

Financial Market Reactions to Patent Litigation: An Event Study of Litigation in Korea*

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This paper investigates patent litigation in Korea to examine how the stock market responds to a patent litigation announcement and determine whether the response is consistent with the final litigation outcome. Employing an event study methodology, we investigate cumulative abnormal returns (CARs) based on various litigant characteristics and find a strong and negative stock market response to a litigation announcement, especially towards patent owners and small firms. The final outcome of litigation for a small innovator is negatively correlated with a stock market response, even when the patent is found valid and the owner wins the case. This implies that small innovators are more likely to experience a negative response from the stock market, and they are much more vulnerable to patent litigation, paying additional fringe costs to protect their intellectual properties. The study suggests a policy implication in which the litigation process needs to consider such disadvantages to small innovators as a means of improving procedural fairness in patent litigation.

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I. Introduction

Patent litigation is an important part of today's corporate life. Once a firm is involved in litigation, it incurs many forms of direct and indirect business costs. It takes a considerable amount of time to prepare documents, give depositions, and negotiate with the parties involved. Indirect business costs could be even more

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substantial when investment is delayed due to uncertainty in litigation outcomes (Bessen and Meurer, 2007; Raghu et al., 2008).

The relative burden of litigation costs can be greater for smaller firms or patent owners than for large conglomerates. A lengthy litigation process may entail substantial financial costs to smaller litigants having a small patent portfolio and deteriorate firm reputation, ultimately ruining the firm's performance. The costs can also be greater for patent owners because those firms are more willing to bear higher costs to protect their patents if the patents under litigation are critical to future growth potential.

A few studies provide indirect evidence that the effects of litigation may not be even. Lanjouw and Schankerman (2004) argue that litigation risk is much greater for patents owned by individuals and firms with small patent portfolios and suggest that small patentees are at a significant disadvantage in protecting their rights because their greater litigation risk is not offset by a more rapid resolution of their lawsuits. Lanjouw and Lerner (2001) also address that preliminary injunctions in patent cases tend to be used as a useful 'predatory device' by large firms hoping to impose financial distress on smaller rivals and to discourage R&D by small firms. Lerner (1995) studies the research programs of biotech firms and finds that small firms tend to avoid R&D in areas where the threat of litigation from larger firms is serious. This means that the effect of litigation can be heterogeneous across firms, and small patent owners could be at a disadvantage from litigation.

This paper investigates stock market responses to patent litigation announcements and examines how a litigation announcement is incorporated into the stock market's firm valuation. We specifically examine whether the stock market reaction has any statistically significant differences with the types of litigant and litigation, such as litigant status (plaintiff vs. defendant), patent ownership, and firm size, among others. We expect that an efficient forward-looking financial market may rapidly reflect the changes in expected gains or losses to the plaintiff and defendant. If a patent litigation entails an asymmetric effect, then it will provide direct empirical evidence through stock market responses.

There exists an extensive body of literature on stock market responses to patent litigation, but the findings are limited and far from conclusive. A few studies find that litigation imposes economic damage on both sides, but the effects are not statistically significant. Other studies conclude that plaintiffs receive positive responses from stock markets when they win but experience moderate or negative responses when they lose from litigation (Bhagat et al., 1994; Bizjak and Coles, 1995; Lerner, 1995; Koku et al., 2001; Bessen and Meurer, 2005; Marco, 2006; Bessen and Meurer, 2007; Raghu et al., 2008). However, these studies categorize litigants simply as plaintiffs versus defendants without considering more detailed heterogeneity across firms and focus on the overall financial effects of litigation. Although these studies provide useful information on stock market response, they

limit our understanding of the effects of litigation on firm innovation activities. Furthermore, most studies have serious data limitations, as they usually involve a small number of firms.¹

This study extends previous studies in the stock market literature by incorporating firm heterogeneity and financial market responses to patent litigation and investigates whether there exist any asymmetric effects across firm characteristics from litigation. We believe this issue is important because patent litigation is the final instrument available to protect an inventor's intellectual property. Furthermore, if patent litigation imposes an asymmetric burden on firms due to direct and indirect costs during the litigation process, then it will eventually discourage innovation activities in the innovation market. The potential possibility of opportunistic motivations by larger firms is also an important concern for small innovators. However, this issue has not yet received much attention, and solid empirical evidence on the asymmetric effect of litigation is rare due to a lack of data. We test this hypothesis by constructing a comprehensive dataset on patent litigation, firm financial status, and stock market response. This study, to the best of our knowledge, provides the first empirical evidence on stock market responses to patent litigation.

We employ all interfirm patent litigation cases that occurred in Korea from 1987 to 2011 and link them to firm financial data and stock market information around the filing dates of the cases. This study resolves firm heterogeneity and the serious data limitation problems in previous studies and provides a more comprehensive understanding of the effects of patent litigation.

The empirical results found a strong and negative market reaction towards defendants upon the announcement of litigation but did not find a statistically significant positive response towards plaintiffs. This means that patent litigation is, in general, a negative-sum game with social welfare leakage. However, the negative stock market responses are limited to defendants only when they are patent owners and small firms. The study further finds that the stock market response towards small patent owners is negatively correlated with the outcome of litigation even when their patents are valid and win the case. This means that the stock market responds to a litigation announcement by taking into account heterogeneity in firm status, and small patent owners are at a disadvantage from the litigation announcement. In other words, the stock market weighs against patent ownership and small firm size when litigation news breaks out.²

¹ One notable exception is Bessen and Meurer (2007), who identified 2648 patent litigations in the U.S. from 1984 to 1999. Their work focused on “infringers” and found the alleged infringers to have lost approximately half a percentage point of their stock market value, a substantial loss.

² Conflicts over patents, on the other hand, always turn out to be good news for nonpatent owners, regardless of whether they act as plaintiffs or defendants. We thank an anonymous reviewer for this comment.

The findings reveal another previously unexploited channel through which the patent litigation system may be more detrimental to small innovators. If a small innovator is involved in patent litigation, then she will likely suffer more from economic damage in the early stages of litigation and was more likely forced to settle the case from the fear of being involved in litigation. This is equivalent to an *ex post* innovation tax caused by the stock market reaction to small innovators under litigation and eventually leads to a decrease in the *ex ante* innovation effort (Somaya 2003; Lanjouw and Schankerman 2004; Bessen and Meurer 2005, 2008; Leiponen and Byrna 2009; Weatherall and Webster, 2014 for a survey).

The remainder of this paper is organized as follows. In Section 2, we provide a brief review of the Korean patent litigation system. Section 3 explains our data and methodology. Section 4 examines the stock market reaction to firms upon the announcement of litigation and its power in predicting the final litigation results. Section 5 concludes our study.

II. Patent Litigation System in Korea

The patent litigation system in Korea has three procedural venues, namely, the Intellectual Property Tribunal (IPT), the Patent Court, and the Supreme Court. The IPT is independently operated by the Korean Intellectual Property Office and functions as the first-instance trial. A trial board of the IPT makes decisions based on a majority vote by three administrative patent judges. A common belief is that IPT is cheaper and quicker than litigation in court, and a decision by technology experts possessing knowledge of intellectual property law results in reliable decisions for the parties. After the ruling by the IPT, if the claimant does not appeal to an appellate court, then the IPT decision becomes final.³ Only after receiving a ruling from the IPT can the applicant/agent appeal to a higher court (the Patent Court and, eventually, the Supreme Court). The Patent Court has exclusive jurisdiction over all appeals from decisions rendered by the IPT.

