16 The Basic Analysis of Anticompetitive Effect on Patent Pools

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In this study, patent pool will be examined, which allows patentees to pool their patents and grant licenses to companies that hope to be licensed. In recent years, technical advancement and segmentation have accelerated especially in the fields where technological innovation is rapid. Consequently, companies often find their own patents insufficient to develop new products. Any company planning to develop a new product is required to carry out licensing negotiations with many patentees. The negotiation-related costs would impose a great burden on the company. As a solution, patent pools are gaining attention. However, since the purpose of patent pools is to centrally manage patents owned by many patentees, some people are concerned that patent pools could function as cartels and have an anticompetitive effect. In this study, it will be examined by using an economic theory model whether patent pools have a latent anticompetitive effect or not. Furthermore, based on various patent data, we will analyze whether patent pools have affected corporate research and development activities.

I Necessity of Patent Pools and Their Anticompetitive Effect

1 Issues related to recent research and development activities

In recent years, research and development activities and product development activities have been hindered by two obstacles: a "patent thicket" and the "tragedy of the anticommons."(*1) Today, in order to conduct research and product development activities, companies need to use many patents for highly advanced technologies in an extremely wide range of fields. Such technical advancement and segmentation necessitates licensing negotiations with patentees, which would require companies to bear a procedural burden as well as a monetary burden such as technology search costs. Such burdens are said to have hindered corporate research and product development. This situation is called "patent thicket," implying that the corporate ability to carry out research and product development would be greatly impaired by a dense web of patents. Another situation that hinders research and product development is called "the tragedy of the anticommons," which is a concept established by Heller and Eisenberg (1998). This concept illustrates a case where research and product development of companies are inhibited if a great number of patents are granted in a particular field in a concentrated manner because companies engaged in research and product development activities in that field face a higher risk of infringing rights of other companies and consequently refrain from using patents in said field.

Such slowdown of research and product development caused by a "patent thicket" and the "tragedy of the anticommons" is attributable to the fact that many companies individually hold patents. The technical advancement and segmentation have put an end to the era where a large company monopolizes all the technologies in related fields. Now, we are in the era where a specialized company only owns the technologies related to its specialized field. As a result, companies are given a strong incentive to provide mutual technical support.

2 Patent pool as a solution

As described above, since corporate research and development activities are hindered by a "patent thicket" and the "tragedy of the anticommons," technical cooperation among companies is indispensable. As a means of such cooperation, a patent pool, which is a topic of this study, is gaining attention. A patent pool is a type of license system that allows patentees to pool all of the patents related to a new product and licenses a package of those patents to a company that hopes to be licensed.(*2) Each company simply

(*1) Comprehensive surveys on a "patent thicket" and the "tragedy of the anticommons" are Shapiro (2001) and Heller and Eisenberg (1998).

(*2) According to "Guidelines for the Use of Intellectual Property under the Antimonopoly Act", which was published by Japan Fair Trade Commission in 2007, a patent pool refers to a business activity in which multiple parties holding the rights to a certain technology concentrate their rights itself or the rights to license the technology in a

needs to conclude a license agreement with a company administering a patent pool in order to receive various benefits from the patent pool system such as a cut in technology search costs, a decrease in transaction costs, enhancement in the motivation to invest in research and development, avoidance of patent infringement lawsuits, and promotion of technical standardization. These benefits would facilitate the development of new products. Famous patent pools include the MPEG2 patent pool containing patents related to image compression technologies, the DVD patent pool containing DVD-related patents, and the 3G patent platform containing patents related to the third generation mobile communications. Many of the currently-operated patent pools seek technical standardization in the electric and electronic field and the telecommunications field, where higher product connectivity and compatibility are especially beneficial. The patent pools in the electric and telecommunication industries are said to have greatly benefited not only producers but also consumers. From the viewpoint of producers, those patent pools have contributed to cost reduction by promoting technical standardization. For consumers, those pools have enhanced product usability. The success of those patent pools, which was highly praised by the competition authorities, is speculated to have promoted the formation of patent pools in those fields.

