

# 蔓延效果或競爭效果？以事件研究法 探討專利侵權訴訟宣告之衝擊<sup>†</sup>

## Contagion or Competitive Effect? An Event-Study Approach to Uncover the Impacts of Patent Infringement Litigation Announcement

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## 摘要

近十年來專利訴訟案件有爆發性的成長，然而探討專利侵權訴訟和市場反應的理論缺口仍然存在。本研究之目的在於瞭解專利侵權訴訟宣告是否對被告廠商和其競爭廠商之股價和交易量產生影響。以 1997-2008 年 78 個與台灣廠商相關的專利訴訟案件為調查對象，本研究發現專利侵權訴訟宣告將對被告廠商之股價和交易量帶來負面影響。除此之外，本研究也觀察到被告廠商之競爭廠商的股價和交易量亦呈現與其相似的走勢，此一現象顯示來自專利侵權訴訟資訊之信號發射效果（蔓延效果）遠大於競爭效果。

**關鍵詞：**專利訴訟、市場反應、研發策略、競爭效果、蔓延效果

## Abstract

While an explosive growth of patent litigation events in the last decade, there is still a theoretical window on exploring the relationship between patent infringement litigation announcement and the market responses. This study aims at investigating whether a patent infringement announcement would have influences on the stock price and trading volume of the defendant firm and its rival firms. Using 78 patent litigation events related to Taiwan electronics industries from 1997 to 2008, we find that patent litigation infringement announcement would bring negative impacts on both the abnormal returns and the trading volume of the defendant firm's stock. Moreover, this study observed that there are similar market responses on the competitive rivals of the defendant firm, indicating that the information-signaling effect resulting from patent infringement litigation outweighs the competitive effect.

**Keywords:** Patent Litigation, Market Response, R&D Strategy, Competitive Effect, Contagion Effect

## 1. INTRODUCTION

In the era of knowledge-based economy, technology firms are engaging in building their competitive advantage through the intellectual property rights (Rivette & Kline, 2000), albeit huge losses caused by rivals' unethical infringement. As the disclosure requirement for a patent, competitive rivals with opportunism are more likely to illegally imitate the focal firm's innovation without committing huge resources and time. In the past decade, how firms can effectively protect their inventions has turned out to be an important practical issue in the knowledge-intensive sectors (Amaraa et al., 2008). Strategic scholars on the basis of resourced-base view and competitive theory have argued that patent litigation may be a viable way to protect firms' proprietary assets (Porter, 1980; Somaya, 2003).

Upon the announcement that firms under investigation or in some way engaged in unethical behavior such as fraud, bribery, price fixing and patent infringement, firms would be penalized for their unethical actions (Gunthorpe, 1997). To the best of our knowledge, only a handful of empirical studies have particularly focused on the relationship between market responses and patent infringement, which further offer inconsistent findings. An earlier study first found that the news of patent infringement litigation is unfavorably accepted in the stock market for the defendants in the information technology industry (Raghu et al., 2008), while a subsequent study on business misconduct points out that copyright and patent infringements are not associated with statistically significant shareholder losses (Murphy et al., 2009). Aside from the inconsistent empirical findings, there are still two major shortcomings in the patent litigation studies. First, they are inclined to rely on one single indicator, namely the abnormal return of the stock, to measure the market response. Second, scholars tend to neglect the competitive or/and contagious effect within the focal industry, which impedes our understanding about the effectiveness of using patent litigation as a competitive weapon.

Following the effort of previous literature, this present study makes substantial contributions to the development of patent theory by refining the measurement of market responses, namely abnormal return and trading volume, as

well as by exploring the market responses on both defendant firm and its rivals simultaneously to clarify if there is a contagion effect or competitive effect. Through the empirical study conducted in Taiwan, we try to offer some managerial insights for MNCs from developed and developing countries in formulating offensive and defensive strategies based on patent litigation.

## **2. LITERATURE AND HYPOTHESES**

The efficient capital market theory states that market value of the firm at any time fully reflects the available information at that time (Fama, 1970). Although in an efficient market trading volume is thought to be not an important factor, several scholars have started challenging this surmise by arguing volumes of securities may also contain valuable information relevant to the target firms (e.g. Gervais et al., 2001; Huang & Heian, 2010). Simply put, price changes in fact reflect the average change in the aggregate market's average beliefs, trading volume, however, is the sum of all individual investors' trades, depending on the prevailing information asymmetry level before disclosure (Kim & Verrecchia, 1991).

Empirically, there are a large body of studies that have discussed the relationship between the movements of stock price and trading volume. Some of them argue that large trade volume measured permanently tends to be accompanied by lower expected returns (e.g. Brennan et al., 1998; Lee & Swaminathan, 2000). Their rationale is that investors demand a premium for holding stocks with illiquidity, the stocks with the largest trading volume (i.e. the most liquid stocks) will not generate returns that are quite as large on average. A negative relationship is thus expected between the movements of stock price and expected returns. However, based on Miller (1977) and Merton (1987), Gervais et al. (2001) propose a visibility hypothesis arguing that stocks which experienced an unusually high (low) trading volume would outperform (underperform) the stocks which had normal trading volume, especially when a stock that experienced unusually large

trading activity over a particular day or a week is expected to subsequently appreciate. Specifically, they posit that periods of extreme high volume contain positive information, whereas periods of extreme low volume contain negative information. According to the above reasoning, there should be a positive relationship between the movement of the stock prices and trading volume based on the visibility hypothesis.