The IPT deals with two types of trial: *ex parte* cases and *inter parte* cases. *Ex parte* cases are trials against a Decision of Refusal (Patent Act Article 132-17). When an applicant has received a rejection from an examiner, the applicant may file an appeal within 30 days from the date of receipt of the examiner's decision. As our main goal is to examine the effect of patent litigation announcements on stock market response, we have excluded *ex parte* cases from our analysis.

Meanwhile, *inter parte* cases include the *trial for invalidation (invalidation trial)* and the *trial to confirm the scope of a patent right (confirmation trial)*. When a patent may have been granted by mistake, an interested party or a patent examiner may

³ In Korea, the plaintiff and defendant at the IPT are called the claimant and claimant, respectively.

request a trial to invalidate the patent.⁴ When the validity of the patent in question is part of an infringement trial, the court may suspend proceedings of the infringement trial until an invalidation trial is concluded.⁵

A patent owner or an interested person may also request a *trial to confirm the scope* of a patent right.⁶ The *trial to confirm the scope* includes two types: *active confirmation trial* and *passive confirmation trial*. An *active confirmation trial* is a trial in which an existing patentee claims that her patent is infringed upon by a later invention, whereas a *passive confirmation trial* is a trial in which a later inventor claims that her invention does not fall within the scope of an existing prior patent. Therefore, in an *active confirmation trial*, the prior patentee is the plaintiff, while in a *passive confirmation trial*, the later inventor is the plaintiff. In practice, when a patent owner files for an *invalidation trial* or for an *active confirmation trial* against the later inventor, the later inventor usually files for a *passive confirmation trial* against the prior patent owner in response.

The two major differences between *invalidation trials* and *confirmation trials* are as follows. First, a *confirmation trial* is a dispute between two inventors over *utilization by later inventions*, but an *invalidation trial* does not require such a relationship, i.e., it can be initiated by a patent examiner or an interested third party. Second and more importantly, a *confirmation trial* does not judge the validity of the focal patent, as it only judges whether the later invention infringes on the focal patent or whether the two inventions are in a *utilizing relationship*. A utilizing relationship is established when the later invention utilizes all technical ideas and elements of the prior (or *utilized*) invention but adds new technical elements that are not obvious to a person skilled in the art (Supreme Court, 92hu1660). In other words, even if the patent owner loses the case in a *confirmation trial* (either *active* or *passive*), it only indicates that the later invention does not infringe on her patent, not that her patent is invalid. As *confirmation trials* do not involve a ruling on the validity of the patent, the economic impact of *confirmation trials* on the patent owner is, in general, expected to be weaker than that of an *invalidation trial*.⁷ Table 1 provides definitions of trials and the status of the patent owner along with suit types.

⁴ Any party may also request a *patent opposition* within six months of publication of the grant of the patent, claiming that the patent in question should be revoked based on prior art.

⁵ Korea practiced a two-tier (bifurcate) litigation system up to 2015, consolidating them into the Patent Court thereafter.

⁶ Austria and the United Kingdom have a trial to confirm the scope of a patent, similar to Korea's proceedings, whereas the U.S., Japan, Germany, France, and China do not have this kind of trial.

⁷ However, a caveat should be considered. If the later invention is also patented, then rulings from an active confirmation trial may render the later patent as *de facto* invalid. Thus, an ongoing legal controversy regarding this unintended consequence of the *active confirmation trial* arises, as the Korean Patent Act requires that patent invalidation can only be ruled upon during an *invalidation trial*.

[Table 1] Definitions of Trial Types, and the Status of the Patent Owner

Type of Trial	Definition	Status of Patent Owner	Judgement of Patent Validity
Invalidation	An interested party or a patent examiner requests a trial to invalidate the patent	Defendant	Yes
Passive confirmation	A later inventor claims her invention does not fall within the scope of an existing patent	Defendant	No
Active confirmation	An existing patentee claims her patent is infringed upon by the later invention	Plaintiff	No

III. Data and Methodology

3.1. Data

The main purpose of the study is to investigate whether a patent litigation announcement has any heterogeneous effects on the stock market and to test whether the stock market response is predictive of the final outcome of litigation. We collect all patent litigation cases in South Korea from 1987 to 2011, focusing on firms that are publicly listed on one of the two main Korea stock exchanges: the Korean Securities Dealers Automated Quotations (KOSDAQ) and the Korea Composite Stock Price Index (KOSPI). The dataset provides rich information regarding the litigations, featuring information on the firm's litigant type (plaintiff/defendant), the firm's code, the date of the event, the type of lawsuit, the patent involved in the case, and the decisions from all three courts (if it goes to higher courts). The litigation data are matched with each firm's financial information as retrieved from the Korea Investors Service–Financial Analysis System (KIS-FAS).⁸

For the study, we collect daily stock returns for each firm for up to 270 days prior to the day the trial is announced and for 30 days following the announcement. Stock returns prior to the event day are used to calculate the expected returns during the event period. Some firms are not publicly listed for a sufficient period before the event day. For the calculated expected return to be reliable, we drop from the dataset those firms with less than 100 trading days before the event day. Please refer to Appendix A for a brief discussion of how the final dataset is constructed.

After data cleaning, 635 cases spanning 1987 to 2011 remain. As we include firms publicly traded only on the main Korea stock markets, we do not have many firm

⁸ Unfortunately, we only have data on litigation cases that went through a full legal procedure. We do not have information on cases settled out of court.

litigation pairs (two firms in the same case). Out of all the litigation cases, we find only 40 litigation pairs (80 observations) of cases that have two firms in the same case (one as the plaintiff and the other as the defendant). This feature in the data has two implications. On the downside, we have limited insights into the combined market returns of the firms involved in litigation. For the upside, we do not have to worry about contemporaneous correlations across our observations, as most of them do not involve the same lawsuit, and relatively few of them fell in the same event window.

A breakdown of the cases by trial type and litigants is shown in Table 2. In the sample, invalidation trials are the majority, constituting 63% of all litigations. The active confirmation trial, which argues infringement of later invention but does not address the invalidity of the patent, is 12.6% of the cases, which is one-fourth the number of invalidation trials. This circumstance is understandable because inventors, in general, prefer an invalidation trial to an active confirmation trial, where the plaintiff has to prove that the later invention is in a utilizing relationship with the invention in all its elements. The economic impact of the confirmation trial when the plaintiff wins is weaker because it does not invalidate the patent of the later invention.

