

IPOs and Patent Lawsuits

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ABSTRACT

This paper examines the effects of legal environment on corporate acquisition and innovation activities in periods around a company’s initial public offering (IPO). Using a comprehensive, hand-collected data set of patent lawsuits, we find that firms become targets of excessive patent lawsuits beginning just “one quarter” before the IPO, and the intensity of such lawsuits persists in the post-IPO period. Following the IPO, companies significantly increase their acquisition activities. This increase is most prominent among firms that have been exposed to patent litigation, and these firms acquire targets that have substitute patents. We do not observe an increase in patent lawsuit threat for firms that withdraw their IPO filings. Taken together, our results indicate that the intensified patent litigation risk is an important factor that drives the change in IPO-firms’ innovation strategies to increase the acquisition of external innovation as an alternative to incremental in-house innovation.

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“As it prepares for one of the biggest IPOs ever, Facebook is coming under the same fierce attacks being waged against other big technology companies: patent lawsuits.”

*Reuters (February 1, 2012)*¹

The number of IPOs that occur in a given year is typically considered as an important measure of the success of innovation in the economy. After a drought in the IPOs in the 2000s ([Gao, Ritter and Zhu \(2013\)](#)), JOBS Act was signed into law in 2012 to increase number of IPO firms to encourage innovation and boost economic growth. However, evidence shows that, following an IPO, there is a decrease in the quality of internal innovation ([Bernstein \(2015\)](#)) and an increase in the acquisition of external innovation ([Celikyurt, Sevilir, Shivdasani \(2010a\)](#), [Celikyurt, Sevilir, Shivdasani \(2010b\)](#) and [Bernstein \(2015\)](#)). Despite the issue’s importance for the policy makers, the underlying reasons that drive the change in innovation strategy is largely unknown.

In this paper, we argue that patent lawsuits explain the acute need for acquisitions and decrease in the internal innovation following the IPOs. In the book building phase, possible investors pay close attention to any news about the company. Therefore, companies become more vulnerable to negative news such as being target of a lawsuit. We find that there is a jump in the likelihood of being a lawsuit target just one quarter before an IPO. As shown in [Figure 1](#), in the last quarter preceding an IPO, a company is more than twice more likely to be a lawsuit target than it is in any other preceding quarters. These excessive lawsuits persist even after the IPO completion. Previous literature shows that there is a causal relation between patent lawsuits and acquisition activity. As shown in [Caskurlu \(2017\)](#), after lawsuits, lawsuit targets make acquisitions to access to substitute patents. Consistent with [Caskurlu \(2017\)](#), we find that, following the IPOs, companies make acquisitions at a torrid pace to get substitute patents as an alternative to incremental in-house innovation.

Our study is motivated by survey results and anecdotal evidences. In a recent survey, [Feldman and Frondorf \(2015\)](#) talk with in-house legal staff of 50 companies which have completed their IPOs in the 2007-2012 period. They find that there is extensive patent demand activity (i.e., litigation or the threat of litigation) near IPOs and most of the demands are either shortly before or after IPO. In addition to this survey, there are also many anecdotal evidences of strategic timing of the lawsuits.

¹“Analysis: Patent plaintiffs target Facebook as IPO approaches”

For example, Facebook Inc. went to an IPO on May 18, 2012. In the last four quarters before the IPO, Facebook had 23 patent lawsuits; in the previous four quarters before that, it had been targeted only 9 times. Moreover, just three months before the Facebook IPO, Yahoo sued Facebook for infringements of its 10 patents. Yahoo had used a similar tactic before: Google agreed to issue shares to Yahoo nine days before Google went public in 2004 in exchange for a license to Yahoo's patents². Another well known example is the Paypal, which was planning to complete its IPO on February 7, 2002. However, just three days before the planned IPO completion date, CertCo, Inc. filed a patent lawsuit against Paypal. According to the Paypal's management, even though CertCo claims that its patent has been infringed for more than 2 years, it had never communicated with them on the issue³. This patent lawsuit case caused a one-week delay in Paypal's IPO. There are many other examples such as Twitter which was threatened by IBM just three days before its IPO⁴.

A major empirical challenge to test the causal effects of IPO on patent lawsuits is the endogeneity problem. It is possible that unobservable variables that would affect the likelihood of going IPO may also affect the likelihood of being a patent lawsuit target. For example, a company that has received a positive production shock may be more likely to go to an IPO. At the same time, after this positive shock, company may be more likely to get onto radar of other companies with strong patent portfolios, in turn making it a patent lawsuit target.

To overcome this endogeneity problem, similar to [Bernstein \(2015\)](#), we use NASDAQ fluctuations over the two months following the IPO filing date as an instrumental variable (IV) for IPO completion. As shown in [Busaba, Benveniste and Guo \(2001\)](#), IPO withdrawals are sensitive to aggregate stock market movements during the book-building phase. In our analysis, the IPO effect is identified from differences in long-run patent lawsuit frequency between firms that file to go public in the same year but experience different post-filing NASDAQ returns.

