THE CAUSES AND ECONOMIC CONSEQUENCES OF PATENT LITIGATION

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ABSTRACT

A survey of patent litigation in the Taiwan electronics industry between 2010 and 2015 provides insight into the causes and economic consequences of patent litigation. This survey had three key what were the findings of this study? First, companies with patents for new inventions are more likely to file plaintiff-initiated lawsuits and less likely to suffer defendant-related lawsuits. Second, credit ratings can reflect the effects of patent litigation and industry expertise on their rating decisions in cases where companies involved in patent litigation are audited by industry experts. Third, auditors with industry expertise tend not to be as concerned when their clients face patent litigation as those without such expertise.

Contribution/ Originality: This study contributes to an understanding of the economic consequences of litigation and determinants of credit rating. Also, our findings address the debate as to whether credit ratings provide useful information to investors.

1. INTRODUCTION

Innovative capacity is vital to the value of companies and their operations as a perpetual going-concern. However, innovative capacity is difficult to measure or stock, due to the fact that innovation is a continuous process of strategic objectives, and largescale diffusion is a gradual process. Patents are seen as an appropriate index by which to measure innovative capacity (Hirshleifer et al., 2013; Fang et al., 2014) and the fact that the associated intellectual property rights can be legally enforced means that the patentee reserves exclusive rights to the use or distribution of an invention. Patents play an important role in technological and economic development, and the benefits of patents have been studies extensively (Hsu, 2009; Lerner et al., 2011; Cohen et al., 2013; Hirshleifer et al., 2013). However, researchers are now turning their attention to the potential risks and costs imposed on capital markets (e.g., litigation costs) in the form of patent litigation (Government Accountability Office (GAO), 2013;

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Chien, 2014; Price Waterhouse Coopers (PWC), 2014; Scott and Shapiro, 2014; Feldman and Frondorf, 2015; Marco *et al.*, 2015; Beauchamp, 2016; Kiebzak *et al.*, 2016). Patent litigation and its' effects became an important issue to market participants in capital markets because these lawsuits may lead to significant losses in firm value.

Patent litigation in the U.S. has increased dramatically over the last 20 years, and the resulting economic impact can reach $80 billion per year (Bessen *et al.*, 2012; Anderson and Menell, 2014; Cotropia *et al.*, 2014; Schwartz and Kesan, 2014; Marco *et al.*, 2015; Sag, 2016). The expansion of patent litigation has received attention from regulators and legislators, who've expressed concern that this increase may be associated with non-practicing entities (NPE).[1] Thus, the America Invents Act (AIA) mandates that the U.S. Government Accountability Office (GAO) conduct a study on the consequences of patent litigation by NPEs. The GAO (2013) reported a 129 percent increase between 2007 and 2011 in the number of lawsuits concerning patent infringement, with the legal costs for just one case increasing from $650,000 to $5 million. Furthermore, many patent infringement lawsuits are related to the prevalence of low quality patents.[2] The cost and time spent on patent litigation can be harmful to innovation and undermine economic vitality. Additionally, rating agencies and auditors both play an important information intermediary in capital markets by providing investors and other related parties with information about the financial health and long-term perspective of companies they rate or audit, and hence their credit ratings and audit opinions should be able to reflect litigation information to market participants and mitigate the problem of asymmetric information. This study sought to reveal the underlying causes and economic consequences of patent litigation through an investigation of innovative capacity, credit ratings, and audit opinions. Our main results and contributions are summarized as follows. First, we found that companies with new invention patents are more likely to file plaintiff-initiated lawsuits and less likely to suffer defendant-related lawsuits. This implies that companies with quality innovative capacity are able to defend their rights and protect themselves. We also found that the type of patent (e.g., invention, utility model, design) is associated with the likelihood of patent-related lawsuits. This study differs from previous work[3] in its examination of whether and how the likelihood of patent litigation is affected by the quality of innovative capacity. An understanding of the causes of patent litigation is of considerable importance to the market, and assessments of the economic consequences could provide useful and timely information to investors. Second, we found that credit rating agencies are more likely to assign unfavorable ratings to companies involved in patent litigation. The expertise and experience of auditors was also shown to affect the risk perceived by raters in cases where auditees are involved in patent-related lawsuits. This is an indication that raters may take into account the engagement-specific expertise of auditors in their rating decisions. This contributes to an understanding of the economic consequences of litigation and determinants of credit rating (Güttler and Wahrenburg, 2007; Jorion *et al.*, 2009; Güntay and Hackbarth, 2010; Afonso *et al.*, 2011). Our findings also address the debate as to whether credit ratings provide useful information to investors (Crabtree and Maher, 2005; Yi and Mullineaux, 2006; Cheng and Neamtiu, 2009; U.S. Department of Justice, 2013). Third, our results show that auditors are more likely to issue unclean opinions[4] about clients involved in patent litigation. Non-specialist auditors are more likely to take into account involvement in patent litigation in their assessment of risk, thereby earning the firm an unclean opinion. In contrast, auditors specializing in a particular industry have a deeper

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[1] NPE is people or company that obtains patents and sues alleged infringers but do not make useful products of their own.

[2] GAO (2013). provides an overview of consequences of litigation and suggests that there is no NPE patent litigation crisis; meanwhile, this report also dedicated a good portion of its report on how the courts' administrative improvements and the implementation of AIA are likely to affect the handling of patent cases and patent quality in the future.

[3] Prior accounting studies Bonner, Palmrose and Young (1998), Schmidt (2012), Lisic, L.L., S.D. Silveri, Song and Wang (2015). mention the litigation are more likely to focus on client's fraud or auditor's legal liability.

[4] Unclean (unfavorable) opinions indicate that companies did not receive an unqualified audit opinion. In this study, we will use "unclean opinions" and "unfavorable opinions" interchangeably.

understanding of the risk of litigation, and are therefore more likely to base their opinions on the specifics of the case. These results extend our understanding of the relationship between auditor types and auditor opinions (Li, 2009; Chi and Chin, 2011).

The remainder of the paper is structured as follows. In the next section, we review relevant literature and develop our research hypotheses. The third section discusses the research method. The fourth section describes the sample and reports descriptive statistics. The fifth section presents empirical results. The final section concludes the paper.

2. RELATED LITERATURE AND HYPOTHESIS DEVELOPMENT

2.1. Causes of Patent Lawsuits

The cost of lawsuits and their effects on investors drives home the need to elucidate the underlying causes of litigation. In the auditing literature, previous studies have focused on identifying the determinants leading to lawsuits and how ex-ante auditor risk of litigation affects auditor behavior.[5] Bonner *et al.* (1998) identified a correlation between fraud in financial reporting and the likelihood of litigation against auditors. Some studies have shown that the likelihood of litigation against auditors depends on the type of client, stock price volatility, restatements, and financial distress (Shu, 2000; Heninger, 2001; Palmrose and Scholz, 2004). Other studies have shown that auditing firms screen for potentially risky clients (Johnstone, 2001; Johnstone and Bedard, 2003; Johnstone and Bedard, 2004; Asare *et al.*, 2005) and adjust auditing fees according to the risk of litigation (Seetharaman *et al.*, 2002).