3 Anticompetitive use of patent pools

Despite the aforementioned benefits, patent pools could have a strong anticompetitive effect because they are designed to centrally manage the intellectual property rights owned by many patentees. (*3) For example, a patent pool could be a breeding ground for such illegal acts as imposing unfair transactional restraints aimed to limit the adoption of any technology that competes with any of the technologies contained in the patent pool or private monopolization committed in the form of exclusion of newcomers and constraint of the patent pool participants. Historically, most countries have restricted anticompetitive monopolization under a competition law. While patent pools centrally manage intellectual property rights, it does not necessarily reinforce monopoly power. This is because patents themselves are properties that the patentees are entitled to monopolize under the patent law. It is not certain whether exclusive sales of such monopolized properties would really reinforce monopoly power. Therefore, we need to carefully examine how to handle patent pools under a competition law.

4 Discussion on package license menus

In recent years, patent pools have been created specifically for certain technical standards. The patents contained in each of those patent pools are limited to the mutually supplementary patents that are indispensable to satisfy a technical standard due to the restrictions imposed by the antitrust law. In principle, those patents need to be licensed to a company as a package. However, such a package licensing system, which licenses all the patents contained in a patent pool as a package, has its limitations, especially in this age of technical advancement and segmentation. For example, in the case of the DVD patent pool, a technical standard covers various products. One technical standard is applicable to many product categories such as DVD players and DVD disks. Consequently, each licensee needs to selectively use patents contained in the patent pool according to the product category to which its products under development pertain. A package licensing system would force companies to purchase unnecessary patents as well. As a result, such a license would fall under the case of a tying arrangement between patents or a case of a mandatory package license, which are included in "Nine Prohibited Acts Related to Intellectual Property Licensing (Nine no-no's)." (*4) This case of package licensing could be regarded as a sale of patents under a tying arrangement because licensees are forced to purchase unnecessary patents. As a means of preventing a sale of patents under a tying

particular corporation or organization so that the body may grant the necessary licenses to the members of the pool or others (3-2-(1)). This study regards the patent pool as not the licensing scheme but the organization, since license is offered through the licensing administrator.

(*3) See "Patent and Know-How Licensing Guidelines" and "Guidelines on Standardization and Patent Pool Arrangements", which were published by Japan Fair Trade Commission in 1999 and 2005.

(*4) "Nine no-no's" is nine prohibited principles related to intellectual property licensing, which were published by DOJ in 1970's. These nine prohibited principles are a tying arrangement between patents, assign back, assignment of resale, unreasonable restraint of trade, exclusive license, a mandatory package license, unreasonable royalties, product restraint, and price restraint of the patent products.

arrangement, a licensing system called a package license menu is gaining attention. Under this new system, each licensee is allowed to freely select patents according to its needs. (*5)

5 Purpose of this study

As described above, the patent pools established in the past have revealed that they have both positive and negative aspects. On one hand, patent pools are important means of corporate technical development activities. On the other hand, patent pools could hinder competition. Therefore, it is imperative to determine clear criteria for judging whether a patent pool has an anticompetitive effect. The purpose of this study is to examine, based on an economic theory model, whether a patent pool has an anticompetitive effect. First, we will examine the pros and cons of package license menus, which have been considered as an important means of preventing sales of patents under a tying arrangement. Then, we will analyze how the relationships among the patents contained in a patent pool determine its anticompetitive effect. Through such analysis, we will determine the criteria for judging whether a patent pool has an anticompetitive effect.

