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A DISCUSSION OF THE SECONDARY PATENT MARKET: HOW BULK PATENT PURCHASES AND SALES AFFECT STOCK PRICES

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ABSTRACT

This thesis looks at patents and intellectual property mainly focusing on the secondary patent market. The first section of this paper is an in depth discussion of the patent market. It explores the people and companies involved in buying, selling, and filing for patents, the relatively recent emergence of the non-practicing entity, different valuation techniques of patents, and legal trends with regard to intellectual property. The second section of this paper is a statistical analysis of how stock prices change when companies buy and sell large pools of patents for hundreds of millions of dollars. The analysis finds that companies that buy large amounts of patents see almost no change in stock price while those that sell their patents usually have a positive return. The paper concludes with an interpretation of the analysis and speaks to how the results can influence both managers and investors.

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Chapter I: Introduction

Microeconomic principles suggest that a competitive market setting is the most efficient way to transfer assets and scarce resources to those who value them most. Corporations especially must be effective in allocating their limited capital in order to purchase assets that they can use to create value. This market-based system incentivizes companies to accurately value the resources they are purchasing in order to get the best deal possible. Consequently, people and companies continually create better methods for valuation, negotiation, and capital allocation. However, these methods are not without flaws. One class of assets that still seems to make even the most seasoned professionals appear as if their playing a guessing game when it comes to valuation and investment is intellectual property assets, especially patents.

Patents are extremely important to the business process in several industries. *Investopedia* defines a patent as "A government license that gives the holder exclusive rights to a process, design, or new invention for a designated period of time." The spirit of these licenses is to give incentive for the potentially expensive research and development process that goes into creating new hardware, software, processes, drugs, and other lucrative products and designs. With effective enforcement, these patents allow the holder to monopolize their intellectual property for several years so they can recoup their losses and profit from their work without worrying that another party will take what they have done and sell the same product without having to incur the initial costs. However, for a myriad of reasons that this paper will explore, the current patent system is leading to a multitude of disruptions for corporations and detracting from the value that intellectual property rights should help create. These disruptions are especially prevalent in the technology industry

Recently, there has been a major increase in lawsuits regarding patents, most of which are coming from the tech industry. Some of the most intense and high profile of these lawsuits, such as the famed Apple-Samsung dispute, are beginning to result in verdicts touching the billion dollar mark. The increase in lawsuits has led companies to up the ante in terms of protection. They do this by licensing and buying hundreds of millions of dollars' worth of patents. In the past few years, there have been a number of large patent deals between corporations. These deals are an effort by companies to build their intellectual property arsenal in order to sue others and defend themselves from lawsuits. All of this effort is occurring despite the extreme difficulty when it comes to valuing these assets. In short, companies are spending billions of dollars in order to purchase assets that they have trouble valuing, and then spending even more in court fees to attack competitors and defend themselves. It is hard to believe that social welfare as a whole would not be better served if corporations instead spent the capital they waste on lawsuits on actual research and production that would ultimately add value and benefit the customers and investors of these companies.

This paper has two sections. The first is an in depth discussion about the state of the patent market. It will examine the people and companies who buy, sell, and register the licenses, explore the difficulties in valuation, and look at the trends in the legal environment of patents and intellectual property. It will explore how intellectual property can act as a market inefficiency and possible reasons as to why. I hope that by creating awareness and understanding, further research will commence that can lead to solutions on both the legal and business ends. The second section of this paper is an event study measuring investor reactions to companies buying or selling large pools of patents. This section will explore if there are any potentially profitable investment strategies by using patent portfolios as indicators. In addition, it will examine, from an investor standpoint, if companies are mismanaging their intellectual property.

Chapter II: The Patent Market

i. Patent Background

As previously mentioned, patents are licenses granted to inventors and innovators to protect their work. They restrict the ability to use the intellectual property for everyone but the person who owns the patent. This allows inventors and companies to recoup costs sunk into the expensive research and development process. Essentially, patents create a monopoly with a time limit in order to incentivize innovation.

In order for something to be patentable, it must first meet certain criteria. According to the United States Patent and Trademark Office (USPTO), a patent must be novel, non-obvious, adequately described or enabled, and claimed by the inventor in clear and definite terms. The first two requirements, novel and non-obvious, seem self-explanatory on the surface, but are actually vague and open to interpretation. For example, the law may recognize an idea that combines already patented technology as novel. The camcorder was a combination of the video camera and tape recorder, both patented before the camcorder, but it was considered a novel and non-obvious idea to combine the two. Also, minor changes to an established product or process are considered novel and can lead to extremely similar patents. The requirements that a patentable idea must be adequately described and claimed in clear and definite terms mean that the idea must be both specific and clear enough that if it were described to someone who is knowledgeable in the field the patent relates to, he or she would be able to duplicate the product or design.

Since 1995, U.S. law gives the filers of most patents exclusive rights for 20 years from the date that the USPTO grants a patent. Design patents, which are patents for the design of

functioning items, expire after 14 years. The burden of enforcement of a patent falls on the assignee, the person or corporation who owns the patent. They must be on the lookout for infringement and bring these cases to court themselves.

Although it is not the focus of this paper, it is important to note that the patent filing process in the U.S. is itself ripe with issues. As reported by the USPTO patent statistic dashboard, currently there are almost six hundred thousand unexamined patents on backlog for less than 8,000 examiners to review. These statistics show some major areas of concern for the patent application process. It is possible that there are unintended consequences, such as increased legal action, as a result.

ii. The Players

There are several different players at the forefront of this evolving intellectual property market. Major participants include initial filers as well as buyers and sellers of patents. These buyers and sellers adjust their patent portfolio in the growing secondary patent market. Within those groups, there are further subcategories. This grouping is for convenience and not always cut and dried in practice. Many times these groups will overlap. For example, initial filers may be sellers of patents, as they do not always have the capabilities to produce their innovations on a commercial scale.

Individuals in the United States who are initially filing for patents are overwhelmingly employees of corporations and research institutions. These individuals will often assign their intellectual property rights over to their employer after they apply. According to data from the USPTO, provided by IFI Claims, less than one percent of patent assignees accounted for approximately 44% of the 160,000 patents filed in 2012. All of the top 50 assignees are

corporations or research institutions. Yuichi Watanabe (2008) explains the reasons for this inequality:

> Even though a significant number of the most important and cutting-edge inventions come from individual inventors, small companies, and nonprofit research groups, such small scale patentees are often unable to monetize their inventions for several reasons. First, because most small patentees do not have the financial resources to practice their inventions commercially, they have little access to license negotiators representing potential licensees. Second, even if they somehow succeed in getting that first meeting, they usually do not have the budget or time to engage in lengthy negotiations. (450)

The independent inventor is not an extinct concept; however, due to their lack of leverage, a modern day Thomas Edison would have several obstacles when trying to sell or license his intellectual property. Consequently, the career of an individual inventor is becoming less economical. One major fallout of this lack of leverage is that individual inventors have taken to holding on to their patents and litigating against infringers. Some inventors find this strategy more lucrative then selling the patents at what they consider a major discount. This litigation strategy is similar to the business plan of non-practicing entities, as defined in the coming paragraphs.