In the accounting literature, previous studies have focused on the influence that litigation risk exerts on the behavior of management, such as the relationship between voluntary disclosure and litigation (Healy and Palepu, 2001; Johnson *et al.*, 2001; Field *et al.*, 2005; Graham *et al.*, 2005; Johnson *et al.*, 2007). Researchers have reported that many companies change their disclosure policies after being sued because they gaining a better understanding of the link between disclosure and litigation after going through the litigation process (Kothari *et al.*, 2009; Ball *et al.*, 2012; Billings and Cedergren, 2015).[6] Some researchers have shown a link between the quality of financial reporting, such as earnings management and restatements, and the risk of litigation (Palmrose and Scholz, 2004; Johnson *et al.*, 2007; Cohen *et al.*, 2008; Bardos *et al.*, 2013). It has also been suggested that poor stock price performance is associated with a higher risk of litigation (Arena and Julio, 2015).

Much of the literature pertaining to the causes of litigation disregards the differences between various types of lawsuit and their underlying causes. In this study, we focused on patent-related lawsuits with the aim of elucidating the link between patent litigation and innovative capacity. Patents can be viewed as an indication of innovative capacity and the hidden crisis/defense capability of a patent's dispute. In 2012, the Price Waterhouse Coopers (PwC) pointed out that many factors affect the likelihood of involvement in patent litigation; however, a direct correlation has been established between the number of patents issued and the number of patent-related lawsuits. Clearly, understanding the relationship between patent-related lawsuits and innovative capacity may provide direct evidence for the causes of patent litigation. We state our first hypothesis as follows:

H1. Innovative capacity is positively associated with patent lawsuits

2.2. Economic Consequences of Patent Lawsuits

Patent-related lawsuits can distract companies from the development of novel products, cause them to disregard their product strategy, and impose heavy litigation costs. Patent-related lawsuits also tend to attract public attention and raise questions concerning product integrity, which can have serious economic consequences.

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[5] See Latham, and Linville (1998). for detailed discussions about the audit litigation.

[6] See Beyer, Cohen, Lys and Walther (2010). for detailed discussions about the association between disclosure and litigation risk.

Patent-related lawsuits can affect a company's business decisions as well as the valuation of equity on the market. Besides the companies themselves, capital markets include two types of participants: investors and information intermediaries. Information intermediaries play a critical role in disseminating information, they help mitigate the problems caused by asymmetric information in economic transactions. In capital markets, credit rating agencies and auditors are particularly important certification intermediaries, they contribute to enhance disclosure effectiveness by disclosing the information that is not available to the public but is incorporated in their credit ratings and audit opinions. Credit ratings represent the perceptions of investors (Chernenko and Sunderam, 2012; Baghai *et al.*, 2014) including their current observations of company characteristics as well as their expectations with regard to future performance (Czarnitzki and Kraft, 2004). Audit opinions reflect the current financial condition of the company and their expectations with regard to its future well-being (Ajona *et al.*, 2008; Herbohn and Ragunathan, 2008). An understanding of the perceptions of credit raters and auditors can help to elucidate the economic consequences of patent-related lawsuits. Thus, we focused on the role of credit raters and auditors in our examination of the economic consequences of patent-related lawsuits.

2.2.1. Credit Rater

A number of high-profile bankruptcies among credit raters has undermined the confidence of regulators and investors with regard to the independence, skills, and quality/diligence of credit rating agencies (U.S. Securities and Exchange Commission (SEC), 2003; Thomas *et al.*, 2011). The U.S. Congress sought to increase transparency and the integrity of the rating process by passing the Credit Rating Agency Reform Act (CRA Reform Act) of 2006, which includes new recognition standards and more formal oversight of rating agencies. In Taiwan, the Financial Supervisory Commission[7] has clearly indicated that the management of risk by raters should include established procedures for the identification, assessment, monitoring, and reporting of risk. Furthermore, the process of analysis should include industry risk, corporate strategy, business reviews, performance, investment and capitalization, liquidity, and financial flexibility. A number of recent studies have shown that regulatory pressure and public criticism can be helpful in making rating agencies more responsible with regard to credit analysis. Since the Enron episode (Cheng and Neamtiu, 2009; Alp, 2013; Bruno *et al.*, 2016)[8] many of the rating agencies have greatly improved the timeliness, accuracy, and stability of their ratings. As mentioned above, rating agencies are becoming increasingly flexible in their assessment of risk and their subsequent rating decisions. We therefore propose that rating agencies are more likely to assign unfavorable ratings for companies involved in patent litigation when their perceived risk is affected by litigation disclosures.

H2. Patent lawsuits are positively associated with unfavorable credit ratings.

2.2.2. Auditor

Stanley (2011) claimed that client business risk affects audit risk, such that the judgement of auditors may be more conservative in cases where clients face higher risk of litigation (DeFond and Subramanyam, 1998; Lu and Sapra, 2009). Auditors tend to be more responsive to the risk of litigation when it conflicts with incentives to seek profits (Tucker *et al.*, 2003; Blay, 2005)[9] and previous researchers have reported that auditors should consider the risk of litigation in their opinion decisions (Blay, 2005; Cahan and Zhang, 2006; Elder *et al.*, 2009). A number of

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[7] For more laws and regulations on the Matters Required to be Included in the Corporate Bylaws of Credit Rating Agencies, see the web site http://law.fsc.gov.tw.

[8] In Enron's case, Enron announced its intention to restate its financial statements for 1997 through 2000 and the first and second quarters of 2001 to reduce previously reported net income by an aggregate of $586 million. However, Enron's ratings remained at investment grade until four days before bankruptcy.

[9] AU-C Section 570 (SAS No. 126) states that auditors must "evaluate whether there is substantial doubt about the entity's ability to continue as a going concern". Moreover, auditors' evaluation should identify events or conditions affecting clients' going-concern uncertainty, for example, legal proceedings, legislation, or similar matters that might jeopardize an entity's ability to operate; loss of a key franchise, license, or patent, etc.

studies have found that since the Sarbanes-Oxley Act (SOX) of 2002, auditors have been more likely to issue going-concern opinions (Fargher and Jiang, 2008; Li, 2009; Feldmann and Read, 2010) which have been shown to reduce the risk of litigation (Mong and Roebuck, 2005).[10,11] We thus suppose that auditors are more likely to assign unfavorable audit opinions for companies involved in patent litigation when their perceived risk is affected by litigation disclosures.

H3. Patent lawsuits are positively associated with unfavorable audit opinions.

