Patent Enforcement Strategies in the United States: An Integrative Framework

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Growing international commerce in high technology products has increased the potential for cross border patent disputes. However, there is no consensus regarding the nature, structure and change of patent disputes in the context of international competition. Although patent protection is intended to promise a unifying measure of commercial protection, entrepreneurial practices may influence its efficiency. Investigations into how patent enforcement functions effectively and what drives competitors’ decision to litigate are called for. This paper develops theories concerning the theoretical evolution of strategic management in patent enforcement from a firms’ strategic international context.

This paper begins with a literature review and discussions of previous empirical studies dealing with patent enforcement strategies and a framework is proposed. Cross-border trade disputes are highlighted and insights from various empirical studies are synthesized into an integrative framework that addresses the cost of litigation, characteristics of patentees, value of patent and innovation activities, and the development of six testable propositions.

Keywords: Cross border trade disputes, patent enforcement, patent infringement, patent strategy

The patent portfolio management through legal process manipulation nowadays has been viewed as an important tool of a firm’s overall business development strategies. Many companies now view their patent portfolio as a tradable capital asset that is fully enforceable in capital markets and the market place. Patent enforcement strategy, which is one of the many uses of patent rights, employs the legal system to enforce patent rights in an attempt to hold competitors at bay. While the number of patent lawsuits in the US dramatically increased by around 50 per cent in a decade since 1984 and registered an overall compound annual growth rate of 6.4 per cent since 1991, patent infringement reached a record highest of 4,015 cases in 2011. Behind this trend there is, however, a concern about whether the abuse of patent enforcement rights by those such as non-practising entities has distorted the function of patent protection. This paper provides an integrative framework to understand the factors of patent litigation and sheds light on the implications of patent litigation by firms. In other words, the enforcement issues related to patent protection become significant when one considers how patent protection enforcement impacts business practices in an ideal, theoretical open free market that serves the interests of society fairly.

Despite the great attention that has been directed toward the impact of patent strategies, there have been relatively few studies on the theme of patent litigation. The determinants and impacts of patent litigation is one of the most provocative issues in earlier research relating to patent strategies. For example, Lanjouw and Schankerman show that the likelihood of patent disputes can be analysed by means of the application of economic analysis of legal suits. Somaya concludes that the determinants of non-settlement litigation are positively related to the ‘strategic stakes’. However, patent litigation behaviour is a cross cutting theme that resides in the relatively unexplored area bound by legal framework, the stage of technological development and a firms’ strategic behaviour. Any analysis must take into account a multi-disciplinary perspective that combines strategic management, the economics of legal actions and the particulars of patent law. In this

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paper, a critical realist’s stance is taken with regard to the question of whether the events observed (and those not observed but implied) are caused by a wide variety of different and conflicting mechanisms. The chaotic complexity makes it difficult to see what exactly caused a particular event. After the legal mechanisms have been described, this paper focuses on various components and their potential impact on firms’ strategic implications of patent enforcement mechanisms.

While the empirical analysis of legal actions has provided some insights associated with firms’ valuations, predatory behaviours, and lawsuit-filing decisions, this paper integrates all of these findings into a single framework of strategic implication of legal process in the context of patent enforcement. The context encourages investigations into how patent enforcement works and what makes competitors decide to file a lawsuit. In this context, this paper aims to further develop the theories and examine the practices of patent strategies, focusing on the enforcement mechanism, to understand firms’ strategic calculations in an international enforcement environment.

Literature Review

This section evaluates how firms attempt to appropriate innovation rents based on patent rights ownership with the expectations generally held in the innovation and strategy management literature, particularly, this paper shed lights on patent enforcement within the jurisdiction of the United States. A brief overview of enforcement process is followed below by an analysis of the stylised factors associated with patent enforcement. Finally, the issues regarding how enforcement affects the functions of patent protection are underscored.

Reviews of patent protection at the macro level have highlighted several features of the law that promote economic efficiency: legal protection for invention encourages investment; disclosure requirements enhance technological knowledge and spur further research; incentives to develop and commercialise research rapidly diffuse advancements, etc. These accounts emphasize an economic incentive rationale which view the appropriability (ability to extract profits resulting from an innovation) of economic returns from investment as the driving force behind technological innovation. In line with national differences in economic development, intellectual property right (IPR) regimes and the enforcement of existing laws also differ widely across countries. This difference is primarily concerned with legitimately balancing the protection of IPRs and the promotion of some consumer benefits.