Increasingly, companies are buying and selling patents in the recently emerging secondary market. Buyers of patents can be grouped into one of two categories: practicing and non-practicing entities. A non-practicing entity (NPE) is a firm that purchases patents with no intention of developing a commercial use for the intellectual property. Anne Kelley (2011) further subcategorizes these NPEs in her paper *Practicing in the Patent Marketplace*. First and most commonly known of the NPEs are the "patent assertion firms." Commonly referred to as "patent trolls," these companies make money by licensing the right to use their patents to other

firms and/or litigating against infringing parties in hopes of being awarded settlements or damages. In a combative effort against patent assertion firms, many companies are funding the second type of NPE, "defensive aggregators." Practicing entities usually pool their funds to create these defensive aggregators in order to create a large patent portfolio in hopes of reducing risk of litigation from the assertion firms (118-120). NPEs are a highly controversial issue. Opponents argue that they disrupt the production of commercializing firms and they should be deemed illegal. Proponents rebut that NPEs are simply exercising their legal rights and as a result are helping to enforce patents that were simply being overlooked.

The final major buyers of patents are practicing entities (PEs). In contrast to NPEs, practicing companies do use the technologies that their licenses protect in an attempt to create profit (Kelley 2011, 120). These theoretically distinct lines of practicing and non-practicing entities are beginning to blend. Many of the secondary patent market trades are now taking place by practicing technology firms but for defensive, or in some cases offensive, legal motivations. For example, near the time of its initial public offering, Facebook faced a major patent suit brought by Yahoo. In response, Facebook spent millions of dollars increasing its patent arsenal for protection from this and potential future lawsuits. Apple had a similar legally motivated patent buildup in the wake of the highly publicized trial with Samsung, which resulted in an approximately $1 billion verdict in favor of Apple.

Practicing companies that acquire a portfolio of patents in the secondary market do so in a way that fits with their business strategy. Watanabe (2008) generalize these portfolio strategies into two main categories: broad portfolios and deep portfolios. Broad portfolios contain patents across several different technologies. Large corporations and conglomerates that have a large pool of capital and resources, and that can reach their arms into several different technological industries, tend to employ this method. Often these companies create additional revenue streams by licensing the right to use their intellectual property. Companies that are more specialized tend

to use a deep portfolio model. This means that a company's patent portfolio, like the company itself, only focuses on a few or even a single technology, but contains a wide array of protection for those specific areas. Many companies in the wireless, memory chip, and semi-conductor industries fall under this category (452). Non-practicing entities are not constrained by having to commercialize in the field designated by the patent. However, these firms are constrained in the sense that, as they gain more patents, they must actively enforce them. This requires substantial research and labor, the amount of which increases significantly when NPEs acquire intellectual property across multiple technologies.

On the other end of the secondary patent market are the sellers. These include individual inventors who initially file, although, for the reasons previously mentioned, they are an underwhelming proportion. Instead, the majority of sellers are companies and research institutions. These include both practicing and non-practicing entities that decide to thin out their patent portfolios. In the large patent deals that the event study will later explore, the sellers are often companies that are contracting in size, low in cash, or going out of business altogether.

iii. The Secondary Market

The practice of purchasing patents and licensing them as a business model has existed for a relatively long period of time on a small scale. However, bulk purchases and NPEs have recently been increasing at an exponential rate. From 1985 to 2004, international licensing fees have increased by 1000% from $10 billion to $110 billion USD (Yanagisawa and Guellec 2009, 7). This growth has been in nearly exponential fashion in the United States, Japan, and The European Union, which make up approximately 90% of the international licensing market. Figure 1 demonstrates this pattern:

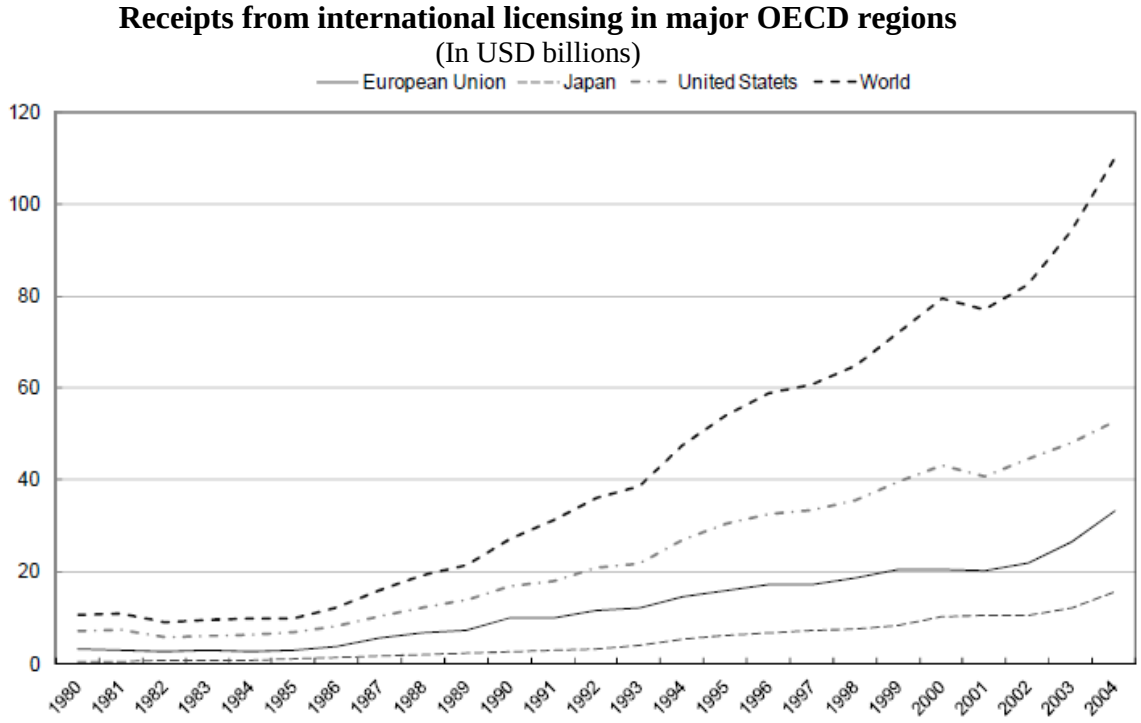

Figure 1: Receipts from international licensing in major OECD regions
Source: *OECD Science, Technology and Industry Outlook 2006.*

A market with this much revenue changing hands has attracted entrepreneurs to act as market facilitators in order to find additional ways to earn profits. Currently there are brokers, clearinghouses, auctions, lenders, and investment firms, heavily or entirely devoted to earning revenues from the secondary intellectual property market (Yanagisawa and Guellec 2009, 10-11).

So how does this market breakdown? What companies have increased the amount spent on licensing and purchasing patents by 100 times over the last twenty years? Practicing entities account for only 25% of transactions as buyers, but upwards of 60% of the total market value of these transactions. Therefore, NPEs are buying patents much more frequently while PEs are buying in bulk purchases. The well-known NPE Intellectual Ventures has spent a notable $5 billion on thirty thousand patents since 2000 (Kelley 2011, 120).

iv. Valuation

Patent valuation is a difficult task, so much so that there are experts whose careers consist entirely of providing valuation services solely for intellectual property. There are three techniques widely used with dozens of papers offering new strategies to account for the inherent unknowns and variability. These techniques mirror some of the most common business valuation techniques. The three valuation methods, which this paper will now explain in brief, are the cost approach, the market approach and the income approach.

The cost approach measures the replacement value of the patent. Using the cost approach, the acquirer would measure how much it would cost to patent the IP himself and only pay up to that amount. The major problem with this method is that replacing a patent is only theoretical. Once a patent exists another person cannot create the same patent, consequently the price computed is not always realistic. This method would only be practical for determining a price to pay for a patent if the purchaser could tweak the product or design so that it is different enough to file as a separate patent. The cost approach is similar to using the book value of an asset in order to value it. Like the cost approach, using the book value can be problematic. This is because the book value of an asset is an accounting value and may not accurately reflect the current market value of an asset.