3. RESEARCH DESIGN

3.1. Causes of Patent Lawsuits

3.1.1. Innovative Capacity

In this study, we sought to reveal the causes of patent-related lawsuits by examining the relationship between the likelihood of patent lawsuit and innovative capacity. In Equation (1), we use three dependent variables as proxies for patent-related lawsuits: *LAWSUIT*, *DEFLAW* and *PLALAW*. *LAWSUIT* is a dummy variable equal to 1 if the company is involved in patent-related lawsuits; otherwise 0. We further differentiate between defendant-related and plaintiff-initiated. *DEFLAW* is a dummy variable equal to 1 if the company is involved in patent-related lawsuits as a defendant; otherwise 0. *PLALAW* is a dummy variable equal to 1 if the company is involved in patent-related lawsuits as a plaintiff; otherwise 0. We focused on the sign and significance of the coefficients on *PAT*, which is a dummy variable equal to 1 if the company obtained new patents; otherwise 0. If innovative capacity increases the probability of patent-related lawsuits, then β_1 should be positive. Variables are defined in Table 1.

$$PATENT\ LAWSUIT = \beta_0 + \beta_1\ PAT + \beta_2\ SIZE + \beta_3\ ROA + \beta_4\ GROWTH$$

$$+ \beta_5\ OCF + \beta_6\ DE + \beta_7\ CONTROL$$

$$+ \beta_8\ DEVIATION + \beta_9\ DUALITY + \beta_{10}\ INBOD$$

$$+ \varphi\ YEAR + \varepsilon. \qquad (1)$$

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[10] Conversely, some studies show that going-concern opinions did not prevent auditor litigation Blacconiere and DeFond (1997).

[11] Auditors became more conservatism to reflect risk on their judgements, because they face heavy public criticism and expectation in their responsibility after a serious of accounting scandals (e.g., Procomp, Infodisc, Rebar, etc.).

Table-1. Variable Definitions

Variable		Definition
LAWSUIT	=	1 if the company is involve in patent-related lawsuits, otherwise 0;
PLALAW	=	1 if the company is involved in patent-related laws its as a plaintiff, otherwise 0;
DEFLAW	=	1 if the comp ny is involved in atent-related lawsuits as a defendant, otherwis 0;
NUMLAW	=	the natural log of number of the companies involved in patent-related lawsuits;
AMOLAW	=	the natural log of the total amount of damages due to patent infringement;
PAT	=	1 if the company obtained new patents, otherwise 0;
PATINV	=	the natural log of number of the company obtained new invention patents;
PATUM	=	the natural log of number of the company obtained new utility model patents;
PATDES	=	the natural log of number of the company obtained new design patents;
TCRI	=	Taiwan Corporate Credit Rating Index, where the credit rating is divided into ten degrees, with the highest degree representing the highest credit risk;
GC	=	1 if the company receives a unclean opinion, otherwise 0;
EXPERT	=	1 if the company belongs to industry specialization audit, otherwise 0;
IZE	=	the natural log of total assets;
ROA	=	net income divided by total assets;
GROWTH	=	percentage growth in sales;
OCF	=	cash flow from operations divided by total assets;
E	=	total debt divided by total assets;
CONTRO	=	number of seat-control d rectors divided by the total board size;
DEVIAITION	=	the stock-control right minus the earnings-distribution right;
DUALITY	=	1 if the chairman of the board is also the CEO, otherwise 0;
INBOD	=	the number of independent directors on the board divided by the total board size;
YEAR	=	dummy variables controlling for years.

3.1.2. The Content of Innovative Capacity

The Patent Act of Taiwan divides patents into three categories: invention, utility model, and design.[12] The three types of patents represent different levels of innovative capacity, which may differ in their effects on patent-related lawsuits. In Equation (2), we used three independent variables as proxies for the different types of patent: *PATINV*, *PATUM* and *PATDES*. *PATINV* is the natural log of the number of the companies obtaining new patents for inventions; *PATUM* is the natural log of the number of the companies obtaining new utility patents; and *PATDES* is the natural log of the number of the companies obtaining new design patents.

$$PATENT\ LAWSUIT = \beta_0 + \beta_1\ PATINV\ (PATUM\ /\ PATDES) + \beta_2\ SIZE$$

$$+ \beta_3\ ROA + \beta_4\ GROWTH + \beta_5\ OCF + \beta_6\ DE$$

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[12] The Patent Act of 2014 describes the different among these three types of patents: Invention patents mean the creation of technical ideas, utilizing the laws of nature; utility model patents mean the creation of technical ideas relating to the shape or structure of an article or combination of articles, utilizing the laws of nature; and design patents mean the creation made in respect of the shape, pattern, color, or any combination thereof, of an article as a whole or in part by visual appeal.

$+\beta_7 CONTROL + \beta_8 DEVIATION + \beta_9 DUALITY$

$+\beta_{10} INBOD + \varphi YEAR + \varepsilon.$ (2)

3.2. Economic Consequences of Patent Lawsuits
3.2.1. Credit Rating

We sought to determine the economic consequences of patent-related lawsuits. In accordance with previous studies (Cheng and Subramanyam, 2008; Jiang, 2008; Ashbaugh-Skaife *et al.*, 2009; Gul and Goodwin, 2010; DeFond *et al.*, 2011) we adopt the Taiwan Corporate Credit Rating Index (TCRI ratings) as a proxy for economic consequences from the perspective of investors in order to capture credit risk. We expected that patent-related lawsuits would have negative consequences for credit ratings due to the unfavorable implications for the future economic prospects of the company. *TCRI* divides credit ratings into ten degrees, with the highest value representing the highest credit risk.[13]

$TCRI = \beta_0 + \beta_1 PATENT\ LAWSUIT + \beta_2 SIZE + \beta_3 ROA + \beta_4 GROWTH$

$+\beta_5 OCF + \beta_6 DE + \beta_7 CONTROL + \beta_8 DEVIATION$

$+\beta_9 DUALITY + \beta_{10} INBOD + \varphi YEAR + \varepsilon.$ (3)

3.2.2. Audit Opinion

We used audit opinions as a measure of economic consequences from the perspective of auditors, and then investigated whether and how the perspective of auditors is affected by the frequency and number of patent-related lawsuits. In Equation (4), *GC* is a dummy variable equal to 1 if the company receives a unclean opinion; otherwise 0. *NUMLAW* is the natural log of number of the companies involved in patent-related lawsuits, and *AMOLAW* is the natural log of the total amount of damages due to patent infringement.

$GC= \beta_0 + \beta_1 LAWSUIT\ (NUMLAW\ /\ AMOLAW) + \beta_2 SIZE + \beta_3 ROA$

$+\beta_4 GROWTH + \beta_5 OCF + \beta_6 DE + \beta_7 CONTROL$

$+\beta_8 DEVIATION + \beta_9 DUALITY + \beta_{10} INBOD + \varphi YEAR + \varepsilon.$ (4)

3.3. Control Variable

Following prior research (Chandra, 2011; Bentley *et al.*, 2013; Kaplan and Williams, 2013) we include several variables to capture the underlying condition of the company: *ROA* is net income divided by total assets. *GROWTH* is percentage growth in sales; *OCF* is cash flow from operations divided by total assets; and *DE* is total debt divided by total assets. We expect companies that are more profitable have less likelihood of litigation, and companies with larger leverage have more likelihood of litigation, unfavorable ratings and opinions. Then we follow previous studies (Cheng and Farber, 2008; Coles *et al.*, 2008) to control for companies' governance environment: *CONTROL* is number of seat-control directors divided by the total board size; *DEVIATION* is the stock-control right minus the earnings-distribution right; *DUALITY* is a dummy variable equal to 1 if the chairman of the board is also

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[13] The 10th degree represents that companies are in financial distress.

the CEO, otherwise 0; and *INBOD* is the number of independent directors on the board divided by the total board size. We expect that companies whose board seat-control and equity deviation are larger and the CEO duality will be more likely to associate with higher likelihood of litigation, unfavorable ratings and opinions. The board is more independent have less likelihood of litigation. In addition, we also controlled for size and year effects. *SIZE* is the natural log of total assets and *YEAR* is dummy variables controlling for years (Chandra, 2011; Bentley *et al.*, 2013).