As the present study is concerned with the market responses of patent litigation infringement announcement on the stock price and trading volume of defendant and competitive rivals during the event window, we will develop hypotheses on the basis that advocates positive association with the movements of stock price and trading volume (Gervais et al., 2001).

## **2.1 The Effect of Patent Litigation Announcement on Defendant Firms**

A patent infringement litigation announcement should convey information about the plaintiff and defendant firms. Due to huge lawsuit costs and the loss of reputation, defendant firms in comparison to plaintiff firms take more risk when the patent litigation lawsuit is announced to the public. Business ethics scholars point out that publicly traded corporations engaging in unethical behavior such as fraud, bribery, price fixing, patent infringement are more likely to receive punishment from financial markets (e.g. Gunthorpe, 1997). They infer that customers can penalize a firm for unacceptable business practices by reducing their purchase of, or even boycott, that firm's products. This will, of course, have negative influences on the cash flow and profitability of the focal firm, and hence produce a negative impact on its stock price.

Following the effort of Gunthorpe (1997), Murphy et al. (2009) conducted a more detailed analysis and found the losses in wealth associated with allegations of fraud are substantially larger than those in the other categories examined, and that the allegations of bribery and copyright and patent infringement are not related to significant shareholder losses in any multi-day windows examined. However, Raghu et al. (2008) reexamined the market reaction to patent infringement litigations in the information technology industry and confirm that the news of

patent infringement litigation will bring negative influence in the stock market for the defendant firms.

Based on the resource-based theory (Barney, 1991), plaintiff firms would commit more resources to protecting their valuable patents against the defendant firms who are suspected to illegally use their intellectual property rights. With the huge compensation and lawsuits costs, we argue the market response would bring negative impacts on the defendant's stock price when the patent litigation announcement is released, especially in high-tech industries. In addition, according to the visibility hypothesis proposed by Gervais et al. (2001), trading volume may also play an important role in delivering positive or negative information about a specific patent litigation during the event window. Thus, we argue that there is a positive relationship between the market reaction of the stock price and trading volume.

**Hypothesis 1-1:** The initial announcement of patent infringement litigation will lead to negative abnormal returns to the defendant firms.

**Hypothesis 1-2:** The initial announcement of patent infringement litigation will lead to negative abnormal trading volume to the defendant firms.

## **2.2 The Industry Effects of Patent Litigation Announcements**

While recent studies have explored the patent litigation impacts on both plaintiff and defendant firms (e.g. Raghu et al., 2008), none of them has focused their concerns on expanding the research scope to rival firms, namely the competitive effect and contagion effect derived from the defendant firm's patent litigation. Scholars have shown that the event announcements, such as bankruptcy (Lang & Stulz, 1992), foreign acquisition (Akhigbe & Martin, 2000), and reorganization filing (Chi & Tang, 2008) of the target firms would also affect the rival firms' stock price through contagion effect or/and competitive effect. We infer that the similar effects of patent infringement litigation would also exist between defendant firms and their peer firms within the same industry, especially in oligopoly industries. Hypothesis 2 and 3 are constructed as two contrasting hypotheses based on the contagion effect and competitive effect respectively.

### **2.2.1 Contagion Effect**

When the focal firm releases event information which conveys the common phenomenon within the industry, investors will not only reevaluate the value of the focal firm, but also reevaluate the values of the focal firm's peer competitors. Under the information-signaling hypothesis, patent infringement litigation would indicate that further litigations are imminent to the defendant's peer firms which would also experience a negative stock price reaction. No matter the announced event is a good or bad news, since the releasing information may reflect the whole industry phenomenon, the direction of stock price change of the focal firm would be consistent with that of its competitors with similar characteristics, which is the so-called contagion effect.

**Hypothesis 2-1:** The initial announcement of patent infringement litigation on the defendant firm will lead to negative abnormal returns to the competitive firms.

**Hypothesis 2-2:** The initial announcement of patent infringement litigation on the defendant firm will lead to negative abnormal trading volume to the competitive firms.

### **2.2.2 Competitive Effect**

When the defendant firm releases event information, it may result in the wealth redistribution within the industry. That is, the direction of stock price change of the focal (defendant) firm would be exactly opposite to that of its peer firms with similar characteristics, which is the so-called competitive effect.

Under the competitive hypothesis, the firms that are alleged by the plaintiff firms will incur huge direct lawsuit costs and intangible organizational costs and may lose their competitive advantage. Hence, the defendant's rival firms would experience a positive stock price reaction as the plaintiff firms indirectly enhance the competitiveness of the defendant's rival firms.

**Hypothesis 3-1:** The initial announcement of patent infringement litigation on the defendant firm will lead to positive abnormal returns to the competitive firms.

**Hypothesis 3-2:** The initial announcement of patent infringement litigation on the defendant firm will lead to positive abnormal trading volume to the competitive firms.

