

Full Length Research Paper

Market behavior of patent infringement litigations

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Accepted 30 January, 2010

In recent years, the tremendous increase in the amount of patent infringement litigation within the information technology industry has incurred substantial damage on the part of patentees, such as the cost of litigation. Corporations have also been seriously affected. By adopting the event study method, this study explores how patent infringement litigation impacted stock prices listed in Taiwan from 1998 to 2008. Empirical results indicate that patent litigation negatively affects the prices of related, underlying stocks.

Key words: Patent infringement litigation, event study, abnormal return.

INTRODUCTION

When firms were not publicly listed, or if the time of the event overlapped, these stocks were eliminated. In earlier days, factors such as production, labor and funds constituted the company's tangible and generally sole assets. However, the nature of company assets has change over time, particularly following the arrival of the knowledge-based economy. The most obvious change was the replacement of tangible company assets with intangible assets (Drucker, 1993). Intangible assets have been firms' Competitive Advantages generated by corporation inventions. According to "the global Competitiveness Report" from the World Economic Forum, Taiwan ranked 10th in the world in terms of "invention competitiveness" in 2008. However, invention itself is not enough; patent protection is also essential.

The importance of patents as a means of gaining or maintaining a competitive advantage, and for serving as an entry barrier, has long been recognized in the management literature (Chakrabarti et al., 1993; Porter, 1980). A patent represents the legal right to prevent competitors from using an innovation and enables the inventor to earn royalties generated by the use of said patent. A recent study found that patented inventions significantly and positively affect business performance as well as the value of the firm (Griliches, 1981; Pakes,

1985; Cockburn and Griliches, 1987; Griliches et al., 1987; Griliches et al., 1998; Deng et al., 1999).

Since 1996, multinational corporations have committed their efforts and resources to research and development of technology through internal integration, patent portfolio development, and licensing strategy formulation to obtain global patent protection. Deng et al. (1999) showed that research and development ability will impact the future earnings and value of the firm, while the patent quality will reflect its R and D capability.

Moreover, the United States collects patent royalties paid by license to foreign companies amounting to \$36.8 billion U.S. dollars, while paying up to \$11 billion in authorized payments to Germany, Japan and other foreign companies in 1998 alone. The trading market has gradually increased. In a knowledge-based economy, the impact of patents or technology licensing is comparable to that of commercial activities; the underlying technology supports the active-marketplace. For example, in 1990, the patent royalty revenue received by IBM was about \$300 million dollars; in 2000, the right to income reached one billion dollars, which constituted almost one-ninth of the pre-tax revenue of the company. Net assets were about \$22.5 billion dollars in April, 1995, and share price was \$54 billion dollars.

Patent royalties are a major source of corporate income, so corporations must remain vigilant in order to avoid patent infringement and the attendant loss of royalty payments to patentees (Muoghalu et al., 1990;