For the experiment, we hand-collect patent lawsuit data from different data sources including Westlaw, BloombergLaw, Public Access to Court Electronics Records (PACER) and RECAP, which

²<https://www.reuters.com/article/us-yahoo-facebook-lawsuit/yahoo-sues-facebook-for-infringing-10-patents-idUSBRE82B18M20120312>

³<https://www.sec.gov/Archives/edgar/data/1103415/000091205702004798/a2070244zex-992.htm>

⁴In a recent example, just three days before its IPO on November 7, 2013, Twitter disclosed in an updated S-1 that it had received a letter from IBM alleging that Twitter had infringed on three IBM patents. Four months later, Twitter purchased 900 patents from IBM to settle the dispute

is a subset of PACER that serves as a free repository of PACER. After gathering our data, we compare our results with the USPTO patent lawsuit database and LexMachina. Our dataset includes information about the parties, judges, case number, jurisdiction, patent level decision on the case and whether the case is a declaratory judgment. For each of the alleged parties (i.e., defendants for regular cases and plaintiffs for declaratory judgments), we check the official name in the SEC filings at the time of patent filings to account for name changes. For the non-matched parties, we check the SEC Filings to determine whether the company is a subsidiary of a public company. For the subsidiaries, we base our estimation at the parent company level.

We start our analysis by a visual inspection that demonstrates the likelihood of being a patent lawsuit target around the IPO date. For each company that went through an IPO between 1996 and 2012, we count the number of patent lawsuits that it was targeted in the 12 quarters before and after its IPO. Next, for each company, we calculate the ratio of its quarterly lawsuits to its total number of lawsuits. Then, we calculate the average for each quarter. This approach provides us a framework to investigate the change in the patent lawsuit frequency within the company. Figure 1 shows the results: just one quarter before the IPO, the likelihood of being a lawsuit target is more than two times of the likelihood in any other preceding quarters. Moreover, after the increase in the likelihood in one quarter before the IPO, it keeps in the same level in the post-IPO phase.

Even though it would be difficult to explain the jump in just one quarter preceding the IPO with a reason other than the strategic timing, an increase in lawsuit frequency in the post-IPO phase can be explained by a time trend. To inspect whether the relation is simply caused by a time trend, we explore the situation for the withdrawn deals. As shown in Figure 2, there does not exist an increasing pattern of patent lawsuit likelihood after the withdrawn date. This gives us some comfort that the relation observed in Figure 1 may be a causal relation.

After the initial visual inspections, we employ formal econometric tests to investigate the effects of IPO on patent lawsuits. Using the two-month Nasdaq returns after the IPO filing as our IV for the IPO completion, we test whether there is an increase in the likelihood of being a patent lawsuit target. Our results show that completion of an IPO increases the likelihood of being a patent lawsuit target. As a placebo test, we test the correlation of patent lawsuit intensity and two-month Nasdaq return one year before the IPO filing. We find that there is no statistically significant relation between them. This result confirms that the relation between post-IPO filing

Nasdaq return and patent lawsuit intensity is through the IPO channel.

Next, we test whether companies increase acquisitions in the post-IPO phase and whether this increase is mostly caused by patent lawsuit targets. Employing an IV estimation, first we find that IPO companies significantly increase their acquisition activity in the two years after the IPO. This results are consistent with the findings in (Celikyurt, Sevilir, Shivdasani (2010a) and Celikyurt, Sevilir, Shivdasani (2010b)). In our estimation, we also find that being a lawsuit target increases the likelihood of the acquisition. More than 50% of all post-IPO acquisitions are conducted by companies which had a lawsuit around the IPO date, even though only 20% of the companies have been targeted in patent lawsuits. This supports the hypothesis that patent lawsuits may be one of the reasons for acquisitions.

To further link patent lawsuits and the acquisitions conducted by firms after the IPO, we examine the patent portfolios of the acquisition targets. We find that following an IPO, among similar targets, companies acquire targets that have substitute patents to the ones that the acquirers allegedly have infringed. We argue that this provides a strong evidence that patent lawsuits are one of the major reasons for the increase in the acquisition intensity in the post-IPO phase.

Our paper makes several contributions to the literature. Firstly, our paper is the first paper to form a link between the patent lawsuits and post-IPO acquisition and innovation activities. IPO is considered an important measure of the success of innovation in the economy. The JOBS Act was passed into law in 2012 to increase the number of IPOs. However, surprisingly, existing evidence suggests that in the post-IPO phase, companies has a decrease in internal innovation quality and an increase external innovation motivated acquisitions. Given that innovation is a central issue for the policy makers, we believe that understanding the reasons of this pattern is important.