Ⅱ Analysis of an Anticompetitive Effect of a Patent Pool

1 Basic conditions

The basic framework of analysis is as follows.(*6) We calculate the total net surplus for the following two cases respectively: a case where a patent pool exclusively grants licenses to licensees and a case where each patentee individually grants a license (a case where a patent pool does not exist). By making a comparison between the two cases in term of the total net surplus, we examine whether the patent pool has an anticompetitive effect. If the total net surplus of the patent pool case exceeds that of the non-patent pool case, the patent pool would be considered anticompetitive. If the opposite is the case, the patent pool would be considered pro-competitive.

For the analysis conducted in this study, the basic conditions for a model are set as follows for the purpose of simplification. We assume that only two technologies exist in an economy. Those technologies are developed and patented by two companies respectively. A company that needs either of the two patents for the development may use the patent by paying a license fee to the patentee. Each licensee obtains a gross surplus by using the licensed technology. The gross surplus is not affected by a combination of technologies but is solely influenced by the number of technologies that the licensee has used. Furthermore, the gross surplus is affected by type. The technical relationships between patents will be defined either alternative or supplementary depending on how much the gross surplus of a licensee has increased as a result of adding a patent.

In the following section, we will use the aforementioned gross surplus function to make a comparison between the following two cases: a case where a patent pool has been formed and a case where each patentee grants licenses. Based on the results of the comparison, we will analyze whether the patent pool in question has an anticompetitive effect.

2 Case where a patent pool grants licenses

In a case where a patent pool grants licenses, we need to take the patent pool and licensees into consideration. The patent pool exclusively grants package licenses for two patents. Each licensee pays a license fee for the patent package that it has purchased. The licensee can gain a gross surplus by purchasing either of the two package licenses (1, P(1)) and (2, P(2)). The amount of gross surplus gained from an additional patent that a licensee can obtain differs from one patent to another. The sequence of events presumed in the economic theory model is as follows. First, the patent pool presents a fee structure for its patent package licenses. Then, each licensee selects an appropriate package license based on the fee structure. The purpose of each licensee is to maximize the net surplus by using the licensed patent. The optimization

(*5) In practice, it is observed that 12% of the pools surveyed by Lerner et al. (2003) offer the multiple package licenses. According to Guidelines on the application of Article 81 of the EC Treaty to technology transfer agreements (2004/C 101/02), European Commission does not deny the multiple packages licensing as the useful way to provide licensees with a broader choice. Thus the multiple packages licensing is important for both firms and antitrust authority.

(*6) The framework of this analysis is based on that of Lerner and Tirole (2004).

problem faced by each licensee is a matter of selecting a package license that would maximize the net surplus. From the viewpoint of a patent pool, the problem of optimization is a matter of establishing a fee structure that would maximize the profits based on a prediction about licensees' demand.

The findings of this analysis are as follows. In the state of economic equilibrium where a patent pool has been formed, if the two patents are alternative to each other for all of the licensees, the two package licenses are both in demand. This means that the equilibrium fee structure satisfies the first order condition of the optimization problem of the patent pool. On the other hand, if the two patents are supplementary to each other for all of the licensees, it is not that both patent packages are in demand. Only the package (2, P(2)) is in demand. This means that the equilibrium fee satisfies the first order condition of the optimization problem of the patent pool.

3 A case where individual patentees grant licenses

In a case where individual patentees grant licenses, we need to take two patentees and licensees into consideration. Each patentee owns one patent and grants licenses to licensees at the price Pi (i =1,2). Each licensee pays a license fee for the patent that it has purchased. The licensee can obtain a gross surplus by purchasing the license individually. The amount of gross surplus that a licensee can gain by obtaining an additional patent differs from one patent to another. The sequence of events presumed in the economic theory model is as follows. First, a patentee individually presents a license fee. Based on the fee, each licensee decides whether to purchase the patent. The purpose of each licensee is to maximize the net surplus by using the licensed patent. The optimization problem faced by each licensee is a matter of selecting a package license that would maximize the net surplus. From the viewpoint of a patent pool, the problem of optimization is a matter of establishing a fee structure that would maximize the profits based on a prediction about licensees' demand. Each licensee makes a comparison between the license fees set by respective patentees and chooses the most suitable patent.

