. In actual infringement suits, the court makes determination on the relationship between the scope of claim(s) of the patent and the allegedly infringing product [whether or not the allegedly infringing product falls within the scope of claim(s) of the patent]. Lanjouw (1998) shows the empirical estimates that support the relevance between the number of patent claims and the economic value of the patent, as well as the finding that the number of patent claims has a positive correlation with the number of forward citations and a negative correlation with the number of backward citations. In the present study, the data of patent claims is cited from patent gazettes and the IIP Patent Database.

(3) International Patent Classification (IPC) dummy

Following Lanjouw and Schankerman (2004) and Galasso and Schankerman (2010), the patents included in the data set are divided into the following four technical fields in accordance with the International Patent Classification (IPC).

- Chemicals/biotechnology: A01, A21–A24, A41–A47, A61K, B01–B09, B31, C01–C05, C07–C14, C12N15, C21–C30, D01–D07, D21
- Machinery: A61–A63 (excluding A61K), B21–B23, B24–B30, B32, B41–B44, B60–B68, C06, E01–E06, E21, F01–F04, F15–F17, F21–F28, F41–F42
- Electronics: G01–G08, G21
- Information: G09–G12, H01–H05, B81–B82

The relevant data is cited from the IIP Patent Database.

(4) Patentee dummy

Following Lanjouw and Schankerman (2001, 2004), the patentees included in the data set are divided into three groups: (i) Japanese companies; (ii) non-Japanese companies; and (iii) individuals.

The relevant data is cited from the IIP Patent Database.

(5) Number of subclasses

Following Lanjouw and Schankerman (2001, 2004), the subclass or subclasses to which each patented technology pertains and the number of such subclasses are designated as indicators of the technical scope of each patent included in the data set.

The relevant data is cited from patent gazettes.

(6) Litigation costs

In the present analysis, the estimated fee for petition is used as a proxy variable in place of a variable of litigation costs, which are not made public under the Japanese court system. The computational logic is in accordance with the provisions of Articles 3 and 4 and Appended Table 1 of the Act on Costs of Civil Procedure (Act No. 40 of April 6, 1971). The data used for estimation is based on the amounts claimed by the patentees, stated in the judgment documents on patent infringement suits. Two conditions are set under the property rule and liability rule, advocated by Kaplow and Shavell (1996). In the case where the patentee claims damages in an infringement suit, it is regarded as a claim under the property rule and the fee for petition is calculated pursuant to Article 4, paragraph (1) of said Act, whereas in the case where the patentee claims only an injunction against infringement, it is regarded as a claim made under the liability rule and the fee for petition is fixed at a certain amount. Although the amount of costs is fixed exceptionally in the case of claiming only an injunction, the fee for petition can basically serve as a proxy variable representing the scale of infringement, because it reflects the amount of damages estimated beforehand by the patentee. Where more than one patent is involved in one suit, the amount of costs per patent is calculated by equally dividing the amount of the fee for petition in the suit.

The relevant data is cited from the judgment documents retrievable from the database of the Supreme Court and from the database of Westlaw Japan.

(7) Final judgments on patent infringement suits

Since Japan adopts the three-instance system, under which the parties have chances to be heard by a court three times, the final judgment on each case cannot be treated as a final and binding one and included in the database until the plaintiff and the defendant accept a lower court judgment or the case is finally judged by the Supreme Court. For this reason, the data set compiled for the present study only uses judgments on infringement suits that have already become final and binding by the time of its compilation

Table 1 Basic statistics—variables (2005-2010)

Variables	Average	Standard deviation	Maximum value	Minimum value
No. of forward citations	4.10	7.80	72	0
No. of backward citations	4.78	4.99	40	0
No. of patent claims	5.89	6.31	44	1
No. of subclasses	2.58	1.80	12	1
Period of patent pendency (years)	14.65	5.47	28.28	2.21
Fee for petition (yen)	95,504.60	324,837.20	39955920	2413

Table 2 Basic statistics—dummy variables (2005-2010)

Patentee	No. of patents	Business field	No. of patents
Japanese companies	213	Chemicals/ biotechnology/ pharmaceuticals	64
Non-Japanese companies	26	Machinery	110
Individuals	34	Electrics	40
		Information engineering	63

Table 3 Basic statistics—final and binding judgments (2005-2010)

Courts that rendered the final and binding judgments	No. of patents concerned	In favor of plaintiff	Against plaintiff
District court	147	40(27.2%)	107(72.8%)
High court	121	31(25.6%)	90(74.4%)
Supreme Court	9	3(33.3%)	6(66.6%)

2 Variables and Estimation Formula

Following Lanjouw and Schankerman (2004), the present study uses six variables: the number of forward citations, the number of backward citations, the number of patent claims, the litigation cost, the period of patent pendency, and the number of subclasses. Among these variables, those not used in the preceding studies are the litigation cost and the period of patent pendency. As for the litigation cost, because the data of the total costs is not disclosed in Japan, the fee for petition, which is an observable factor, is used instead. The period of patent pendency is introduced for the following reasons. After the establishment of the Intellectual Property High Court, the period of patent pendency is now under control of the Intellectual Property High Court, the Tokyo District Court, and the Osaka District Court, and therefore no significant difference can be seen beforehand. Another reason is that, among the data items used in the data set, only the duration of patent and the period of patent pendency are variables by which time can be measured by day, and in this respect, the period of patent pendency is important in observing the quantitative impact of time.

