INFORMATION VALUE OF PATENT LITIGATION AND INDUSTRY COMPETITION IN TAIWAN

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Abstract. Internationally, news on patent infringement is often seen, and patent infringement lawsuits affect stock prices. However, fewer studies have discussed how market reflects corporate value and impact of patent infringement lawsuit on investment returns when a patent infringement lawsuit occurs and the news is released. This study applied event study to discuss changes in information value of plaintiffs and defendants, and information value difference of different patent lawsuit sources in competitive environment. The empirical results showed that patent infringement lawsuits may cause negative perception of investors or insider shareholders. This event may become an arbitrage opportunity. Through five forces analysis, the lawsuits from various sources are bad news. Reverse correction is conducted after the event, and makes stock price rational. Thus, in Taiwan market, patent infringement lawsuit is negative news for plaintiff and defendant.

Keywords: patent infringement litigation, information value, enterprise competition, abnormal return.

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Introduction

In an information society, the global economy has witnessed the transition from industrial age to knowledge-based economy age. According to the definition of the Organization for Economic Cooperation and Development (OECD), knowledge-based economy is directly based on the production, distribution and use of knowledge and information (David, Foray 2002;

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Shinn 2002; Godin 2004; Velmurugan 2010; Capik, Drahokoupil 2011). The corporations can develop exclusive right of product or even use patent right or patent infringement to create profit and maintain competitiveness when they obtain patent right. However, patent infringement lawsuits are lengthy and costly. It is trans-market and transational, and requires a considerable amount of legal fee. Companies should have strong financial strength to face revenue loss and market risk (Cohen *et al.* 2002; Langinier, Marcoul 2009; Tseng *et al.* 2009; Galasso, Schankerman 2010; Lo 2011).

Infringement lawsuits are common in recent years. In the long litigation process, for investors, both plaintiff and defendant have highly uncertain market information. Many studies have focused on the impact of lawsuits on stock price or shareholder wealth (Banks, Kinney 1982; Frost 1991; Koku *et al.* 2001; Shane, Somaya 2007; Cockburn, MacGarvie 2009). When an enterprise is charged or files lawsuit, due to the impact of news release on psychology of investors, they concern about future corporate operation and have uncertain reaction, resulting in stock price volatility and serious shock to enterprise. However, investment information caused by information value of infringement lawsuit is not always negative. If the enterprise has specific patents, patent portfolios can be extended to other market, which is a key to lawsuit response strategy (Bhagat, Romano 2002; Somaya 2003; Marco 2005; Bessen, Meurer 2006; Raghu *et al.* 2008; Siebert, Graevenitz 2010).

Past studies have explored the impact of patent infringement lawsuits of information industry and judgments on stock price volatility (Raghu *et al.* 2008; Konchitchki, O'Leary 2011). For listed companies in Taiwan, the empirical results suggested that patent lawsuits have a negative impact on stock price. From filing lawsuits for patent infringement to making the lawsuits publically known, information disclosure may affect financial market (Agarwal *et al.* 2009; Chen, Chang 2010; Wagner, Cockburn 2010). This is due to advanced release of information. Investors may believe that the lawsuits would affect the normal operation of the company, even cause bankruptcy, so they tend to have negative views on the lawsuits. When global industrial output value depends on intangible asset, patent infringement lawsuits have become increasingly important, and even affect the national economy (Lanjouw, Schankerman 2001; Raghu *et al.* 2008).

Patents can enhance industrial competitiveness, but long-drawn litigation processes increase uncertainty. This means that more investment risks can affect stock market. Current studies have focused on measuring patent and innovation capabilities (Megna, Klock 1993; Hirschey, Richardson 2001; Hall, Bagchi-Sen 2002; Lanjouw, Schankerman 2004; Chiu, Chen 2007; Ernst *et al.* 2010; Agliardi, E., Agliardi, R. 2011; Suzuki 2011). However, patent lawsuits often occur overseas, and the newspaper coverage may be delayed. When lawsuits occur, with transmission of news, market reaction and the impact of patent infringement lawsuit on companies should be explored (Jang, Chen 2009; Konchitchki, O'Leary 2011). **In addition, industrial difference may affect the reactions of listed companies' stock prices.**