Secondly, by identifying a new dark side of IPO linked to patent lawsuits, this paper contributes to understanding the costs associated with going public. Traditionally the focus of such costs has been on agency issues, regulatory burdens, loss of privacy and flexibility, and short-term market pressures. By showing that firms increasingly become targets of patent lawsuits during and after the IPO and subsequently adjust their acquisition strategy to make up for the patents being targeted in the lawsuits, we identify a new consideration that firms may need to fully evaluate before embarking on the IPO process. Examining such concerns and tradeoffs faced by firms going public may also help enrich our understanding as to why IPO volume fluctuates over time (Lowry (2013)) and why

there are IPO droughts (Gao, Ritter and Zhu (2013)).

Thirdly, we contribute to the literature on the relation between acquisitions and IPOs. Celikyurt, Sevilir, Shivdasani (2010a) and Celikyurt, Sevilir, Shivdasani (2010b) argue that there is a causal relation between M&As and IPOs; companies that intend to acquire become public in order to fund these transactions. In this paper, we complement these papers and show that the other side of the causality also holds. We argue that IPO-firms with intensified patent litigation cause firms to make acquisitions to access to substitute patents.

Fourthly, our paper contributes to the literature on acquisitions and small firm R&D. On this issue, Phillips and Zhdanov (2013) argue that an active acquisition market encourages innovation, particularly by small firms in an industry. Small firms optimally may decide to innovate more when they can sell out to larger firms. Therefore, large firms can optimally outsource R&D investment to small firms instead of conducting it in-house. Our results would be in line with the argument that IPO droughts cause a decrease in patent motivated acquisitions, which in turn, lead to a decrease in small firm R&D.

Finally, our paper makes contribution to the patent lawsuit literature. Recently, there have been arguments that patent protection does not stimulate innovation (Lerner (2009), Qian (2007)) and that we should abandon patent enforcement altogether (Boldrin and Levine (2013)). The issue has attracted attention also from policy makers. In 2011, Congress passed the largest patent reform of the last 60 years and recently has been discussing different regulations that would change patent enforcement⁵. In the midst of these discussions, we show one of the dark sides of patent lawsuits on the public companies.

I. Hypotheses Development

A. *IPO and Patent Lawsuits*

Patent lawsuits may have some detrimental effects for the corporations. In addition to lawyer fees, after a defendant loses a patent lawsuit, it may receive an injunction order, which would bar the company from producing an infringing product. Moreover, the company may need to pay the patent holder substantial amounts as damages per product already sold. Therefore, being a

⁵<http://www.bloomberg.com/news/articles/2015-03-03/the-u-s-can-t-fix-a-broken-patent-system-alone>

target of a patent lawsuit brings uncertainty for the future prospects and current valuation of the company.

One of the most important times for a company history is the IPO process. This is the time possible investors monitor companies more closely and try to make valuations as accurate as possible. Therefore, possible investors seek to receive any news about the company. Even though this monitoring may have some disciplining role, it may also make the companies in the IPO process more vulnerable to strategic lawsuits. Investors who are considering to buy some shares during the IPO process would be less likely to do so if the company faces a patent lawsuit, which may bar it from producing a product.

In addition to strategic lawsuits, detailed filings about the company products, financial statements and expectations about the future may also increase the possibility of being a lawsuit target. After the IPO filing, as company and products come under the spotlight of the analysts, a patent holder who previously may not sue the company can become more likely to file a lawsuit after the alleged infringer's publicity. This would lead us to the first hypothesis:

HYPOTHESIS 1: In the post-IPO phase, companies are more likely to become patent lawsuit targets.

B. Patent Lawsuits and Acquisitions in the post-IPO Phase

In the literature, there has been some evidence that company who would like to make acquisitions go to IPO to receive some funding ([Celikyurt, Sevilir, Shivdasani \(2010a\)](#) and [Celikyurt, Sevilir, Shivdasani \(2010b\)](#)). This evidence is also backed by surveys such as [Brau and Fawcett \(2006\)](#), who find that the desire to create an acquisition currency ranks as one of the most important reasons for an IPO.

In this paper, we argue that the other side of the causality may also hold. The companies who would like to go to an IPO are exposed to litigation. As shown in [Caskurlu \(2017\)](#), after lawsuits, if defendant loses the case, then it makes acquisitions at a torrid pace. Therefore, if the companies are exposed to more patent lawsuits in the IPO phase, then we expect them to increase their acquisition activity in after the IPO is completed.

HYPOTHESIS 2: Companies increase their acquisition activity in the post-IPO phase.

HYPOTHESIS 3: Exposure to patent lawsuit in the book building phase increases the acquisition activity in the post-IPO phase.

[Caskurlu \(2017\)](#) explains the reasoning of increase in acquisition after the lawsuits as the demand for gaining access to substitute patents. If the patent lawsuits is one of the drivers of the post-IPO acquisition activity then we expect that in the post-IPO phase, companies acquire targets that have substitute patents to the ones they were found infringing.