[Table 2] The Number of Cases by Trial Type and Litigants

Trial Type	By Litigant		Total (%)
	Defendant	Plaintiff	
Invalidation	179	221	400 (63.0)
Passive confirmation	63	92	155 (24.4)
Active confirmation	57	23	80 (12.6)
Total for each type of litigant	299	336	635 (100)

The data include roughly equal numbers of defendants and plaintiffs. However, as explained above, they are generally not paired in litigation. Notably, the number of defendants in active confirmation trials is larger than the number of plaintiffs (57 vs. 23), whereas in passive confirmation trials, the reverse is true (63 vs. 92). In active confirmation trials, a plaintiff can file the lawsuit against multiple later inventors. By contrast, in passive confirmation trials, multiple plaintiffs can file a lawsuit arguing that they do not infringe on a prior invention.

We match the financial information of the litigants with the litigation information, which includes industry classification, sales, number of employees, tangible and intangible assets, market capitalization, and market share of the firm in the industry.⁹ Table 3 shows that the number of defendants on average is higher

⁹ Market share is the share of sales out of total industrial sales based on three digits under the 9th Korean Standard Industrial Classification (KSIC-9). KSIC comprises 21 sections, each denoted by a single letter from A to U. The sections are broken down into divisions (denoted by two digits). The

than the number of plaintiffs in almost every aspect, especially in terms of labor, intangible assets, and market capitalization.

[Table 3] Summary Statistics by Litigant Type

	Defendants	Plaintiffs
Sales (KRW)	4.31×10^{12} (5.15×10^{11})	4.27×10^{12} (5.75×10^{11})
Number of employees	8181 (883)	6067 (720)
Market share (%)	18.29 (1.36)	14.53 (1.14)
Tangible assets	2.00×10^{12} (3.18×10^{11})	1.81×10^{12} (2.70×10^{11})
Intangible assets	1.24×10^{11} (2.62×10^{10})	7.67×10^{10} (1.73×10^{10})
Market capitalization	5.62×10^{12} (8.90×10^{11})	3.48×10^{12} (6.05×10^{11})
Size of patent portfolio	1.14 (0.02)	1.13 (0.02)
N	299	366

Note: 1. Standard error is in parentheses.

2. Market share is measured by share of sales out of total industrial sales (three digits) based on the 9th Korean Standard Industrial Classification (KSIC-9).

3. Size of the patent portfolio is the number of patents involved in litigation.

3.2. Methodology

The main objective of this study is twofold. We first measure abnormal returns for the litigating firms to see if any statistically significant differences based on the type of litigant and type of litigation are found. Then, we evaluate how accurately abnormal returns at the time of the litigation announcement are correlated with court decisions. The measurement of abnormal returns is hence the key part of the study because properly estimated abnormal returns are analyzed and used in the second part.

3.2.1. Measurement of Abnormal Returns

To measure market reactions to the two parties from the announcement of patent litigation, we adopt the event study methodology and examine the abnormal

divisions are further categorized into groups (three digits), classes (four digits), and subclasses (five digits).

changes in equity values induced by the litigation event (Schwert, 1981; Brown and Warner, 1985; MacKinlay, 1997). An abnormal return is the actual *ex post* stock return over the event window minus the “normal return” of the firm over the same period. Normal return is defined as the expected return under normal market circumstances (without the event occurring).

The first step is to fit a model of the expected return of the firm by using the average daily market returns in a period before the event occurred, also called the “*estimation window*”:

$$R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it} \quad (1)$$

where R_{it} is the return for a particular firm, i , on day t , and R_{mt} is the market return (compounded return on a market portfolio) on the same day. The model assumes a stable linear relation between the market return and the individual stock return and uses a sufficiently long pre-event window to fit the coefficients. The abnormal return (\widehat{AR}) caused by the event is then measured as the residual between the realized stock return on the event day (or over the event window) and the expected stock return during the same period, as fitted from Equation (1).

$$\widehat{AR}_{it_0} = R_{it_0} - \hat{R}_{it_0} \quad (2)$$

where t_0 is the date of the event, and $\hat{R}_{it_0} = \hat{\alpha}_i + \hat{\beta}_i R_{mt_0}$. In this study, we set the day of the litigation announcement as day 0 and use day -270 to day -15 as the estimation window to calculate the expected returns around the event day for each stock. For firms that have fewer than 270 trading days, we use all the days that are available. We drop roughly two weeks leading to the event to mitigate the concern of possible information leakage. A key assumption of the event study method is that the change in the firm’s market value around the time of the litigation announcement reflects investors’ estimates of the effects of the litigation on the profits of the firm and does not systematically reflect any unrelated information. Note that this assumption will be violated when the firm has another recent litigation before the current litigation. In light of this, we drop observations that have other litigations in the prior month. Please refer to Appendix A for details.

We can conveniently combine the estimation and event window together and run the dummy variable regression to obtain the abnormal returns from the coefficient of δ .

$$R_{it} = \alpha_i + \beta_i R_{mt} + \gamma_i \cdot \delta + \varepsilon_{it} \quad (3)$$

where the variables are defined in the same manner as in Equation (1). We add a

dummy variable δ , which equals 1 on the event day (or event days) and is zero for the estimation window. The dummy variable model fits the data by assuming an “abnormal” jump on the event day while maintaining the relationship between the firm’s return and the market return. Given that the estimation window is much longer than the event window and with the assumption that abnormal returns are not extreme, the estimation of α_i and β_i will be mostly driven by the estimation window and are not greatly influenced by returns around the event. In this case, the calculated abnormal return, $R_{it} - \hat{R}_{it}$, from Equation (1) will be very close to the estimated $\hat{\gamma}$ from Equation (3). The coefficient γ gives us the abnormal return on the event day. The benefit of using Equation (3) in the estimation is that we not only obtain the abnormal return but also conveniently derive the standard error of the abnormal return for each observation.

The cumulative abnormal returns (CARs) over several days are calculated as the sum of the abnormal returns over these days. Equivalently, we can set the dummy variable δ in Equation (3) to 1 for all days in the event window to obtain the average daily abnormal return. Multiplying this number by the number of days in the event window gives us the CARs. The variance in the CARs can also be approximated as the variance of the average daily abnormal return multiplied by the square of the length of the event window.

$$\begin{aligned}\widehat{CAR}_i &= \sum_{t=0}^T \widehat{AR}_{it} = T \cdot \overline{AR}_{it} = T \cdot \hat{\gamma} \\ \widehat{Var}(CAR)_i &= \sum_{t=0}^T \widehat{Var}(AR_{it}) = T^2 \widehat{Var}(\overline{AR}_{it}) = T^2 \widehat{Var}(\hat{\gamma})\end{aligned}\quad (4)$$

The estimated variance is an approximation because of the intertemporal correlation across the event days (i.e., the correlation between abnormal returns of consecutive days). Even though the true abnormal returns are independent through time, the estimated abnormal returns are serially correlated because they are estimated using the same $\hat{\alpha}_i$ and $\hat{\beta}_i$. The accuracy of the approximation depends on the ratio of the length of the event window to the length of the estimation period. A smaller ratio results in a more accurate approximate standard error. In our study, the event window covers fewer than 10 days, while the estimation period lasts for approximately 300 days. Therefore, intertemporal correlation is not a major concern.