Working of Patent Enforcement

Patent strategies can be said to occur in a space defined by at least three dimensions: technological advance, techno-legal scope and time. Within this space, firms target a desired financial return from innovative products or services. Patent strategies, therefore, are formalized by interwoven factors of legal and technology concerns and business opportunities.

The Space for Patent Enforcement in the US

As for legal space, when patentees find that their rights are being infringed, a variety of means may be employed to enforce patent rights through the legal procedures of patent enforcement. A patent dispute may be determined either by a judicial decision, a commercial settlement or agreements amongst the parties during these processes. In general, patent holders notify alleged infringers of the potential or current infringement of existing patent rights before initiating legal action. The alleged infringers’ activities involving patent rights should then be terminated or negotiations should be arranged amongst all parties. If such approaches do not resolve the controversy, patent holders may consider initiating civil proceedings to enforce their patent rights. After a lawsuit is filed, legal action will protect the exclusive patent rights from infringement by preliminary motions and judgment in a civil court. As for defendants, a limited number of defences may be asserted for a claim of patent infringement. Firstly, defendants may provide evidence to show there existed prior art before the allegedly violated patent was issued in order to invalidate a patented invention owned by the complainants. Secondly, defendants may prove that the use of a patented invention is subject to a contractual condition prohibited under a patent act. A court finally must determine whether the patentable idea of an invention disclosed in a patent claim has been taken or embodied in another product without permission from the owner.

However, the technical scope of the lawsuit process can limit the relevant development in appropriating innovation. Both patent holders and alleged infringers need to prove that their patent rights are valid. Moreover, differences between countries make the
technical issues more difficult to overcome. The patentability of the human gene, for example, is a highly controversial issue, which has been interpreted differently by patent offices all over the world. Most importantly, first mover advantage has created an important factor for financial returns from cutting-edge technologies and has been considered as more important than follow-up innovations. Advanced technology provides technology business leaders with enforceable rights and good licensing practice helps the legitimate first inventors on the issue of appropriability. For example, Monsanto filed a patent application for a core technology (in plant biotechnology) and then disclosed the invention widely to academia. Monsanto eventually benefited from the follow-up developments that had commercial potential because the participating university incubators firms were required to obtain licences from Monsanto. Monsanto adopted a strategy of diffusion and imposed a de facto standard for extending the zone of effective patent protection.

The utilization of a patent in the enforcement legal space cannot be considered only within a limited timeframe due to the commercial possibilities of business. That is to say, considerations must also be given to the potential of new product development over time. With the cumulative technologies, one can combine a variety of patents to develop a new product and launch it onto the commercial market, such as the development process of global system for mobile communications. Developing a patent portfolio may be concerned with controlling the technology development trajectory if a patent has the potential to open up a whole range of follow-up developments or complementary mainstream products. For example, according to Arora, the strategic use of patents can be demonstrated in the competitive chemical industry. In the 19th century, chemical market leaders combined core patents and consequently indirectly prevented competitors from entering the chemical market. During the post-World War II period, licensing became an important means of generating income from process innovations.

Patent enforcement process is thus complex and involves many stages. Each stage consists of litigants’ decisions on whether to proceed with their disputes or to pursue an alternative resolution to settle and cooperate with the opposing party. Inventors’ technological capabilities and the commercialization of their patents, which can affect their rewards from the patent rights, are interwoven.

**Patent Strategies and their Enforcement**

Patent strategies are involved during various stages of the enforcement process. It has become more and more difficult to clearly define patent strategies due to the fact that the motivation for holding and enforcing patents are diverse.

Firstly, firms can sell and/or license their patent portfolios to make a profit. Licensing occurs particularly in markets with fragmented technologies, e.g., semiconductor industries. Firms expand their own patent portfolio by acquiring proprietary technologies in response to the rapidly changing markets and potentially mutual hold-up problem. Mutual hold-up in patent strategy has been regarded as a threat to new product development due to a higher transaction cost as a result of seeking an appropriate technology or alliance partner.

Secondly, firms can prevent competitors from imitating their valuable assets by using patents as an isolating mechanism. The patent portfolios are often used as means of deterring the development of similar products or blocking competition. For example, according to Bekkers et al., IPRs have played an important role in building 3rd generation mobile telecommunications (3G) standard and in turn influenced the market power in the mobile phone market. Philips Electronics Inc was reluctant to participate in the cross-licensing of the relevant 3G standards because the company wanted to maintain proprietary monopoly.