HYPOTHESIS 4: IPO companies which had a patent lawsuit in the book building phase are more likely to acquire companies with substitute patents in the post-IPO phase.

II. Data

A. *Patent Lawsuit Data*

For our research, we use several sources to compile a complete patent lawsuit database. We start our analysis by using Westlaw and Bloomberg databases, which provide information about the published court opinions. Then, we supplement it with Public Access to Court Electronics Records (PACER) database, which provides public access to all cases litigated in US district courts, and RECAP, a subset of PACER that serves as a free repository of PACER. Our dataset includes information about the parties, judges, case number, jurisdiction, and whether the case is a declaratory judgment. For each of the alleged parties (i.e, defendants for regular cases and plaintiffs for declaratory judgments), we manually check the official name in the SEC filings at the time of patent filings to account for name changes. For the non-matched parties, we check the SEC Filings to determine whether the company is a subsidiary of a public company. For the subsidiaries, we base our estimation at the parent company level.

B. *IPO Filing Data*

We use several resources to gather data on IPO. Our main source of information is SEC regulatory filings. A company that would like to apply for an IPO files S-1 filings. After the first filing,

the company may issue S-1A amendment filings. If the company would like to withdraw filings, then it has to file RW filings. A filing registration automatically expires 270 days after the last amendment of the IPO filing.

After gathering our data from the regulatory filings, we cross match our observations to Thomson Reuters Issues Database and Jay Ritter's IPO database. Then we eliminate financial companies, limited partners, trusts, unit offers, closed-end funds and acquisition related vehicles. In our sample of completed and withdrawn IPO applications, we hand-collect information about the pre-IPO financial information from the S-1 filings.

C. Other Data

In our analysis, we use CRSP database to find historical SICs, trusts, unit offers and closed-end funds. For the acquisition data, we use SDC Mergers and Acquisitions Database.

III. Empirical Analysis

A. Patent Lawsuits Around IPO

In our analysis, we use our hand-collected patent lawsuit data to form the list of alleged infringers that were accused between 1996 and 2012. For each case that was filed between these dates, we compile the list of defendants as alleged infringers for the regular cases and plaintiffs as alleged infringers in the declaratory judgments. Then, we match the list of alleged infringers to our sample of completed and withdrawn companies, which we formed from S-1 filings, Thomson Reuters Issues Database and Jay Ritter's IPO database. For both completed and withdrawn deals, we hand-collect the subsidiary information from the list enclosed in S-1 filings. For the subsidiaries, we base our estimation at the parent company level.

A.1. Visual Inspection

We start our analysis by investigating the frequency of patent lawsuits around the IPO date. For each company that went through an IPO between 1996 and 2012, we count the number of patent lawsuits that it was targeted in the 12 quarters before and after its IPO. Next, we calculate the ratio of quarterly lawsuits to the total number of lawsuits and then take the average for each

quarter. Figure 1 shows the results: just one quarter before the IPO, the likelihood of being a lawsuit target doubles the likelihood in any other preceding quarters. Moreover, the likelihood remains high during the post-IPO phase. However, one issue with this interpretation is that it is possible that there may be a time trend for the lawsuits, a case that would be unrelated to the IPOs. Therefore, next we investigate the situation for the withdrawn deals.

The relation of patent lawsuits frequency for the withdrawn IPOs is quite different from the relation for the completed deals. Figure 2 shows the results for the withdrawn deals: there does not exist an increasing pattern of patent lawsuit likelihood after the withdrawn date. This gives us some comfort that the relation observed in Figure 1 may be a causal relation.

A.2. Effects of IPO on Patent Lawsuits

Our formal analysis starts with investigating the effect of IPO on the likelihood of being a lawsuit target. Among the companies who filed to go to an IPO through S-1 filing, we examine whether companies who have successfully completed the IPO has an increase in the the long run patent lawsuit frequency compared to companies which have withdrawn their applications. Equation 1 shows the basic experimental setup.

$$Y_i = \alpha_1 + \beta_1 IPO_i + \vartheta_1 X_i + \varphi_t + \varepsilon_i \quad (1)$$

In this specification, Y_i refers to number of patent lawsuits that company was targeted 2 years after the IPO completion or IPO withdrawal date. IPO_i is a dummy variable that takes the value of 1 if the IPO was successfully completed; it takes the value of 0 if the IPO application was withdrawn. X_i refers to company specific variables including whether company received Venture Capital financing, earlyfollower or Pioneer. φ_t is the year fixed effects.

A major empirical challenge in Equation 1 is the endogeneity problem. It is possible that unobservable variables that would affect the likelihood of going IPO may also drive the likelihood of being a patent lawsuit target. For example, a company that has a positive production shock may be more likely to go to the IPO. At the same time, after this positive shock, company may be more likely to get into radar of other companies with strong patent portfolios, in turn making it a patent lawsuit target.