For the last step, we need to calculate the aggregate average CARs (ACARs) for all observations to understand the aggregate effect of the event on a firm’s market performance. As most of the observations in our data are not firm pairs in litigation lawsuits and the litigation dates have a wide range from 1987 to early 2011 such that overlaps in event windows are rare, we do not need to worry about contemporaneous correlation across the events. Therefore, we assume

independence across firm-litigation events, and we estimate abnormal returns separately for each event. The sample aggregate average (cumulative) abnormal return across observations of the litigation event is the mean of the CARs of all observations. The variance in ACARs can be computed similarly using the property that CARs from different observations are independent.

$$\begin{aligned}\widehat{ACAR} &= \frac{1}{N} \sum_{i=1}^N \widehat{CAR}_i \\ \widehat{Var}(ACAR) &= \frac{1}{N^2} \sum_{i=1}^N \widehat{Var}(CAR_i)\end{aligned}\quad (5)$$

3.2.2. Testing the Consistency of Market Reactions

If the market incorporates information about litigation, then the market reaction during the period of the event will be consistent with the final litigation outcome. We test this hypothesis by regressing the court trial outcomes on the CARs during the litigation period. The regression equation is as follows:

$$Outcome_i = \alpha + \beta \cdot CAR_i + \eta \cdot D_{p.o.} + \gamma \cdot X_i + \varepsilon_i \quad (6)$$

where $Outcome_i$ is a binary indicator that takes the value 1 if a firm won the litigation case and zero otherwise. How $Outcome_i$ is determined is discussed in more detail in Section 4.2. CAR_i is the cumulative abnormal return for firm i over the event window. X_i controls for firm characteristics, including sales, labor, market share (variables roughly measuring the size of the firm), the number of prior IP lawsuits (which measures the experience of the firm faced with litigation), and the number of patents involved in the case (which measures the stake of the case). The dummy variable $D_{p.o.}$ indicates whether the litigant is the owner of the patent in dispute.

One technical complexity in this work is that the regressor CAR_i in the model is estimated from the coefficient in Equation (3). As we estimate Equation (6) with generated regressors from another regression, such a two-step strategy may lead to biased estimation. The canonical solution is to estimate equations (3) and (6) jointly (Barro, 1997; Leiderman, 1980; Mishkin, 1982). However, in our case, although the regressor CARs are estimated as the coefficients from Equation (3), we show in Section 3.2.1 that they can be equivalently derived as the residuals from Equation (1). That is, we regress the outcome variable on the abnormal part of the firm's market return, which is derived as residuals from the first-stage regression. The problem falls into the domain of residual-generated regressor models, and econometric properties can be conveniently used for such models (Sargent, 1976).

Following the discussion in Pagan (1984), the OLS estimates of β and its variance are both consistent in the second-stage regression, as long as we do not include any regressors that are used in the estimation of the first-stage model, i.e., Equation (3).

IV. Results

4.1. Market Reactions to Litigation: Cumulative Abnormal Returns

Table 4 shows the aggregate average abnormal returns for the litigating firms on the event day. The abnormal returns for each firm are computed with Equation (3), and we obtain the estimated coefficient γ with its variance. The mean and standard errors of the aggregate abnormal returns are calculated with Equation (5). We separate the parties based on litigant and litigation type and on whether the firm is the patent owner.

[Table 4] Average Abnormal Returns from Different Types of Litigants and Lawsuits on the Event Day for the Patent Owner and the Non-Owner (%)

	Patent Owner	Non-Owner	Difference-in-means Test
Defendants	-0.35* (0.20)	0.77* (0.44)	2.32**
N	242	57	
Plaintiffs	0.33 (0.65)	0.47*** (0.18)	0.21
N	23	313	
Invalidation trial	-0.46** (0.23)	0.42** (0.21)	2.83***
N	179	221	
Passive confirmation trial	0.02 (0.41)	0.58* (0.34)	1.05
N	63	92	
Active confirmation trial	0.33 (0.65)	0.77* (0.44)	0.56
N	23	57	

Note: 1. Standard errors are in parentheses.

2. *, **, and *** indicate statistical significance at 10%, 5%, and 1%, respectively.

The empirical results are broadly consistent with the previous literature.¹⁰

¹⁰ Another method is to use the estimated variance for individual CARs as weights for the CARs to calculate weighted abnormal returns. Intuitively, as CARs are estimated values, we allocate higher

Plaintiffs generally fare better than defendants after the announcement of litigation, while the results for defendants are mixed, depending on patent ownership. When we classify the firms based on patent ownership, the stock market shows a statistically significant positive response to plaintiffs when they are not patent owners (0.47% in abnormal returns, p value < 0.01), whereas the market demonstrates a moderate reaction to a patent owner. An interesting finding is that the stock market tends to react negatively to defendants when they are patent owners (−0.35% in abnormal returns) and reacts positively to non-owners. This finding implies that patent owners generally fare worse than non-owners for the same type of litigation, and the stock market further brings constraints to patent owners when they consider the possibility of going to court.

We divide the cases even further based on the type of litigation, and the lower three lines of Table 4 present the regression results for the different types of litigation and patent ownership. The results confirm our findings from the previous analysis on CARs for plaintiffs and defendants and provide interesting insights regarding the type of litigation. First, the market reacts positively to plaintiffs in *invalidation trials* and *passive confirmation trials* in which the plaintiffs are not patent owners but not in *active confirmation trials* in which the plaintiffs are patent owners. Moreover, the market reaction to the defendants is negative only for *invalidation trials* where the patent owners are sued over the validity of their patents.

The different market reactions to *invalidation trials* and *passive confirmation trials* merit further discussion. In the former, the validity of the patents for defendants (patent owners) is challenged directly, while in the latter, the patentability of a target invention is not questioned; only the breadth of the patent rights involved is to be clarified. Therefore, patent owners suffer a greater loss from *invalidation trials* compared with *passive confirmation trials* (−0.46% and significant at the 5% level in *invalidation trials* compared with 0.02% and not significant in *passive confirmation trials*). Meanwhile, plaintiffs gain less from *invalidation trials* compared with *passive confirmation trials* (0.42% in *invalidation trials* compared with 0.58% in *passive confirmation trials*). This is likely because the invalidation of someone's patent benefits all competitors within the same market, whereas *passive confirmation trials* benefit only the plaintiffs by ruling noninfringement of plaintiffs on the target invention. That is, plaintiffs may not appropriate all the benefits from winning *invalidation trials* because there may be free-riding companies that benefit from *invalidation trials* compared with *passive confirmation trials*.

The last group of results from *active confirmation trials* is noteworthy. In this group of trials, even though the non-owners are defendants being sued by the patent

confidence to values that have a smaller standard error. Therefore, the weighting matrix is constructed as the inverse of the estimated variance. The results and statistical inference are robust to this weighting scheme.

owners, they apparently enjoyed a positive response from the stock market. One possible explanation is that *active confirmation trials* need to address whether the later invention has a *utilizing relationship* with the former patent. As discussed in the legal background, when such a relationship exists, the later inventor obtains an opportunity to seek permission from the patent owner of the utilized invention. Furthermore, when the prior patent owner files for an active confirmation trial, she needs to confirm that the later invention has an important technical improvement with substantial economic value before the patent owner contracts a nonexclusive license with the later inventor.¹¹ In this case, the *active confirmation trial* may have an advertisement effect for the later invention without hurting its patentability, which may lead to a positive effect on the stock market.