Thirdly, firms can negotiate cross-licensing agreements with other companies with complementary patent portfolios. When competitive technologies from other firms are made available, isolating mechanisms may not be effective. In this instance, cross-licensing is a well-known method used in an attempt to gain the commercialized value of patents through sharing patent portfolios with other firms. However, cross-licensing cannot safeguard investments in new technologies, may increase costs and may delay the establishing connection with royalties and ex ante contracting.

The primary defensive strategy available to firms in such context is to create a mutual hold-up problem for competitive technologies or firms. Hall and Ziedonis explain the increase of patenting activities in the US as the result of an arms race (as reflected in patent application data) among semiconductor firms. Firms obtain and extend large portfolios of patents as a defensive mechanism or to threaten potential
adversarial patent enforcers. In addition, patentees also safeguard their core patents by inventing around a core technology. The aim of such ‘picket fence’ behaviour is to restrict the potential competitors’ claims around core patents when the patentees further improve the technologies or when they conduct reserve engineering.\textsuperscript{31} In addition, if firms face patent litigation from competitors, they may either file ‘patent invalid’ lawsuits to render opponents’ patent rights unenforceable or undertake other actions, such as threatening financial damage to the patentee by making the litigation extremely expensive and inconvenient.\textsuperscript{6} They can also extend the dispute by taking retaliatory actions in the marketplace or by searching for other functionally similar patents to licence to enable them to continue their production runs.

It must be noted that the patent strategy is a very specific issue in the context of complex industries, where one product consists of multiple technologies.\textsuperscript{31,32} In complex industries, firms are expected to commercialize their downstream products by obtaining protection for all commercial embodiments to avoid potential infringement which may lead to a decline in profits. For example, new biotechnology firms are required by the exigencies of the market to acquire complementary assets from other pharmaceutical firms in order to commercialize their patents. Firms can either defensively establish safeguards for their patent portfolio, or offensively enforce patents through the legal process to gain the expected return in the market.

Whether patent rights are fully and cost effectively enforceable is a critical factor in implementing patent strategies. A patent is particularly valuable if a patent can be enforced self-assuredly in the courts. In the technology market, if patentees can convince potential licensees of the value of their patents, then, as licensor, the patentee can obtain an advantageous position when negotiating rents.

The Determinants of Patent Enforcement

Given that the strategic use of a patent portfolio has been recognized as an important part of business strategy, various researchers have highlighted issues ranging from patent protection to strategic interaction in the market place,\textsuperscript{2,31,33} particularly with cumulative technologies, where patents are viewed as a bargaining currency\textsuperscript{34-36} or strategic stakes.\textsuperscript{6} The strategic value of patents to a firm is thus partly based on the firm’s ability to strategically manipulate patent litigation and orchestrate the outcome of lawsuits. The issues raise various questions: What are the determinants of patent litigation where complex technologies are involved? What is the impact of tightening trade sanctions on a foreign firm’s strategic behaviours? In this regard, the aim of this section is to evaluate the existing empirical literature related to negotiation process of patent litigation and to identify the components influencing enforcement. Attention is particularly paid below to the stylised factors influencing patent litigation before an integrative framework and propositions are suggested. Table 1 summarises the empirical studies in relation to patent enforcement.

Despite the fact that the role of negotiation in the litigation process has been studied for a long period of time, only since the 1990s has the issue become a subject of primary research. Until 1990, the patent protection system had not been sufficiently robust to enable patent holders to enforce their rights through legal action.

The Value of a Patent

If patent holders believe that the quality patents they possess would give them high returns, they would be very willing to quickly defend those patents against infringements. Based on the theoretical models of litigation developed by Cooter and Rubinfeld, Lanjouw and Schankerman’s series of papers in 1997, 2001, and 2004 have proposed to explain the determinants of patent litigation through analysing a patent litigation database from 1978 to 1999 (ref. 35). By implementing a probit model, they found that litigation rates differed hugely and were higher when innovations are more valuable.\textsuperscript{11-13} Harhoff and Reitzig, who developed the stylised model of Priest and Klein and used the patent opposition procedure datasets in the Europe Patent Office (EPO), also confirmed an economic, self-interested, motivating proposition.\textsuperscript{17,34} Their studies empirically evaluated the determinants of opposition by the measurement of patent citation in biotechnology and pharmaceuticals. Post-grant opposition mechanism allows third parties to challenge the validity of granted patents at the European Patent Office (EPO) where opponents may argue that a patent granted by the EPO should be either revoked or amended.\textsuperscript{17}
A valuable patent is one that earns more patent claims, patent renewals, forward-citations and self-citations for a firm than that its previous patents. Confirming what Lanjouw and Schankerman have concluded, Harhoff and Reitzig’s study infers that the possibilities of opposition increase with patent values, and that opposition is particularly frequent in areas of very active scientific research with strong patenting activity and with high technical or market uncertainty.\(^{17}\)