In this analysis, we have found that, in a case where individual patentees grant licenses, equilibrium does not exist if the two patents are alternative to each other, while it exists when the two technologies are supplementary to each other.

4 Welfare analysis

In the analysis described in the preceding section, economic welfare is defined as the total of the profits gained by patentees and the net surplus obtained by all of the licensees. An analysis of the economic welfare at the state of equilibrium has revealed that the formation of a patent pool would decrease economic welfare if the patents are alternative to each other, whereas the formation of a patent pool would increase economic welfare if the patents are supplementary to each other. In the case where patents are alternative to each other, a licensee would not necessarily purchase both patents because one of the patents would bring a sufficient surplus. This means that a patent with a higher price would not be purchased. Therefore, in the state of equilibrium among individual patentees where no patent pool has been formed, competition among patentees on license fees is fierce. The formation of a patent pool would hinder such competition. If patents are supplementary to each other, a licensee would always purchase both patents in order to obtain a sufficient surplus. In this case, the patentees can raise fees without worrying about the possibility of seeing their patents not being purchased by potential licensees. Consequently, in the state of equilibrium among individual patentees where no patent pool has been formed, a license fee would be higher than a fee that would be set by a patent pool. In short, if patents are supplementary to each other, concentration of patent monopoly power to a patent pool through the formation of a patent pool would contribute to lowering fees.

Ⅲ Analysis of Patent Pools and Corporate Patent Application Filing

1 Effects of a patent pool on companies

So far, we have analyzed whether a patent pool has an anticompetitive effect from the perspective of price control power based on the presumption that a patent pool has a certain positive effect. In this chapter, we will examine various patent data in order to examine whether patent pools have really had a positive effect on companies, more specifically, whether they have

truly contributed to corporate research and development activities.

As described in Chapter I, it has become difficult for companies to carry out research and development activities and product development activities based solely on their own patents due to segmentation of research fields and advancement of technology. One of the most fundamental roles of intellectual property rights is to strengthen the incentive for research and development by increasing the chances for exclusive use of the results of research and development activities. However, the existence of a "patent thicket" or the "tragedy of the anticommons" indicates that the technologies in demand are scattered in a wide range of technical fields. The ensuing transaction costs and license negotiations would prevent companies from using those technologies in an effective manner. This means that the existence of intellectual property rights could lower the incentive for research and development. In this way, a "patent thicket" can be one of the factors that discourage corporate research and development activities. As a solution, the use of a patent pool has been increasing. A patent pool, which is designed to centrally manage patents scattered in a wide range of fields, allows companies to make effective use of the results of research and development activities of other companies. Therefore, we can formulate the hypothesis that a patent pool enables companies to make effective use of the results of research activities of other companies and thereby promotes corporate research and development activities as a whole, increasing the number of patent applications as a result. In order to verify this hypothesis, we will examine whether the number of patent applications filed by companies has structurally increased after the formation of a patent pool. In particular, we will focus on the MPEG2 patent pool, which is one of the famous patent pools, and also on the Japanese companies participating in the pool.

2 Outline of the data

The main sources of the patent data used in this study are as follows. We used the data provided by MPEGLA as a source of information on the licensors and licensees of MPEG2-related patents.(*7) Regarding information on patent applications filed by Japanese companies (applicant data, application year, patent classification, inventor data), we extracted data from the IIP Patent Database (Institute of Intellectual Property) and the JPO Industrial Property Digital Library.