### 3. METHODOLOGY

#### 3.1 The Event-Study Method

We followed the standard procedure of event-study method to generate abnormal returns and abnormal trading volume of the sampled events (Chae, 2005; Chen et al., 2005; Graham et al., 2006). The Taiwanese value-weighted index return was used as the proxy for market return. Defining the event date as day 0, abnormal stock returns were generated using market model residuals estimated from day -110 to day -11. As interested in the price diffusion effect between event and match firms, we adopted a longer event period from -10 to 10 (Foerster & Karolyi, 1999).

In addition, we used cumulative abnormal return (CAR) and cumulative abnormal trading volume (CATV) to study the different market reaction between event and match firm groups. Further, we developed the following multiple regression model to examine the major determinants of market reaction.

$$CAR_i = \alpha + \beta_1 Continue_i + \beta_2 Match_i + \beta_3 MV_i + \beta_4 F\_hold_i + \beta_5 MB_i + \beta_6 PE_i + \beta_7 RD_i + \varepsilon_i \quad (1)$$

where  $CAR_i$  is the cumulative abnormal return, we formed several windows of (-10,10), (-5,5), (-2,2), (-10,0), (-5,0), (-2,0), (0,10), (0,5) and (0,2) to test.  $Continue_i$  is a dummy variable, one if the firm was suited in the past and zero else.  $Match_i$  is also a dummy variable, one if the firm is the match group and zero else.  $MV_i$  is the logarithm of market value.  $F\_hold_i$  is foreign institutional holding divided by outstanding shares.  $MB_i$  is the ratio of market to book value.  $PE_i$  is the ratio of the stock price to earning per share, measured by the closing price on the event date divided to the average net income in the past four quarters.  $RD_i$  is the ratio of R&D expenditure to total revenue.

#### 3.2 Data

During the period from 1997 to 2008, we initially collected 108 patent litigation events and further deleted 29 unqualified event(s), which experienced other events such as M&A, dividend announcement, earning announcement, and

secondary equity offering (SEO) during the event window. 78 patent litigation events were used for the final analysis.

Taiwanese electronics sectors were regarded as an appropriate research context based on the following criteria. First, since patents are closely related to the commitment of R&D, knowledge-intensive firms in the electronics sectors always play major roles on the battlefield of patent litigation. Second, in order to compete with MNCs from developed countries, patent infringement has been prevailing over emerging economies such as Taiwan, Korea, and China.

## 4. EMPIRICAL RESULTS

Table 1 reports the descriptive statistics of event firms. Foreign institutions own the 18.16% shares on average and the maximal ownership reaches 73.06%. The average MV (market value) is 10.42 and the maximal value is 14.31. The high values of the MB (market to book) ratio and PE (price to earnings) ratio indicate that most of the event firms are at their growth stage. The mean of R&D expenditure ratio, RD, is 5.33% and the maximal value is 25.12%.

**Table 1: Descriptive statistics**

	Foreign holdings	MV	MB	PE	RD
Mean	18.16	10.42	2.91	32.42	5.33
Median	12.33	10.72	2.11	14.38	3.9
Std	17.42	1.71	2.61	102.19	3.89
Min	0.01	6.85	0.48	0	0.03
Max	73.06	14.31	17.97	899	25.12

Data source: this research

Table 2 documents the market reaction around the litigation event window of (-10, 10). The abnormal returns of the defendant firm at the patent infringement litigation announcement date (t=0) and one day before the announcement date (t=-1) were -0.903 and -1.353 respectively, both showing the abnormal returns were

Contagion or Competitive Effect? An Event-Study Approach to  
Uncover the Impacts of Patent Infringement Litigation Announcement

negative and significant at 1 percent level and indicating investors expected that event firms would incur high lawsuit and organizational costs, or/and have detrimental impact on their corporate reputation, which, in turn, resulted in negative abnormal returns. Hypothesis 1-1 was supported<sup>1</sup>.