Across all the comparisons of different litigant types and lawsuit types, the negative effect of trial news on patent owners stands out. Patent owners are more likely to be penalized by the market, especially when they are the defendants in *invalidation trials*; however, non-owners generally receive a favorable response from the market, even if they are defendants.¹² We provide Welch's difference-in-means *t* test in the last column of Table 4 for statistical comparisons between patent owners and non-owners. The market reaction to patent owners and non-owners is significantly different when they are defendants or when they engage in *invalidation trials*.

We further employ multivariate regression analysis to evaluate the difference in CARs between patent owners and non-owners, considering other factors that may affect CARs. The controls include the type of suit (invalidation, or passive or active confirmation trials), the litigant and suit-level characteristics (firm size, market share, sales, the firm's experience in litigation, and the number of patents involved in the suit). They also included macrolevel factors (controlled by dummy variables for the years when the litigation occurred) and industry-level factors (controlled by dummy variables for the two-digit industry code). The results are shown in Table 5. The estimates on patent owners are robust across different specifications of models and are comparable to the simple difference without controls.

¹¹ In principle, the active confirmation trial is not allowed because it seeks to confirm that the later invention falls within the scope of the right of the prior invention and eventually results in invalidity of the later patent. It is allowed only when an active confirmation trial can be sought without denying the validity of the later patent (Supreme Court 99hu2433, June 28, 2002; Supreme Court 2015hu161, April 28, 2016). However, if the prior invention and the later invention are in a use relationship, then the later invention falls within the scope of the invention patented first. Thus, if two inventions are in a use relationship, then the later invention adds a substantially new technical element to the earlier invention, including the gist of the earlier invention, and uses it as is, maintaining its integrity as an original invention (Supreme Court 98hu522, August 21, 2001; Supreme Court 2015hu161, April 28, 2016).

¹² We thank one of the anonymous reviewers for this comment.

[Table 5] CARs for Patent Owners vs. Non-Owners by Considering Other Factors (%)

CARs	(1)	(2)	(3)	(4)
Patent owner	-0.80*** (0.26)	-0.77*** (0.25)	-0.76*** (0.26)	-0.77*** (0.29)
Suit type	No	Yes	Yes	Yes
Firm-level characteristics	No	No	Yes	Yes
Industry fixed effect	No	No	No	Yes
Year fixed effect	No	No	No	Yes
R-squared	0.017	0.021	0.028	0.066
N	635	635	622	622

Note: 1. Standard errors are in parentheses.

2. *, **, and *** indicate statistical significance at 10%, 5%, and 1%, respectively.

Finally, we expand the time frame of cumulative abnormal returns to multiple days. Table 6 presents the empirical results of CARs in different event windows. We consider the possibility of information leakage before the announcement of the trial (which may be possible for litigation) and include the day before the event. Additionally, to allow the market time to digest and react to information on litigation, we expand the window of the event to three and seven trading days (including the event day) and compute the respective CARs. If a market underreaction exists and the stock market captures news slowly, then additional days after the litigation date may be needed to capture the effect.

[Table 6] Average Cumulative Abnormal Returns from Different Types of Suit during Different Event Windows for Patent Owners and Non-Owners (%)

CARs	<u>Day -1 to Day 0</u>		<u>Day -1 to Day 2</u>		<u>Day -1 to Day 6</u>	
	Patent Owner	Non-Owner	Patent Owner	Non-Owner	Patent Owner	Non-Owner
Invalidation trial	-0.62* (0.33)	0.47 (0.30)	-0.97** (0.47)	-0.09 (0.42)	-1.75** (0.66)	-0.28 (0.60)
Passive confirmation trial	0.01 (0.58)	0.64 (0.84)	0.03 (0.82)	0.28 (0.68)	-0.14 (1.17)	-0.74 (0.96)
Active confirmation trial	-0.71 (0.93)	1.38** (0.62)	-0.40 (1.31)	1.03 (0.88)	-1.21 (1.88)	0.69 (1.27)

Note: 1. Standard errors are in parentheses.

2. *, **, and *** indicate statistical significance at 10%, 5%, and 1%, respectively.

3. Sample sizes are the same as in the lower three lines of Table 4 (omitted to save space).

Each group of columns in Table 6 shows the cumulative abnormal returns with different windows (Day -1 to Day 0, Day -1 to Day 2, and Day -1 to Day 6). The empirical results are qualitatively consistent and robust to different windows. The signs of a market reaction to patent owners are negative in all the different windows and become larger as the event window is expanded. Within the first week

of the event, the average CARs for patent owners in *invalidation trials* decreased by as much as 1.75%, which is a sizable negative effect. This implies that the market takes time to digest information about the trial and is suggestive of a market underreaction, which has often been observed after earnings, dividends, or stock splits (Bernard and Thomas, 1990; Ikenberry et al., 1995; Michaely et al., 1995).

However, the two types of patentee defendants have different market responses: defendants in *invalidation trials* (the more disadvantageous type) suffered more than the relatively lenient type (*passive confirmation trials*), with the latter being insignificant in general. These empirical results suggest that markets treat patent invalidation trials as very negative signals for patent owners. Meanwhile, the CARs for plaintiffs are generally not significantly different from zero when we analyze a longer event window.¹³ This implies that the effect of patent litigation on financial markets may not be a zero-sum game but may be a negative-sum game with substantial wealth leakage during litigation.

4.2. Correlations between Market Reaction and Litigation Outcome

The second goal of the study is to test whether the market response is consistent with the final litigation outcome. If the market considers outcome as the most important factor for a firm's value, then the stock market reaction should be positively correlated with the outcome from litigation. The market response could be more complex than, and even opposite to, the outcome when the market considers other factors for a firm's value. We test these opposing hypotheses by regressing litigation outcomes on the CARs during the event period.

The Korean patent trial system follows a three-instance procedure, and the legal outcomes can be determined in any instance (IPT, Patent Court, or Supreme Court). In general, intellectual property disputes are ruled upon first by the IPT. The decision of the IPT, therefore, is extremely important, as it will either be the final decision or provide important information for a higher court (Patent Court or Supreme Court).¹⁴ For each observation, we construct two outcome variables: one corresponding to the legal outcome of the IPT ($\text{outcome}_{\text{IPT}}$) and the other to the final legal outcome ($\text{outcome}_{\text{final}}$). The final legal outcome could be from any of the three courts, depending on whether the parties appealed the IPT ruling.

The five main types of legal outcomes are acceptance, rejection, partial acceptance with partial rejection, dismissal, and plaintiff withdrawal. For a detailed explanation of each legal term (and some of the less frequent terms in our data),

¹³ The patent owner is the defendant in invalidation trials and in passive confirmation trials but is the plaintiff in active confirmation trials. The non-owner is the plaintiff in invalidation trials and passive confirmation trials but is the defendant in active confirmation trials.