The market method involves pricing a patent by looking at similar patents that companies and inventors have sold and using those prices as benchmarks. The market method assumes that an active patent market exists and that the information is readily available. Patent prices and specifications are not always easily accessible. Even if the information is obtainable, extensive research is often required. The market valuation technique is similar to using the multiplier valuation method to value companies. Using this method to value a firm (Firm A) an analyst would find a different, publically traded firm, called a comparable, which is in the same line of

business as the firm he is trying to value. The analyst would then examine a specific ratio from the comparable. One common ratio is the price to earnings ratio (P/E). The analyst would then multiply that P/E by his estimate of the future earnings per share of Firm A to calculate his estimate of Firm A's share price.

The final patent valuation technique is the income method. This valuation technique estimates the future cash flows resulting from obtaining a patent and then discounts those flows at some interest rate into a present day value. The major issue with the income method is that the cash flows are extremely subjective. Cash flows that are considered include sales and costs of practicing the patent, costs avoided from legal cases that may result if you do not have the patent, lost sales that may occur if a competitor obtains the patent, and possible revenues from licensing or litigation. Many of these cash flows are extremely difficult to predict. This final valuation method is similar to the discounted cash flow method used to calculate the value of a firm or project. Using this technique an analyst predicts the future free cash flows to a firm each year for every year until some horizon value. Often five years is used. The analyst assumes some form of perpetuity for the free cash flows for all years following the horizon value. Using a discount rate, the analyst can then calculate the present value of each of the free cash flows and sum them in order to determine the present value of the firm.

Most commonly, the discount rate used for these kinds of transactions is the weighted average cost of capital (WACC). WACC is a weighted average of what the company must pay in order to obtain financing from debt and equity. The debt portion of WACC is calculated by multiplying the debt proportion of a firm's financing by the interest rate it pays on that debt and by one minus the corporate tax rate that the firm pays (in order to account for the tax savings of debt). The equity portion of WACC is calculated by multiplying the equity proportion of a firm's financing by the return that investors of the firm demand to make. The return investors expect to make varies in proportion to how risky the cash flows of the firm are. The sum of the debt

portion and equity portion gives the total weighted average cost of capital. (See Appendix B Formula B-1 for the formula to calculate WACC). In addition to valuing a firm, managers can use WACC to discount the cash flows resulting from owning patents to determine the present value of the patents.

v. The Legal Environment

Patents have many unique legal characteristics under U.S. law. They come with the potential for significant overlap between different licenses. These facts help to create a legal environment that has become murky at best. Recent developments in the technology sector have also helped lead to an explosion of patent cases internationally and in the United States. Designs for recent technologies, such as cell phones and laptops, are converging to meet consumer preferences. Differentiation is decreasing and companies are using similar technologies to try to deliver the best possible devices. As a result, it appears that a few major "winners" are emerging in these markets. This creates cutthroat business conditions where market share and brand loyalty will dictate who stays on top and who closes their doors.

This combination of design convergence and maturing consumer tastes, added to the complexity of intellectual property law, has led to a new business strategy, sue and be sued. Figure two shows the number of patent lawsuits filed every year from 1980 to 2010:

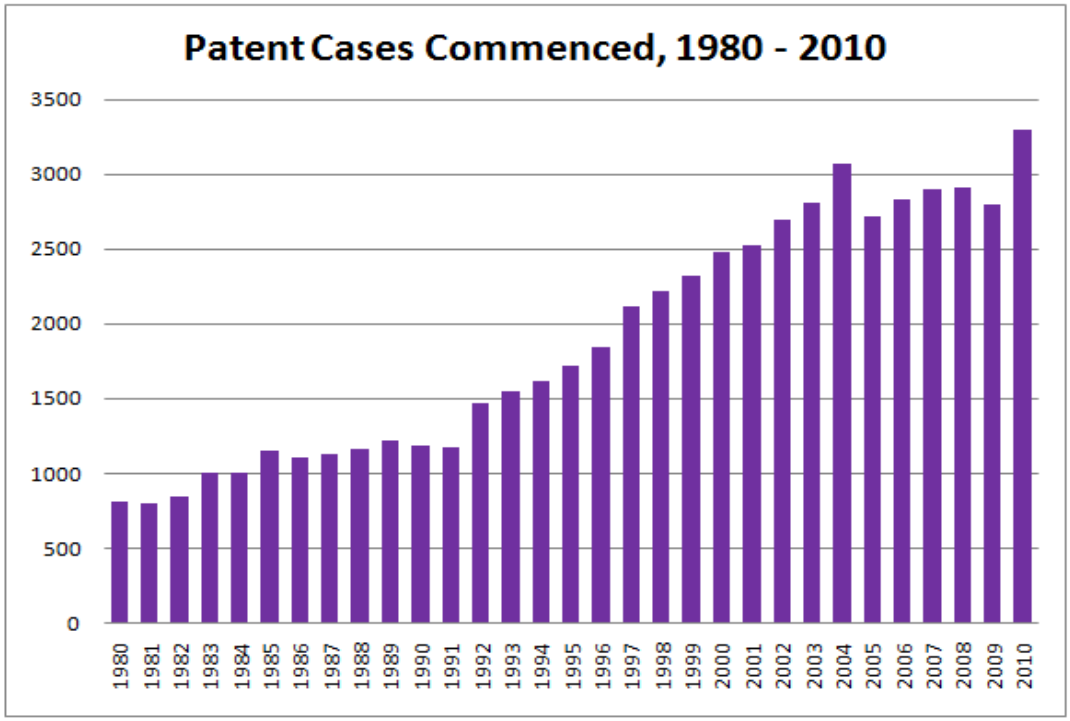

Figure 2: Patent Cases Commenced, 1980-2010
Source: ipwatchdog Patent Litigation Statistics: 1980-2010

According to a study by PricewaterhouseCoopers, the number of patents issued by the United States Patent and Trademark Office has increased at a compounded annual growth rate of 4.5%, while the amount of patent cases filed has grown at an average of 6.4% annually (Barry et al. 2012, 6).

The cause and effect relationship between more patents and more lawsuits is unclear. Are firms feeling the need to assert their patents because there are more to assert or are firms being sued more regularly and feel the need to buy more patents in defense? Most likely, it is a combination of the two. According to a BBC interview with Daniel O'Connor, an expert in anti-trust and internet policy, a major reason for the increase in cases filed, especially in the telecommunications, semiconductors, and 4G data networks industries, is that "Software patents are also particularly broad and vague, and that makes infringement difficult to avoid. 'That creates the conditions for a kind of patent perfect storm.'" As a result, it is easier and cheaper for companies to simply, "Cross their fingers and hope for the best," than it is to put in the extra

money and effort towards ensuring that they are not infringing in the first place (Rubens 2012). Legal ambiguities and flawed incentives have given rise to a spiral of lawsuits and patent purchases, creating an arms race of sorts between some of the largest technology companies in the world.

In addition to the number of cases filed, there has also been an increase in damages awarded. The median damages awarded to firms in the technology and software industries engaged in patent lawsuits have risen from $8.5 million to $31.4 million between 1997 and 2007 (Kelley 2011, 115-116). In 2012, there were two separate verdicts of over $1 billion awarded in the United States. Apple won the first in their high profile case against Samsung. Apple originally filed the case in April of 2012 claiming that Samsung was infringing on patents protecting Apple's smart phone technologies. The lawsuit made headlines almost daily as each firm continued to file claims and counter claims. In the second, less popularized case, the U.S. courts awarded Carnegie Mellon University $1,169,140,271. The damages, which were paid by Marvell Semiconducter for patent infringement, were actually larger than those awarded to Apple.