4. SAMPLE DISTRIBUTION AND DESCRIPTIVE STATISTICS

4.1. Sample Distribution

The financial performance of firms in the electronics industry is closely tied to innovation. This has led to a large number of patent-related lawsuits, with wide ranging economic consequences. Thus, focusing on the electronics industry can help us addressing our research issues. Our sample selection was guided by the following considerations. First, data concerning the content of lawsuits was hand-collected from annual reports of the Market Observation Post System (*MOPS*), whereas patent-related data was hand-collected from the Taiwan Patent Search System (*TPSS*). For this reason, we tried to keep the sample size manageable. Furthermore, we focused on patent-related lawsuits in the electronics industry, due to the vigor with which innovation is pursued in this field. Based on the above criteria, our sample comprised 4,851 firm-year observations of the electronics firms listed on the Taiwan Stock Exchange (*TSE*) over the period from 2010 to 2015. Company-level accounting and corporate governance data were obtained from the Taiwan Economic Journal (*TEJ*) database.

Table-2. Sample Distribution

Panel A：Distribution of observations by year and lawsuit							
Year Lawsuit [a]	2010	2011	2012	2013	2014	2015	Total
No Lawsuit	699	722	718	722	729	741	4,331
	(14.41%)	(14.88%)	(14.80%)	(14.88%)	(15.03%)	(15.28%)	(89.28%)
Lawsuit	87	87	93	93	80	80	520
	(1.79%)	(1.79%)	(1.92%)	(1.92%)	(1.65%)	(1.65%)	(10.72%)
Total	786	809	811	815	809	821	4,851
	(16.20%)	(16.68%)	(16.72%)	(16.80%)	(16.68%)	(16.92%)	(100%)

Panel B：Distribution of lawsuit observations by expertise and patent			
Patent [c] Lawsuit [b]	Patent	No Patent	Total
Expertise	13 (2.50%)	161 (30.96%)	174 (33.46%)
Non-Expertise	68 (13.08%)	278 (53.46%)	346 (66.54%)
Total	81 (15.58%)	439 (84.42%)	520 (100%)

Panel C：Distribution of lawsuit observations by credit rating									
Rating [d]	Investment-Grade						Speculative - Grade		
	lower risk rating				medium risk rating		higher risk rating		
	1	2	3	4	5	6	7	8	9	10
Lawsuit	6	18	47	99	111	113	61	28	20	17
	(1.15%)	(3.46%)	(9.04%)	(19.04%)	(21.35%)	(21.73%)	(11.73%)	(5.38%)	(3.85%)	(3.27%)

Panel D：Distribution of lawsuit observations by expertise and opinion			
Opinion [e] Lawsuit	Clean	Unclean	Total
Expertise	94 (18.08%)	80 (15.38%)	174 (33.46%)
Non-Expertise	131 (25.19%)	215 (41.35%)	346 (66.54%)
Total	225 (43.27%)	295 (56.73%)	520 (100%)

[a] Lawsuit (No Lawsuit) denotes companies (not) involved in patent-related lawsuits.
[b] Expertise (Non-Expertise) denotes companies (not) belong to industry specialization audit.
[c] Patent (No Patent) denotes companies (not) obtained new patents.
[d] Taiwan Corporate Credit Rating Index, where the credit rating is divided into ten degrees, with the highest degree representing the highest credit risk.
[e] Clean (Unclean) denotes companies receive clean (unclean) opinions.

Panel A of Table 2 reports on the distribution across years as well as patent lawsuit disclosures among firm-year observations, showing that 10.72% of observations were associated with patent-related lawsuits. Panel B shows that 33.46% of lawsuit observations were audited by industry specialists; and 15.58% of lawsuit observations involved the awarding of new patents in the year of patent litigation. These findings indicate that industry specialists may be able to provide legal advice regarding how to avoid litigation. Furthermore, it appears that greater innovative capacity is associated with a lower probability of being involved in patent-related lawsuits. Panel C lists the distribution of lawsuit observations by credit rating, which shows that companies involved in patent lawsuits have the highest percentages (43.08%) in the medium risk rating. Panel D shows that approximately 56.73% of the lawsuit observations involved unclean opinions, which implies that the auditors may be taking into account the risk of damages associated with possible patent infringement. The clients of auditing firms that do not specialize in the industry were more likely to receive unfavorable opinions than were the clients of industry specialists.

4.2. Descriptive Statistics

Table 3 presents the descriptive statistics for variables used in our analysis. To mitigate the effects of outliers, we winsorized all continuous variables at the 1st and 99th percentiles. In our sample, companies with patent-related lawsuits exhibit greater innovative capacity (*PAT*), have lower credit risk (*TCRI*), receive more unclean opinions (*GC*), have larger size (*SIZE*), perform worse (*ROA* and *GROWTH*), have more payable (*DE*), and have weaker corporate governance (*CONTROL* and *INDBOD*) compared to companies that are not involved in patent-related lawsuits.

Table-3. Descriptive Statistics

Variables [a]	No Patent Lawsuit [b] (n=4,331)				Patent Lawsuit (n=520)				Test of Differences [c]	
	Mean	Median	Std. Dev		Mean	Median	Std. Dev		*t*-test	Wilcoxon
PAT	0.5336	1.0000	0.4989		0.8442	1.0000	0.3630		−13.77***	−13.51***
TCRI	5.8746	6.0000	1.4632		5.4096	5.0000	1.8684		6.63***	6.87***
GC	0.4274	0.0000	0.4948		0.5673	1.0000	0.4959		−6.09***	−6.07***
SIZE	15.0534	14.8749	1.3107		16.1506	15.7882	1.8041		−17.23***	−13.61***
ROA	0.0388	0.0453	0.0888		0.0301	0.0422	0.0981		2.10**	1.95*
GROWTH	0.0793	0.0340	0.3131		0.0403	0.0171	0.2907		2.70***	2.29**
OCF	0.0727	0.0716	0.1084		0.0657	0.0637	0.1081		1.39	1.81*
DE	0.3900	0.3821	0.1671		0.4274	0.4315	0.1846		−4.77***	−4.55***
CONTROL	0.4438	0.4167	0.1842		0.4791	0.4545	0.1759		−4.15***	−5.29***
DEVIATION	0.0684	0.0215	0.1116		0.0602	0.0958	0.0257		1.62	−1.01
DUALITY	0.4066	0.0000	0.4913		0.3885	0.0000	0.4879		0.80	0.80
INBOD	0.2434	0.2857	0.1668		0.2222	0.2857	0.1603		2.75***	4.27***

[a] TABLE 1 provides our variable definitions. All continuous are winsorized at the first and 99th percentiles.
[b] Patent Lawsuit (No Patent Lawsuit) denotes companies (not) involved in patent-related lawsuits.
[c] Asterisks *, **, *** indicate significance at the 0.10, 0.05, and 0.01 levels, respectively.