**Table 2: Abnormal returns around the patent litigation announcement date**

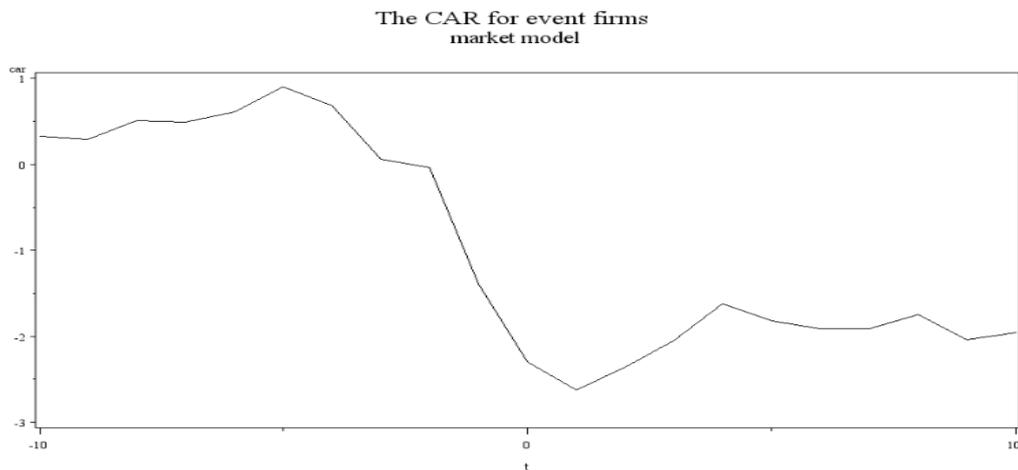
T	Mean	Median	t-value
-10	0.329	0.298	1.28
-9	-0.036	0.175	-0.12
-8	0.22	0.195	0.77
-7	-0.022	-0.182	-0.1
-6	0.119	-0.178	0.42
-5	0.296	-0.066	1
-4	-0.225	-0.426	-0.7
-3	-0.616*	-0.535	-2.33
-2	-0.104	0.113	-0.38
-1	-1.353***	-1.48	-4.49
0	-0.903***	-1.188	-4.02
1	-0.331	-0.299	-1.03
2	0.268	0.109	0.96
3	0.309	0.026	0.97
4	0.426	0.123	1.49
5	-0.194	-0.651	-0.83
6	-0.098	-0.082	-0.42
7	0	-0.418	0
8	0.165	-0.068	0.69
9	-0.286	-0.411	-1.45
10	0.079	0.161	0.27

\* p<0.1; \*\* p<0.05; \*\*\* p<0.01

Data source: this research

<sup>1</sup> We did not find a significant short sale effect existing in this study. Statistical analysis about the short sale effect is available upon request.

Table 2 shows the abnormal returns would turn positive from the second day (t=2) to the fourth day (t=4) after the patent infringement litigation announcement date, which indicates the investors initially overreacted to the announcement. The pattern of CAR in Figure 1 also reveals the market overreacted to the patent litigation news, which illustrates the CAR slightly increased after the announcement date.



**Figure 1: Cumulative abnormal returns around the event window**

Data source: this research

As Table 3 shows the abnormal trading volume during the event window, there was no significant negative impact on the investors' trading volume. However, Figure 2 indicates CATV dropped 10% during the event window. Investors were unwilling to trade stocks involved in patent lawsuits and hence the trading volume decreased. Hypothesis 1-2 was supported. Since Hypothesis 1-1 and 1-2 were supported, the empirical finding is in accordance with the prediction of visibility hypothesis.

To examine whether the investors changed their cognition towards those firms involved in patent lawsuits over 1997 to 2008, the present study further divided the sampling period into two horizons. The cutting point was set in July, 2002, at the time Taiwan Stock Exchange initiated important regulations. There were 15 events

Contagion or Competitive Effect? An Event-Study Approach to  
Uncover the Impacts of Patent Infringement Litigation Announcement

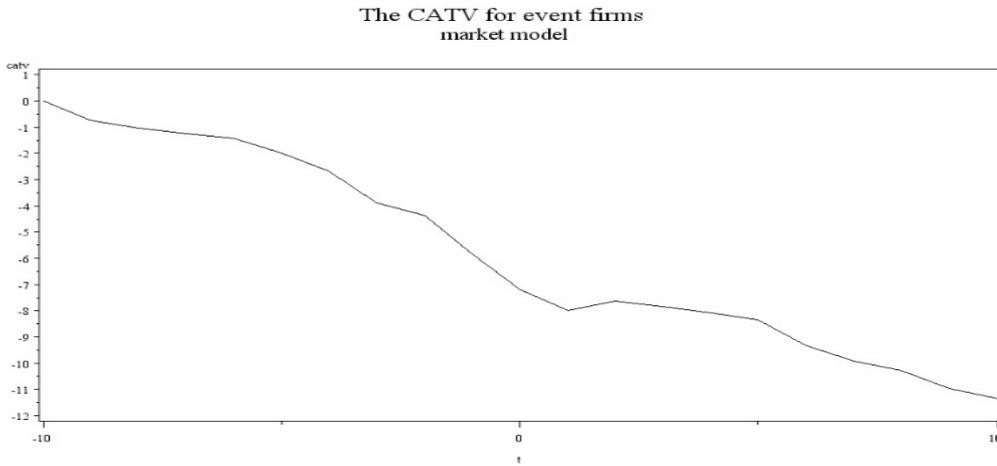
in the period before July, 2002 (Period 1), and 64 events after July, 2002 (Period 2).

**Table 3: Abnormal trading volume around the patent litigation announcement date**

T	Mean	Median	t-value
-10	0.022	-0.065	0.14
-9	-0.102	-0.097*	-0.85
-8	0.011	-0.099	0.08
-7	-0.031	-0.166	-0.18
-6	-0.115	-0.13	-0.97
-5	-0.081	-0.098	-0.47
-4	-0.098	-0.074	-0.71
-3	0.046	-0.066	0.27
-2	0.052	-0.029	0.44
-1	0.013	-0.055	0.11
0	-0.093	-0.087	-0.9
1	-0.002	-0.065	-0.01
2	0.033	-0.067	0.24
3	-0.108	-0.054	-0.87
4	0.011	-0.058	0.07
5	0.011	-0.049	0.07
6	-0.146	-0.157***	-0.8
7	-0.06	-0.095*	-0.3
8	-0.069	-0.036	-0.47
9	-0.154	-0.192***	-0.96
10	-0.044	-0.148**	-0.23