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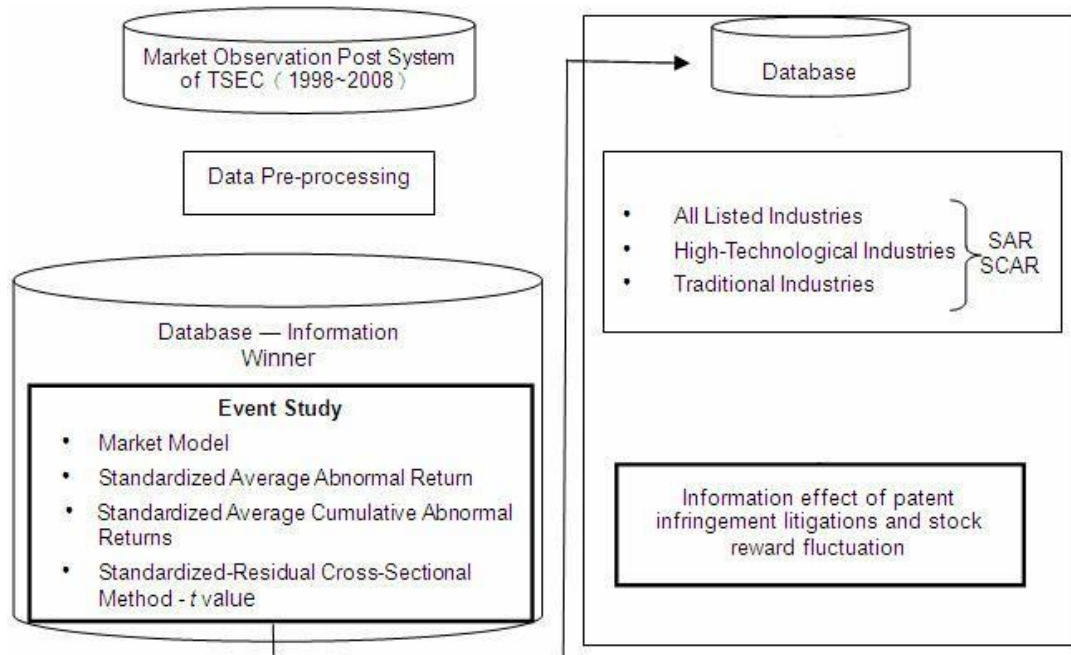


Figure 1. The research of system architecture.

Ramirez et al., 1991; Chakrabarti et al., 1993; Lanjouw and Schankerman, 2001). Patent infringement litigation is one of the most expensive types of litigation. According to the American Intellectual Property Law Association (AIPLA), litigating a patent infringement case in the U.S. court system can potentially cost both parties upwards of \$1.5 million dollars to try the average case (Berman, 2001). Losing a patent infringement case requires a company to abandon its use of the infringed technology, which can seriously impact future revenues if the technology constitutes a significant portion of overall business revenues. Litigation generally does cause markets to reevaluate the firms thus involved; prior research on the impact of litigation announcements indicates that the litigation filings lead to a 2 - 3.1% average decrease in the market value of the firms involved (Bhagat et al., 1994; Lerner, 1994). For example, while defendants may experience economically meaningful and statistically significant wealth losses upon the filing of the suit, defendants involved in government suits suffer even larger declines in shareholder wealth (Bhagat and Romano, 2002) as demonstrated in a study by Raghu and Raghav (2008) whose results agree with those of this researcher. Although the markets may monitor the progress of the litigation and update the forecasted prospects of the firm, the termination may still contain enough new information that is unanticipated by the markets as a reflection of the uncertainties surrounding patent law and the patent granting process. To the extent that an "average" reaction exists at the time of settlement, defendant firms would be expected to exhibit opposite signs in regard to abnormal returns.

Furthermore, despite the explosion in litigation, legal action is not the only option or even the preferred method of settling disputes in Taiwan. Litigation is usually the last resort and an indication of the failure or unwillingness of the parties involved to settle amicably through arbitration or hearings. At the heart of this study is whether the financial markets react to litigation news involving all corporate defendants in the same fashion. Different financial markets could lead corporations to use different strategies for addressing litigation initiated by defendant corporations.

The above studies suggest that the market discounts the stock price of a firm at the onset of such patent infringement litigations being filed. This study uses an event study approach based on data from major Taiwanese listed companies to investigate the effect of patent infringement on their stock prices, as well as any informational effect.

This paper is organized as follows. Section 1 presents the related literature. Section 2 presents the event study modeling of financial returns. Section 3 describes the data and preliminary analysis. Section 4 presents empirical evidence. Finally, Section 5 discusses the results and presents conclusions. The system architecture is shown in Figure 1.

METHODOLOGY

Data and sample

This study employed an event study methodology to explore the informational effect of litigation of patent infringement of electron

industry during the period from 1998 - 2008. Data included daily individual stock returns from registered Taiwanese listed companies and market returns for the Taiwan Stock Exchange Value Weighted Index (TAISEX). The news stories collected from the database was then closely analyzed to identify the actual date that the complaint was announced. Then, the daily stock index data provided by the Science and Technology Policy Research and Information Center National Applied Research Laboratories (STPI) data and UDN database in Taiwan were examined. Finally, the data were restructured according to patent infringement litigations news.