Only fewer studies have explored stock price behaviour responses to patent litigation (Raghu *et al.* 2008). Therefore, in this study, we examine not only the stock price impact of patent litigation, but also adopt the viewpoint of industrial competitiveness, Porter's Five Forces of Competitive Position Model (Porter 1980), to integrate patent development and financial economics through the empirical case in Taiwan. Thus, the purpose of this study

is to explore the changes in information value of plaintiff and defendant when discussing patent lawsuit. Second, we discuss the information value difference of different patent lawsuit sources in a competitive environment and determine the financial factors affecting cumulative abnormal returns of different lawsuit sources. This paper is organized as follows. Section 1 presents the data selection and market model. Next, section 2 presents empirical evidence. Finally, the last section discusses the results and presents conclusions.

1. Methodology

1.1. Data Selection

Following Taiwanese electronic industry gradually integrated into the global supply chain, electronic industry has been the engine of rapid economic growth. Today, Taiwan has become the world's fourth largest supplier for the electronic industry that provides evidence of the importance of electronic industry to economic development in Taiwan (Malerba, Nelson 2011). Thus, this study investigates the listing and OTC electronic companies in Taiwan. The data are sourced from UDNDATA, and searched by the key words of "patent, infringement, suit, charge, defendant and lawsuit". The patent infringement lawsuit news during the period from January 1, 1998 to October 31, 2010 is selected as samples. The samples are compared with the Market Observation Post System, and are selected according the following criteria. First, the stock price data having no estimation period and event period are not included. Moreover, if the same event is declared repeatedly, the first event is selected. To avoid confounding effect, if the announcement period is too close, for the data which the first announcement date and the second estimation period is repeated, the second data is not selected. After deleting repeated announcements and insufficient estimation period, the number of plaintiff samples is 39, and the number of defendant samples is 120.

Based on Porter's Five Forces of Competitive Position Model and electronic industry flow chart, this study divides the lawsuit sources into vendors, purchasers, and industry competitors by upstream and downstream industry. The non-electronic industry or the undefined sources are listed as potential competitor, as shown in Figure 1. As seen, most patent suits are filed by the upstream and the downstream and competitive manufacturers.

1.2. The market model

The event study methodology has been widely *used in different events* (Raghu *et al.* 2008; Konchitchki, O'Leary 2011). The recent event study methodology is often used in accounting and financial fields, such as announcement of merger and acquisition, important investment event, lawsuit and capital increase by cash (Fama 1969; Corhay, Tourani 1994; Pantzalis *et al.* 2000; Chen, Su 2010; Lai *et al.* 2010; Chuang, Wang 2010; Asgharian *et al.* 2011; Cheung 2011). The event study methodology aims to discuss whether the occurrence of some event affects abnormal change of stock price and causes excess returns (Yang *et al.* 2010; Li, Tallman 2011). The information can be used to determine whether market securities price and specific event is correlated.
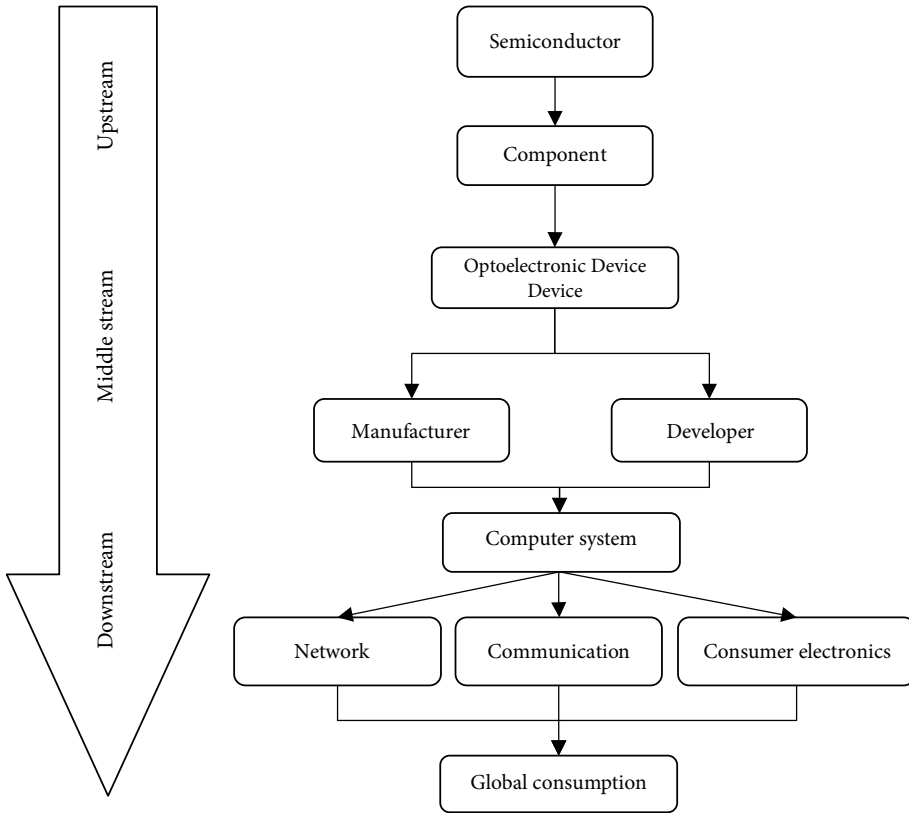
Fig. 1. The electronic industrial structure