In addition, both studies also agree that the ownership of a sequence of technologically related innovations may increase the possibility of a lawsuit-filing decision.\(^{11,17}\) Somaya demonstrates as well that when there are more self-citations associated with litigated patents in the technological domain, it is more difficult to settle a dispute.\(^6\) Thus, when the value of patents reflects a proxy of the patentees’ interests in selective patents that carry significant commercial value, patent holders tend to file a lawsuit due to the patentee’s non-tradable strategic stakes in them.

### Table 1 — Summary of empirical studies in relation to patent enforcement in the United States

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Authors</th>
<th>Year</th>
<th>Focus</th>
<th>Empirical settings</th>
<th>Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost of litigation</td>
<td>Culter and Summers(^{37})</td>
<td>1988</td>
<td>Indirect cost and financial distress</td>
<td>Case study: Texaco and Pennzoil</td>
<td>Case study</td>
</tr>
<tr>
<td></td>
<td>Lanjouw and Schankerman(^{11,12})</td>
<td>1997</td>
<td>The determinations of patent lawsuits</td>
<td>Case study</td>
<td>Event-study</td>
</tr>
<tr>
<td></td>
<td>Yang and Zhang(^{38})</td>
<td>2001</td>
<td>The law and economic analysis</td>
<td>US FDJ</td>
<td>Literature analysis</td>
</tr>
<tr>
<td></td>
<td>Tansey and Carroll(^{16})</td>
<td>2005</td>
<td>High risk predatory litigation</td>
<td>Case study: Rambus and Infineon</td>
<td>Probit model</td>
</tr>
<tr>
<td></td>
<td>Lanjouw and Schankerman(^{13})</td>
<td>2004</td>
<td>Firms with small patent portfolios</td>
<td>US FDJ</td>
<td>Probit model</td>
</tr>
<tr>
<td></td>
<td>Somaya(^{6})</td>
<td>2003</td>
<td>Strategic determination</td>
<td>US FDJ</td>
<td>Probit model</td>
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<tr>
<td></td>
<td>Tansay and Carroll(^{16})</td>
<td>2005</td>
<td>Strategic determination</td>
<td>US FDJ</td>
<td>Probit model</td>
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<tr>
<td></td>
<td>Mutt and Yeung(^{39})</td>
<td>1996</td>
<td>The feature of complainants</td>
<td>US Section 337</td>
<td>Econometric analysis</td>
</tr>
<tr>
<td></td>
<td>Hahn and Singer(^{40})</td>
<td>2008</td>
<td>Bias in patent infringement cases</td>
<td>US Section 337</td>
<td>Law analysis</td>
</tr>
<tr>
<td></td>
<td>Lanjouw and Schankerman(^{12})</td>
<td>2001</td>
<td>Patent portfolio and its value</td>
<td>US FDJ</td>
<td>Econometric analysis</td>
</tr>
<tr>
<td></td>
<td>Somaya(^{6})</td>
<td>2003</td>
<td>Value of patent</td>
<td>US Section 337</td>
<td>Econometric analysis</td>
</tr>
<tr>
<td></td>
<td>Raghu T, et al.(^{42})</td>
<td>2008</td>
<td>The impact of stock market</td>
<td>US Section 337</td>
<td>Econometric analysis</td>
</tr>
<tr>
<td></td>
<td>Aoki and Prusa(^{43})</td>
<td>1993</td>
<td>R&amp;D decision</td>
<td>US Section 337</td>
<td>Econometric analysis</td>
</tr>
<tr>
<td></td>
<td>Lerner(^{10})</td>
<td>1995</td>
<td>Patenting behaviours and costs of litigation</td>
<td>US Biotechnology industries and US FDJ</td>
<td>Probit model</td>
</tr>
<tr>
<td></td>
<td>Chiang(^{14})</td>
<td>2004</td>
<td>Industry level competition</td>
<td>US Section 337</td>
<td>Probit model</td>
</tr>
<tr>
<td></td>
<td>Larios(^{45})</td>
<td>2009</td>
<td>Industry level competition</td>
<td>US International Trade Commission</td>
<td>Literature analysis</td>
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</table>