The initiators of these lawsuits are both practicing and non-practicing entities. NPEs go after companies that infringe on their patents and that are not paying a licensing fee in hopes of recouping more in settlements and damages than the costs of the trial. The strategies of practicing companies are more debatable. The high profile cases of late have led some to wonder if the motives are truly to stop infringement, or if companies are using the intellectual property laws as a sword to disrupt their competitors. According to a New York Times article, a lot of the judges, policy makers, economists, and other experts agree that the patent system in the United States is so flawed that it is disrupting the innovation it was designed to protect. Technology patents are allowed to be so broad that, according to one employee at Apple, "Even if we knew it wouldn't get approved, we would file the application anyway. If nothing else, it prevents another

company from trying to patent the idea." As a result, companies are spending massive sums of money, $20 billion in the last two years just in the smartphone industry, on patent licensing and litigation fees (Duhigg & Lohr 2012). It may be no surprise that "the rate of patent lawsuits is rising faster than any other type of litigation," (Chan & Fawcett 2005, 3).

The current intellectual property laws are severely flawed and are a drain on technological innovation. Changing these laws can fix many of the problems that intellectual property poses to companies nationwide. Congress passed a patent reform bill in 2011; however, most experts agree that it has done little to affect the issues that are at the heart of the problems posed to the tech market. The initial congressional debate in 2005 aimed to decrease the breadth and scope of technologies that companies could license in a single patent with the hopes of decreasing litigation. After several years of debate, politicians finally passed a bill in 2011, but not before removing any measures that could have made any significant change to the market.

One possible solution is to require inventors to create a prototype before being eligible to file for a patent. This extra requirement would force innovators to spend more on research and development prior to filing for a patent. As a result, inventors would file fewer patents and the ones that the USPTO decided to grant would likely be more specific in nature. In the long term, this would thin out the amount of existing patents, especially in the technology market. Fewer patents in the marketplace would lead to fewer bulk sales and fewer lawsuits. Patent assertion firms would not be able to obtain as many vague patents and would have to pay more for them, rendering their business plans significantly more costly. With fewer patent assertion firms exploiting practicing entities, there would be less of a need for defensive aggregators as well. Practicing companies could spend less on maintaining large patent portfolios and spend less time and resources on intellectual property lawsuits. Instead, companies could funnel these resources back into productive activities benefiting consumers and shareholders.

Chapter III: Event Study

i. Purpose of Study & Hypothesis

The above discussion on the problems of the patent market warrants further analysis. Issues previously discussed, including problems with vague patents and corporations using the legal system as a sword, imply possible problems and inefficiencies for businesses. By performing a statistical study, I was able to measure, through market movements, how investors react when companies buy large amounts of patents for hundreds of millions of dollars. The study highlights possible investment strategies using intellectual property as an indicator and discusses whether the management of patent portfolios by corporations is effective.

The analysis preformed is an event study. I compiled a list of large patent deals between corporations (the "events") and examined how the stock prices of both the buyers and sellers of the patents changed as a result. I chose this particular study for multiple reasons. First, corporations buying and selling patents on such a large scale is a recent phenomenon. All of the sales compiled for this study have taken place less than two years prior to the time of writing. Consequently, this paper appears to be one of the first attempts at measuring the effect of these mass purchases on the stock prices of corporations. This specific type of study highlights if investors can make a positive return. While this paper will not look into specifically building a portfolio, it may provide evidence that, with additional research, investors can develop a profitable investment strategy. Another benefit of performing an event study is that the results help to show how effective managers are at valuing the patents they are purchasing in the eyes of investors.

My hypothesis was that the results of the event study would show that both buyers and sellers would see an increase in their stock price resulting from the patent purchases and sales. This paper previously mentioned some of the difficulties of patent valuation. Because these corporations have large amounts of resources and capital at their disposal, one would expect that these companies are effective at determining the value of patents and do not pay more than the fair valuation amount they determine. If this is true and managers are effective at investing in patents, then company stock prices should increase from these investments. This prediction assumes that markets are efficient, meaning that once a patent deal becomes public information, the stock price adjusts to reflect this information almost instantaneously. In addition, it assumes that there is minimal leakage of information before the official announcement of the deal to the public.

ii. Data Collection

Finding the actual events required searching through several news sources for any mention of specific patent deals. After I discovered a deal I then searched multiple news outlets and company press releases to determine several pieces of information. First, I had to determine the companies involved and ensure that at least one was a public entity to be certain that their stock returns would be publically available. Next, I searched for the earliest mention of the deal to pinpoint exactly when it became public information. In addition, I took note of the price paid and number of patents sold when this information was available. In most cases, both values were public, but in four instances, only one of the two was available. The full master table can be found in Appendix A (Tables A-1 and A-2) containing the companies involved in each transaction, their tickers, their betas, the amount of patents sold, the sale price, and the date the sale became public information. Table 1 summarizes the companies involved in each transaction:

Table 1: Companies in Each Transaction

Transaction #	Buying Company	Selling Company
1	Microsoft	AOL
2	Facebook	Microsoft
3	Universal Display	Fujifilm
4	Google	IBM
5	Google	IBM
6	Microsoft	Nortel
6	Apple	Nortel
6	Research in Motion	Nortel
6	Sony	Nortel
6	Ericsson	Nortel
6	EMC Corporation	Nortel
7	Vringo	Nokia
8	Wi-Lan	Glenayre Electronics
9	Facebook	IBM
10	Google	Motorola Mobility
11	Acacia Research	Adaptix
12	Intel	Real Network
13	Intel	Inter Digital

For some transactions, the companies listed were not public during the event. Those corporations include Facebook in transactions 2 and 9, Glenayre Electronics in transaction 8, Motorola Mobility in transaction 10, and Adaptix in transaction 11. In addition, Nortel was publically listed at the time that transaction 6 was announced, but was in the process of liquidation. For this reason, I chose not to include Nortel in the aggregated results and instead noted the stock reaction separately in the results section. Transaction 6 was a sale of patents by Nortel at auction in which all of the buying companies listed agreed to pool their funds. As such, I have listed each buying company separately. Transaction 10 was an acquisition of the private company Motorola Mobility by Google. The general public consensus is that the overwhelming incentive behind the merger was for access to Motorola Mobility's patents so I chose to include this event. However, because it was an acquisition, I examined the effect on the stock returns on the announcement date, August 15, 2011, instead of the acquisition date. (For more information, see the full master table of events in Appendix A.)

Once I obtained a master list of patent deals, I assigned an event period to each purchase. The first trading day during which a deal became public information, or the day after if the announcement was made after trading hours, is referred to as day zero or the event day. The event window for each deal consists of the five trading days before the event day (days negative five through negative one) up to the five trading days after the event day (days one through five). I collected the returns of the stocks for the public buying and selling corporations for each day during the event window. To do this I obtained the returns using the Factset program available in the trading room at the Smeal College of Business. I then used Yahoo Finance to collect the S&P 500 daily-adjusted closing prices for days negative six through five for each event. I used these prices to calculate the daily returns of the S&P 500 for every day of the event window (negative five through five). I did this by taking each day's closing price, subtracting the previous day's closing price and then dividing the difference by the previous day's closing price. (See Appendix B Formula B-2 for the formula to calculate the return of an asset.)