¹⁴ The correlation between the two legal outcomes is quite high (0.81), which attests to the importance of the IPT ruling.

please refer to Appendix B. By combining the legal terms with the litigant type, we classify the legal outcomes as either win or lose. For example, if a firm is a plaintiff in the case and the court outcome is rejection, then the firm is considered to have lost the case, whereas the outcome is win if the firm is the defendant. A detailed description of how win/lose outcomes are coded is shown in Appendix C.

[Table 7] Correlation between Abnormal Returns on Event Day and Litigation Outcome

Firm Type	Outcome _{IPT}		Outcome _{Final}	
	OLS	logit	OLS	logit
CAR	-1.90*** (0.66)	-1.88*** (0.67)	-1.33** (0.64)	-1.32** (0.63)
Dummy _{patentec}	-0.13*** (0.04)	-0.13*** (0.04)	-0.23*** (0.04)	-0.22*** (0.04)
Sales (in 10 ¹⁵ KWR)	7.21*** (2.48)	7.64*** (2.65)	7.18** (2.98)	7.58** (3.35)
Labor	3.70×10^{-8} (1.94×10^{-6})	3.27×10^{-9} (1.98×10^{-6})	-2.43×10^{-6} (2.14×10^{-6})	-2.58×10^{-6} (2.19×10^{-6})
Market share (%)	-1.45×10^{-3} (1.13×10^{-3})	-1.49×10^{-3} (1.14×10^{-3})	-6.60×10^{-4} (1.08×10^{-3})	-6.61×10^{-4} (1.08×10^{-3})
Number of previous cases	-0.004 (0.008)	-0.004 (0.008)	-0.002 (0.008)	-0.002 (0.008)
Number of patents involved	-0.05 (0.06)	-0.05 (0.06)	-0.03 (0.06)	-0.03 (0.06)
N	614	614	614	614

Note: 1. Clustered standard errors are in parentheses.
2. *, **, and *** indicate statistical significance at 10%, 5%, and 1%, respectively.
3. The logit model reports the marginal effects evaluated at mean values.

After the outcome variables are properly coded, we test whether there exists a significant positive correlation between the CARs and the legal outcome. The empirical results using abnormal returns on the event day are reported in Table 7. As we categorize the final outcome as win or lose, the logistic model is employed for regression analyses. We report estimates from both the OLS and logistic regression models, but we explain the regression results based upon the OLS model for two reasons. First, the incidence of the outcome (winning at trial) is not a rare event: more than half of the cases end with a win. In this case, the logistic coefficients (the odds ratio) cannot be a straightforward interpretation of marginal effects related to CARs (i.e., the difference in the winning probability from a change in CAR). Second, as long as the distribution of the data is well behaved, the estimation results from the OLS model and the logistic model (evaluated at mean values) are

generally comparable.¹⁵ The standard errors are clustered at the litigant level.

Overall, the estimates from the OLS model and the marginal effects from the logit model (evaluated at mean values) are very close to each other, and our empirical results are consistent with the previous literature. On average, larger firms with higher *sales* have a higher probability of winning a lawsuit, while patent owners are more likely to lose.¹⁶

[Table 8] Correlation between Abnormal Returns on the Event Day and the Litigation Outcome by Patentee Type

	Outcome _{IPT}		Outcome _{Final}	
	Day -1 to 0		Day -1 to 6	
	Patent Owner	Non-Owner	Patent Owner	Non-Owner
CAR _{day0}	-3.86*** (0.93)	-0.93 (0.87)	-2.59** (1.00)	-0.76 (0.81)
Sales (in 10 ¹⁵ KWR)	8.81** (4.84)	4.26 (2.83)	6.91 (6.78)	3.20 (2.98)
Number of previous cases	-0.01 (0.01)	-0.001 (0.008)	-0.01 (0.01)	-0.002 (0.009)
Number of patents involved	-0.12 (0.09)	-0.12** (0.06)	-0.17 (0.10)	-0.13** (0.06)
N	259	355	259	355

Note: 1. Standard errors are in parentheses.

2. *, **, and *** indicate statistical significance at 10%, 5%, and 1%, respectively.

Surprisingly, an abnormal return on the event day has a significant and negative correlation with the litigation outcome. The estimates of the CAR from an IPT outcome are -1.90 and -1.33 from the final outcome and are statistically significant at 1% and 5%, respectively. The negative coefficient means that firms with a negative response from the stock market during the event of the trial have a higher probability of winning at trial. As the empirical results presented in previous tables indicate that the stock market response to the patent owner is likely to be different from that to a non-owner, we separate the sample based on patent ownership and run the regression again. The results are shown in Table 8. Interestingly, the negative correlation between CARs and litigation outcome was

¹⁵ Stock market participants may use information about a firm's characteristics to form their expectation of the litigation outcome and subsequently make investment decisions. In such a scenario, a better approach is to examine market response without controlling for other variables, such as firm size and litigation type, among others. Thus, we also run a regression analysis of litigation outcomes on CARs without controlling for other variables. The size of the coefficients and the statistical significance are similar to and consistent with the original version of the regression model. Empirical results are available upon request.

¹⁶ As *labor* and *market share* are not significant, we have excluded them from X_i in the regressions and kept *sales* only as a firm size variable.

significant only for patent owners, while no correlation appeared for non-owners. As shown in Table A1, the empirical results are robust, even when we have employed different event windows.¹⁷

We further separate patent owners into two groups based on firm size (measured by sales). Table 9 exhibits the regression results and shows a statistically significant and negative correlation between litigation outcome and stock market response only when the patent owners are smaller firms. The negative effect is reinforced when patent owners or small firms are involved in litigation. This result implies that small innovators are likely to suffer additional damage from the stock market response if they are engaged in legal disputes with other firms, even if their patents are valid and they eventually win the case.

[Table 9] Correlation between Abnormal Returns on Event Day and Litigation Outcome for Patent Owners, by Firm Size (measured by sales)

	Outcome _{IPT}		Outcome _{Final}	
	Day -1 to 0		Day -1 to 6	
	< Median	> Median	< Median	> Median
CAR _{day0}	-4.85*** (1.07)	-2.04 (1.85)	-3.52*** (1.10)	-0.67 (1.99)
Sales (in 10 ¹³ KWR)	8.36 (8.22)	7.66 (5.98)	8.17 (8.97)	0.06 (0.08)
Number of previous cases	-0.02 (0.02)	-0.007 (0.015)	-0.01 (0.03)	-0.007 (0.014)
Number of patents involved	-0.23* (0.12)	0.07 (0.12)	0.13 (0.15)	0.20 (0.13)
N	128	129	128	129

Note: 1. Standard errors are in parentheses.
2. *, **, and *** indicate statistical significance at 10%, 5%, and 1%, respectively.

This is reasonable because market participants likely have public information regarding the importance or value of the case and its impact on the firm, but they may not have enough information on the likely outcome of the case. Therefore, their beliefs about litigation will be more sensitive to the potential gain/loss, rather than a properly formed expected gain/loss, which requires a good estimation of the probability.

