12 Economic Analysis of Software Patent

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In this study, the author focuses on economic differences between copyrights and patent rights that have not been considered in existing studies, and considers the protection of the intellectual property rights for "software" that is protected by both of these intellectual property rights. Since the patent right is a right protecting "ideas," by applying the patent right to software, it can prevent both the "copying of innovative ideas among manufacturers" and the "copying of software." Meanwhile, the copyright protects "expression" so that if the patent right does not apply, it cannot prevent the "copying of innovative ideas among manufacturers." Focusing on this point, the author analyzes which right is preferable for protecting software from the perspective of social welfare, the patent right or the copyright.

The author considers this study to be important not only for the validity of software patents, but also for distinguishing the patent right and copyright in models from an economic perspective and to consider the protection of intellectual property rights from a more realistic viewpoint.

I Background of the Problem

In recent years, the number of applications for software patents has been increasing in the United States of America. According to Bessen and Hunt (2004), approximately 25,000 applications are filed per year. On the other hand, in Europe, Article 52 of the European Patent Convention provides that software would not be protected by patent. As mentioned above, stances on how to protect intellectual property rights for software may vary greatly in the world. Consequently, in this study, the author considers protection systems for the intellectual properties of software by using economic theories.

In theoretical economics, analysis is processed by expressing reality with simple mathematical formulas. In order to consider the meaning of mathematical models of theoretical economics, it is easier to understand by thinking about a place you have never visited before in your travels. For example, say you want to know the way to a famous art museum from your hotel. The most accurate way to find the way is to take pictures of the actual roads to the destination in high-resolution satellite imagery. However, this method is wasteful for achieving the goal of "learning the way to the destination." Since reality is very complicated, if the photos reflect reality as it is, they may show cigarette butts that were thrown on the street, a hungry stray dog, dented guardrails, etc. This information is not only redundant, but may become an obstacle to achieving the original purpose. Theoretical economics aims to discuss the essentials of an issue (the way to the destination) by drastically discarding the phenomena unrelated to the purpose of "learning the way to the destination" and creating a "map" that simplifies the reality. The economic theory model in this study aims to create a map as simple as possible for the purpose of examining the "optimal protection of intellectual properties in the software market."

In the field of theoretical economics, there have been various maps created to discuss the validity of patent rights (Klemperer, 1985; Gallini, 1992; Gilbert and Shapiro, 1990; O'Donoghue, Scotchmer and Thisse, 1998; Tandon, 1982). However, since software has special features that are different from normal properties, it is difficult to apply these arguments to software patents.

The patent right is a right to protect an innovative "idea." Consequently, if innovative ideas are included in the software, it is possible to protect them by patent rights. Moreover, software is also an "expression" of source codes; therefore, it is also subject to copyright protection that protects expression. Therefore, when considering the protection of the intellectual property rights of software, it is necessary to clarify the differences between copyrights and patent rights in economic terms.

The study of intellectual property rights in economic terms establishes a trade-off, where the intellectual property rights "give incentives for development to companies," while "causing social damages by its exclusive right," as the subject of analysis. However, this trade-off is a common problem with all intellectual property rights. Therefore, there is no study that clearly indicates the differences between copyrights and patent rights in the form of a model among existing

documents.

Since the patent right is a right to protect "ideas," it can prevent both the "copying of innovative ideas among manufacturers" and the "copying of software." The copyright, on the other hand, only protects "expression" so that it cannot prevent the "copying of innovative ideas among manufacturers." Focusing on this point, the author、 in this study, analyzed which is preferable for protecting software from the perspective of social welfare, the patent right, or the copyright.

Ⅱ Analysis

This study analyzes the simplest models. In Section II and III, "cases where a patent right is established for software" and "cases where the patent right is not established for the software, but the software is protected only by copyright" are expressed with simple theoretical economic models. By using these two kinds of models, how the patent right of software affects the welfare of society as a whole is considered.

For simplification, let us assume that there are two software companies (Company A and Company B) in the market. Company A currently has an innovative idea and can select whether they develop software by paying a certain amount at a fixed cost. If they do not conduct the development, the software will not be supplied to the market. In considering the situation where the invention of Company A is protected by the patent right, Company B cannot produce software by using the new technology of Company A.

With regard to the consumers of the software, they shall be expressed in the model based on the following assumption. Let us say there are two kinds of consumers: (1) normal users who always purchase regular products and (2) copy users who always use copied products. The normal users may obtain utility by purchasing the software, and they still have the option "to purchase nothing;" assuming that a consumer has "0" utility, if he/she does not purchase the software. With regard to the copy users, let us assume that they can produce copies of the regular product with the same quality at zero cost (or at very low cost). This assumption is based on the situation where increasing numbers of digital copies are made by end users in recent years. Based on the abovementioned situation, all of the copy users would copy the software of Company A. It is given that the government can control the ratio of normal users in the market through protective policies for intellectual properties against end users.

Based on the above assumptions, the optimal strategies for each economic entity (the government, the software companies, and consumers) shall be considered. As a standard assumption of economics, the presumption is that consumers behave reasonably to maximize their own utility, companies to maximize their profits, and the government to maximize social welfare. In these economic models, economic entities are assumed to behave based on the following phases:

Phase I: The government establishes protection standards for intellectual properties against end users in order to maximize social welfare.

Phase II: Company A decides whether it improves the quality of its own products by spending a certain amount at a fixed cost.

Phase III: Company A specifies the price of the software.

Phase IV: The normal users select their behaviors from either "purchasing nothing," or "purchasing the software of Company A." The copy users copy the software in order to maximize their utility.