Finally, I recorded the beta for each corporation I was analyzing by using the betas reported on Yahoo Finance. Yahoo Finance calculates beta by taking the co-variance of returns of a stock with the returns of the S&P 500 and dividing by the variance of the returns of the S&P 500. Yahoo Finance does this using three years of monthly returns, or 36 data pairs. (See Appendix B Formula B-3 for the formula to calculate beta.) Beta, or market risk, is a measure of how much investors expect a stock to vary in proportion to the market. For example, if stock A has a beta of two and the market increases by 2%, investors would expect stock A to increase by 4%. Similarly, if stock B has a beta of 0.5 and the market decreases by 2%, investors would expect stock B to decrease by 1%. Because Fujifilm did not have a beta readily available on Yahoo Finance, I calculated their market risk myself. I collected monthly closing prices of Fujifilm (FUJIY) and of the S&P 500 from Yahoo Finance. I recorded the adjusted closing prices for the last trading day of each month from December of 2009 through December of 2012 and

calculated the returns for both Fujifilm and the S&P 500 during each month by using the formula for returns of an asset mentioned previously (Appendix B Formula B-2). This resulted in returns for both assets from January 2010 through January 2012. I then used these 36 data pairs to calculate the beta of Fujifilm using the formula to calculate beta previously discussed (Appendix B Formula B-3).

In the following section, I will describe how I used this data to observe the effects of the events on the returns of each company's stock.

iii. Methodology

To measure how these bulk patent purchases moved companies stock prices I used the cumulative abnormal return (CAR) method. This method allowed me to measure the changes in a stock price beyond what was expected based on market movements throughout the course of the designated event window. This measure of abnormal returns assumes that the capital asset pricing model (CAPM) holds true. The CAPM was developed by "Sharpe (1964) and Treynor (1961), and extended and clarified by Lintner (1965a; 1965b), Mossin (1966), Fama (1968a; 1968b), and Long" (Jensen et al. 1972). The model makes four basic assumptions about investors:

> (1) All investors are single period risk-averse utility of terminal wealth maximizers and can choose among portfolios solely on the basis of mean and variance, (2) there are no taxes or transactions costs, (3) all investors have homogeneous views regarding the parameters of the joint probability distribution of all security returns, and (4) all investors can borrow and lend at a given riskless rate of interest. (Jensen et al. 1972, 1-2)

By using these assumptions, the CAPM model shows that the expected return on any asset is equal to the risk free rate plus the product of the asset's beta and the difference between the expected return of the market and a risk free rate. Any excess return, either positive or negative, are "abnormal returns" and can be attributed to firm specific events and announcements, say, for example, a bulk purchase or sale of patents. For the purposes of this study, I used the S&P 500 as a market proxy.

To measure the cumulative abnormal return I first measured the abnormal return for each stock on every day of the 11-day event window and summed the abnormal returns. To do this I took the actual return of the stock on a given day and subtracted the product of the stock's beta and the return on the S&P 500 on that day. This difference is the stocks abnormal return for that day. (See Appendix B Formula B-4) In this calculation, I am assuming the daily risk free rate to be zero. This is because risk free assets, such as U.S. government bills and bonds, have small interest rates. For example, the return on a three-month U.S. treasury bill at the time of writing is 0.12%. The equivalent daily returns are negligible. Next, I summed the abnormal returns of a given stock for each day of the event window to examine the cumulative abnormal return.

I repeated this process for every public stock identified in the master table. I then repeated this process using a three-day event window consisting of the day prior to the patent purchase announcement until the day after (day negative one to one). Finally, I repeated the CAR method for just the event day (day zero) to use as a comparison. Throughout this process, I kept the buyers and sellers of the patents in separate lists. As a result, I had calculated six lists of CARs for three event windows, 11 days, three days, and one-day, one each for buyers and one each for sellers. I used Excel's data analysis tool pack to create and examine summary statistics for each of the six lists. I also took the average abnormal return for each day of the event window for all buyers and again for all sellers. I created plots of these averages for days negative five

through five for both buyers and sellers. These plots help to give a visual representation of the market reactions. The following results section shows the summary statistics and plots

iv. Results

This section demonstrates the results of the previously explained empirical test of patent purchases on company stock returns. The general findings were that most buyers of patents saw no significant change to their stock price while the stock prices of several of the selling companies had a significant gain on the day of the event. Tables 2, 3, and 4 show the summary statistics of the cumulative abnormal return during the 11-day, three-day, and one-day event windows for the buying corporations:

Table 2: 11-Day Buyer CAR Summary Statistics

Summary of Buyers CARs using an 11 day event window	
Mean	0.02599123
Standard Error	0.01481485
Median	0.02951373
Mode	#N/A
Standard Deviation	0.05925938
Sample Variance	0.00351167
Kurtosis	0.75959362
Skewness	-0.4513145
Range	0.24026655
Minimum	-0.1127667
Maximum	0.12749984
Sum	0.41585965
Count	16

Table 3: 3-Day Buyer CAR Summary Statistics

Summary of Buyers CARs using a 3 day event window	
Mean	-0.0070657
Standard Error	0.01080088
Median	-0.0029678
Mode	#N/A
Standard Deviation	0.04320351
Sample Variance	0.00186654
Kurtosis	3.72327097
Skewness	-1.0269615
Range	0.20401596
Minimum	-0.1242011
Maximum	0.0798149
Sum	-0.1130515
Count	16

Table 4: 1-Day Buyer CAR Summary Statistics

Summary of Buyers CARs using a 1 day event window	
Mean	-0.0019684
Standard Error	0.00590045
Median	-0.0016866
Mode	#N/A
Standard Deviation	0.0236018
Sample Variance	0.00055705
Kurtosis	7.40477104
Skewness	2.30643752
Range	0.10408585
Minimum	-0.0299839
Maximum	0.07410195
Sum	-0.031494
Count	16

These tables show that the effect of the patent purchases on buyer's stocks is weak. The average CAR during the 11-day event window is 2.6%. To examine the significance of this result I divided the average CAR by the standard error, 1.5%. The standard error is equal to the standard deviation of the CARs divided by the square root of the count (16), or number of CARs in the sample. By dividing the mean CAR by the standard error, I calculated a t-statistic, 1.75. (See Appendix B Formula B-5 for the formula to calculate a t-statistic.) A t-statistic corresponds to the probability that the average value, in this case the average CAR, is not equal to zero. The probability for a t-statistic of 1.75 from a sample with 15 degrees of freedom (one less than the number of values in the sample) is approximately 90%. In addition, the average CARs for a three-day and one-day event window are -0.7% and -0.2% respectively. Each has a t-value corresponding to a probability of less than 50% that the effect of the patent purchases on the stock returns is significantly different from 0%. Figure 3 below shows a visual representation of the average of the buyer's abnormal return for each day of the 11-day event window:

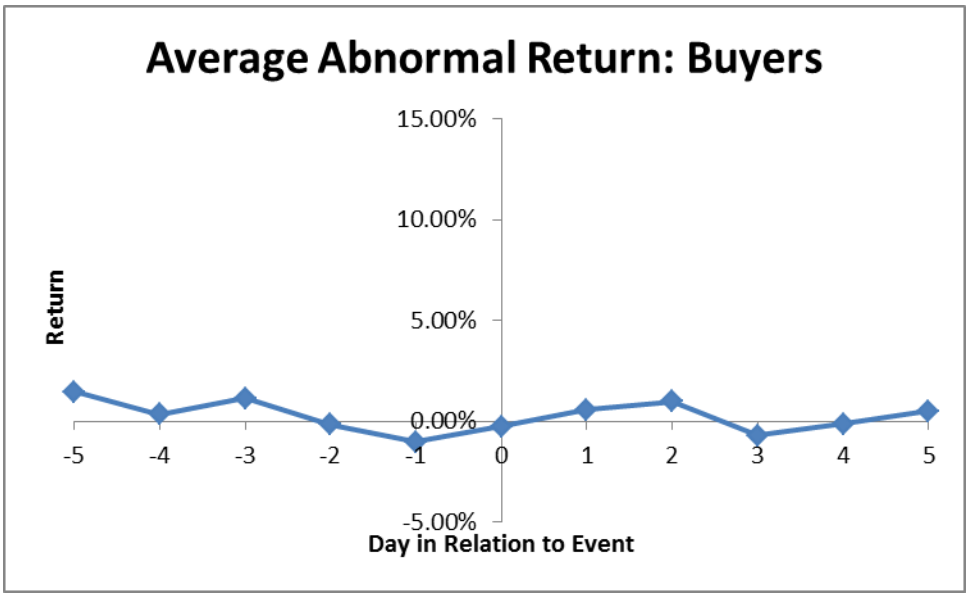

Figure 3: Daily Average Abnormal Return for buyers

This evidence suggests that bulk patent purchases have little to no significant effect on the stock price of buyers.