Table 4 presents the Pearson correlation matrix for the dependent and independent variables, the results of which are consistent with Table 3. Most of the explanatory variables are not significantly correlated with each other. Only the correlations between *ROA* and *OCF* (0.5940), and *ROA* and *GROWTH* (0.3898) are greater than 0.30. We further computed variance inflation factors (VIF) for all models, wherein the largest was only 1.57, which is well below the 10 threshold of concern recommended by Kennedy (1998) and Gujarati (1995). Thus, our empirical results were shown to be unaffected by multicollinearity.

Table-4. Pearson Correlation Matrix

Variables [a]	LAWSUIT	DEFAW	PLALAW	PAT	TCRI	GC	SIZE	ROA	GROWTH	OCF	DE	CONTROL	DEVIATION	DUALITY
DEFAW	0.9641													
PLALAW	0.4009	0.2516												
PAT	0.1939	0.1882	0.1017											
TCRI	-0.0947	-0.0943	-0.0852	-0.2732										
GC	0.0872	0.0836	0.0464	0.0171	0.0011									
SIZE	0.2402	0.2467	0.1092	0.3038	-0.6005	0.1383								
ROA	-0.0302	-0.0377	0.0514	0.0856	-0.5429	-0.1040	0.1606							
GROWTH	-0.0388	-0.0419	0.0117	0.0061	-0.1118	0.0218	0.0510	0.3898						
OCF	-0.0200	-0.0256	0.0493	0.1370	-0.4112	-0.1094	0.1760	0.5940	0.1945					
DE	0.0683	0.0653	0.0091	-0.0168	0.1893	0.0858	0.2960	-0.2207	0.0640	-0.2199				
CONTROL	0.0596	0.0690	0.0087	-0.0468	-0.1148	0.1777	0.2332	-0.0024	-0.0284	-0.0165	0.0350			
DEVIATION	-0.0232	-0.0182	-0.0502	0.0077	-0.0377	-0.0512	0.0374	0.0209	0.0294	0.0693	0.0051	0.1464		
DUALITY	-0.0114	-0.0099	0.0029	-0.0541	0.1427	0.0056	-0.1392	-0.0689	-0.0329	-0.0930	-0.0138	-0.0147	-0.1334	
INBOD	-0.0395	-0.0414	-0.0332	0.0941	-0.0225	-0.2140	-0.0603	0.0454	0.0250	0.0772	-0.0144	-0.4706	0.0323	-0.0600

[a] TABLE 1 provides our variable definitions. All continuous variables are winsorized at the first and 99th percentiles.

5. EMPIRICAL RESULTS

In this section, we report and discuss the empirical results. We also include year fixed effects in research models and adopt clustering by companies plus White's heteroskedasticity-adjusted standard errors (Petersen, 2009; Gow et al., 2010; Boone et al., 2013).

5.1. Causes of Patent Lawsuits

5.1.1. Innovative Capacity

Column 1 of Table 5 reports the results of the research models described in Equation (1), using $LAWSUIT$ as the dependent variable. As shown in column 1, the coefficient on the test variable PAT was 0.6313, which is significant at the 1% level ($z = 10.03$). This result is consistent with H1, suggesting that companies with greater innovation output are more likely to be involved in patent-related lawsuits. This finding is consistent with the PWC (2012). Focusing on the sample of patent-related lawsuits, we then considered defendant-related and plaintiff-initiated lawsuits to test H1, based on the fact that it does not matter whether plaintiffs or defendants are influenced by patent litigation. The coefficient of PAT in column 2 is insignificant and negative, whereas the coefficient of PAT in column 3 is significant and positive. These empirical results imply that companies with greater innovative capacity are more likely to defend their patent rights by filing a lawsuit for patent infringement. All of the estimated coefficients on the control variables $SIZE$, $GROWTH$, OCF, $DUALITY$, and $INBOD$ are significant, with the expected signs.

Table-5. Patent Lawsuit and Innovative Capacity

Variables [a]	Pred. Sign	(1) Dep. Var. = $LAWSUIT$		(2) Dep. Var. = $DEFLAW$		(3) Dep. Var. = $PLALAW$	
		Coef.	z-value [b,c]	Coef.	z-value	Coef.	z-value
$CONSTANT$		-5.0602	-14.76***	-3.4193	-2.99***	0.1890	0.23
PAT	+	0.6313	10.03***	-0.2407	-1.01	0.6830	2.98***
$SIZE$	+	0.2303	10.34***	0.2756	3.91***	-0.0470	-0.93
ROA	−	-0.4695	-1.10	-1.6743	-1.16	1.8576	1.59*
$GROWTH$	−	-0.2589	-2.15**	-0.1437	-0.48	0.0371	0.13
OCF	−	-1.0232	-2.99***	-2.5874	-2.12**	2.3729	2.71***
DE	+	-0.0508	-0.28	-1.6113	-2.61***	0.3635	0.76
$CONTROL$	+	0.0038	0.02	1.9105	2.86***	-0.8264	-1.67**
$DEVIATION$	+	-0.4636	-1.83**	0.5574	0.38	-3.2741	-2.02**
$DUALITY$	+	0.0888	1.64**	0.3390	1.86**	0.1057	0.70
$INBOD$	−	-0.3755	-2.24**	0.5610	0.74	-1.1332	-2.23**
$YEAR$		Included		Included		Included	
Pseudo R^2		12.16%		17.34%		11.85%	
N		4,851		520		520	

[a] TABLE 1 provides our variable definitions. All continuous are winsorized at the first and 99th percentiles.

[b] Asterisks *, **, *** indicate significance at the 0.10, 0.05, and 0.01 levels, respectively. One-tailed for directional expectations, two-tailed for others.

[c] This TABLE adopts clustering by company and white adjustments.

To identify which levels of innovation are more likely to drive patent-related lawsuits, we considered various innovation outputs in Equation (2), the results of which are presented in Table 6. In Panel A, the coefficient of $PATINV$ is significant and positive, whereas the coefficients of $PATUM$ and $PATDES$ are insignificant but positive. In Panel B, the coefficient of $PATINV$ is significant and negative, the coefficient of $PATUM$ is significant and positive, and the coefficient of $PATDES$ is insignificant and positive.