Under these assumptions, the author seeks strategies to balance each economic entity and calculates social welfare in cases where the patent right is established for software.

In the same way, the author analyses in Section III the effect on social welfare when the software is only protected by copyright. The basic assumptions for the analysis are the same as the case of establishing the patent right for the software; provided, however, that in cases where the software is protected only by the copyright, the treatment of new technologies among companies is different. In the previous Section, Company A develops a new technology, but Company B cannot produce anything based on it. In this Section, since the innovative ideas included in the software are not protected by the patent right, Company B, under the assumptions of this Section, is able to copy the software of Company A to a certain extent. Before starting the analysis, let us check the assumptions of the models again.

As in the previous Section, let us assume that there are two software companies in the

market. Company A has an innovative idea and can select whether they develop software by paying a certain amount at a fixed cost. Presuming that if Company A does not conduct development, the software will not be supplied to the market. In cases where Company A conducts development, as it is different from above, Company B can produce software with a slightly lower quality by copying the idea. For simplification, Company B can copy the idea at almost no cost. Similarly, there may be different cases of consumers' behavior from those in the previous Section.

In the assumptions of this Section, the normal users have three choices: "purchasing the software of Company A," "purchasing the software of Company B," and "purchasing nothing." Each economic entity in this model is assumed to behave based on the following phases:

Phase I: The government establishes protection standards e for intellectual properties against end users in order to maximize social welfare.

Phase II: Company A decides whether it improves the quality of its own products by spending a certain amount at a fixed cost.

Phase III: Both Company A and B specify the price of their software at the same time.

Phase IV: The normal users select their behaviors from "purchasing nothing," "purchasing the software from Company B," or "purchasing the software from Company A." The copy users copy the software in order to maximize their utility.

Under these assumptions, the author seeks the strategies of each economic entity and considers social welfare.

Ⅲ Protection by the Patent Right and by the Copyright

In this analysis, whether the special property, i.e. software, shall be protected by establishing the patent right or protected only by the copyright is considered from the perspective of social welfare. For this analysis, the author has constructed a model focusing on the point that if a copyright is granted to the software, it can only prevent copying by the end user, while if a patent right is established for the software, it can prevent not only the copying of software, but also the copying of ideas among companies. The following conclusions are obtained.

Proposition 1

In cases where the software is protected by the patent right, protective standards for end users become lower than in those cases where the software is protected only by the copyright.

The argument for this proposition is as follows:

Under the assumptions of this model, in order to maximize social welfare, the protective standards shall be as low as possible in order to give companies incentives for development. Now, let us focus on the companies' profits under both schemes. In cases where patent rights are established for the software, the copying of technologies among companies is not permitted; while in cases where the software is protected only by copyright, it becomes possible for Company B to copy the new technology of Company A. This copying of new technology makes Company A, which has dominated the market, to face competition with Company B and reduce the profits of Company A. The government needs to secure incentives for the production of Company A. This causes the necessity of establishing more severe standards of protection for intellectual properties to promote development under the copyright schemes than under the patent right schemes.

Next, the author will argue which schemes shall be applied to improve social welfare.

Proposition 2

When comparing social welfare in cases where the patent right is established for the software and in cases where it is not established, social welfare improves when the patent right is not established for the software, but the software is protected only by copyright.

The argument for this proposition is as follows:

According to proposition 1, when deciding whether the patent right is established for the software or not, it is found that one trade-off problem occurs. When a patent right is established for the software, the necessary protective standards for intellectual properties to allow production by another company can be lower than under the copyright schemes. This

enables a greater increase of the number of software users in society as a whole when adopting patent right protection schemes than when adopting copyright protection schemes. On the other hand, if a patent right is established, it allows Company A, which is a developer, to dominate the market. The result is that high quality software is sold at a high price to the normal users. If the copyright schemes are adopted, Company B copies the software and it enters into competition so that the price of the software produced by Company A is lowered. This proposition indicates that the adverse effects from monopoly are greater by establishing a patent right.

Ⅳ Conclusion

In this analysis, the author considered whether a special property, i.e. software, should be protected by establishing a patent right or protected only by copyright from perspective of social welfare. For the analysis, the author constructed a model focusing on the point that if a copyright is granted to the software, it can only prevent copying by the end user, while if a patent right is established for the software, it can prevent not only copying of software, but also the copying of ideas among companies. The following conclusions are obtained:

In cases where the new idea developed by a company is fully innovative, but the development cost is not so high, the government can provide better social welfare by applying a copyright instead of a patent right (proposition 3). However, when applying a copyright to the new idea, it cannot prevent copying technologies among companies. Therefore, it requires a stricter control of the copying by consumers in order to give companies sufficient incentives for development (proposition 2). Intuitively, this has great effects on the improvement of welfare by improving the quality of the software in the whole market and on the promotion of competition by weakening the monopoly power of the developer. Therefore, as a result, the copyright is more preferable from the perspective of society. This study indicates the utility of copyright when considering the protection of intellectual property rights for software.

However, this does not directly lead to the conclusion that the patent right is unnecessary. As proposition 3 indicates, if the development costs are very high, there are some cases where the development costs cannot be covered only by protection against copying by consumers due to the copying of technologies by rival companies. In these cases, it becomes very important for the development of useful technology for society to establish the patent right for software and to regulate copying by companies. The conclusion reached by this study supports the EU's standpoint in principle; however, it also suggests that if the software is innovative and requires very high development costs, the software must be exceptionally protected by the patent right.