To overcome this endogeneity problem, similar to [Bernstein \(2015\)](#), we use NASDAQ fluctuations over the two months following the IPO filing date as an instrumental variable (IV) for IPO completion. Since the IPO completion is a binary variable, two-stage IV estimation falls into the domain of regression fallacy. Therefore, we employ a 3-stage estimation. In the first stage, we estimate $\widehat{P} = P(\text{NASDAQ}, X)$ using a probit regression. When the endogenous regressor is a dummy, this estimator is asymptotically efficient in the class of estimators where instruments are a function of NASDAQ and other covariates ([Wooldridge \(2002\)](#)). After getting our predicted variable in the first stage, we estimate the following two-stages:

$$IPO_i = \alpha_2 + \beta_2 \widehat{P}_i + \vartheta_2 X_i + \varphi_t + \varepsilon_i \quad (2)$$

$$\Delta PatentLawsuits = \alpha_3 + \beta_3 \widehat{IPO}_i + \vartheta_3 X_i + \varphi_t + \varepsilon_i \quad (3)$$

In our regression, $\Delta PatentLawsuits$ is the difference in the number of lawsuits that the company was targeted during 2 years after and before the IPO completion or withdrawal date. Our coefficient of interest is β_3 , which measures whether the completion of the IPO significantly increases the number of lawsuits. [Table II](#) shows the regression results. Columns (1) and (2) show the results of IV estimation. The coefficients are statistically significant at the 1% level. In this table, columns (3) and (4) show the regression results of OLS estimation without any instrumentation. Our results show that also without instrumentation, coefficients are statistically significant at 1% level, even though magnitudes are smaller.

To examine the exclusion restriction that Nasdaq returns affect the patent lawsuits only through the IPO channel, we employ a placebo test. In this test, we inspect the correlation between Nasdaq returns in different times and $\Delta PatentLawsuits$. In addition to the 2-month Nasdaq returns after the IPO filing that we use for our instrumentation, we regress the 2-month Nasdaq returns one year before the IPO filing date, 2-month Nasdaq returns after the IPO outcome is determined and also 2-month Nasdaq returns one year after the IPO filing date to $\Delta PatentLawsuits$. [Table III](#) shows the regression results. In this table, only returns after the IPO filing are correlated with the $\Delta PatentLawsuits$. This result gives us some comfort that Nasdaq returns affect the outcome only through the IPO channel.

B. Effects of IPO on Acquisition Activity

In this section, we start by investigating whether there is an increase in the acquisition activity after a company has completed its IPO. As in section III.A.2, since the endogenous regressor is a dummy variable, first we estimate $\widehat{P} = P(NASDAQ, X)$ using a probit regression. Then, we use the following two-stage model.

$$IPO_i = \alpha_4 + \beta_4 \widehat{P}_i + \gamma_4 Acq_i^{Pre} + \vartheta_4 X_i + \varphi_t + \varepsilon_i \quad (4)$$

$$Acq_i^{Post} = \alpha_5 + \beta_5 \widehat{IPO}_i + \gamma_5 Acq_i^{Pre} + \vartheta_5 X_i + \varphi_t + \varepsilon_i \quad (5)$$

In this model, *NASDAQ* refers to the 2-months Nasdaq returns following the IPO filing. *IPO* is a dummy variable that takes the value of 1 if the IPO was completed; it takes the value of 0 if IPO application was withdrawn. $Acq_i^{Post}(Acq_i^{Pre})$ refers to the 1+ logarithm of total value of acquisitions completed in two years after (before) the IPO or withdrawn date. X_i refers to company specific variables including whether company received Venture Capital financing, early follower or Pioneer. φ_t is the year fixed effects.

Table IV shows the results of the regression. In this regression, both IV and the pre-IPO acquisitions are statistically significant at the 1% level. The coefficients in this estimation show that, following IPO, companies' spending on acquisitions is about 5.3 times as much as the amount spent on acquisitions by companies that have withdrawn from the IPO.

As a robustness test, we investigate whether Nasdaq returns affect the acquisition activity in ways other than through the IPO channel. In this test, we inspect the correlation between Nasdaq returns in different times and Acq_i^{Post} . In addition to the 2-month Nasdaq returns after the IPO filing that we use for our instrumentation, we regress the 2-month Nasdaq returns one year before the IPO filing date, 2-month Nasdaq returns after the IPO outcome is determined and also the 2-month Nasdaq returns one year after the IPO filing date to Acq_i^{Post} . Table V shows the regression results. In this table, only the 2-months return after the IPO filing is correlated with the Acq_i^{Post} . This result gives us some comfort that Nasdaq returns affect the outcome only through the IPO channel.

