Accounting Reporting Decisions and firms' innovativeness.

Authors:

Mathius Gómez Ávila

María Victoria Pedraza Orjuela

End of Master Project.

Medellin

Universidad eafit

Escuela de economía y finanzas

2018

This end of master project was exposed in the Universidad Carlos III de Madrid as part of an exchange program where we achieved a double degree (Maestria en Adminitración Financiera from EAFIT and Msc in Finance from Universidad Carlos III de Madrid).

Universidad Carlos III De Madrid

MSc in Finance

Accounting Reporting Decisions and firms' innovativeness.

Authors:

Mathius Gómez Ávila

María Victoria Pedraza Orjuela

Supervisor:

Bing Guo

June 2017

ABSTRACT

We collect information about how financial factors affects innovation in a company, we focus on papers that have studied how innovation, measure by patents granted to a firm and non-self citations of those patents, is affected when a company goes public, when the stock present high liquidity and if the type of investors play an important role. Also we study, if laws and regulation regarding credit supply and anti takeover laws impacts innovation.

Introduction 6
1. Does going public affect innovation? Bernstein (2014) 6
Model 7
Performance 9
2. Does stock liquidity enhance or impede firm innovation? (Fang, Tian and Tice 2011) 12
Model 13
Performance 14
3. Innovation and institutional Ownership (Aghion, Van Reenen and Zingales 2009) 16
Model 17
Performance **¡Error! Marcador no definido.**
4. Do hostile takeovers stifle innovation? Evidence from antitakeover legislation and corporate pateting (Atanassov) 19
Model 20
Performance 21
5. Credit supply and corporate innovation (Amore, Schneider and Zaldokas 2013) 22
Model 23
Performance 24
Conclusion 25

Introduction

An enterprise has a life cycle, the same way as almost everything else, they start, grow, mature, and if they don't find a way to survive, they die. So, a company must achieve self-sustainability to keep attracting new customers, improving and releasing new products and services, and this is why innovation is key in an enterprise. However, innovation is not an easy task, it requires enterprises to invest time and capital in research and development, this could take long periods and considerable amount of money. Keeping that in mind, we would like to know which financial factors have an impact on innovativeness, and specially which ones affects it in a positive way, for example the sources of capital used (internal or external), if the company is public or private and the accounting reporting decisions.

As is known, our topic of how financial factors affects innovation is very extensive, we are going to focus on the following 5 perspectives of our topic:

- How being a private or public company affects innovation?
- What is the effect of stock liquidity on innovation?
- Is innovativeness affected by the type of investors that own the company?
- Effect of hostile takeovers on innovation
- Deregulation and banking development effect on innovation

In the following sections, we are going to cite 5 papers that captures differents financial factors and their effect on innovation, in where we can see the effect of each of the perspectives named before. For each, we have the hypothesis and a brief summary of the model used and results obtained. To finish, in the last section of the papers there is a conclusion.

1. **Does going public affect innovation? Bernstein (2014)**

So the first one will be evaluating how going public affects innovation. This helps us understand the difference between companies that went public on a certain moment of time, and companies that started its IPO's and withdrawned it, remaining private. This is very important because we can determine the relationship between the transition to public equity market and the access to capital, and the company's innovation after their IPO's. In other words, in this case it is seen how the priority for innovation of a company changes when the company goes public.

Since, being a public company gives the firms a better access to capital, one can expect that a public company invest more in innovation because of the less financing constraints that it would have if it were private. However, usually listed companies face more agency problems, meaning that managers might behave and make decisions in their own benefit and not in the benefit of the company or the shareholders, which can mitigate innovation, for example if managers decide not to invest in R&D expenses in order to show a better profit, so they could receive a bonus.

Model

For this purpose, the author considers three dimensions of the innovation activity that are taking into account: the creation of internally generated innovation, the productivity and mobility of individual investors, and the acquisition of external innovation. For this discussion, the model used is the following;

$$\square_{\square}^{\square\square\square\square} = \square_{1} + \square_{1}\square\square\square_{\square} + \square_{1}\square_{\square}^{\square\square\square} + \square_{\square}^{'}\square_{1} + \square_{\square} + \square_{\square} + \square_{1\square}$$

Where $\square_{\square}^{\square\square\square\square}$ is the average innovation performance in the five years after the IPO filing (average scaled citations , average scaled originality/generality, and average scaled number of patents per year), $\square_{\square}^{\square\square\square}$ is the equivalent measure in the three years prior to the IPO filing,

and □□□□ is a dummy variable of interest, indicates whether a filer goes public or remains private. It also includes, industry ($\nu_{□}$) and IPO filing year ($\mu_{□}$) fixed effects.