The evidence for the sellers in these bulk patent deals, however, shows a different story from that of the buyers. Below are tables 5, 6, and 7, which show the summary statistics for the 11-day, three-day, and one-day event windows of seller CARs:

Table 5: 11-Day Seller CAR Summary Statistics

Summary of Sellers CARs using an 11 day event window	
Mean	0.13218671
Standard Error	0.06271357
Median	0.04610581
Mode	#N/A
Standard Deviation	0.18814071
Sample Variance	0.03539693
Kurtosis	1.09097703
Skewness	1.51282512
Range	0.5228959
Minimum	-0.0068262
Maximum	0.51606966
Sum	1.18968042
Count	9

Table 6: 3-Day Seller CAR Summary Statitistics

Summary of Sellers CARs using a 3 day event window	
Mean	0.11592465
Standard Error	0.05422133
Median	0.03404573
Mode	#N/A
Standard Deviation	0.16266398
Sample Variance	0.02645957
Kurtosis	-0.460684
Skewness	1.10930929
Range	0.43443314
Minimum	-0.0353582
Maximum	0.39907494
Sum	1.04332181
Count	9

Table 7: 1-Day Seller CAR Summary Statistics

Summary of Sellers CARs using a 1 day event window	
Mean	0.12943179
Standard Error	0.05639099
Median	0.01495536
Mode	#N/A
Standard Deviation	0.16917296
Sample Variance	0.02861949
Kurtosis	-0.4809716
Skewness	1.03910693
Range	0.44357057
Minimum	0.00033106
Maximum	0.44390163
Sum	1.1648861
Count	9

The average CARs for the selling companies are 13.2%, 11.6% and 12.9% for 11-day, three-day, and one-day event windows respectively. The t-statistics for these event windows, in the same order, are 2.11, 2.14, and 2.30. All of these t-values correspond to probabilities between 90% and 95% that the results are significant. Figure 4 shows the average abnormal returns of the sellers for each day of the event window:

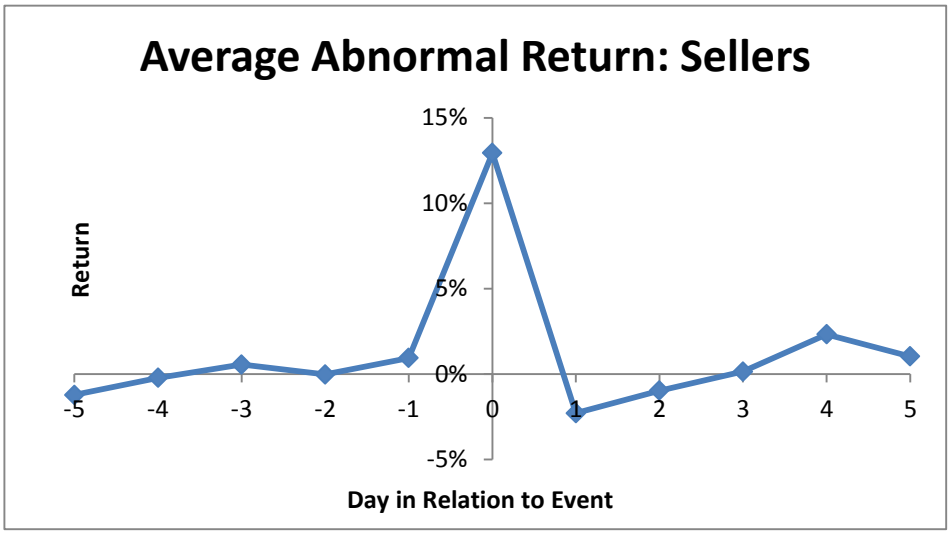

Figure 4: Daily Average Abnormal Return for Sellers

This evidence suggests that, unlike buyers, sellers gain a significant increase to their stock price upon selling their patents. The graph of the daily returns also suggests that most of this return occurs on the day of the event, meaning there is no major leakage of information about the sale to the public. It is also worth noting that the Canadian telecom company Nortel, which was a seller in one of the patent deals, experienced incredibly high CARs of 47.8%, 64.3%, and 40.6% for each of the respective event windows. Their data was not included when computing the summary statistics or creating the graph of average daily abnormal returns because they were going through liquidation at the time of the patent sale.

v. Interpretation

The gains and losses calculated in the event study are not spread evenly across the companies tested. Of the buyers, the average market capitalization of companies buying patents that saw an absolute value of their 11-day CAR equal to 5% or more is $53.48 billion. If Google is excluded, that average drops to $940 million. The only buyer that saw a 5% CAR on the day of the event, Acacia Research, has a market cap of $1.45 billion. Similarly, the average market capitalization of sellers that saw a CAR of 5% in either direction was $4.75 billion. These numbers compare with an average market capitalization of $94.51 billion for all of the buyers and $73.30 billion for all of the sellers. In addition, of the nine sellers examined, only four saw a CAR with a greater absolute value than 5% over the course of the 11-day event window, and they each had an abnormal return of greater than 10%. This does not include the data from Nortel, which saw the greatest abnormal returns and has the lowest market capitalization of all the firms examined. The size of the companies appears to play a significant role in the size of the events'

effects on stock returns. Tables of each company's 11-day, three-day, and one-day, CAR along with their market capitalization are included in the appendix. (Appendix A Tables A-3 & A-4)

These results show that only smaller companies tended to see any major effect from the patent deals. The effects were generally positive for sellers and mixed for buyers. This trend of a larger effect on stock prices of companies with a smaller relative market capitalization is most likely because the patent deals are relatively larger in scope to these smaller companies. Therefore, the deals have a much larger impact on valuations and share prices of smaller corporations.

Examining the mostly smaller companies that saw significant effects on their stock returns, there are several possible reasons why sellers tended to see an increase in share prices while buyers had mixed results. As previously mentioned valuing patents is difficult and can often be inaccurate. The effect on stock returns from these sales could be a result of different valuation methodologies or different beliefs of future income between firm managers and investors. For example, it is possible that investors are not taking the resale value of the patents into consideration. Some managers feel that they will be able to make more money from owning a patent than the managers of another company. Therefore, the valuations of these licenses can differ from company to company. Consequently, if company A can make more from practicing or licensing a patent than company B, and company B owns the patent, company B should only then sell the patent for more than what they would earn by practicing or licensing it themselves. If investors have not previously taken the resale value of the patents into account, the stock price will increase from the sale, similar to the stock price increases often realized by a company when it is acquired. In some cases, companies actually purchase patents with the intention of reselling them shortly thereafter, possibly unbeknownst to their investors. Microsoft, for example, spent over a billion dollars buying patents from AOL in April of 2012 and in the same month, sold over half of those licenses to Facebook. The event study included both of those deals.