The market model was proposed by Sharpe (1964), and it assumes that the rate of returns on individual securities and market investment portfolio have linear relationship. Brown and Warner (1985) compared various methods, and found that market model is a better approach (Lin *et al.* 2008; Campbell *et al.* 2010). This study uses market model to discuss the reaction when patent infringement is reported in newspapers, and lawsuits are filed to court. This model is a linear model expressing relations between corporations.

$$R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it} , \tag{1}$$

where: R_{it} is the returns on the i stock in the t period; R_{mt} is the returns on stock market in the t period; α_i is the constant term of market scale; β_i is used to measure effect of change in market returns on returns on individual stock. Excess return means the difference between actual return rate and expected return rate when event occurs, and the difference is called abnormal return (AR). It aims to discuss whether the event causes excess returns on sample stocks. The two parameters, α_i and β_i are estimated in market model, and substituted in stock return and market return, $AR_{it} = R_{it} - \hat{\alpha}_i - \hat{\beta}_i R_{mt}$.

Average excess returns (ARR) refers to the summation of day excess returns of all event samples divided by number of samples**.** The equation is as follows:

$$\overline{AR_t} = \frac{1}{N}\sum_{i=1}^{N} AR_{it} ,$$ (2)

where: $\overline{AR_t}$ is the average excess returns of the t day; N is the number of samples. To determine the cumulative effect or excess returns during some specific period, the average excess returns in some specific time during the observation period are accumulated to obtain cumulative abnormal return (CAR). The equation is as follows:

$$CAR_i(\tau) = \frac{1}{N}\sum_{t=\tau_1}^{\tau_2}\sum_{i=1}^{N} AR_{it} ,$$ (3)

where: N is the number of samples, and τ is the verification period $(=\tau_2 - \tau_1)$.

1.3. Multiple regression model

This study uses a multiple regression model to discuss the factors affecting abnormal returns. The samples are classified into different sources of lawsuits to verify the company's financial performance measures. Previous studies in Taiwan have used operating efficiency, growth, profitability, debt paying ability and equity structure to analyse financial ratio. This study uses the following six terms as the independent variables of cross-sectional analysis.

$$CAR_i = \alpha + \beta_1 RT + \beta_2 AIT + \beta_3 ROA + \beta_4 EPS + \beta_5 CR + \beta_6 QR ,$$ (4)

where: CAR_i is the cumulative abnormal returns of event window period; RT is the receivables turnover rate (RT) that evaluates how operating efficiently sample uses its assets, RT = Net Credit Sales / Average Accounts Receivable; AIT is the average inventory turnover rate (AIT) that measures the relationship between the cost of goods sold during a sample period of time and the cost of average inventory during a sample period, AIT = Cost of goods sold / Average inventory at cost; ROA is the return on total assets ratio (ROA) that defines how profitable sample is relative to its total assets, ROA = Net Income / Total Assets; EPS is the earnings per share (EPS) that a measure indicator of sample profitability, EPS = (Net Income – Dividends on Preferred Stock) / Average Outstanding Shares; CR is the current ratio (CR) that is measured by dividing current assets by current liabilities, CR = Working Capital / Current Liabilities; QR is the quick ratio (QR) calculated by dividing current assets from which inventory has been excluded, by current liabilities, QR = (Cash + Marketable Securities + Accounts Receivable) / Current Liabilities; β_i are regression parameters, and these financial historical data were collected from TEJ database (Taiwan Economics Journal).