The empirical findings address another channel through which the patent litigation system may be detrimental to small innovators. Small firms are more likely to suffer from a negative market reaction in the early stages of litigation and may have to pay additional indirect business costs (losing firm value or being forced

¹⁷ To save space, we stack the results from different regressions into Table A1, and only the coefficients for the CARs are reported.

to settle the case). As Lanjouw and Lerner (2001) pointed out, such a negative response from the stock market may discourage R&D by small firms in areas where the opportunistic threat of litigation by large firms is high. This finding has important policy implications for the ongoing debate about the fairness of the legal system in regard to patents.

V. Conclusion

In this study, we investigate stock market responses to patent litigation announcements and examine whether the responses are consistent with the final outcome of litigation. We extend the previous patent litigation literature by employing stock market analysis, taking into account firm heterogeneity with the various characteristics of the litigants and the type of litigation (e.g., defendants vs. plaintiffs, patent ownership, firm size, and type of lawsuit). The main purpose of the study is to examine whether small innovators are at a greater disadvantage from patent litigation, paying additional costs from the stock market response.

The study examined all interfirm patent litigation in Korea from 1987 to 2011 and matched up a variety of information, such as a firm's financial data, stock market responses, and patent litigation filings. We examined the cumulative abnormal returns of the plaintiffs and defendants around the date of filing for litigation.

Our empirical results are overall consistent with those of previous studies. We find that news of litigation seems to be incorporated slowly into prices, resulting in a greater and more significant negative response when we include additional days in the event window (up to a week). The defendant, in general, experience a significantly negative stock market response to a patent litigation announcement, whereas plaintiffs fare moderately better or have no statistically significant positive response. This scenario implies that patent litigation is, in general, a negative-sum game causing social welfare leakage due to asymmetric and negative net gains.

However, the market's negative response to defendants is limited to small firms and patent owners. The final outcome of litigation for small innovators correlated negatively with stock market response, even when the patent is valid and they win the case. The empirical results suggest that stock market participants consider not only the expected outcome of litigation but also other factors, such as the potential economic status of the firm based on size or patent ownership. Small firms are more likely to suffer from a negative market reaction in the early stages of litigation and have to pay additional indirect business costs, such as losing firm value.

The empirical findings address an important policy implication in that the patent litigation system can be detrimental to small innovators. In other words, the patent

litigation system seems to cause additional indirect business costs for small innovators from the financial market's reaction in protecting their intellectual assets. This finding can be taken as an important concern for small innovators because, even if they expect to win in litigation, smaller firms will suffer a major blow in the early stages, especially when the patent subject to litigation is critical to a firm's future growth potential. The risk must be higher when the firm size or patent portfolio is smaller. The firm will then be forced to settle out of court for fear of losing market value. The same story can be applied to patent owners because they lose monopoly rights when they lose at trial, while non-owners only return to the status quo.

As Lanjouw and Lerner (2001) pointed out, we know that a patent dispute can be utilized strategically by larger firms by filing 'opportunistic' litigations. This circumstance is equivalent to an *ex post* innovation tax imposed on small innovators through the litigation process and eventually discourages their R&D activities. Thus, when the status of litigants is highly asymmetric (i.e., large plaintiff vs. small defendant), a better approach for policymakers is to consider such asymmetry in the litigation process to improve fairness in the legal system.

Appendix A. Multiple Entries

Before proceeding with the analysis, we need to first rearrange the dataset along with the event dates at the firm level to analyze the market reaction to firms around the time of litigation. The current data are constructed in such a manner that they can provide a separate entry if the patent involved has multiple applicants, if the case involves multiple patents, or if the case has multiple firms as defendants/plaintiffs.

We follow the three steps below to rearrange the firm-level dataset by event date.

1. Multiple entries due to multiple applicants for a patent involved in a case: these entries have the same plaintiffs and defendants, the same event date, and the same patent(s), but the patent(s) involved have more than one applicant. The entries are duplicated based on the number of applicants. We drop the duplicate observations and generate a variable to record the number of applicants, which can be considered a quality indicator of the patent. After this round of cleansing, the data are reduced to 777 observations from 829.
2. Multiple entries due to the presence of multiple patents in a case: these entries have the same plaintiffs and defendants and the same event date but a separate entry for each patent involved. In almost all cases, multiple patents are involved in the same lawsuit type.¹⁸ Therefore, we pool multiple entries of this type together and include a variable indicating the number of patents involved in litigation. After this round of cleansing, the number of observations in the dataset is reduced to 686.
3. The last round of cleansing considers that some firms engage in litigation several times within a short time span, such that the later litigation may not have the same market reaction as the first. We construct a variable indicating the number of days between the current case and the previous case. In the main analysis, we can use this variable to control for different market reactions due to recent precedent cases. Our main results are obtained by excluding litigation cases that included a party involved in other cases in the previous month. This final round of data cleansing leaves 635 cases.

Appendix B. Explanation of the Legal Terms

In this section, we briefly explain the meaning of the legal outcomes. Note that the

¹⁸ There are only two exceptions. First, one of the patents is involved in a “patent invalidation”; second, it is involved in a “confirm-the-scope (passive) case. For these two observations, we record them together as “confirm-the-scope (passive)” cases.

legal outcomes from the IPT stage and higher courts are typically recorded using different terms, even when they have the same legal meaning.

1. Dismissal: A request for a suit does not satisfy the requirements in law. This decision is rendered in court.
2. Dismissal (President Decision): This is one type of dismissal by the IPT. This means that the decision is made by the president of the panel of judges.
3. Dismissal (Panel Decision): This is the other type of dismissal by the IPT. This means that the decision is made by consensus among the panel of judges.
4. Rejection: The IPT or higher court made a decision to reject the plaintiff's demands. The plaintiff loses at litigation.¹⁹
5. Acceptance (in contrast to Rejection): The court decides to accept the plaintiff's arguments. The plaintiff wins in court.
6. Acceptance (IPT): The IPT decides to accept the plaintiff's demands. The plaintiff wins.
7. Plaintiff Withdrawal: The claimant withdraws the lawsuit at a later stage (in court). We consider withdrawal a loss for the plaintiff.
8. Plaintiff Withdrawal (IPT): The claimant withdraws the lawsuit at the first stage. We consider this a loss for the plaintiff.
9. Partial Acceptance, Partial Rejection: If the suit involves multiple patent infringement claims and the IPT accepts some, but not all, and rejects the others (similar to a rejection), then this legal outcome will be assigned. Even though some arguments are not accepted by the IPT, we still consider this a win for the plaintiff.
10. Partial Acceptance, Partial Dismissal: The suit involves multiple claims, and the IPT accepts some, but not all, and dismisses the others (similar to a dismissal). Even though some arguments do not qualify for legal consideration, we still consider this a win for the plaintiff.
11. Partial Dismissal, Partial Rejection: The suit involves multiple claims, and the IPT rejects some, but not all, and dismisses the others. As the demands are either rejected or dismissed, we consider the outcome a loss for the plaintiff.
12. Invalidation: This decision is rendered by the IPT when there is a deficiency in the legal procedures the plaintiff goes through. This outcome is perhaps given only temporarily. We need to check the legal outcome in court to determine its context. In the current study, we drop these cases (eight altogether).
13. ETC: The legal outcome is missing from the court records. We search for them manually.