The Cost of Patent Litigation

Patent litigation can incur substantial direct and indirect costs. The annual median damages award ranged from US$ 1.9 million to 16.1 million between 1995 and 2011 (ref. 7). Bhagat et al. show that the common stock of a typical defendant firm declines by about 1 per cent when a lawsuit is filed.\(^{14}\) The cost of litigation may also include the assessed damages, opponent’s legal fees and court costs. Indirect costs involve considerable time-consuming documentation, which may demand ‘wasted’ financial and R&D resources in support of court actions.
In addition, preliminary injunctions in the US increase the risk and cost of defendants. Schankerman and Scotchmer repeat the same concern when investigating the strategic use of the preliminary injunctions. Given that preliminary injunctions prevent the infringers from using disputed patents in potential products during legal procedures, the cost of patent litigation is expected to increase. It seems that large corporate plaintiffs with high levels of cash flow and large patent portfolios aggressively seek injunctive relief to reduce the bargaining chips of defendants or to increase the possibilities of a favoured settlement. Lanjouw and Lerner's study confirms heavy reliance on an injunctive remedy as well.

When considering the cost of a trial in relation to the cost of settlement, the data suggests that firms will go to trial if their expected rents from legal costs are equal to or larger than the expected outcome of a settlement. One would expect that litigation actions along with their associated cost motivate the involved parties, particularly small firms, to consider whether costly litigation actually benefits patentees and whether the diversion of resources can be seen as a disincentive for further R&D investment.

**Characteristics of Patentees**

Empirical studies also illustrate distinguishing characteristics of patentees. For example, the size of the patentee and the relevant technological dominance of the parties are likely to affect the probability of litigation. If the relative size of litigants is measured by size of their patent portfolios, a cooperative resolution between disputants is likely to be produced in the case where patentees have a large portfolio of patents to trade. Compared with those with a smaller portfolio, firms with more valuable patented technologies or relatively larger patent portfolios may tend to proceed to trial while refusing settlement because of the bargaining strength due to the outlook for prevailing in the litigation. The patent portfolio is recognized as a defensive mechanism to prevent the occurrence of mutual hold-up with competitors and to ensure freedom of production and design precisely because a settlement compromise is more discretionary and less involuntary.

In addition, financial performance can be considered as an indicator of the relative size of patentees. A financially robust firm is more likely to threaten a lawsuit because it is better resourced to recover lawsuit costs over a long period of time. The indirect costs of litigation put relatively smaller firms into a disadvantaged economic position. Firms that are already handicapped by low sales or high production costs, financing and credit difficulties, inferior management and inefficient investment policy, in turn would have to face worse financial distress as a result of unsuccessful patent litigation.

Last but not the least, whether patentees are based domestically or overseas, affects the possibility of involvement in litigation. Lanjouw and Schankerman argue that the patents that are domestically owned are more likely to be involved in litigation. Not surprisingly, if the litigants originate from the same jurisdiction, a speedier resolution to the controversy is likely to be made. Cross-border patentees must take the cost of inconvenient geography into consideration. The unique distinguishing characteristics of patentees directly impact the likelihood for patent litigation to occur.

**Technological and Economic Conditions**

Technological and economic conditions affect patentees’ decisions on whether to file a lawsuit, particularly with the appearance and convergence of new areas of technology. New technology is associated with uncertainty and asymmetric information which in turn may lead to overly optimistic expectations for the benefits of patent litigation. Research by Lanjouw and Schankerman as well as Harhoff and Reitzig confirms the greater likelihood of litigation occurring in frontier technology. In addition, uncertain economic conditions lead to different expectations between parties for the estimated outcomes of litigation. The parties’ expectation is based on asymmetric information and diverse expectations for acceptable economic returns from legal action. For example, a firm may pursue a ‘do or die’ litigation campaign with low potential for success against a larger rival as in the Rambus case, where the accuser, Rambus, in fact successfully challenged Infineron, a market leader.