The data were restricted to patent litigation cases filed among Taiwanese firms; irregular samples were expunged from the file. With the estimation of time involved, the case was eliminated from further analysis. Afterwards in cases where disputed patent information was unavailable, those cases were also eliminated from the regression analysis.

The selection criteria used to filter sample data included the following. First, the date that the patent infringement litigation was announced for 149 samples met the first criterion. The second criterion removed samples in which the estimate period and event period were deleted due to defects, and 129 samples met the second criterion. Next, the third criterion removed samples where the firms were not publicly listed or the stocks overlapped. Finally, matching the selection criteria produced a total of 108 patent litigation samples.

Event study

To decide whether there was information effect of patent infringement litigations around the announcement date, the event study methodology was performed (Bank and Kinney, 1982; Brown and Warner, 1985; Dos Santos et al., 1993; Michaely et al., 1995; Yermack, 1996; Koku et al., 2001; Suchard et al., 2001; Chuang and Chuang, 2005; Lin et al., 2008; Wang and Yang, 2008; Wang et al., 2008). The event day is defined as the announcement date of patent infringement litigations. The announcement date of patent infringement litigations is defined as day 0, and the estimation period is from days -105 to -16. The event window of interest begins from day -15 and ends on day +15; the total observational period covers 115 trading days. The expected return was derived using the market model where the model parameters α and β were obtained

from the estimation period, $R_{it} = \alpha_i + \beta_i R_{mt} + \epsilon_{it}$. The term R_{mt} is representative of the information available at time t , which affects the stock returns of all the firms. R_{it} is the expected return on firm i on day t . α_i is the risk-adjusted return, β_i is the

Beta modulus, that is individual stock of system risk, and ϵ_{it} is the component of returns which is abnormal or unexpected.

Therefore, abnormal returns on day t (AR_{it}) are calculated for a reference period surrounding the event date of stock i . These are obtained as the difference between the observed returns and those predicted by the market model,

$$AR_{it} = R_{it} - \alpha_i - \beta_i R_{mt} \quad (\text{Lin et al., 2008a, b})$$

The mean of abnormal returns (\overline{AR}_{it}) on day t for a portfolio of N stocks can be calculated as

$$\overline{AR}_{it} = \frac{1}{N} \sum_{i=1}^N AR_{it} \quad t = -15, -14, \dots, 14, 15. \quad (1)$$

The cumulative abnormal returns (CAR_t) through τ days

$$CAR_t = \sum_{\tau=1}^{\tau} \overline{AR}_{it} \quad (\text{Lin et al., 2008a, b})$$

$$CAR_i(\tau) = \frac{1}{N} \sum_{t=\tau_1}^{\tau_2} \overline{AR}_{it} \quad (2)$$

The ordinary cross-sectional method ignores estimation period estimates of variance, thus, this paper uses the standardized residual cross-sectional for its t -test (Boehmer et al., 1991). The

resulting t -test statistic for \overline{AR}_{it} is

$$t_{SROCSM}^{AR} = \frac{SAR_E}{\sqrt{\frac{1}{N(N-1)} \sum_{i=1}^N (SAR_{iE} - \frac{SAR_E}{N})^2}} \quad (3)$$

where $SAR_E = \frac{1}{N} \sum_{i=1}^N SAR_{iE}$. The t -test statistic for the CAR_t for standardized residual cross-sectional is calculated as

$$t_{SROCSM}^{SCAR} = \frac{SCAR(\tau_1, \tau_2)}{\sqrt{\frac{1}{N(N-1)} \sum_{i=1}^N (SCAR_i(\tau_1, \tau_2) - \frac{SCAR(\tau_1, \tau_2)}{N})^2}} \quad (4)$$

where $SCAR(\tau_1, \tau_2) = \frac{1}{N} \sum_{i=1}^N CAR_i(\tau_1, \tau_2)$

Preliminary analysis and empirical results

In Table 1, this study utilized the Two-Sample Test to test whether there exists the difference of without patent-related litigation (292 samples) and patent-related litigation electronic companies (108 samples) by Two-Sample test. Based on the empirical result, revealing there was non-significant difference between without patent-related litigation and patent-related litigation electronic companies.