One explanation of the disparity between the stock returns of buyers and sellers relates to a phenomenon seen in mergers and acquisitions called the winner's curse. Varaiya and Ferris (1987) attribute this curse to competitive bidding by multiple corporations interested in the same acquisition. In order for an acquisition to be beneficial to a firm, that company must offer a bid "high enough to induce the target shareholders to relinquish their control rights, but not so high as to make the acquisition economically undesirable" (64). In a situation where multiple parties target the same firm, the winning bid will be from whichever firm has estimated the highest value of the acquisition target and submits the highest bid. Unless every competing bid has underestimated the fair market value of the acquired firm, the winning bid will be an overestimate of the fair market price. As a result, the acquiring firm will earn a return on their investment less than the return required by its investors and their stock price will drop. Varaiya and Ferris (1987) find in their analysis of 96 acquisitions, that it is a relatively common occurrence for the stock price of an acquiring company to fall after it places a winning bid. In the case of patents, a similar situation can easily occur. Patents are similar to acquisition targets in that they are a unique product with very few, if any, substitutes. This makes it more likely for several potential acquirers to bid for the product. Often, companies sell their patents in an auction setting allowing parties to place multiple bids. By increasing the number of bids, the probability that the highest bid is higher than the fair market value of the patents also increases. In this event, the stock price of the company that places the winning bid would decrease while the stock of the selling company would increase. This theory is consistent with the results found in the analysis.

It is easy to imagine companies and investors arriving at starkly different valuations of patents when factoring in things like potential lawsuit costs and licensing benefits, which could be a reason that buyers of bulk patents saw mixed reactions in their stock return. Perhaps investors viewed patent investments as riskier projects than the managers of that firm, and therefore discounted the future cash flows at a higher discount rate than the firm's managers. As

a result, the stock price would drop because the company paid what investors determined to be too much for the intellectual property. Assuming the investors of firms that sold their patents made similar valuations when those patents were originally acquired, an opposite reaction would occur upon the sale. The cash flows that investors originally discounted heavily in the previous example are now realized entirely in the form of the patent sale. If the sale price was higher than what investors determined to be the present value of what the firm would have realized from holding the patents, the stock price would increase.

It can be extremely difficult for investors of companies that are buying or selling hundreds or even thousands of patents at a time to determine the specifics of all the licenses. This information is sometimes not readily available without grueling and time-consuming research. It is possible that investors use rudimentary valuation techniques when determining the fair price of the patents. In this event, a patent deal could have a profoundly different price from that of an investor's valuation. Another possibility is that the specific information about the intellectual property is so difficult for investors to obtain that they are not accounting for it at all.

The results of the event study have different implications for managers and investors. Managers of technology companies may want to be less eager when it comes to purchasing patents. The new trend seems to be to grab every license within sight for protection from lawsuits or so that a competitor does not get the opportunity to purchase the patent, but according to the event study, these patents do not appear to be adding any value. If managers are considering purchasing patents with no intention of practicing them, they may want to reconsider and instead use that capital for other projects. On the other hand, if a firm has several patents that they do not intend to use themselves, they could gain large returns by simply selling them.

Looking at the event study, investors may want to search for firms that they believe will soon be selling their patents. Several of the sellers in the study that saw a major stock price increase resulting from the sales, notably AOL, Nortel, Nokia, and Real Network, are companies

that have products or services in the mature or declining phase of the product life cycle. If an investor can identify a company with a bloated portfolio of patents that are either not in use, or that relate to mature products and services, that firm could prove to be a worthwhile investment with large short-term payoffs.

Chapter IV: Conclusion

In summary, the state of the patent market in the United States, especially with regard to the technology sector, is starting to reach chaotic levels. The current laws allowing patents to be vague and cover a broad amount of technology are having some severe and adverse effects on the market. The state of the legal environment has given rise to the non-practicing entity, commonly known as the patent troll. These companies amass large patent portfolios and earn revenues by forcing practicing corporations to pay licensing fees or by litigating against anyone who is possibly infringing on their intellectual property. While this author does not feel that the patent troll business model is ethically sound, it is not my belief that focusing on shutting down NPEs directly would be the best response. Instead, by changing the laws so that patents must be more specific and therefore more difficult to license, the NPE business model would not be feasible from an economic standpoint. Another ill effect resulting from vague patents is the rise in court cases and judgments that have been occurring over the last 20 to 30 years. These cases are a combination of NPEs suing practicing corporations and practicing companies suing each other. Whether practicing entities sue each other as a strategy to slow competitors is a topic that is up for debate. Regardless, companies arguably waste huge sums of capital in court fees and defensive aggregation. Instead, they could more effectively invest these resources in creating new and improved products and services, benefitting both the economy and their investors.

One possible solution is to require inventors to create a prototype before they are eligible for a patent. Doing so would increase the amount of money required for research and development before filing for a patent. This would incentivize less patent filing overall leading to fewer and more specific patents in the marketplace. Eventually this could lead to less intellectual

property lawsuits. Corporations could then funnel the capital and other resources spent on lawsuits and patent purchases back into production and other productive uses.

Because of the increase in court cases and emergence of non-practicing entities, companies are beginning to buy patents in bulk. They are sometimes spending billions of dollars to build up patent arsenals for various reasons. An event study of the effect of these sales and purchases on share prices has shown that investors do not generally see these large investments as adding value to a firm, while investors of companies that sell off their patents seem to appreciate the influx in cash and their share prices will often see a sizeable appreciation. These results are similar to the winner's curse phenomenon resulting from mergers and acquisition. Because multiple parties are bidding for the same object, the highest bid, which will usually be the winning bid, often overestimates the fair value of the product or target causing a negative effect to the stock price of the buyer. It must be noted that the small sample size means that the statistical analysis does not provide anything that can be considered a hard and fast rule. However, at the least it demonstrates an incentive for managers to look into selling off potentially valuable patents that they themselves are not finding useful, as well as to be mindful when looking into building up mass portfolios of intellectual property. In addition, the study is evidence of a possible investment strategy that could lead to substantial short-term gains for those who identify companies that are bloated with unnecessary amounts of patents. Finally, the statistical observations and the recent trend of such large sales in the secondary patent market could be further evidence that the state of the intellectual property market is becoming a hindrance to American corporations

The ideas and evidence presented in this paper only scratch the surface of what is going on with regard to patents in the technology industry, which is only a part of the all-encompassing intellectual property field. Further research needs to be conducted to determine where improvements can be made from both legal and managerial standpoints. In addition, it could be

worthwhile to see if investors are capable of creating a profitable investment strategy by using intellectual property as an indicator of return. It will be interesting to see the direction taken by managers, investors, and the government, as well as any other stakeholders who arise in the coming years as the intellectual property market continues to develop and evolve.

Appendix A

Table A-1: Master Table of Events: Companies and Betas *

Transaction #	Buying Company	Ticker (if Public)	Beta	Selling Company	Ticker (if Public)	Beta
1	Microsoft	MSFT	1.14	AOL	AOL	0.94
2	Facebook	-	-	Microsoft	MSFT	1.14
3	Universal Display	PANL	0.57	Fujifilm	FUJIY	1.03
4	Google	GOOG	1.16	IBM	IBM	0.62
5	Google	GOOG	1.16	IBM	IBM	0.62
6	Microsoft	MSFT	1.14	Nortel	-	-
6	Apple	AAPL	0.75	Nortel	-	-
6	Research in Motion	RIMM (BBRY)	1.6	Nortel	-	-
6	Sony	SNE	1.81	Nortel	-	-
6	Ericsson	ERIC	1.35	Nortel	-	-
6	EMC Corporation	EMC	1.39	Nortel	-	-
7	Vringo	VRNG	2.21	Nokia	NOK	1.84
8	Wi-Lan	WIN	0.96	Glenayre Electronics	-	-
9	Facebook	-	-	IBM	IBM	0.62
10	Google	GOOG	1.16	Motorola Mobility	-	-
11	Acacia Research	ACTG	1.04	Adaptix	-	-
12	Intel	INTC	1.01	Real Network	RNWK	1.85
13	Intel	INTC	1.01	Inter Digital	IDCC	1.11

* A dash (-) indicates that the ticker and beta were not available because the company was not public at the time of the event. Nortel was publically listed at the date of the event but was in the process of liquidation so was not included in the results.