C. Effects of Lawsuits on Acquisition Activity

In the above tests, we have shown that IPO increases firms' acquisition activity. In this section, we investigate the reasons for this increase. Specifically, among the companies who have completed the IPOs, we test whether companies who had a lawsuit have a higher increase in the acquisition activity.

To test this hypothesis, we estimate the following model using the sample of firms which have successfully completed their IPOs:

$$Acq_i^{Post} = \alpha_6 + \beta_6 LitigationExposed + \gamma_6 Acq_i^{Pre} + \vartheta_6 X_i + \varphi_t + \varepsilon_i \quad (6)$$

In this model, $Acq_i^{Post}(Acq_i^{Pre})$ refers to the 1+ logarithm of total value of acquisitions completed in two years after (before) the IPO date. $LitigationExposed$ is a dummy variable that takes the value of 1 if the company been a target of a patent lawsuit in 2 years preceding its IPO; it takes the value of 0 otherwise. X_i refers to company specific variables including whether the company received Venture Capital financing, early follower or Pioneer. φ_t is the year fixed effects.

Table VI shows the regression results. Our coefficient of interest, β_6 , is statistically significant at the 1% level. The results show that exposure to litigation increases the acquisition around 36% for an average company. Next, we run the same regression in Equation 6 but this time instead of $LitigationExposed$, we use the Number of litigations, which is the total number of litigations the company was exposed during the 2 years preceding the IPO. Table VII shows the results of the regression. Similarly, the our coefficient of interest is statistically significant at the 1% level.

IV. Conclusion

This paper examines the effects of legal environment on corporate acquisition and innovation activities in the periods around a company's initial public offering (IPO). Using a comprehensive, hand-collected data set of patent lawsuits, we find that firms become targets of excessive patent lawsuits starting just one quarter before the IPO, and the intensity of such lawsuits persists in the post-IPO period. Following the IPO, companies significantly increase their acquisition activities. This increase is most prominent among firms that have been exposed to patent litigation, and

an examination of the patent portfolios of the post-IPO acquisition targets shows that firms are more likely to acquire targets that have substitute patents to the ones that the acquirers allegedly have infringed. We do not observe an increase in patent lawsuit threat for firms that withdraw their IPO filings. Taken together, our results indicate that the intensified patent litigation risk is an important factor that drives the change in IPO-firms' innovation strategies to increase the acquisition of external innovation as an alternative to incremental in-house innovation.

V. Figures

Figure 1.
Patent Lawsuit Probabilities for IPO Firms

This figure shows the probability of being a lawsuit target around the IPO date. It is calculated as follows: For each firm, we calculate the number of lawsuits that the company was targeted in the 12 quarters (3 years) around the IPO date. Then, for each quarter, we divide the number of lawsuits that the company was targeted in that quarter to total number of lawsuits that the company has received in the 3 years interval. This gives us a weighted average for each firm for each quarter. Finally, we take the averages of these percentage weights in each quarter.



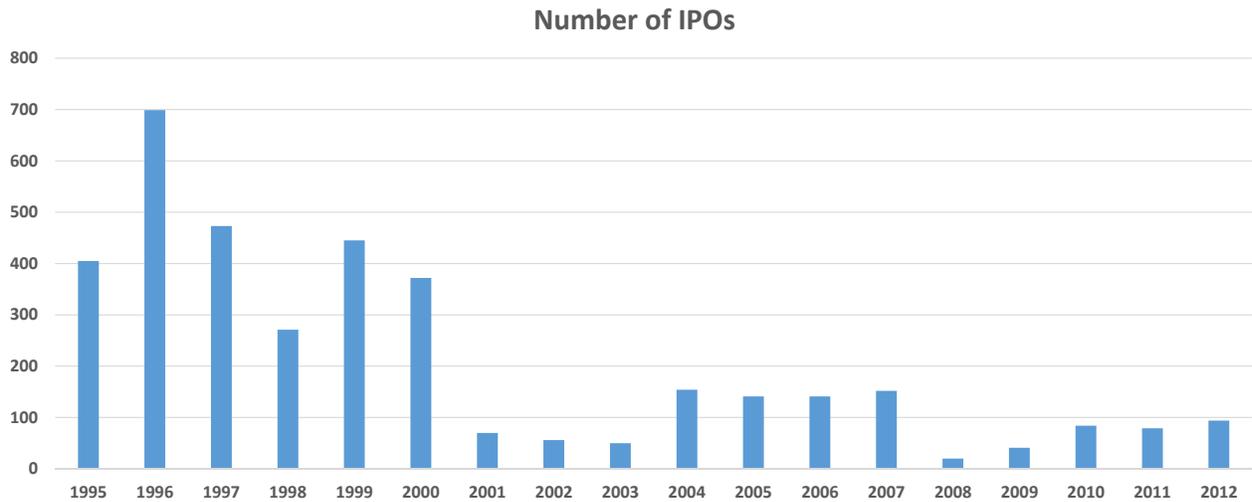
Figure 2.
Patent Lawsuit Probabilities for Withdrawn Firms

This figure shows the probability of being a lawsuit target around the IPO withdrawal date. It is calculated as follows: For each firm, we calculate the number of lawsuits that the company was targeted in the 12 quarters (3 years) around the withdrawal date. Then, for each quarter, we divide the number of lawsuits that the company was targeted in that quarter to total number of lawsuits that the company has received in the 3 years interval. This gives us a weighted average for each firm for each quarter. Finally, we take the averages of these percentage weights in each quarter.