Table-6. Patent Lawsuit and Innovative Level

Panel A : Companies of patent lawsuit

Variables [a]	Pred. Sign	(1) Coef.	z-value [b,d]	(2) Coef.	z-value	(3) Coef.	z-value
CONSTANT		-2.4744	-4.92***	-3.5489	-6.51***	-3.5747	-4.46***
PATINV	+	0.3243	10.60***				
PATUM	+			0.0125	0.36		
PATDES	+					0.0488	0.84
SIZE	+	0.0879	2.54***	0.1807	5.15***	0.2490	4.66***
ROA	−	-0.0869	-0.13	-0.8706	-1.26	-2.8382	-2.30**
GROWTH	−	-0.0163	-0.10	-0.3172	-1.76**	-0.1778	-0.63
OCF	−	-2.0940	-3.97***	-1.8058	-3.11***	-1.6168	-1.72**
DE	+	-0.1393	-0.52	-0.1778	-0.61	-0.1884	-0.40
CONTROL	+	-0.1368	-0.59	-0.1484	-0.59	-1.2094	-2.62***
DEVIATION	+	-0.4564	-1.29*	-1.0010	-2.24**	-0.3331	-0.39
DUALITY	+	0.0835	1.06	-0.0580	-0.75	0.0345	0.25
INBOD	−	-0.9805	4.13***	0.0303	0.12	-0.5914	-1.31*
YEAR		Included		Included		Included	
Pseudo R²		17.03%		5.87%		9.99%	
N [c]		1,862		1,910		520	

Panel B : Defendant companies of patent lawsuit

Variables [a]	Pred. Sign	(1) Coef.	z-value [b,d]	(2) Coef.	z-value	(3) Coef.	z-value
CONSTANT		-8.0492	-4.46***	-0.5925	-0.51	-21.5215	-2.95***
PATINV	+	-0.2823	-2.54**				
PATUM	+			0.2175	2.04**		
PATDES	+					0.0284	0.07
SIZE	+	0.6339	5.04***	0.1428	1.81**	1.2593	2.96***
ROA	−	-1.3341	-0.62	0.5359	0.38	-12.5469	-2.25**
GROWTH	−	0.6263	1.49*	0.5006	1.21	0.0888	0.10
OCF	−	-2.8149	-1.57*	-2.4091	-1.40*	15.6951	1.99**
DE	+	-1.1518	-1.81**	-2.3207	-2.64***	-0.4290	-0.17
CONTROL	+	0.1257	0.16	1.3682	1.69**	3.8008	0.99
DEVIATION	+	2.6808	1.59*	1.7466	0.63	126.9289	3.45***
DUALITY	+	1.3048	3.57***	0.3704	2.11**	2.4885	2.05**
INBOD	−	-0.4760	-0.58	-1.6318	-1.54*	2.8570	0.98
YEAR		Included		Included		Included	
Pseudo R²		27.51%		17.64%		69.79%	
N [c]		361		263		146	

Panel C : Plaintiff companies of patent lawsuit

Variables [a]	Pred. Sign	(1) Coef.	z-value [b,d]	(2) Coef.	z-value	(3) Coef.	z-value
CONSTANT		4.9015	2.69***	-0.4784	-0.43	9.6421	4.32***
PATINV	+	0.3242	3.00***				
PATUM	+			-0.1704	-1.97**		
PATDES	+					0.0663	0.44
SIZE	+	-0.3671	-2.97***	-0.0398	-0.54	-0.5248	-3.48***
ROA	−	1.5061	1.08	1.7467	1.07	5.6364	1.76**
GROWTH	−	-0.0764	-0.20	-0.7577	-1.45*	-2.5644	-2.55***
OCF	−	3.2029	3.00***	3.8698	2.83***	7.2920	2.85***
DE	+	0.5551	1.06	1.3995	1.79**	-0.2887	-0.23
CONTROL	+	-0.3044	-0.49	-0.0490	-0.07	-1.4817	-1.25
DEVIATION	+	-4.3543	-2.27**	-3.3085	-1.34*	-22.7614	-3.61***
DUALITY	+	-0.0776	-0.39	0.3162	1.52*	0.4876	1.28*
INBOD	−	-1.0041	-1.84**	-0.6113	-0.79	-3.2289	-2.59***
YEAR		Included		Included		Included	
Pseudo R²		18.07%		15.18%		40.52%	
N [c]		361		263		146	

[a] TABLE 1 provides our variable definitions. All continuous variables are winsorized at the first and 99th percentiles.

[b] Asterisks *, **, *** indicate significance at the 0.10, 0.05, and 0.01 levels, respectively. One-tailed for directional expectations, two-tailed for others.

[c] The number reported in TABLE 6 is different from other TABLEs because some companies obtained new patents more than one type of patents in the same year. In addition, some companies involved in patent-related lawsuit more than one case in the same year. Thus, these companies may be both plaintiffs and defendants.

[d] This TABLE adopts clustering by company and white adjustments.

In Panel C, the coefficient of *PATINV* is significant and positive, the coefficient of *PATUM* is significant and negative, and the coefficient *PATDES* is insignificant and positive. These empirical results indicate that companies are more (less) likely to file plaintiff-initiated lawsuits when they obtain new invention (utility) patents, and companies are less (more) likely to suffer defendant-related lawsuits when they obtain new invention (utility) patents. These results imply that companies that are more involved in innovative activities are more likely to have to defend their patent rights and fight off defendant-related lawsuits. Furthermore, utility patents are inherently unstable and uncertain, due to the fact that Taiwan uses a non-substantive examination system for utility patents. As a result, companies with new utility patents are likely to face defendant-related lawsuits and unlikely to file plaintiff-initiated lawsuits.

5.2. Economic Consequences of Patent Lawsuits
5.2.1. Credit Rating

Table 7 presents the results obtained when Equation (3) was used to investigate whether patent-related lawsuits increase credit risk leading to unfavorable ratings. Panel A shows that the coefficient of *LAWSUIT* is significant and positive at the 1% level ($z = 2.45$). This result is consistent with H2, suggesting that credit rating agencies are more likely to assign unfavorable ratings to companies with patent-related lawsuits. Auditors play an important role in validating financial information being released to capital markets, as well as in providing non-financial information to clients. Specifically, auditors can provide industry-related information as long as they possess engagement-specific expertise. Previous researchers have demonstrated that industry specialization is associated with higher quality financial reporting (Gul *et al.*, 2009; Burnett *et al.*, 2012; Hegazy *et al.*, 2015) which tends to reduce uncertainty among debt market participants, thereby affecting rating decisions (Ashbaugh-Skaife *et al.*, 2006; Alissa *et al.*, 2013). Ferguson and Pündrich (2015) recently reported that assurance from industry specialists with regard to non-financial information is of considerable importance to investors. This raises the question as to whether the expertise and experience of auditors can alleviate the risk perceived by raters in cases where auditees are involved in patent-related lawsuits. Thus, we further partitioned the sample into groups in which the auditors were with and without expertise in the industry. We found that *LAWSUIT* is significant and positive (p < 0.01) only in the group without industry expertise, which implies that credit raters may consider whether such companies are audited by industry specialists in the assignment of ratings. When defendant-related and plaintiff-initiated lawsuits were taken into account to test H2, the results in Panel B were very similar to those listed in Panel A; however, none of the results of *LAWSUIT* in Panel C were significant. These findings suggest that credit raters may regard defendant-initiated lawsuits as a violation of patent rights, leading them to assign unfavorable ratings. Further, these findings suggest that raters incorporate the effects of industry expertise in their rating decisions.