2. Preliminary analysis and empirical result

This study divides plaintiff and defendant into vendors, purchasers, industry competitors, and potential competitors. Due to insufficient plaintiffs, only defendants are used in sample analysis. On the date of filing a suit, the excess returns of the different enterprises are shown in Table 1. For vendors, AR reaches 5% significance level on the –15th day and the –10th day (–1.299, 1.100). This means that the suit is disclosed on –15th day. The investors or insider shareholders have a negative impact on the event. The reaction is too strong, and excess returns are modified to be positive value. On the 2nd day and the 4th day, there is a significant negative impact, and significant level is reached on the –15th day, the –14th day and the –13th day of CAR event. This means that news is disclosed in advance. For purchasers, AR reaches a significance level and has a positive impact on the –4th day, indicating that insider shareholders are optimistic about the suit. On the 1st day and the 2nd day of the event (–0.715, –0.715), the returns have significant negative impact and are modified to significant positive impact on the 5th day after the event, indicating that the suit is considered negative news for companies. CAR fails to reach a significance level. For industry competitors, AR shows a significant negative impact on the –14th day (–1.173), and has a significant positive impact on the –5th day (1.038), and a significant negative impact on the 1st day after the event (–0.722). CAR shows a significant negative impact for many days. It can be found that lawsuit has an adverse impact on stock price. For potential competitors, AR show a significant negative impact on the –11th day and the –12th day (–1.002, –0.975), and a significant positive impact on the –2nd day, 0 day, the 2nd day, 5th day, 8th day and 14th day. Investors have negative views on potential companies, and are confident about the defendant, which are positive impact. CAR shows significant negative impact for many days due to lawsuit. Although CAR fails to reach significant level after event, it shows positive impact. It can be seen that investors are confident about the defendant.

Table 1. Patent infringement from different sources

	Supplier		Customers		Competitive rivalry		Potential Competitors	
	AR	CAR	AR	CAR	AR	CAR	AR	CAR
–15	**–1.299****	**–1.299***	0.136	0.136	0.002	0.002	–0.538	–0.538
–14	–0.055	**–1.354***	–0.115	0.021	**–1.173****	**–1.171****	–0.676	–1.214
–13	–0.137	**–1.492***	–0.137	–0.116	0.138	–1.032	–0.288	–1.502
–12	–0.795	–0.695	–0.330	–0.446	0.278	–0.754	**–1.002***	**–2.505****
–11	–0.088	–0.784	–0.164	–0.611	–0.617	–1.371	**–0.975***	**–3.480*****
–10	**–1.100****	–0.315	0.551	–0.060	–0.198	–1.569	–0.205	**–3.686*****
–9	–0.274	0.041	–0.434	–0.494	0.008	–1.561	–0.512	**–4.199*****
–8	–0.111	0.153	0.113	–0.381	0.086	–1.475	0.200	**–3.998*****