This study tests that whether the Taiwan stock return is stationary by ADF and PP tests. ADF and PP tests are the Augmented Dickey- Fuller and the Phillipps-Perron statistics which the lag interval is determined by the minimum values of AIC and SBC. Table 2 showed that AIC and SBC values statistics suggest optimal values are 1, and the return of Taiwan stock market depends on itself of lagged 1 period to test unit root. Table 3 reports that Taiwanese stock returns is stationary under the unit root test.

Figure 2 illustrates the abnormal return and the accumulative abnormal return of patent infringement litigations. Table 4 summarizes the results of abnormal

Table 1. Preliminary analysis of Samples.

	Sample	Mean	S.D.	t-statistics
Size	Without patent-litigation	3094.887	17508120	1.992997
	Patent-litigation	2072.721	11212680	(0.107292)
Age	Without patent-litigation	20.31078	80.53409	1.991254
	Patent-litigation	21.08163	95.06481	(0.573099)

Note: The *p*-value is reported in parentheses.

Table 2. The AIC and SBC value of unit root test.

Lag	None		Intercept		Trend and intercept	
	AIC	SBC	AIC	SBC	AIC	SBC
1	2.1541*	2.1607*	2.15371*	2.1625*	2.1544*	2.1654*
2	2.1567	2.1631	2.1563	2.1648	2.1570	2.1677
3	2.1555	2.1640	2.1550	2.1656	2.1557	2.1685
4	2.1551	2.1647	2.1561	2.1665	2.1568	2.1693

*Denotes minimum. The Augmented Dickey-Fuller (ADF) and the Phillipss-Perron (PP) statistics which the lag interval is determined on the criterions of minimization of AIC and SBC value. The function of AIC and SBC areas follows:

$$AIC(k) = T \ln \frac{\sigma^2}{T} + 2k.$$

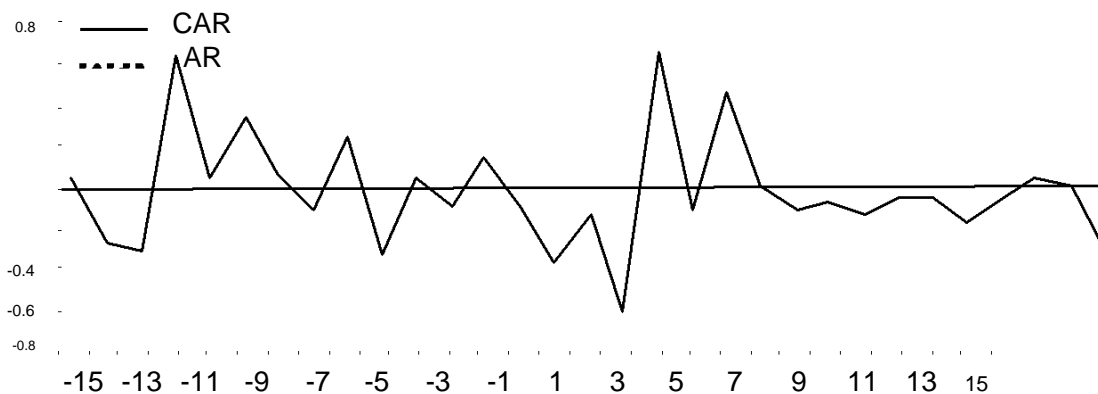
$$SBC(k) = T \ln \frac{\sigma^2}{T} + k \ln T.$$

Where *k* denotes the lagged period, *T* denotes the number of sample, and σ^2 denotes the lagged *k* periods of $\frac{\sum_{i=1}^T \varepsilon_i^2}{T}$.

Table 3. Unit root test.