Among the six variables set for the present analysis, the number of backward citations, the number of patent claims, the period of patent pendency, and the number of subclasses are exogenous variables, while the number of forward citations and the litigation cost are endogenous variables that are determined as of the time of the final judgment.

P (finding of infringement | final judgment)
= number of forward citations + number of forward citations (dummy with not more than five citations)
+ number of backward citations + number of backward citations (dummy in chemicals/biotechnology) + number of backward citations (dummy in machinery)
+ number of backward citations (dummy in electrics)
+ number of patent claims + number of patent claims (dummy with not more than six claims)
+ number of subclasses + number of subclasses (dummy in chemicals/biotechnology) + number of subclasses (dummy in machinery)
+ number of subclasses (dummy in electrics)
+ fee for petition
+ period of patent pendency
+ constant term + error term

The error term is supposed to follow a normal distribution where the average is 0 and the variance is σ^2.

3 Estimation Results

The estimation results can be roughly categorized into those relating to the "number of forward citations and number of patent claims," "litigation cost and constant term," "number of backward citations and number of subclasses," and "period of patent pendency."

As for the number of forward citations and the number of patent claims, the estimates show threshold levels in relation to certain values.

The estimates are significantly negative for patents with not more than five forward citations and patents with not more than six claims, respectively. This is contrary to the estimates indicated in Lanjouw and Schankerman (2001, 2004), which discussed prior probability of litigation. While this preceding study estimates that a patent that has more forward citations and more claims is more economically valuable and more likely to be involved in suits, the estimates obtained in the present analysis are opposite in sign for these two explanatory variables.

A patent with more forward citations means that the patented technology is more easily cited. In reference to Hall, Jaffe and Ziedonis (2005) and other studies regarding citations, it is presumed that the technology covered by such a patent is itself less innovative than the technology covered by a highly technically innovative patent. As for the number of patent claims, in a patent infringement suit, it is often the case that not all patent claims clearly stated in the patent gazette but only a specific claim or claims are found to be infringed. Therefore, patents that exceed the threshold level in terms of the number of forward citations and the number of patent claims are indicated as those found to be infringed afterward (as a kind of noise).

The estimation result in terms of the number of patent claims is consistent with the result presented in Lanjouw and Schankerman (2001, 2004) with regard to a dummy with not more than six claims. Technology covered by a patent with fewer citations is more like basic technology, and it is evaluated as the *essential part of the invention* in the meaning used in jurisprudence. On the other hand, the estimation result is not significant for a dummy with seven claims or more. This may be because not all patent claims are taken up in the process of finding infringement of a patent. Supposedly, the patentee, when filing a patent application, attempts to include many claims so as to broaden the scope where infringement is to be found. However, in infringement suits, the judges seem to closely examine the content of the technology, regarding patent claims as being independent from one other and having different qualities.

As for the litigation cost, no significant result is obtained, nor is there any significant result with regard to the constant term.

In relation to the number of backward citations and the number of subclasses, the estimates differ by business field.

As for the number of backward citations, the estimates show different signs between the business fields of chemicals/biotechnology, machinery, and electrics, and the business field of information. The estimates relating to the business fields in the former group are significantly negative, which is consistent with the estimates presented in Lanjouw and Schankerman (2001). On the other hand, the estimate relating to information is significantly positive. This is contrary to the preceding study and needs to be closely examined. A positive estimate in relation to the number of backward citations signifies that a patent which cites more documents in its gazette is more apt to be found to be infringed. A patent gazette containing a number of cited documents, irrespective of whether they are cited by the applicant him/herself or by the patent examiner, means that the patent by itself limits the scope of inventive step or novelty of the technology covered by the

patent. That patents whose technical scope appears to be narrow are more likely to be found to be infringed is a characteristic of the field of information technology. In particular, the estimates shown above suggest that information is a new technical field as compared to other technical fields, and therefore its technical scope is ambiguous and broad in general.

As for the number of subclasses, signs of the estimates are different between the group of chemicals/biotechnology and information and the group of machinery and electrics. The IPC sub-classification rule is that a new subclass is created for a technical matter that can be defined by none of the conventional technical classifications, whereas a technical matter that falls under any of the conventional technical fields is assigned to the relevant existing subclass. The estimates for the fields of chemicals/biotechnology and information are significantly negative in relation to the number of subclasses, which suggests that developments in patented technologies follow as an extension of the conventional technologies. On the other hand, in the fields of machinery and electrics, where the estimates are significantly positive, technological progress brings along with it the spreading of technical fields.

Based on the combination of the two factors, the business fields can be categorized as follows.