To sum up, from a sufficient number of empirical studies that have been conducted, certain observations and analysis of a limited number of selected studies have been made in order to identify market and economic factors external to the parties that affect patent enforcement strategies.

**Integrative Framework Development and Propositions**

An integrative framework for comprehensively addressing international patent enforcement strategies
should focus on four dimensions: the cost of litigation, the features of litigants, technological economic conditions and innovation activities. No overarching framework exists to help in understanding the components of trade-relevant patent enforcement and the manner and methods by which firms strategically manipulate litigation action. One of the questions raised is: Under what circumstances might the issues or stylised factors described above be beneficial to a theoretical foundation for the development of further propositions? There are at least three factors to consider: the philosophical orientation, researchers’ preferences and the sufficiency of empirical studies.

Integrative Framework Development

Contrary to the philosophical stance, this study takes a critical realist stance to decipher the strategic implications of patent enforcement. Critical realism considers reality much more complex than what could be observed. What happens in any particular situation is determined by a wide variety of different and conflicting mechanisms. Complex circumstances make it difficult to precisely identify the causes of any event. From a critical realist’s point of view, social theory sorts out relationships that can only be perceived in a social context and thus are not always empirically adequate. Hence, this study develops a general proposition, while carrying out exploratory work on the analytical framework under a philosophy of critical realism. This study identifies a number of key components that influence strategic patent enforcement decision making. The key components, including the cost of litigation, characteristics of litigants, technological economic conditions and the area of innovation activities, may indeed determine the strategic implications of a statistically significant number of firms’ patent enforcement actions.

The general proposition (Fig. 1) suggests that compounded patent protection factors may increase the incentive for strategic manipulations of patent litigation, especially in the context of cumulative technologies. The general proposition can be broken down into a number of more precise hypotheses by considering the limited amount of previous empirical evidence and the great variety of variables analysed.

Proposition Development

With the basic understanding of an integrative framework relevant to patent enforcement which takes into account litigation costs, litigant characteristics, technological economic conditions and the specific area of innovation activities, an appropriate proposition with which to analyse and explore the complexity of patent enforcement strategies can be developed.

Strategic Implications of Patent Litigation

Regardless of their size, strength or technological capabilities, firms appear to be at a disadvantage when competing in an unfamiliar market where an unknown institutional environment usually breeds uncertainty that changes the balance of negotiating strength between foreign and domestic firms. Foreign firms, therefore, tend to avoid being drawn into protracted litigation disputes if a settlement agreement can be reached. In addition, foreign firms also face trade sanctions in the form of patent enforcement from their own governments. Domestic firms recognize that trade sanctions can be efficacious not only for patent rights protection, but also for gaining relief from import competition. A number of issues arise: How do complainants act in the litigation process? Do complainants threaten legal action against competitors with favourable settlement before such actions actually begin to proceed? Is such behaviour strategic?

Prior literature suggests that the availability of different levels of protection may increase the strategic response of firms. Thus, firms may pursue legal actions, such as preliminary injunctions and lawsuits in the civil courts simultaneously, pressing for a trade investigation. Given that a preliminary injunction prevents the alleged infringers
from using disputed patents in potential products during legal proceedings, the cost of patent litigation would be expected to increase.\textsuperscript{39}

In addition, while trade relevant protection is available for domestic firms, the strategic parameters relevant to foreign firms are relatively limited. The potential efficiency of trade sanctions may also be attractive to firms strategically as a viable alternative. Uncertainty about the legal environment may result in excessively conservative expectations and therefore firms may become more selective when deciding which patents to defend. If an importer’s product is potentially threatened and in danger of exclusion, complaints may be filed as trade sanction actions along with civil lawsuits in order to create more uncertainty. The following propositions are therefore made:

Proposition 1: Domestic firms are able to take legal action not only in civil court, but also in trade sanction, to compete against foreign companies. As a result, patentees may institute legal action in both jurisdictions (in civil courts and with trade sanction agencies) to increase their advantage.

Proposition 2: Given a potential legal disadvantage, foreign firms may settle disputes before complainants institute further litigation.

During the course of a costly litigation process, the decision about whether to settle or continue with a trial must take business risk into consideration. One possible outcome of the litigation is that although significant litigation expenses may be incurred, settlement may be at a lesser amount than the anticipated cost of a lawsuit. For a foreign company, such a possible settlement will be desirable but the outcome is uncertain and unpredictable. Therefore, the question to be addressed is: To what extent should a foreign competing firm continue to defend a lawsuit based on the cost of litigation, their innovation activities, the characteristics of patentees and the economic conditions and technological conditions? By fully considering the limited amount of previous empirical evidence, a number of more precise propositions, in relation to each stylised factor are proposed below.