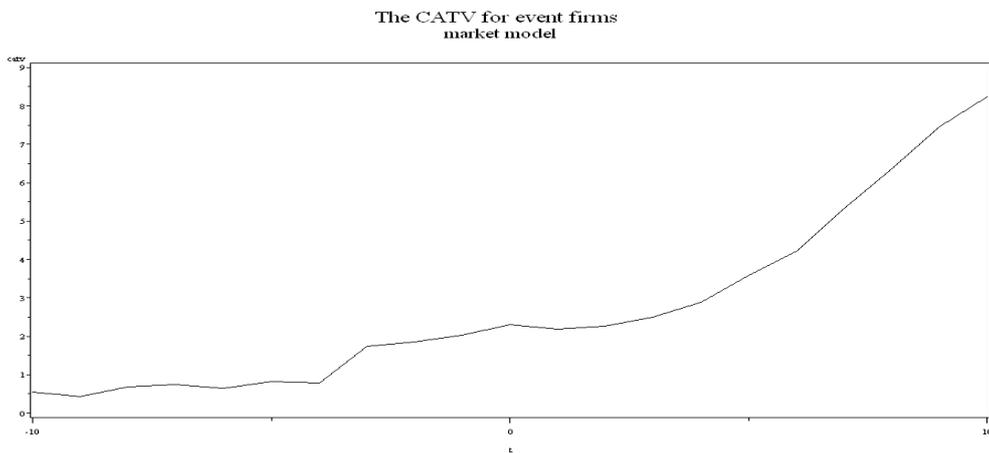
\* p<0.1; \*\* p<0.05; \*\*\* p<0.01.

Data source: this research



**Figure 2: Cumulative abnormal trading volume around the event window**  
Data source: this research

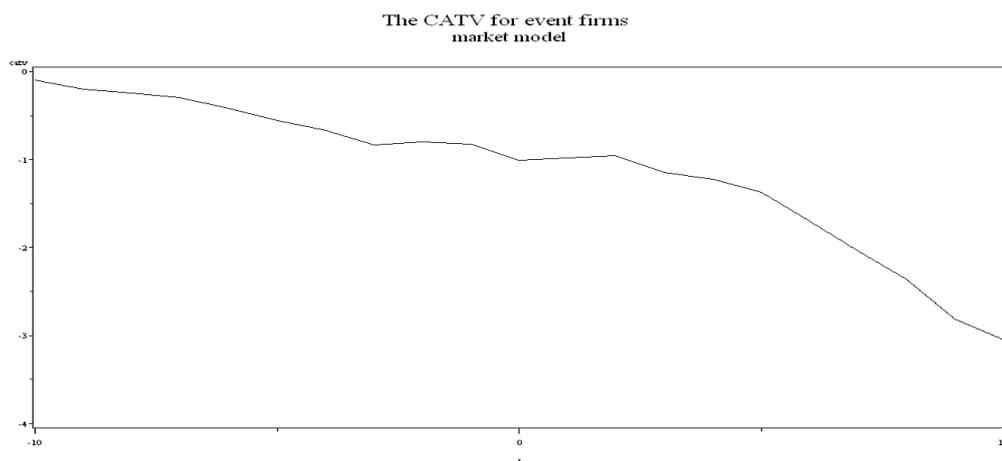
Figure 3 shows the pattern of CATV during Period 1. We found the cumulative trading volume increased after the announcement date. Investors without much experience to interpret the patent litigation impact on defendant firms may expect the operating conditions of event firms would be highly uncertain, which resulted in a large change of shareholder structure.



**Figure 3: Cumulative abnormal trading volume around the event window:  
199701~200206**  
Data source: this research

Contagion or Competitive Effect? An Event-Study Approach to  
Uncover the Impacts of Patent Infringement Litigation Announcement

Figure 4 shows the pattern of CATV in Period 2. We found the cumulative trading volume decreased after the announcement date. Investors may have learned the experience from past experiences, and understood the lawsuits may last longer than two years. Shareholder structure became more stable during the event period from July 2002 to December 2008.



**Figure 4: Cumulative abnormal trading volume around the event window:  
200207~200812**

Data source: this research

Moreover, we examined the determinants of price impact on the defendant firms. Table 4 shows that the coefficient of Continue is negative but not very significant, which implies investors could learn from the negative information of the focal event, so the successive patent litigation would not have significant influence on the defendant firm's stock price. That the coefficient of R&D is positive and significant indicates R&D expenditure not only creates firm's value in the future, but also buffers the negative impact of the patent litigation event.