Nevertheless, β_1 can be biased, taking into account that the decision of withdrawn the IPO could had been taken because some of the innovation policies or opportunities. These problem of endogeneity was solved instrumenting the IPO completion choice using NASDAQ return for the two month of the book-building phase (the two-month window was arbitrary). In any case, since the length of the book-building phase is correlated with the likelihood of withdrawing, it was chosen a fixed window shorter than the average period. The first-stage regression model was the following;

$$□□□_{□} = □_2 + □_2□□□□_{□} + □_2□_{□}^{□□□} + □_{□}^{'}□_2 + □_{□} + □_{□} + □_{2□}$$

where □□□□□ is the instrumental variable. Then the initial model, that is the second-stage equation is going to be;

$$□_{□}^{□□□□} = □_3 + □_3\widehat{□□□}_{□} + □_3□_{□}^{□□□} + □_{□}^{'}□_3 + □_{□} + □_{□} + □_{3□}$$

and $\widehat{□□□}_{□}$ are the predicted values of the first- stage regression.

The data used was taking from different sources as follows:

- IPO filings (application for an IPO and withdraws) from 1985 to 2003 collected using Thomson Financial's SDC New Issues database. the author excluded IPO filing of financial firms, unit offers, closed-end funds, ADRs, limited partnerships, special acquisition vehicles and spin-offs.
- National Bureau of Economic Research (NBER) patent database is used to match patents to firms that complete the IPO Filing and withdrawn IPO filings. The sample was restricted to firms with at least one successful patent application between 3 years before and five years after the IPO filing.
- NBER patent database and Harvard Business School (HBS) patent database (after 2006) was used to calculate the citations a patent received.

- Financial info of IPO firms was taken from COMPUSTAT and Capital IQ, while financial info of withdraw firms was taken from initial registration statements.

Performance

Table 1 shows the innovation novelty of the firms, in where are found 3 different ways they approach this situation. First, they used a OLS with the endogenous problem in column 1 that shows no difference between IPO firms and withdrawn ones. In column 2, it is found the reduced-form in which is substituted the independent variable IPO for the NASDAQ returns, This result is significant and show the impact that the instrument on IPO completion choice, which is a negative correlation, but this result is not intuitive, because it wasn't expected that the short-term NASDAQ return had this effect on long-term innovation. In column 3 it was estimated by 2SLS, this coefficient is significant and equals to -0.831, it implies that the average of scaled citation of IPO firms is reduced in 43.51%, this is calculated dividing the coefficient in the average scaled citation in the years before the event that is 1.91. Finally column 4 it is calculated by the quasi-maximun likehood (QML) Poisson model and has similar results than the 2SLS.

Table 1[1]

Dependant Variable Model	(1) Scaled Citations OLS	(2) Scaled Citations OLS	(3) Scaled Citations 2SLS	(4) Scaled Citations Poisson
IPO	-0,019		-0,831**	-0,980**
	(0,069)		(0,409)	(0,427)
NASDAQ		-0,498**		

[1] Bernstein H 2015. Does Going Public Affect Innovation? The journal of finance VOL. LXX, NO. 4 Pag. 1384

returns		(0,239)		
Magnitude	-1,02%		-43,51%	-52,41%
Observations	1079	1079	1079	1079
R2	0,239	0,242	0,128	0,148
Filing year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Control variables	Yes	Yes	Yes	Yes

Table 2 shows if the reduce of patent citations is related to a change in the nature of the project. The important finding on this subject is that the average of originality of firms that complete the IPO declines taking into account the negative correlation and significant of the coefficient of the 2SLS. And in the generality measure, all the results are not significant.

Table 2[2]

Dependant Variable Model	**(1) Scaled Originality OLS**	**(2) Scaled Originality OLS**	**(3) Scaled Originality 2SLS**	**(3) Scaled Generality OLS**	**(4) Scaled Generality OLS**	**(5) Scaled Generality 2SLS**
IPO	-0,006		-0,137**	-0,001		-0,087
	(0,010)		(0,068)	(0,016)		(0,092)
NASDAQ returns		-0,081**			-0,050	
		(0,036)			(0,051)	
Magnitude	-0,10%		-13,00%	0,00%	-52,41%	-8,00%
Observations	1079	1079	1079	1079	1079	1079

[2] Bernstein H 2015. Does Going Public Affect Innovation? The journal of finance VOL. LXX, NO. 4 Pag. 1385

R2	0,231	0,234	0,102	0,226	0,226	0,206
Filing year FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Control variables	Yes	Yes	Yes	Yes	Yes	Yes

And table 3 is explaining if the reduce of novelty is driven by low-quality projects or lower-impact topics. But, as seen in the table, the only significant coefficient is the endogenous one, which mean that is biased and it can not be taken into account.