Figure 3.
Yearly IPO Statistics

We use several resources to gather data on IPO. Our main source of information is SEC regularity filings. A company that would like to apply for an IPO files S-1 filings. After gathering our data from the regulatory filings, we cross match our observations to Thomson Reuters Issues Database and Jay Ritter's IPO database. Then we eliminate financial companies, limited partners, trusts, unit offers, closed-end funds and acquisition related vehicles and the ones not included in CRSP-Compustat merged database.



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VI. Tables

Table I
Summary Statistics

This table presents the summary statistics for the completed vs withdrawn companies in our sample for the year preceding the IPO year. The data was hand collected from the S-1 filing of the IPO application. *VC – backed* is a dummy variable that takes the value of 1 if the company has received VC investment before the IPO stage. *Nasdaq – Return* is the 2 months Nasdaq return following the S-1 filing.

	Completed			Withdrawn			Difference
	Mean	Median	Std. Dev	Mean	Median	Std. Dev	
<i>Log(TotalAssets)</i>	3.25	3.24	2.06	3.20	3.21	2.40	0.05
<i>Cash/Assets</i>	0.25	0.13	0.27	0.26	0.29	0.11	-0.01
<i>Liabilities/Assets</i>	0.64	0.68	0.28	0.66	0.75	0.32	0.02
<i>R&D/Assets</i>	0.26	0.03	1.13	0.21	0.01	0.077	-0.01
<i>NetIncome/Assets</i>	-0.64	-0.02	5.08	-0.95	-0.16	4.93	0.30*
<i>VC – Backed</i>	0.33	0.00	0.47	0.31	0.00	0.46	0.02
<i>Nasdaq – Return</i>	0.03	0.04	0.09	-0.013	-0.02	0.01	0.04***

Table II
IV Regression for Patent Lawsuits

In this regression, $\Delta PatentLawsuits$ is the difference of the number of lawsuits between two years after and two years before the company has completed or withdrawn its IPO application. $IPO(IV)$ refers to 3-stage estimation, where IPO is instrumented with 2 months Nasdaq return following the IPO filing. In this table, IPO is a dummy variable that takes the value of 1 if IPO is completed and takes the value of 0 if it is withdrawn. T-statistics are reported in parentheses; *, **, and *** denote significance at the 10%, 5% and 1% level.

Dependent variable: $\Delta PatentLawsuits$	(1)	(2)	(1)	(2)
	(3SLS)	(3SLS)	(OLS)	(OLS)
IPO(IV)	0.393*** (2.66)	0.435*** (2.63)		
IPO			0.084*** (3.82)	0.084*** (3.80)
<i>N</i>	5010	5010	5010	5010
<i>Pseudo(R²)</i>	0.018	0.019	0.016	0.017
<i>Industry Controls</i>	YES	YES	YES	YES
<i>Year Controls</i>	YES	YES	YES	YES
<i>Other Controls</i>	NO	YES	NO	YES

Table III
Placebo Test for IV-Estimation and Lawsuits

This table shows the correlation of two-month Nasdaq return with the change in the number of patent lawsuits targeted. $\Delta PatentLawsuits$ is the difference of the number of lawsuits targeted between the two years after and the two years before the company has completed or withdrawn its IPO application. T-statistics are reported in parentheses; *, **, and *** denote significance at the 10%, 5% and 1% level.

Dependent variable: $\Delta PatentLawsuits$	(1)	(2)	(3)	(4)
Returns following IPO Filing	0.213** (2.09)			
Returns in one year before IPO Filing		0.082 (0.71)		
Returns one year after IPO Filing			0.106 (1.45)	
Returns following IPO outcome				-0.079 (-0.96)
<i>N</i>	5010	5010	5010	5010
<i>Pseudo(R²)</i>	0.014	0.013	0.014	0.013
<i>Industry Controls</i>	YES	YES	YES	YES
<i>Year Controls</i>	YES	YES	YES	YES
<i>Other Controls</i>	YES	YES	YES	YES

Table IV
IV-Estimation and Acquisition

This table shows the relation between IPO filing and the amount spent on acquisitions. In this regression, IPO is instrumented with the Nasdaq two-month return. $\log(Post - Acq.)$ refers to the logarithm of sum of the value of acquisitions in the 2 years after the company has completed or withdrawn its IPO application. $\log(Pre - Acq.)$ refers to value of acquisitions that the company conducted in the 2 years before the company has completed or withdrawn its IPO application. T-statistics are reported in parentheses; *, **, and *** denote significance at the 10%, 5% and 1% level.