	Supplier		Customers		Competitive rivalry		Potential Competitors	
	AR	CAR	AR	CAR	AR	CAR	AR	CAR
−7	−0.301	0.455	0.465	0.083	−0.595	**−2.071***	−0.259	**−4.258****
−6	−0.223	0.678	0.013	0.097	0.089	−1.980	0.602	**−3.655***
−5	−0.631	0.047	0.165	0.262	**1.038***	−0.943	−0.187	**−3.842***
−4	−0.380	0.428	**0.849***	1.112	0.501	−0.441	0.024	**−3.818***
−3	−0.024	0.452	0.281	1.393	0.124	−0.317	0.066	**−3.752***
−2	−0.820	−0.368	−0.088	1.305	−0.194	−0.512	**1.133***	−2.618
−1	−0.247	−0.120	−0.302	1.002	−0.471	−0.984	0.367	−2.251
0	−0.144	−0.265	−0.430	0.572	−0.568	−1.552	**0.935***	−1.310
1	−0.141	−0.124	**−0.715***	−0.142	**−0.722***	−2.274	0.351	−0.965
2	**−0.985***	−1.109	**−0.715***	−0.247	−0.25	−2.524	**1.070***	0.104
3	−0.331	−0.777	0.258	0.011	−0.602	**−3.127***	−0.302	−0.197
4	**−1.042***	−1.820	**−0.215****	−0.204	0.452	−2.674	0.195	−0.002
5	−0.547	−2.367	1.063	0.859	−0.474	**−3.148***	1.029*	1.086
6	**−0.919***	−3.286	0.006	0.865	−0.307	**−3.455***	0.059	1.086
7	**−0.851***	−2.435	−0.14	0.451	−0.375	**−3.831***	0.479	1.565
8	−0.294	−2.141	−0.235	0.215	**−0.683***	−3.147	**1.274***	2.840
9	−0.567	−1.570	−0.027	0.188	0.070	−3.077	0.523	3.364
10	−0.609	−2.183	−0.146	0.041	0.169	−2.907	0.472	3.836
11	**−1.225***	−0.958	−0.214	−0.172	0.375	−2.531	0.161	3.997
12	−0.051	−1.010	0.089	−0.083	−0.003	−2.535	−0.215	3.782
13	−0.660	−0.350	−0.246	−0.330	−0.638	−3.173	−0.262	3.520
14	−0.408	0.058	−0.185	−0.516	−0.543	**−3.717***	**0.946***	4.466
15	−0.099	0.157	0.397	−0.118	−0.060	**−1.777***	−0.059	4.407

Notes: 1. *** denotes statistical significance at 1% level. 2. ** denotes statistical significance at 5%. 3. * denotes statistical significance at 10%.

Regardless of lawsuit sources, patent lawsuits lead to negative perception of investors, and affect stock prices. After the event, reverse correction is conducted, and makes stock price rational, thus bringing investors an arbitrage opportunity. Overall, patent lawsuit is bad news for enterprises.

This study uses the multiple regression model to discuss the factors affecting abnormal returns, divides the samples into different sources of lawsuits to verify company financial performance measure, and utilizes operating efficiency, growth, profitability, debt paying ability and equity structure for analysis. Table 2 shows whether CAR is significant in various window periods. In lawsuits by vendors, negative abnormal returns reach a significance level in window periods (0,4), (0,5) and (0,6). In lawsuits by purchasers, negative returns reaches a significance level in window periods (2,1), (–1,1) and (0,1). In lawsuits by industry competitors, negative abnormal returns are more significant than vendors and purchasers in window periods. In lawsuits by potential competitors, significant positive abnormal returns are found in many periods. For investors, the lawsuits by potential competitors can lead to positive returns, and differ from the first three.

Table 2. Window analysis for patent infringement litigation

Supplier			Customers		
period	CAR	t-value	period	CAR	t-value
(−1,0)	0.1028	−0.1672	(−5,0)	−0.4752	−0.5931
(0,1)	−0.0034	−0.0044	(−2,1)	−1.5361	−2.0063*
(0,4)	**−1.6997**	**−1.9846***	**(−1,1)**	**−1.4479**	**−2.0548****
(0,5)	−2.2468	−2.0762*	(0,1)	−1.1453	−1.7517*
(0,6)	−3.1659	−2.2785**	(0,2)	−1.2501	−1.4481
Competitive rivalry			Potential Competitors		
period	CAR	t-value	period	CAR	t-value
(0,1)	−1.2906	−1.9100*	(−2,0)	2.4347	2.2493**
(0,2)	−1.5405	−1.7518*	**(0,5)**	**3.2778**	**2.3142****
(0,3)	−2.1430	−2.1192**	(−1,5)	3.6449	2.2548**
(−1,3)	**−2.6150**	**−2.5872****	(−2,5)	4.7780	2.5040**
(−1,2)	−2.8098	−2.4532**	(−3,5)	4.8443	2.6065**

Notes: 1. *** denotes statistical significance at 1% level. 2. ** denotes statistical significance at 5%. 3. * denotes statistical significance at 10%.