Cost of Litigation

Several studies have attempted to present a stylised model on the tendency of filing litigation and found that whether the litigant decides to continue the legal action depends on the comparative value between the expected benefits and cost of taking a case to trial.\textsuperscript{14,15}\textsuperscript{45}

Thus, both direct and indirect costs of litigation have the potential to change the balance of the negotiating power between defendants and plaintiffs. Direct costs (e.g. attorney fees) are large and necessary, whereas indirect costs may increase because of the strategic implications of patent litigation made by the complainants and defendants.

Given that trade sanctions prevent the alleged foreign infringers from using contested patents in potential products, litigation costs can be expected to increase for defendants.\textsuperscript{39,44,48}\textsuperscript{49} Cost increases, particularly, are probable in the case where technologies are cumulative and the patent is employed as a blocking mechanism to discourage competitors from entering indigenous home markets.\textsuperscript{43} Therefore, a trade sanction investigation may incur either a loss of market share and sales or damages in business reputation.

Proposition 3: The indirect cost of litigation may increase when firms strategically employ the use of patent litigation as a blocking mechanism.

The Size of Patent Portfolio and Financial Assets

The strategic management of patent litigation is affected by unique distinguishing characteristics of the patent-holders. For example, compared to firms with different financial capacities, a large firm with sufficient financial assets is more capable of recovering from all the costs over a lengthy lawsuit.\textsuperscript{13,14} A large firm can commit a larger quantity of resources to steadily build up its level of innovation activity. On the other hand, a small company may only be able to pursue occasional innovation activity due to its limited financial resources.

Prior research has suggested that the size of patent holders is likely to affect the probabilities of litigation.\textsuperscript{6,13,38} As Lanjouw and Schankerman state, costly litigation carries a disadvantage for small firms.\textsuperscript{13} This is because firms with a larger patent portfolio are more likely to settle with complainants if cross licence agreements or other market-expanding alternatives can be negotiated. Mutti and Yeung offer a detailed look into trade sanction Section 337 cases (from 1980 to 1991), which involve publicly traded complainant firms. It was found that the firms filing Section 337 cases tend to be larger, have greater product range and have higher R&D expenditures.\textsuperscript{39}

However, the literature provides no comparative market value data to quantify the patent value difference between plaintiffs and defendants.\textsuperscript{48,49} Foreign competitors may or may not have a patent
portfolio with high value in their home country. The patent portfolios of a foreign firm may be stronger or weaker than a competing domestic firm. Multinational firms may seek to build a patent portfolio over a targeted market segment as a defensive tactic. Thus, the asymmetric information resulting from geography and the diverse expectations about trial outcomes may encourage domestic firms to file a lawsuit against foreign competitors, leading to the following hypothesis.

**Proposition 4:** The (financial assets and patent portfolio) size of patent holders may affect complainants’ decision on whether to file a lawsuit. Relative strength may also affect defendants’ decision on whether to accept non-settlement offers. However, the diverse expectations about the disputes’ outcomes, resulting from geographical differences, need to be taken into consideration, as country specific factors become influential when deciding whether to take enforcement actions.

### Value of a Patent

When patented technologies cannot be commercialized, patent values decline or they become ‘sleeping patents’.³⁴,³⁵ In contrast, if patented technologies can be commercialized, the patents have a monetized value that can denominate the home country’s currency. Patented technologies are embodied in trade relevant products implicating trade relevant protection concerns. In other words, patentees who believe they possess commercially valuable patents that are likely to give high returns are more willing to act more quickly to defend those patents against infringement. The key question relevant to trade sanctions to be addressed is: Do infringement actions occur more often because the patent values under trade sanction investigation actions are expectedly higher or because imported end products are involved?

The true value of a patent is achieved when manifested in a product. If patentees consider a competitor’s use of their intellectual property an infringement, the patentee has the right to challenge the alleged infringement in court. If such an action results in a finding of infringement as a matter of law, the same patent cannot be revoked by further lawsuits challenging its validity in the US. If the courts hold that the challenge is invalid and the conduct of the defendant does not amount to infringement then the court delivers a strong message warning of potential costly consequences to other possibly infringing competitors that the patent, which has been challenged, cannot be revoked by invalidation patent lawsuits. In relation to trade sanction investigation, the key question to be addressed is: Are such challenges made because a trade sanction gives a higher patent value or is it because these patents are integrated as imported end products?