In order to prepare a data set for analysis, we first identified patent classifications of the patents comprising the MPEG 2-related technologies by using the data on the patents contained in the MPEG2 patent pool, which is the subject of this analysis. The patents used to cover the MPEG2 technology can be roughly categorized into ten classifications of two technical fields, i.e., field G (physics field) and field H (electric field). Similarly, we identified the licensors and licensees by using the MEG2 patent pool list. More specifically, we checked the website of each company in order to determine whether each licensor or licensee is a Japanese company. The licensors and licensees subject to this analysis consisted of 104 Japanese companies including Japan-based affiliates of foreign companies. These companies were extracted from the 1,638 licensors and licensees (no overlaps) participating in seven patent pools operated by MPEG-LA (MPEG2, ATSC, AVC/H.264, VC-1, MEPEG-4 VIDUAL, MEPEG-2 SYSTEMS, 1394). We extracted patent data from the IIP Database to obtain information on the patents owned by the 104 licensors and licensees that can be categorized into 10 patent classifications of two technical fields. The extracted patent information covered the application number, application date, patent number, registration date, IPC, applicant data, and inventor data for each patent. The application years subject to extraction were from 1994 to 2000. Similarly, we extracted information on the number of inventors of each company from the IIP Database based on the names of the applicants identified in the aforementioned process. In the end, we are left with a total of 34 companies as samples consisting of eight licensors and 26 licensees.

3 Estimation method and explaining variables

We are going to conduct a panel data analysis to examine whether the formation of the MPEG2 patent pool had an effect on corporate patent application filing. In general, in order to identify

(*7) The source of information on the licensors and licensees of MPEG2-related patents be available in the following homepage; http://www.mpegla.com/index1.cfm.

the characteristics based on attributes, it is common to conduct a cross section analysis on attribute-based data at a specific point of time. However, a cross section analysis would not be able to reflect each attribute. On the other hand, a chronological analysis would not be able to analyze common factors based on attributes. Therefore, for the purpose of assessing corporate patent application filing before and after the formation of a patent pool, it would be appropriate to conduct a panel analysis, which can analyze both attribute-based individual factors and chronological common factors. In this study, we are going to focus on the number of patent applications, which reflects the intensity of corporate research and development activities and the number of inventors, which reflects the size of their research departments. We will analyze whether those variables had any effect on corporate research and development activities after the formation of a patent pool.

In this analysis, we are going to use the number of MPEG2-related patent applications (MPEG2-related patents) as an explained variable, while using the following three variables as explaining variables: the number of inventors of MPEG2-related technologies (inventor), a time dummy variable (time dummy) indicating the time of patent pool formation, and a dummy variable (applicant dummy) indicating whether the company in question is a licensor or not. In this analysis, we estimated two models as generally done in a panel data analysis. One of the models is called a fixed effect model, in which the estimate equation is solved on the presumption that a certain fixed effect is experienced by each company throughout a year. The other model is a random effect model, in which a fixed effect experienced by each company is estimated as a random variable. The Housman Test has revealed that the statistical reliability of an estimate equation is the highest in the fixed effect model.

4 Results of estimation

According to the results of estimation, it is not clear whether the formation of a patent pool has structurally changed the number of patent applications filed by the licensors. However, it has become clear that the number of patent applications filed by the licensees has been structurally changed after the formation of the pool. With regard to the total number of patent applications, the time dummy variable had a statistically significant effect. This indicates that the number of patent applications filed in the relevant patent classifications by licensors and licensees has structurally risen since the formation of the pool. According to the estimation results for each applicant type, as far as licensors are concerned, a positive relationship is observed with the number of patent applications and the number of inventors. However, we did not observe any statistically significant effect that would indicate a structural change caused by a patent pool. On the other hand, with regard to licensees, both the time dummy variable and the number of inventors have a statistically significant effect. As far as licensees are concerned, the number of inventors has a positive relationship with the number of patent applications at a coefficient of 1.51. Generally, a company preparing a patent application indicates the names of researchers of its research department in the application form as the names of inventors. Therefore, the number of inventors may be presumed to be the size of research and development department of each company. Based on this presumption, it would be appropriate to consider that each licensee increases the number of patent applications by expanding the size of its research and development department after the formation of a patent pool.