**Table 4: The determinants of price impact on the defendant firms**

	MODEL1	MODEL2	MODEL3	MODEL4	MODEL5	MODEL6	MODEL7	MODEL8	MODEL9
CAR	(-10,10)	(-5,5)	(-2,2)	(-10,0)	(-5,0)	(-2,0)	(0,10)	(0,5)	(0,2)
Intercept	-31.845*** (-4.51)	-18.208*** (-4.06)	-14.734*** (-4.73)	-21.443*** (-4.44)	-16.667*** (-4.56)	-11.673*** (-4.63)	-14.054*** (-2.65)	-5.193 (-1.52)	-6.713*** (-2.72)
Continue	-1.529 (-0.67)	-0.935 (-0.65)	-0.391 (-0.39)	-0.195 (-0.12)	-0.57 (-0.48)	-0.163 (-0.2)	-1.821 (-1.06)	-0.852 (-0.77)	-0.715 (-0.9)
Match	2.288 (1.18)	1.435 (1.16)	2.134** (2.50)	2.378* (1.79)	2.13** (2.12)	1.769** (2.56)	0.685 (0.47)	0.079 (0.08)	1.14* (1.68)
RD	0.678*** (3.25)	0.511*** (3.85)	0.22** (2.39)	0.348** (2.44)	0.315*** (2.91)	0.188** (2.52)	0.372** (2.37)	0.239** (2.36)	0.075 (1.02)
F_hold	-0.077 (-1.08)	-0.034 (-0.75)	-0.028 (-0.89)	-0.056 (-1.14)	-0.013 (-0.36)	0.009 (0.37)	-0.023 (-0.43)	-0.023 (-0.66)	-0.039 (-1.58)
MV	2.702*** (3.58)	1.358*** (2.84)	1.061*** (3.19)	1.787*** (3.47)	1.223*** (3.14)	0.728*** (2.71)	1.153** (2.04)	0.373 (1.02)	0.571** (2.17)
MB	-0.281 (-0.68)	-0.267 (-1.02)	0.125 (0.69)	-0.221 (-0.78)	-0.251 (-1.18)	0.126 (0.86)	-0.022 (-0.07)	0.023 (0.12)	0.037 (0.26)
PE	-0.006 (-0.65)	-0.001 (-0.13)	-0.002 (-0.37)	-0.003 (-0.45)	0.002 (0.33)	-0.001 (-0.39)	-0.004 (-0.61)	-0.003 (-0.76)	-0.001 (-0.41)
AdjR2	0.13	0.1262	0.1146	0.1086	0.1278	0.1258	0.0336	0.0076	0.015
Nobs	150	150	150	150	150	150	150	150	150

The t-values are reported in parentheses. \* p<0.1; \*\* p<0.05; \*\*\* p<0.01.

Data source: this research

Table 5 and Figure 5 report the abnormal returns of the event (defendant) firms and the rival firms (match firms). We found that the event firms' pattern of the abnormal returns is similar to that of match firms. The announcement of patent infringement litigation has contagion effect on the rival firms within the same industry, which represents the patent infringement litigation announcement is industry-wide rather than firm-specific information. According to the above mentioned finding, Hypothesis 2-1 was supported.

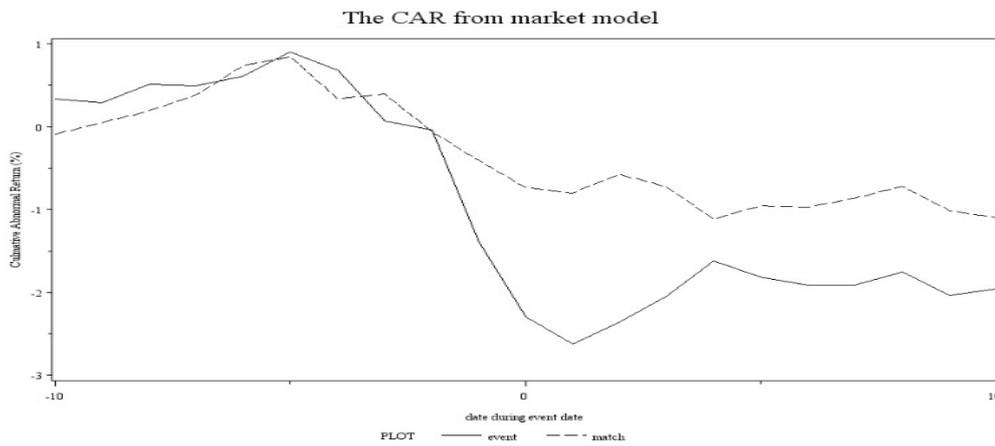
Contagion or Competitive Effect? An Event-Study Approach to  
Uncover the Impacts of Patent Infringement Litigation Announcement