- Chemicals/biotechnologies: negative for both the number of backward citations and the number of subclasses
- Machinery and electrics: negative for the number of backward citations and positive for the number of subclasses
- Information: positive for the number of backward citations and negative for the number of subclasses

The categorization indicated above is close to the results of the economic analysis on research and development. According to the estimates in relation to the number of backward citations and the number of subclasses, the business fields can be divided into the category of chemicals/biotechnology where the research development follows a horizontal line, the category of machinery and electrics where research results are developed into commercial products through a combination of multiple technologies, and the category of information where new technologies are difficult to define.

In terms of the period of patent pendency, the estimate is significantly negative, with no difference being detected by business field. As factors relating to patent prosecution (e.g. whether or not the patent has gone through any amendment or correction to the patent document or invalidation trial, the date of commencement of examination) are not included in variables, the estimation result does not clearly show the relationship between the possibility of finding of infringement and the patent prosecution process. However, it can at least be said that the estimate for the period of patent pendency being highly significantly negative implies that a patent that has gone through the patent prosecution process more smoothly is more likely to be found to be infringed. This leads to the determination that a patent whose technical scope is clearer is more likely to win in litigation

Table 4 Estimation Results (2005-2010)
McFadden's coefficient of determination = 0.1245, log likelihood = -141.91121,
number of observations = 278

Explanatory variables	Estimate	Standard deviation	Prob	Explanatory variables	Estimate	Standard deviation	Prob
No. of forward citations	▲0.0042	0.0098		Period of patent pendency	▲0.1156	0.0386	***
No. of forward citations (dummy with not more than five citations)	▲0.1448	0.1635	*	No. of subclasses	▲0.2884	0.1110	***
No. of patent claims	0.0051	0.0163		No. of subclasses (dummy in chemicals/ biotechnology)	▲0.1260	0.1203	***
No. of patent claims (dummy with not more than six claims)	▲0.1403	0.0540	***	No. of subclasses (dummy in machinery)	0.3606	0.1121	***
No. of backward citations	0.0989	0.4766	***	No. of subclasses (dummy in electrics)	0.4147	0.1480	***
No. of backward citations (dummy in chemicals/ biotechnology)	▲0.1475	0.4830	**	Fee for petition	▲0.0206	0.0146	
No. of backward citations (dummy in machinery)	▲0.1512	0.1289	*	Constant term	0.2476	0. 2839	
No. of backward citations (dummy in electrics)	▲0.1076	0.1597	*				

Prob: ***: <0.001 significance level, ** <0.05 significance level, *<0.1 significance level.
Truncated at the fourth decimal point

Ⅴ Conclusion

The present study attempts empirical analysis on patent infringement suits in Japan, with the use of a database compiled for this purpose. Among a limited number of the preceding empirical studies conducted from the combined perspective of patent law and economic science, the study by Lanjouw and Schankerman (2001, 2004), which addressed the probability of the issue of preliminary injunction against patent infringement in the United States by applying discrete choice analysis (DCA), is applied as a benchmark. While this preceding study discussed the prior probability of filing of patent infringement suits, the present analysis targets final and binding judgments rendered as a result of patent infringement suits (excluding those on remanded cases).

Yuzuki (2009), inquiring into the final judgments on patent infringement suits rendered before the introduction of the Intellectual Property High Court, presented estimation results that were consistent with those of the preceding studies, whereas the estimations results in the present study were inconsistent. More specifically, unlike the estimate by Lanjouw and Schankerman (2001, 2004), which was significant with a dummy variable for the attribute

of the registered patentee, and that by Yuzuki (2009), which was significant with dummy variables for the attributes of the registered patentee and the field of patented technology, the present study shows that the estimate is significant with a dummy variable for the attribute of the field of patented technology. Thus, using the data after the establishment of the Intellectual Property, the estimate does not depend on the attribute of the patentee, suggesting that the subject of discussion in patent infringement suits is now focused on the patent right itself. The present analysis has provided various new findings on the relevant explanatory variables: the consistency with the preceding studies with regard to the number of backward citations and the number of subclasses, which implies a truncation in terms of the number of forward citations and the number of patent claims; the irrelevance of the finding of infringement to the size of litigation; a strong negative correlation between the period of patent pendency and the finding of infringement. Unlike the estimates shown by Lanjouw and Schankerman (2001, 2004) and Atkinson, Marco and Turner (2009), there is no difference in the estimates presented by the present study in relation to the attribute of the patentee or the attribute of court. A considerable difference before and after the Act for Establishment of the Intellectual Property High Court is that the estimate for a truncated dummy is significant after that change.

Meanwhile, there is still room for further discussion with regard to the inconsistency in the estimation results between the present study and the preceding studies, as well as prior probability and posterior probability on outcomes of patent infringement suits. In particular, as it is unrealistic to estimate prior probability in Japan due to the limited amount of publicly available information, analysis should be made by constructing a structural model of the relation between invalidation trials and patent infringement suits. The period of litigation may be used as a variable, as the estimation on this factor suggested by Galasso and Schankerman (2010) is also applicable in Japan.

To date, economic analysis on patent rights has centered on empirical analysis targeting the results of innovation, and analysis on infringement suits has not gone beyond the bounds of expansion of a theoretical model applicable to civil suits. The present study has successfully shown certain estimation results on patent infringement suits and identified a slight but significant difference in estimates depending on the patent policy.