Table A-2: Master Table of Events: (Continued from Above)*

Transaction #	Number of Patents	Amount Paid (Amount Paid by Specific Buyer)	Date Information became Public
1	925	$1,056,000,000	April 9, 2012
2	650	$550,000,000	April 23, 2012
3	1200	$105,000,000	July 24, 2012
4	1030	-	July 28, 2011
5	1023	-	September 14, 2011
6	6000	$4,500,000,000	July 1, 2011
6	6000	$4,500,000,000 ($2,600,000,000)	July 1, 2011
6	6000	$4,500,000,000 ($700,000,000)	July 1, 2011
6	6000	$4,500,000,000	July 1, 2011
6	6000	$4,500,000,000 ($340,000,000)	July 1, 2011
6	6000	$4,500,000,000	July 1, 2011
7	-	$22,000,000	August 9, 2012
8	60	$8,000,000	June 29, 2012
9	750	-	March 22, 2012
10	24500	$12,500,000,000	August 15, 2011
11	230	$100,000,000	January 13, 2012
12	360	$120,000,000	January 26, 2012
13	1700	$375,000,000	June 18, 2012

* A dash (-) indicates that the data was not publically available.

Table A-3: Cumulative Average Returns and Market Capitalization of Buyers

Company	11-day CARs	3-Day CARs	1-Day CARs	Market Cap in Billions*
MSFT	-0.50%	0.95%	-0.04%	$232.52
PANL	-11.28%	-6.62%	0.17%	$1.52
GOOG	8.50%	0.45%	0.99%	$263.63
GOOG	2.95%	-2.28%	-1.08%	$263.63
MSFT	4.73%	-1.05%	-1.57%	$232.52
AAPL	4.63%	2.81%	1.18%	$423.34
RIM	-3.45%	-1.70%	-2.38%	$6.79
ERIC	-1.95%	-1.37%	-1.95%	$39.64
SNE	1.00%	0.21%	-1.93%	$14.12
EMC	-1.44%	-0.37%	-0.99%	$49.39
VRNG	9.97%	-12.42%	-3.00%	$0.257
WIN	8.47%	2.08%	0.15%	$0.536
GOOG	-0.30%	-0.56%	-2.22%	$263.63
GOOG	4.62%	1.00%	-0.30%	$263.63
ACTG	12.75%	7.98%	7.41%	$1.45
INTC	2.95%	-0.75%	0.02%	$101.00
INTC	-0.36%	-0.23%	0.15%	$101.00

Table A-4: Cumulative Average Returns and Market Capitalization of Sellers

Company	CAR 11-day	CAR 3-Day	CAR 1-Day	Market Cap in Billions*
AOL	37.86%	39.91%	44.39%	$2.89
MSFT	1.65%	3.40%	0.03%	$232.52
FUJIY	0.59%	-3.54%	1.00%	$9.31
IBM	-0.68%	1.27%	0.45%	$252.22
IBM	4.61%	2.19%	1.50%	$252.22
NOK	6.60%	4.10%	9.66%	$14.03
IBM	1.32%	0.97%	0.84%	$252.22
RNWK	51.61%	35.63%	31.68%	$0.276
IDCC	15.41%	20.40%	26.94%	$1.82

*All market capitalizations were recorded from Yahoo Finance

Appendix B

Formula B-1: Formula for weighted average cost of capital (WACC)

$$WACC = \frac{E}{V} \times R_e + \frac{D}{V} \times R_d \times (1 - T_C)$$

Where E is the market value of the firm's Equity, R_e is the return on equity demanded by shareholders, D is the market value of the firm's debt, R_d is the interest rate the firm pays on its debt, T_c is the corporate tax rate the company pays, and V = E+D.

Formula B-2: Formula for return of asset i

$$R_{i,t} = \frac{P_{i,t} - P_{i,t-1}}{P_{i,t-1}}$$

Where $R_{i,t}$ is the return of asset i at time t, $P_{i,t}$ is the adjusted closing price of asset i at time t, and $P_{i,t-1}$ is the adjusted closing price of asset i at time t-1.

Formula B-3: Formula for beta of an asset

$$\beta_i = \frac{COV(r_i, r_m)}{VAR(r_m)}$$

Where β_i is the beta of asset i, r_i is the return on asset i, and r_m is the return on the market. In this thesis the S&P 500 is used as a market proxy.

Formula B-4: Formula for abnormal returns

$$\propto_{i,t} = R_{i,t} - \beta_i \times R_{m,t}$$

Where $\alpha_{i,t}$ is the abnormal return on asset i during day t, β_i is the beta of asset i, and $R_{m,t}$ is the return on the market during day t.

Formula B-5: Formula for one sample t-statistics

$$t = \frac{\bar{X}}{S_{\bar{X}}}$$

And,

$$S_{\bar{X}} = \frac{S}{\sqrt{n}}$$

Where *t* is the t-statistic, $\bar{X}$ is the average CAR in the sample group, $S_{\bar{X}}$ is the standard error of the sample group, *S* is the standard deviation of the samples, and n is the number of CARs in the sample group.

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Work Experience

IBM Global Business Services **June 2012-August 2012**
Navy ERP Training Consultant: Department of Navy, Office of Naval Research (ONR) **Arlington, VA**

- Audited 3 instructor led training courses for 3 separate SAP ECC 6.0 financial management roles to acquire understanding of ONR's business processes and SAP software
- Collaborated with government functional leads and SAP subject matter experts to scope and define end user training curriculum, modules covered include: AM CO FI FM MM PS SD WFM
- Consolidated content of 172 generic training slide decks to create 39 master decks tailored to ONR's business processes
- Standardized 20 Navy ERP simulations using the uPerform software to provide consistency for end user training

PSU Knowhow **January 2012-June 2012**
Private Instructor **State College, PA**

- Worked 6-7 hours per week in a 1 on 1 setting with students helping them to better understand complex class concepts
- Specialized in business specific classes including finance, accounting, statistics and economics
- Marketed tutoring and review sessions to Penn State student body

Leadership & Activities **The Pennsylvania State University**

Penn State Investment Association **Spring 2011-Present**
Consumer Staples Analyst

- Support management of the Nittany Lion Fund's day to day operations ($4M investment fund)
- Expand knowledge of financial markets by observing key economic indicators, analyzing fundamentals, and monitoring stock performance for various companies in the industrials sector
- Learn strategies for researching and analyzing equity investments

Phi Gamma Nu Professional Business Fraternity **Fall 2009-Present**
Standards Board Member- Spring 2011, New Member Educator- Fall 2011

- Supervise the process to prepare new members for membership in fraternity
- Contribute to PGN's yearly fundraising activities for the Penn State Dance Marathon (2012 total: $73,988)
- Interpret, amend, and enforce fraternity's bylaws to ensure local and national compliance

Honors & Awards

- Dean's List Recipient: Fall 2009, Spring 2010, Fall 2010, Spring 2011, Fall 2011, Spring 2012
- Academic Excellence Scholarship: Schreyer Honors College, Beta Gamma Sigma Honor Society
- National Merit Scholar: Commended, National Council of Supervisors of Mathematics Award