**Table 5: The event and rival firms' abnormal returns during the event window**

t	Event firms			Rival firms		
	Mean	median	t-value	Mean	median	t-value
-10	0.329	0.298	1.28	-0.092	-0.031	-0.31
-9	-0.036	0.175	-0.12	0.144	-0.001	0.47
-8	0.22	0.195	0.77	0.136	-0.003	0.45
-7	-0.022	-0.182	-0.1	0.196	0.079	0.85
-6	0.119	-0.178	0.42	0.353	-0.264	1.36
-5	0.296	-0.066	1	0.107	-0.121	0.33
-4	-0.225	-0.426	-0.7	-0.507*	-0.76***	-1.73
-3	-0.616*	-0.535	-2.33	0.056	0.146	0.18
-2	-0.104	0.113	-0.38	-0.451	-0.506	-1.63
-1	-1.353***	-1.48	-4.49	-0.349	-0.324	-1.3
0	-0.903***	-1.188	-4.02	-0.33	-0.606***	-1.46
1	-0.331	-0.299	-1.03	-0.063	0.029	-0.24
2	0.268	0.109	0.96	0.224	0.066	0.82
3	0.309	0.026	0.97	-0.149	-0.331	-0.61
4	0.426	0.123	1.49	-0.388	-0.498***	-1.52
5	-0.194	-0.651	-0.83	0.158	0.27	0.56
6	-0.098	-0.082	-0.42	-0.018	-0.384**	-0.06
7	0	-0.418	0	0.111	0.474	0.4
8	0.165	-0.068	0.69	0.143	-0.078	0.65
9	-0.286	-0.411	-1.45	-0.293	-0.321*	-1.09
10	0.079	0.161	0.27	-0.087	-0.104	-0.28

p<0.1; \*\* p<0.05; \*\*\* p<0.01.

Data source: this research



**Figure 5: The event and match firm's cumulative abnormal returns around the event window**

Data source: this research

Table 6 reports the abnormal trading volume of the event and rival firms. The result is similar to that of the abnormal returns. The abnormal trading volume was significant at the announcement date and the next date in both event and rival firms. The contagion effect also existed within the industry when the trading volume was used as the proxy of market reaction. Figure 6 shows the cumulative trading volume of rival firms dropped even more than that of the event firm. We argue the investors may be worried about that the rival firms would be the subsequent victims sued by the plaintiff firm. Hypothesis 2-2 was supported. As Hypothesis 2 and 3 are two contrasting hypotheses, both Hypothesis 3-1 and 3-2 were thus not supported.

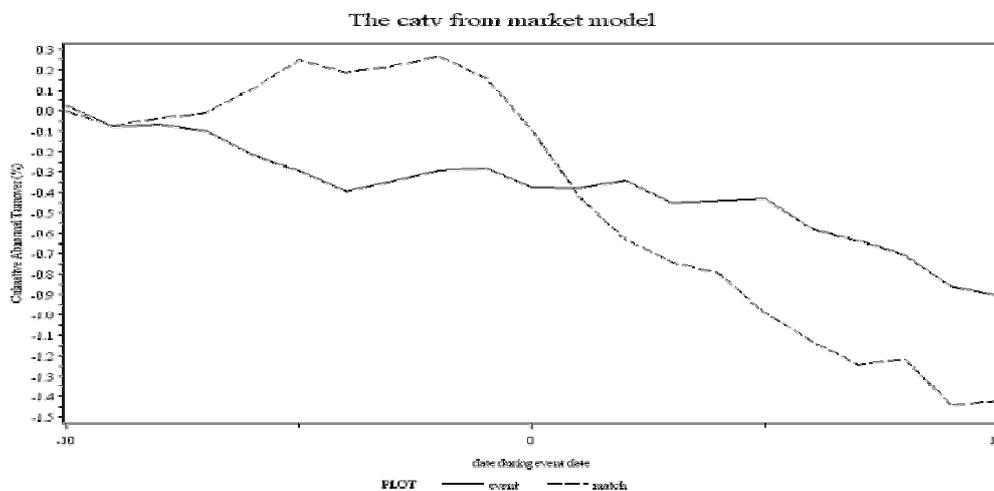
**Table 6: The event and rival firms' abnormal trading volume during the event window**

T	Event firms			Rival firms		
	Mean	median	t-value	mean	median	t-value
-10	0.022	-0.065	0.14	-0.004	-0.108***	-0.03
-9	-0.102	-0.097*	-0.85	-0.07	-0.09	-0.44
-8	0.011	-0.099	0.08	0.036	-0.121	0.28
-7	-0.031	-0.166	-0.18	0.026	-0.086	0.21
-6	-0.115	-0.13	-0.97	0.121	-0.09	1.07
-5	-0.081	-0.098	-0.47	0.139	-0.03	0.84
-4	-0.098	-0.074	-0.71	-0.059	-0.086*	-0.41
-3	0.046	-0.066	0.27	0.029	0.001	0.21
-2	0.052	-0.029	0.44	0.048	0.001	0.35
-1	0.013	-0.055	0.11	-0.104	-0.052	-0.79
0	-0.093	-0.087	-0.9	-0.257***	-0.134***	-2.67
1	-0.002	-0.065	-0.01	-0.324**	-0.097***	-2.32
2	0.033	-0.067	0.24	-0.209	-0.153**	-1.52
3	-0.108	-0.054	-0.87	-0.116	-0.099*	-0.97
4	0.011	-0.058	0.07	-0.051	-0.119**	-0.32
5	0.011	-0.049	0.07	-0.194	-0.079*	-1.35
6	-0.146	-0.157***	-0.8	-0.139	-0.095	-1.13
7	-0.06	-0.095*	-0.3	-0.113	-0.057	-0.98
8	-0.069	-0.036	-0.47	0.027	-0.047	0.15
9	-0.154	-0.192***	-0.96	-0.229	-0.106*	-1.84
10	-0.044	-0.148**	-0.23	0.022	-0.173	0.11

\* p<0.1; \*\* p<0.05; \*\*\* p<0.01.