Table-7. Patent Lawsuit and Credit Rating

Panel A：Companies of patent lawsuit

Variables [a]	Pred. Sign	All		Non-Industry Expertise		Industry Expertise	
		Coef.	z-value [b,d]	Coef.	z-value	Coef.	z-value
LAWSUIT	+	0.1473	2.45***	0.1862	2.50***	0.0684	0.69
SIZE	+	-0.7972	-33.66***	-0.7710	-25.32***	-0.8556	-25.38***
ROA	−	-7.6669	-24.32***	-7.4566	-20.96***	-8.5450	-12.40***
GROWTH	−	0.3616	5.78***	0.3969	5.65***	0.2054	1.56
OCF	−	-0.2378	-1.23	-0.1662	-0.73	-0.6034	-1.57*
DE	+	2.8470	23.94***	2.8447	20.18***	2.8903	13.33***
CONTROL	+	0.0328	0.30	0.1709	1.34*	-0.1818	-0.92
DEVIATION	+	-0.0244	-0.16	0.1094	0.57	-0.2353	-0.98
DUALITY	+	0.1021	3.20***	0.1786	4.54***	-0.0528	-0.97
INBOD	−	-0.3600	-3.34***	-0.5469	-4.40***	0.2113	0.90
YEAR		Included		Included		Included	
Pseudo R²		28.30%		27.58%		30.39%	
N [c]		4,851		3,395		1,456	

Panel B：Defendant companies of patent lawsuit

Variables [a]	Pred. Sign	All		Non-Industry Expertise		Industry Expertise	
		Coef.	z-value [b,d]	Coef.	z-value	Coef.	z-value
DEFLAW	+	0.2149	1.56*	0.3552	2.25***	-0.2335	-0.71
SIZE	+	-0.6689	-10.04***	-0.6635	-7.58***	-0.7958	7.34***
ROA	−	-6.4672	-7.84***	-6.4418	-5.62***	-8.9945	-5.23***
GROWTH	−	0.1708	1.00	0.3346	1.29*	-0.0123	-0.05
OCF	−	-0.2056	-0.31	0.4698	0.48	-1.7557	-1.57*
DE	+	4.0103	11.27***	4.0678	8.68***	3.8713	5.85***
CONTROL	+	0.2764	0.76	0.6087	1.45*	-0.9957	-1.42*
DEVIATION	+	1.6984	3.15***	2.0722	3.14***	0.4185	0.50
DUALITY	+	0.0346	0.30	0.1987	1.44*	-0.4163	-1.70**
INBOD	−	0.6977	2.22**	0.4958	1.21	1.3632	2.00**
YEAR		Included		Included		Included	
Pseudo R²		27.62%		26.26%		37.74%	
N [c]		520		346		174	

Panel C：Plaintiff companies of patent lawsuit

Variables [a]	Pred. Sign	All		Non-Industry Expertise		Industry Expertise	
		Coef.	z-value [b,d]	Coef.	z-value	Coef.	z-value
DEFLAW	+	-0.0629	-0.47	-0.1905	-1.02	0.0718	0.31
SIZE	+	-0.6623	-9.97***	-0.6495	-7.40***	-0.7943	-7.35***
ROA	−	-6.4717	-7.84***	-6.4968	-5.73***	-9.0387	-5.40***
GROWTH	−	0.1645	0.96	0.3494	1.35*	0.0028	0.01
OCF	−	-0.2221	-0.33	0.4870	0.50	-1.7816	-1.53*
DE	+	3.9715	11.26***	3.9724	8.60***	3.8394	5.85***
CONTROL	+	0.3061	0.84	0.6763	1.62*	-0.9672	-1.31*
DEVIATION	+	1.6744	3.08***	1.9901	3.03***	0.4619	0.50
DUALITY	+	0.0433	0.38	0.2053	1.49*	-0.4235	-1.67**
INBOD	−	0.6963	2.21**	0.4937	1.18	1.4140	2.01**
YEAR		Included		Included		Included	
Pseudo R²		27.57%		26.17%		37.73%	
N [c]		520		346		174	

[a] TABLE 1 provides our variable definitions. All continuous are winsorized at the first and 99th percentiles.

[b] Asterisks *, **, *** indicate significance at the 0.10, 0.05, and 0.01 levels, respectively. One-tailed for directional expectations, two-tailed for others.

[c] The number reported in TABLE 7 is different from other TABLEs because some companies obtained new patents more than one type of patents in the same year. In addition, some companies involved in patent-related lawsuit more than one case in the same year. Thus, these companies may be both plaintiffs and defendants.

[d] This TABLE adopts clustering by company and white adjustments.

5.2.2. Audit Opinion

Table 8 presents the results obtained when Equation (4) was used to examine whether the number of lawsuit cases[14] and/or the dollars[15] involved affect auditors' perceived risk of litigation disclosures.

Panel A shows that the coefficient *LAWSUIT* is significant and positive at the 1% level ($z = 2.57$), indicating that companies with patent-related lawsuits are more likely to receive unclean opinions. We also considered the influence of industry specialists in determining whether the expertise and experience of auditors affects their opinion decisions in cases where auditees are involved in patent-related lawsuits. After partitioning the sample into groups in which auditors are with and without industry expertise, we found that *LAWSUIT* is only significant and positive ($p < 0.01$) in the non-industry expert group, which implies that auditors without industry expertise are more likely to view patent-related lawsuits as indicators of risk. Notably, the coefficient of *LAWSUIT* is insignificant and positive in the industry expertise group, which implies that industry experts may have a deeper understanding of the true nature of litigation in innovation-rich industries, such that their reactions do not present obvious patterns. Panel B shows that the coefficient *NUMLAW* in both subsamples is significant and positive, which implies that auditors are more concerned about the frequency of patent-related lawsuits, regardless of whether the company is audited by industry experts or non-experts. Panel C shows that the coefficient *AMOLAW* in the non-industry expertise group is significant and positive, which implies that non-industry experts are more likely than industry experts to be concerned by the dollar amount associated with patent-related lawsuits.