Trade sanction actions tend to estimate higher patent value than federal district court actions.³⁹,⁴¹,⁴³,⁴⁴ Therefore, since trade sanctions tend to precede patent enforcement in a swift manner, firms, particularly those involved with cumulative patented technologies, tend to use trade sanctions to deter competition. In other words, depending on where a patent falls on the spectrum of values, the strategic considerations will differ from one case to another, leading to the following proposition.

**Proposition 5:** When complainants expect high patent value, they may be more willing to take legal action with trade sanction rather than other alternatives.

### Innovation Activities

Prior research suggests that the use of patent protection varies amongst industries. Patents have been utilized in different ways according to whether they relate to simple technologies or complex technologies.²,²⁵,⁵⁰ In some industries, such as the chemical sector, patents are crucial to the appropriability of technology.¹⁸ However, for those who are dealing with complex technology, firms need to integrate other components of end product. A portfolio of patents can be used strategically to trade with or intimidate competitors. As suggested by Ziedonis, the multi-hold up occurs when competing firms with components of patents strategically isolate new market entries often by refusing to cross license.⁴ Hence, within industries involving complex technologies, firms may leverage patent protection as an isolating mechanism to raise barriers to entry by blocking new competitors.

Furthermore, nowadays patents play a role in the management and strategic mechanism. Patents influence not only the R&D process and the physical infrastructure location determination but also the knowledge development generally of firms.²,¹⁰ The process of innovation, the system of patent protection and the commercialization process have become very complex and the impact of litigation on innovation activities is very difficult to estimate. A number of issues arise: Does the threat of litigation affect foreign firms’ patenting behaviours in markets they aim to
penetrate? Is the R&D decision or physical infrastructure location determination influenced by litigation actions?

Because it is difficult to explore a quantifiable impact of litigation on innovation, the literature consulted has suggested that the R&D decision and patenting behaviour is likely to be affected by litigation. Previous studies show that the complexity of technologies may affect patenting and innovation behaviours. Moreover, Aoki and Prusa found that patent protection, based on US trade sanction (Section 337) investigations, may affect the level of investment in R&D. On the basis of these empirical studies, the following proposition is therefore made.

**Proposition 6:** When complex technologies are involved, an effective trade sanction may encourage firms to use patent enforcement as a strategy to prevent competitors from entering their main markets.

**Conclusion**

In the course of the contextual analysis of patent enforcement, the literature related to patent enforcement has been closely reviewed. The review commenced by discussing the debate over the impact of patent strategies on innovation activities. Attention was drawn to discussions and analysis of various empirical studies focusing on legal action associated with patent protection from a firm’s points of view. In particular, firms with cumulative technologies were examined. In the context of cumulative technologies and reorganization of patent strategic behaviours, issues related to strategic implications of patent enforcement were highlighted.

One strategic response a threatened patentee can consider is the decision to undertake legal procedures. The decision-making process addresses how litigants elect to settle their disputes; one alternative always available for consideration is to cooperate and settle with the opposing party. With settlement in mind, the stylised factors were identified from various empirical studies of patent litigation, including the value of patent, the cost of patent litigation, characteristics of patentees and technological and economic conditions, in order to develop propositions regarding the inter-relationships between these determinants and the strategic implications of patent litigation when trade sanction is available for domestic firms.

Given that the economic models of legal disputes can be used as analytical tools to predict the determinants of filing a lawsuit or whether there will be a decision made for settlement, conclusions need to be carefully examined on the implications of patent litigation. Detailed discussion of such theoretical studies is beyond the remit of this study. A further in-depth meta-analysis is called for. This paper, instead, focuses on strategic issues related to the components of patent enforcement. In this regard, compared with civil or other legal actions, patent litigation is distinctive because of the technical aspects associated with the infringed patents. The characteristics of high tech patent infringement lawsuits require future research to take industry-specific technologies into account. To sum up, the current findings are preliminary and must be considered as starting points for further research and debate. The main contribution of this paper lies in the comprehensive presentation of the issue of the strategic use of patents. Cross-border trade disputes are highlighted and insights from various empirical studies are synthesized into an integrative framework and the development of testable propositions.

**References**

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