Data source: this research

Contagion or Competitive Effect? An Event-Study Approach to Uncover the Impacts of Patent Infringement Litigation Announcement



**Figure 6: The event and match firm’s cumulative abnormal trading volume around the event window**  
Data source: this research

## 5. CONCLUDING REMARKS

This study contributes to the literature in several ways. First, we use multiple indicators, namely abnormal return and trading volume, to more comprehensively catch the market responses of patent infringement litigation announcement to the defendant firm. Evidence from Taiwan electronics firms reveals that patent infringement litigation announcements would bring negative influences on the stock price and trading volume to the defendant firm. Second, extending to the efforts made by Raghu et al. (2008), which investigates the economic impact of patent infringement litigation on the plaintiff and the defendant firms in IT industry, this study switches the focus to the market response of the rival firms. We observed that there are similar market responses on the defendant firm and its rival firms, indicating that the information-signaling effect resulting from patent infringement litigation outweighs the competitive effect. This finding is complementary to those

of Raghu et al. (2008), and it implies the patent litigation strategy can be an effective and efficient weapon to punish potential pirated firms.

## 5.1 Managerial Implications

*For managers:*

1. In order to reduce the adverse impacts on the stock price and liquidity, defendant firms' managers working for companies in the developing countries should take proper actions on disclosing such relevant information of the patent infringement allegation to the public to reduce the level of investment risk perceived by the investors.
2. As the patent strategy launched by transnational corporations has evolved from the defensive patent configuration strategy to the offensive patent litigation strategy, firms in the emerging economies especially should stop employing the "hit-and-run" strategy on intellectual property rights, which is opportunistic, unethical, and highly risky. Moreover, in order to prevent huge direct lawsuit costs and indirect organizational costs, firms in the knowledge-intensive industries should develop a standard operating procedure (SOP) to protect their proprietary knowledge assets against rival's infringement and/or respond to the patent lawsuits.
3. Firms must keep surveillance on the domestic and global news of patent litigation to guard themselves against patent lawsuits. Since the contagion effect of patent litigation is harmful for the whole industry, firms may consider forming vertical or/and horizontal strategic alliances to reduce damages from malicious patent litigations.
4. In order to reduce the threat of contagion effect of patent infringement litigation, it may be a feasible strategy to develop patents with higher quality and/or patent portfolios to differentiate the focused firm from its peers.

*For governments:*

1. The most important task for governments in developing countries is to change the atmosphere of patent infringement among industries. Several practices are suggested as follows. First, the local government should strictly implement the

agreement or law of the intellectual property rights established by the World Trade Organization or the Paris Convention for the Protection of Industrial Property<sup>2</sup>. Second, through public and social media, the authority can communicate with the potential infringers about the risks and costs of illegally using intellectual property rights. Third, eventually ethics education is the most effective way to radically eradicate the unethical business practices in the future.

2. The concept of patent bank was initially devised by some US-based firms such as RPX Corp. and Allied Security Trust, which aim to buy out all the patents that might be asserted against their members. Taiwanese government is also accelerating to set up a quasi-government agency, patent banks, to help their local firms to fight against MNCs from developed countries. Some lawyers think it may become a controversial issue and a two-edged sword for governments, arguing the line between antitrust and the protection of domestic industry against MNCs' patent litigation is very obscure (Feng, 2012; Huang, 2012). Governments should be very careful about using patent bank as a defensive tool to deal with the cross-border patent litigation issues.

## 5.2 Limitations and Future Directions

Qualifying these conclusions, we recognize some weakness in the present study. First, we used data from Taiwanese electronics industries to test the proposed hypotheses. Hence, the conclusions drawn from an emerging economy should be interpreted conservatively. Notably, future research targeted on global industries such as TFT-LCD and the smart phone industries is expected to collect patent litigation events across borders to test the generalizability of the research conclusions.

Second, in exploring the relationship between patent litigation and market responses, we assume that the investors are neutral. Although our findings are in favor of supporting information-signal hypothesis rather than behavioral finance hypothesis, we suggest future research can retest these two competing hypotheses regarding subsamples of corporations and individuals.

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<sup>2</sup> Taiwan Patent Law has been revised in compliance with TRIPS and the WTO agreements since 2002 at the time Taiwan entered WTO.

Third, we have found some clues from the effects of control variables on the market response to the defendant firms. With respect to the resource-based view, we have found that not only would the defendant firm's commitment to R&D enhance the firm's value in the future, but it also could buffer the negative impact of the patent litigation event. These findings deserve more in-depth exploration.

Finally, in this study we did not consider the influences of patent quality and the characteristics of patent portfolio on the market responses when plaintiff firms are encountering patent infringement litigations. If patent quality and the characteristics of patent portfolio differ substantially within the industry and the capital market has been aware of this fact or information, the finding of this study that the contagion effect outweighs the competition effect may not be supported. Under such a circumstance, the competition effect of patent infringement litigation announcement may have the chance to dominate the contagion effect. The following studies may take patent quality and the characteristics of patent portfolio into account to more comprehensively explore the market responses of the patent infringement litigation announcement.

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Contagion or Competitive Effect? An Event-Study Approach to  
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