Table-8. Cases and Dollars of Patent Lawsuit and Audit Opinion

Panel A：Companies of patent lawsuit							
		All		**Non-Industry Expertise**		**Industry Expertise**	
Variables [a]	**Pred. Sign**	**Coef.**	**z-value** [b,d]	**Coef.**	**z-value**	**Coef.**	**z-value**
CONSTANT		-2.0260	-7.47***	-2.8726	-8.63***	-0.9930	-2.07**
LAWSUIT	+	0.1656	2.57***	0.2506	3.16***	0.0202	0.18
SIZE	+	0.1394	8.47***	0.1969	9.68***	0.0590	2.01**
ROA	−	-1.5360	-5.28***	-2.0977	-6.07***	-0.1609	-2.09
GROWTH	−	-0.0390	-0.53	0.0105	0.12	-0.1646	-1.08
OCF	−	-0.8880	-3.87***	-0.9587	-3.48***	-0.8355	1.95**
DE	+	0.0420	0.33	0.0079	0.05	0.0782	0.32
CONTROL	+	0.5287	4.24***	0.5941	3.95***	0.6337	2.69***
DEVIATION	+	-0.8010	-4.33***	-0.6371	-2.81***	-1.2143	-3.77***
DUALITY	+	-0.0044	-0.11	-0.0098	-0.21	0.0609	0.83
INBOD	−	-1.1687	-8.84***	-1.0755	-6.83***	-1.3490	-5.21***
YEAR		Included		Included		Included	
Pseudo R²		12.65%		13.30%		13.92%	
N		4,851		3,395		1,456	
Panel B：Cases of patent lawsuits							
		All		**Non-Industry Expertise**		**Industry Expertise**	
Variables [a]	**Pred. Sign**	**Coef.**	**z-value** [b,d]	**Coef.**	**z-value**	**Coef.**	**z-value**
CONSTANT		1.9540	2.60***	0.6422	0.70	4.7455	3.13***
NUMLAW	+	0.1888	2.19**	0.2317	2.06**	0.2971	1.79**
SIZE	+	-0.0359	-0.78	0.0329	0.60	-0.2029	-1.93**
ROA	−	-2.7679	-2.85***	-1.9234	-1.76**	-4.9169	-2.52***
GROWTH	−	0.4784	1.81**	0.5109	1.51*	0.6682	1.40*

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[14] The number of defendant-related (plaintiff-initiated) lawsuits is 487 (93) in our sample, and 60 cases are involved in both defendant-related and plaintiff-initiated lawsuits.

[15] The number of voluntary disclosure about lawsuit dollars is only 177 in our sample. On average, settlement amounts of defendant-related (plaintiff-initiated) lawsuits were $258 ($76) million.

OCF	—	–0.0976	–0.12	–0.7178	–0.68	1.6497	0.99
DE	+	–0.1501	–0.38	0.8702	1.77**	–1.9508	–2.13**
CONTROL	+	–0.4242	–0.98	–0.5916	–1.21	0.8721	0.85
DEVIATION	+	–0.1355	–0.18	0.8933	1.04	–3.5394	–2.41***
DUALITY	+	0.1687	1.33*	0.0093	0.06	0.4253	1.49*
INBOD	—	–2.4173	–5.42***	–1.6155	–2.88***	–3.8690	–3.71***
YEAR		Included		Included		Included	
Pseudo R²		14.38%		12.59%		38.62%	
N		520		346		174	

Panel C : Dollars of patent lawsuit

Variables [a]	Pred. Sign	All		Non-Industry Expertise		Industry Expertise	
		Coef.	z-value [b,d]	Coef.	z-value	Coef.	z-value
CONSTANT		1.0015	0.78	0.4575	0.28	-21.7420	-2.36**
AMOLAW	+	0.1124	1.66**	0.1011	1.30*	0.2687	1.13
SIZE	+	–0.0333	–0.35	–0.0552	–0.47	2.4398	2.57***
ROA	—	–5.2829	–3.00***	–4.6326	–2.63***	–19.7079	–2.92***
GROWTH	—	0.1690	0.42	–0.0172	–0.03	–0.7630	–1.03
OCF	—	1.3431	0.93	1.3426	0.72	–5.3497	–1.40*
DE	+	–0.1671	–0.22	0.8126	0.79	–19.0560	–3.46***
CONTROL	+	–0.6280	–0.74	0.0727	0.07	–16.8920	–2.59***
DEVIATION	+	0.7218	0.49	0.9924	0.53	5.6474	1.27
DUALITY	+	–0.0815	–0.36	–0.2115	–0.73	2.3465	2.16**
INBOD	—	–2.7241	–3.19***	–1.2327	–1.15	–23.6435	–3.62***
YEAR		Included		Included		Included	
Pseudo R²		20.07%		16.03%		72.38%	
N [c]		177		119		58	

[a] TABLE 1 provides our variable definitions. All continuous are winsorized at the first and 99th percentiles.

[b] Asterisks *, **, *** indicate significance at the 0.10, 0.05, and 0.01 levels, respectively. One-tailed for directional expectations, two-tailed for others.

[c] The number reported in Panel C is different because some companies provide only qualitative information of patent lawsuit.

[d] This TABLE adopts clustering by company and white adjustments.

5.3. Sensitivity Analyses (Not Tabulated)[16]

To test the robustness of our results, we conducted three sensitivity tests. First, to ensure that the study results were not sensitive to rating measure, we replaced the continuous rating measure presented here with a measure that collapses the TCRI ratings into four categories: 1 to 4, 5 to 6, 7 to 9, and 10 and reran the research models. Second, as an alternative measure of auditor industry expertise, we adopted the approach proposed by Francis et al. (2005) wherein auditors are classified as experts only in cases where the firm is a market leader, based on their market share using the total assets audited by an auditing firm within a given industry. Third, auditor changes and restatements may also affect the perspective of market participants and thereby bias empirical analysis. Thus, we excluded observations related to auditor changes and restatements. The above sensitivity tests demonstrate the general robustness of our main findings.

6. SUMMARY AND CONCLUSIONS

This study examined the causes and economic consequences of patent-related lawsuits. Our empirical findings can be summarized as follows. First, companies with greater innovative capacity are more likely to be involved in defending their patent rights and/or filing plaintiff-initiated lawsuits for the infringement of a patent. This finding

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[16] Because of the similarity of the sensitivity results to the results already reported in the paper, and for the sake of parsimony, we do not tabulate the sensitivity analyses.

is consistent with the GAO (2013) in which low-quality patents are associated with a higher number of patent infringement suits and tend to hinder innovation. Second, credit rating agencies are more likely to assign unfavorable ratings to companies with patent-related lawsuits, and raters appear to consider the effects of industry expertise in their rating decisions. Third, companies with patent-related lawsuits are more likely to receive unclean opinions, and auditors lacking industry expertise are more likely than experts to be concerned by the frequency of patent-related lawsuits and/or the dollar values involved.

This study faced several limitations, some of which may necessitate future research. First, this study focuses only on patent-related lawsuits in the electronics industry; therefore, our results are not necessarily representative of all companies involved in patent litigation. Second, we acted in accordance with previous studies (Ashbaugh-Skaife et al., 2006; Cheng and Subramanyam, 2008; Jiang, 2008; Gul and Goodwin, 2010; DeFond et al., 2011) in the adoption of credit ratings as a proxy to capture unobservable credit risk and examine the consequences of patent litigation. Nevertheless, we cannot rule out the possibility that our proxies failed to capture credit risk associated with patent litigation, due to the fact that the true credit risk of patent litigation is unobservable. Third, most companies did not disclose the content of patent litigation, which greatly limited the availability of empirical evidence related to the response of auditors to the occurrence of patent litigation and/or the dollar values involved.

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