Dependent variable: $\log(Post - Acq.)$	(1)	(2)	(3)	(4)
IPO (IV)	2.071*** (7.20)	1.747*** (3.26)	1.839*** (3.46)	1.893*** (3.57)
$\log(Pre - Acq.)$			0.305*** (7.18)	0.304*** (7.18)
<i>N</i>	5009	5009	5009	5009
<i>Pseudo(R²)</i>	0.079	0.147	0.164	0.162
<i>Industry Controls</i>	NO	YES	YES	YES
<i>Year Controls</i>	NO	YES	YES	YES
<i>Other Controls</i>	NO	NO	NO	YES

Table V
Placebo Test for IV-Estimation and Acquisition

This table shows the correlation of two-month Nasdaq returns with the amount spent on acquisitions in the 2 years after the company has completed or withdrawn its IPO application. $\log(Post - Acq.)$ refers to the logarithm of sum of the value of acquisitions in the 2 years after the company has completed or withdrawn its IPO application. T-statistics are reported in parentheses; *, **, and *** denote significance at the 10%, 5% and 1% level.

Dependent variable: $\log(Post - Acq.)$	(1)	(2)	(3)	(4)
Returns following IPO Filing	0.900*** (3.14)			
Returns in one year before IPO Filing		-0.112 (-0.31)		
Returns one year after IPO Filing			-0.053 (-0.21)	
Returns following IPO outcome				0.149 (0.50)
<i>N</i>	5010	5010	5010	5010
<i>Pseudo(R²)</i>	0.071	0.069	0.068	0.069
<i>Industry Controls</i>	YES	YES	YES	YES
<i>Year Controls</i>	YES	YES	YES	YES
<i>Other Controls</i>	YES	YES	YES	YES

Table VI
Post-IPO Acquisitions and Patent Lawsuit Exposure

This table shows the relation between patent lawsuit exposure with the amount spent on acquisitions in the 2 years after the IPO. In this regression, $\log(Post - Acq.)$ refers to the logarithm of sum of the value of acquisitions in the 2 years after the company has completed its IPO application. *LitigationExposed* is a dummy variable that takes the value of one if the company was exposed to litigation in the 2 years before the company has completed its IPO application. $\log(Pre - Acq.)$ refers to value of acquisitions that the company conducted in the 2 years before the company has completed its IPO application. T-statistics are reported in parentheses; *, **, and *** denote significance at the 10%, 5% and 1% level.

Dependent variable: $\log(PostIPO - Acq.)$	(1)	(2)	(3)	(4)	(5)
<i>LitigationExposed</i>	0.242** (2.44)	0.317*** (3.18)	0.245** (2.50)	0.309*** (3.13)	0.309*** (3.13)
$\log(PreIPO - Acq.)$		0.357*** (6.75)	0.316*** (7.29)	0.317*** (6.55)	(6.57)
<i>N</i>	3764	3764	3764	3764	3764
<i>Pseudo(R²)</i>	0.032	0.078	0.055	0.096	0.099
<i>Industry Controls</i>	NO	YES	NO	YES	YES
<i>Year Controls</i>	YES	YES	YES	YES	YES
<i>Other Controls</i>	NO	NO	NO	NO	YES

Table VII
Post-IPO Acquisitions and Litigation Intensity

This table shows the relation between patent lawsuit exposure with the amount spent on acquisitions in the 2 years after the IPO. In this regression, $\log(Post - Acq.)$ refers to the logarithm of sum of the value of acquisitions in the 2 years after the company has completed its IPO application. $NumberofLitigations$ refers to the number of patent lawsuits that the company was exposed to in the 2 years before the company has completed its IPO application. $\log(Pre - Acq.)$ refers to the value of acquisitions that the company conducted in the 2 years before the company has completed its IPO application. T-statistics are reported in parentheses; *, **, and *** denote significance at the 10%, 5% and 1% level.

Dependent variable: $\log(Post - Acq.)$	(1)	(2)	(3)	(4)	(5)
<i>NumberofLitigations</i>	0.107*** (5.17)	0.108*** (5.01)	0.089*** (4.07)	0.090*** (3.93)	0.091*** (3.90)
$\log(Pre - Acq.)$			0.340*** (7.10)	0.299*** (6.34)	0.298*** (6.36)
<i>N</i>	3764	3764	3764	3764	3764
<i>Pseudo(R²)</i>	0.037	0.083	0.058	0.098	0.099
<i>Industry Controls</i>	NO	YES	NO	YES	YES
<i>Year Controls</i>	YES	YES	YES	YES	YES
<i>Other Controls</i>	NO	NO	NO	NO	YES