Ⅳ Results and Contribution of This Study

1 Analysis of the anticompetitive effect of a patent pool

In Chapter II, we defined the state of equilibrium in two cases respectively: a case where patents are placed in a patent pool and a case where patents are licensed by individual patentees. Then, we made a comparison between the two. Since the characteristics of the equilibrium would differ depending on whether patents are alternative or supplementary to each other, each case was analyzed separately. The three major findings of this analysis are as follows. First, in the state of patent pool equilibrium, if the patents are alternative to each other, the patent pool would present a license menu. If the patents are supplementary to each other, the patent pool would offer a single package without presenting a license menu. Second, in the state of equilibrium of individual patentees where no patent pools have been formed, if the patents are alternative to each other, there would be no

license price that could achieve equilibrium among the patentees. On the other hand, if the patents are supplementary to each other, there would be a license price that could achieve equilibrium among the patentees. Third, if the patents are alternative to each other, the formation of a patent pool would decrease economic welfare, whereas it would increase economic welfare if the patents are supplementary to each other.

Based on these findings of this analysis, the following two conclusions may be formed. First, according to the above-described analysis result, the formation of a patent pool containing alternative patents would decrease economic welfare, whereas it would increase economic welfare in the case of a patent pool containing supplementary patents. This finding suggests that market competition policies should be formulated in consideration of the type of patents. In other words, the competition authorities should restrict patent pools containing alternative patents, while promoting patent pools containing supplementary patents. In the case of alternative patents, the absence of a patent pool would lead to a decrease in license prices. In contrast, if a patent pool containing alternative patents is formed, such competition pressure would ease, causing an increase in license pieces. On the other hand, in the case of supplementary patents, a license price that would be set in a case where a patent pool centrally exercises monopoly power over those patents would be lower than a price that would be set in a case where patentees individually exercise monopoly power over their patents. This analysis result clearly indicates the relation between the type of patents and the effect of a patent pool on economic welfare. This conclusion would provide the competition authorities with a useful criterion for judging a patent pool and would give the authorities a concrete basis for devising measures in consideration of patent types.

The second conclusion is as follows. According to the analysis result, in the state of patent pool equilibrium, if the patent pool contains alternative patents, the pool would present a package license menu, whereas if it contains supplementary patents, it would not present such a menu. This result suggests that it might be possible to speculate whether a patent pool has an anticompetitive effect or not based on the size of demand for package license menus. If a competition policy is trying to promote patent pools containing supplementary patents, it would be necessary to judge whether the patents in question are alternative or supplementary to each other. However, there is no direct indicator showing the type of patents. According to the analysis result, a patent pool that presents a package license menu may be judged as an anticompetitive patent pool. This is an important finding useful for making at least a temporary judgment as to the type of patents.

2 Analysis of patent pools and corporate patent application filing

In Chapter III, we conducted a panel data analysis (fixed effect model) to examine whether the formation of a patent pool changed corporate patent application filing. This analysis has statistically proved that the formation of a patent pool had a positive effect on corporate patent application filing and, more importantly, that such an effect differed depending on applicant type. The formation of a patent pool had no effect on licensors, whereas it had an effect on licensees. This indicates that licensees regarded the formation of a patent pool as an opportunity to develop MPEG2-related technologies and became more motivated to obtain patents for those technologies. The ensuing increase in the number of patent applications for related technologies is considered to have caused the aforementioned statistically significant effect. These findings have shown that the formation of a patent pool is effective for licensees. These analysis results reflect the success of patent pool formation in the electronic industry and the information and telecommunications industry, where a patent thicket is intertwined with technical standardization. Patent pools, which have been proven to be successful, are expected to go beyond the boundaries of the electric industry and the information and telecommunications industry and establish their presence in other fields as well. If a patent pool is going to be created in any other field, it would be necessary to carefully design the pool to stimulate the incentive of patent applicants, especially licensees.