¹⁹ Comparison of Dismissal and Rejection: The arguments of the plaintiff are not accepted by the court in both cases. The difference is that in a dismissal (president decision or panel decision), the case does not begin because it does not meet the requirements under the law.

Appendix C. Definitions of Winning/Losing

We define winning or losing a case based on the following simple and intuitive reasoning.

- If the case is withdrawn, we consider it a loss for the plaintiff. We believe the plaintiff decides to withdraw the claim when the chance of winning becomes slim or the cost of continuing the litigation becomes extremely high. In either case, it will be viewed negatively by the market.
- If the case is dismissed or rejected by the IPT or a higher court, we consider it a loss for the plaintiff. This scenario includes dismissals (three of them), rejections, and any partial dismissal or partial rejection.
- If the case is at least partially accepted by the IPT, we consider it a win for the plaintiff. This scenario includes partial acceptance, partial rejection, any partial acceptance, partial dismissal, and acceptance (two of them).
- If the case is accepted by the IPT or a higher court, we consider it a win for the plaintiff.
- We do not make decisions on cases marked for invalidation or as ETC unless we find conclusive evidence in legal documents from our manual search.

The criteria listed above are sufficient to obtain the outcomes at IPT. Most of the criteria are easy to interpret. However, to obtain the outcome of litigation, we need to consider one complication where the plaintiff/defendant status of the concerned parties switches on appeal. The decision at each stage is defined from the viewpoint of the plaintiff/defendant. For example, if an interested party pursued an invalidation case against the patent owner (the defendant) at the IPT and the arguments are accepted by the IPT, then it is considered a win for the interested party (plaintiff, called *claimant* at this stage) and a loss for the patent owner (the defendant, or *clamee*). However, if the patent owner chooses to appeal, then the owner becomes the plaintiff, and the interested party becomes the defendant. A decision of acceptance now indicates a win for the plaintiff (the patent owner). If an appeal is submitted to the Supreme Court, then the plaintiff/defendant status of the parties switches again. To address this complication, we disentangle the cases based on the type of lawsuit and decisions made by different courts to obtain the final decision regarding the initial litigation.

Appendix D. A Test of Our Model

In this section, we provide some supporting evidence for our model. According to our model, we expect a negative correlation between the market reaction and the

potential loss to the firm for defendants but would expect a positive correlation between the two values for plaintiffs. However, we do not know the exact cost or gain to the firms in litigation. We use tangible assets (normalized by market capitalization) as an approximation of the firms’ potential losses from litigation. Tangible assets include a firm’s investment in R&D. A loss may mean an injunction against selling their products (for example, patentees in nullity cases or infringers in aggressive trials), which can lead to firms losing their tangible assets (which have been invested).

We regress the CARs on tangible assets (normalized by market capitalization). In the model, we also include controls on other characteristics of the firms, including sales, number of litigation cases the firm had experienced before, the number of patents involved in this case, and industry and year fixed effects. We focus on *invalidation trials* because they are the largest group in our data (roughly two-thirds of all cases), and higher stakes are involved for the litigants compared with *confirmation trials*. The results are shown in Table A2. Consistent with the model predictions, we find that in invalidation trials, the defendant’s (the patent owner’s) market reactions are negatively correlated with their tangible assets, while the correlation for plaintiffs is positive.

[Table A1] Correlation between Abnormal Returns on Event Day and Litigation Outcomes for Patentees

Model: $Outcome_i = \alpha + \beta \cdot CAR_i + \gamma_1 \cdot Sales_i + \gamma_2 \cdot Numofcases_i + \gamma_3 \cdot NumofPatents_i + \varepsilon_i$

Firm Type	Outcome _{IPT}	Outcome _{Final}
CAR _{day0}	-3.86*** (0.93)	-2.59** (1.00)
CAR _{day-1 to 0}	-2.04*** (0.78)	-1.41* (0.81)
CAR _{day-1 to 2}	-1.55*** (0.48)	-1.47*** (0.49)
CAR _{day-1 to 6}	-0.62* (0.35)	-0.63* (0.36)
N	259	259

Note: 1. Standard errors are in parentheses.
2. *, **, and *** indicate statistical significance at 10%, 5%, and 1%, respectively.

[Table A2] Correlation between Abnormal Returns on Event Day and Tangible Assets for Litigants (*Invalidation Trials*)

Model: $CAR_i = \alpha + \beta \cdot TangibleAssets_i + \gamma_1 \cdot Sales_i + \gamma_2 \cdot Numofcases_i + \gamma_3 \cdot NumofPatents_i + \varepsilon_i$

Firm Type	Defendants	Plaintiffs
CAR_{day0}	-0.0020** (0.00098)	0.0018* (0.00097)
Sales (in 10^{16} KWR)	5.81* (3.22)	1.58 (2.40)
Number of previous cases	-0.00097** (0.00048)	-0.0003 (0.0007)
Number of patents involved	0.002 (0.006)	-0.007** (0.003)
N	168	209

- Note: 1. Clustered standard errors are in parentheses.
2. *, **, and *** indicate statistical significance at 10%, 5%, and 1%, respectively.
3. All models control for industry and year fixed effects.

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특허소송과 주식시장의 반응에 관한 실증연구: 한국의 특허소송을 중심으로*

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초 록 본 연구는 한국의 특허소송 및 기업재무 자료를 이용하여 특허소송이 주식시장에서 해당 기업에 어떠한 영향을 미치는지를 실증적으로 분석한다. 특히 특허소송 소식이 알려지기 전후의 누적초과수익률(Cumulative Abnormal Return)을 이용하여 주식시장의 반응에 일정한 패턴이 존재하는지, 주식시장의 반응이 특허소송의 최종 결과와 일관성을 지니는지 등을 살펴본다. 회귀분석 결과, 특허소송은 전반적으로 해당 기업의 주식 시장 성과에 통계적으로 유의미한 부정적인 영향을 미치는 것으로 나타났다. 그러나 특허권 비소유자 또는 대기업보다는 특허권 소유자와 중소기업에게 더 큰 부정적인 효과를 미치는 것으로 나타났다. 또한 피고가 특허권 소유자이거나 중소기업인 경우에는 비록 해당기업이 추후에 재판에서 승소한다 하더라도 특허소송 소식이 주식시장의 부정적 반응을 초래하는 것으로 나타났다. 이는 특허권소유자 또는 중소기업이 특허권 비소유자 또는 대기업에 비해 상대적으로 더 높은 직·간접적 소송 비용을 지불하고 있음을 의미하며, 상대적으로 특허소송에 더 취약한 상태에 있음을 나타낸다. 특허소송에 있어서의 이러한 비대칭적 지위는 중소기업으로 하여금 특허소송이 빈번하게 발생하는 분야의 연구개발을 회피하게 함으로써 사전적인 혁신세(ex-ante innovation tax)로서 작용할 가능성이 존재함을 나타내므로 이를 해결하기 위한 정책적 개선이 요구된다.

핵심 주제어: 특허소송, 주식시장 반응, 소송의 간접비용

경제학문헌목록 주제분류: O32, O34, K41

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