Item	ADF	PP
None	-32.7261**	-71.3512**
Intercept	-32.8192**	-71.3671**
Trend and intercept	-32.8281**	-71.3689**

Notes: ** denotes statistical significance at 1% level Which the critical value is decided on the critical value table of MacKinnon (1991).



Figures 2. Abnormal return and accumulative abnormal return of patent litigations.

Table 4. AR and CAR around announcement date of patent litigations event

Event window	Patent infringement litigations		Event window	Patent infringement litigations	
	AR	CAR		AR	CAR
-15	0.3185	0.3185	1	-2.5425**	-1.3763
-14	-1.0357	-0.7172	2	-2.9688**	1.5925
-13	-1.2601	-1.9773	3	-0.3503	1.2422
-12	2.8497**	0.8724	4	2.1805	3.4227
-11	0.2556	1.128	5	0.1609	3.5836
-10	1.5747	2.7027	6	-0.3802	3.2034
-9	0.3903	3.093	7	-0.2058	2.9976
-8	-0.3609	2.7321	8	-0.4031	2.5945
-7	1.1742	3.9063	9	-0.1351	2.4594
-6	-1.3222	2.5841	10	-0.0967	2.3627
-5	0.2942	2.8783	11	-0.6603	1.7024
-4	-0.3109	2.5674	12	-0.1031	1.5993
-3	0.7914*	3.3588	13	0.2835	1.8828
-2	-0.334	3.0248	14	0.184	2.0668
-1	-1.4408	1.584	15	-1.2092	0.8576
0	-0.4178	1.1662			

1. Abnormal returns for the event window from -15 to 15 are calculated using a market model. Market model is estimated over 90 days prior to the event window.

2. ** (*) denotes statistical significance at the 1% (5%) level.

return behavior and its *t*-test statistics for the stock of listed companies in the event window around the patent infringement litigations data. Based on the estimation of

α

i , we measure the statistically significant positive alpha value, 0.2531, indicates that returns are greater than necessary to compensate for a given level of nondiversifiable risk.

For patent litigation events, *t*-test revealed that negative abnormal returns, -2.5425 and -2.9688, for day 1 and day 2, were statistically significant at the 0.01 level. Statistically significant positive abnormal returns were 2.8497 and 0.7914 for day -12 and day 3 respectively.

These results suggest that the underlying stocks revealed a negative price effect before the infringement litigation filing announcement date and a positive effect after the infringement litigations were filed. This outcome is consistent with the empirical results of Bhagat and Romano (2002). Financial markets tend to react negatively to corporate defendants. When news breaks on litigation being filed they react positively. This phenomenon may be owing to the scheduled release of information. Investors may assume that defendant companies would be impacted by the litigation, regardless of the long-term impact of the solution on the company's normal operation, or even go bankrupt, leading investors to maintain a negative view concerning the company's litigation. Hence, analysis of the cumulative abnormal returns in the windows revealed no significant returns. This phenomenon can be attributed to hedging activity of the investors to reduce risk after the infringement litigations.

Conclusion

This study investigated the impact of patent infringement litigation on Taiwanese corporations from 1998 - 2008 using the price of underlying stocks based on TSEC announcement data. This study demonstrates that a negative price effect occurs before field infringement litigation; around the announcement date there may be a perception of good performance, and the effect is reflected in stock prices. This finding is consistent with those of Beasley (1998).

In regard to the period of time between infringement litigation being filed until it becomes public, possible information exposure may affect financial markets. This phenomenon may be attributed to the release of information ahead of schedule. Investors may assume that the litigation may have a long-term impact on normal operations or even lead to bankruptcy, leading investors in the company's litigation to maintain a negative view.

Finally, when the total value of global industrial output relies on intangible assets, patent infringement litigation becomes increasingly important, and may even affect the economic success or failure of a country.

ACKNOWLEDGEMENTS

The authors would like to thank the National Science Council of the Republic of China, Taiwan for financially supporting this research under Contract No. NSC 98-2410-H-264-008.

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