This study then selects more significant window periods, vendors (0,4), purchasers (–1,1), industry competitors (–1,3) and potential competitors (0,5) for regression analysis to determine other factors affecting excess returns. Table 3 shows that significance level is not reached in lawsuit by vendors. Table 3 shows that patent infringement behaviour has a significant negative impact on inventory turnover rate, and inventory may be affected if purchasers file a suit. Table 3 indicates that return on total assets ratio, earnings per share and current ratio are negatively significant, while patent infringement lawsuit by industry competitors have significant impact on enterprises. Table 3 shows that earnings per share is positively significant, and current ratio is negatively significant in lawsuit by potential competitors. Overall, lawsuits by potential competitors can cause earnings per share to have positive returns, and provide an arbitrage opportunity. Under pressure of production and downstream, supplier utilized

patent litigation as the strategic behaviour to prevent new competitors and unstable supply threats. Hence, these ex post explanatory variables had insignificantly impact on CAR while patent infringement lawsuit by supplier to avoid potential competitive threats.

Table 3. Cross-section analysis for patent infringement litigation

Variable	Supplier	Customers	Competitive rivalry	Potential Competitors
Accounts receivable turnover	−1.1401	−3.5620	−0.2382	−1.5845
Inventory Turnover	1.7059	−4.5153**	−5.0315*	−0.0034
Return on total assets	−0.8543	−0.0011	−1.1619**	−0.1280
Earnings per share	−0.1666	−0.1269	−0.2522**	−0.2258***
Current Ratio	0.1703	−0.5898	−3.3109**	−0.2245***
Quick Ratio	−0.1497	−0.1686*	−0.3262*	−0.3621

Notes: 1. *** denotes statistical significance at 1% level. 2. ** denotes statistical significance at 5%. 3. * denotes statistical significance at 10%.

Conclusion

When a company faces patent infringement suit, this may lead to negative perceptions of investors or insider shareholders. Besides future challenge from the suit, high litigation cost would reduce revenue. The event may become arbitrage investment opportunity. After the event, reverse correction is conducted, and stock price would be rational. However, in Taiwan market, patent infringement suit is regarded negative news for plaintiff and defendant. The empirical results suggest that the suit reported on newspapers is second-hand news, and investors have no obvious reaction. However, the occurrence of the suit is regarded negative news for the companies. The reaction from plaintiffs is not obvious. For defendants, lawsuit requires high legal fee cost, and has adverse impact on corporation reputation, so defendants have obvious reaction.

In lawsuits by vendors, stock price has strong volatility, while the lawsuits by purchasers and industry competitors have a consistent negative impact. This implies that the lawsuits by the upstream against the downstream and lawsuits in the same industry have adverse impact on company stock price. In lawsuits by potential competitors, the investors are confident about the defendants. However, other lawsuit sources have negative impacts, and may affect the stock price. Hence, patent infringement lawsuits can lead to negative perceptions of investors or insider shareholders, and have adverse impact on the future operation of the companies. Patent infringement lawsuits have adverse impact on stock price, and make investors loss confidence on the companies, in turn, affect stock price. After the event, a reverse correction is conducted, and stock price becomes normal, thus bringing investors an arbitrage opportunity. Generally, patent infringement lawsuit is bad news for companies.

In cross-section multiple regression analysis, significance level is not reached in lawsuits by vendors, and perhaps other influencing factors exist. In lawsuits by purchasers, patent

infringement behaviour has a significant negative impact on inventory turnover rate, and inventory may be affected if purchasers file a suit. In lawsuits by industry competitors, many indictors show a negative impact (return on total assets ratio, operating income rate, earnings per share, current ratio, and total assets turnover). The lawsuits by industry competitors have a significant impact on enterprises, while lawsuits by potential competitions have a positive impact on earnings per share. In conclusion, the patent infringement lawsuits by potential competitors can lead to positive earnings per share, and provide an arbitrage opportunity.

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