Table 3[3]

Dependant Variable Model	**(1) Scaled Patents OLS**	**(2) Scaled Patents OLS**	**(3) Scaled Patents 2SLS**	**(3) Scaled Patents Poisson**
IPO	**0,268****		**-0,200**	**0,002**
	(0,066)		**(0,474)**	**(0,662)**
NASDAQ returns		**0,127**		
		(0,305)		
Magnitude	**37,75%**		**28,17%**	**0,28%**
Observations	**1081**	**1081**	**1081**	**1081**
R2	**0,184**	**0,178**	**0,184**	**0,168**
Filing year FE	**Yes**	**Yes**	**Yes**	**Yes**
Industry FE	**Yes**	**Yes**	**Yes**	**Yes**
Control variables	**Yes**	**Yes**	**Yes**	**Yes**

[3] Bernstein H 2015. Does Going Public Affect Innovation? The journal of finance VOL. LXX, NO. 4 Pag 1386

In this first paper, it was found that usually when a firm goes public, innovation experiments a reduction compared to firms that initially filed their IPO filing but then withdraw. However, once a company is public, usually they can increase access to capital, which allows them to acquire new technologies and get new human capital, which can become their new source of innovation.

Here, we can see that, financial factors such whether a firm is private or public, affects innovation, precisely in a negative way once the company goes from private to public. .

2. Does stock liquidity enhance or impede firm innovation? (Fang, Tian and Tice 2011)

Another important perspective is to analyze how stock liquidity affects a firm's innovation, this is because in literature we found that there are two points of view. The first one says that, liquidity of a stock enhance firms innovation because facilitates the entry of blockholders (e.g., Maug (1998), Edmans (2009)). This position is based on the facts that blockholders collects private information and trades based on this information, making the market prices efficient. Also, blockholders would monitor in an active way, which help mitigate managerial myopia, so this can make managers sacrificed short-term profits to invest in long-term investment like innovation.

However, if blockholders collect information that tell them "not to invest or not to keep the investment", it would be easy for them to leave. Since, it is easy for them to exit, they might no longer care about monitoring the company closely, and this can put pressure on managers to show short-term profits, to avoid the exit of the investors.

Additionally, high liquidity can make a takeover easy to attempt, so the managers has an incentive to pursue short-term profits, to avoid the stock to be undervalue (e.g., Stein (1988), Shleifer and Summers (1988), Kyle and Villa (1991)). As well, high liquidity helps the entry and exit of institutional investors, pursue short-term performances that leads to invest in

firms with higher expected earning in the following years (e.g., Bushee (1998), Bushee (2001), Graham, Harvey and Rajgopal (2005)).

Model

In this paper, the authors also take the data (firm year patent and citation of patents) from the NBER database, to calculate stock liquidity measures intradays trades and quotes were taken from the Trade and Quote (TAQ) database, and information for the control variables comes for several sources that give financial statement items. It is important to say, that only firms continuously traded in NYSE, AMEX or NASDAQ for 6 months minimum between 1994 and 2005 were taken into account.

In order to measure innovation, it is taken the number of a firm patent applications filed in a year that are granted, also it is taken into account the number of non-self citations each patent receives in subsequent years. Because of the right skewed distribution of patents counts and its citations, it is used the natural logarithm for both measures.

This positions entails to prove whether the stock liquidity enhance or impede firms innovation. To do so, it was estimated the following model;

$$\square\square\square\square\square\square\square\square_{\square,\square+\square}(\square\square\square\square\square\square\square\square\square\square_{\square,\square+\square})$$

$$= \square + \square\square\square\square\square\square_{\square,\square} + \square'\square\square\square\square\square\square\square\square_{\square,\square} + \square\square_{\square} + \square\square\square\square\square_{\square}$$

$$+ \square_{\square,\square}$$

where i indexes firms, and t indexes time and n equal one, two or three (depending on the year). $\square\square\square\square\square\square\square\square_{\square,\square+\square}$ refers to the natural logarithm of one plus the number of patents filed and granted, $\square\square\square\square\square\square\square\square\square\square$ refers to the natural logarithm of non-self citations per patent, *ILLIQ* stands for the liquidity measure: relative effective spread (absolute value of the difference between the execution price and the mid-point of the prevailing bid-ask

quote), *CONTROLS* are the characteristics of a firm that can affect innovation productivity such as market capitalization, profitability, asset tangibility, leverage among others.

As it is seen there are some control variables, these control variables are to solve the problem of simultaneity between stock liquidity and innovation. The solution was to make some tests during periods surrounding exogenous shocks to liquidity changes in the minimum tick size using a difference-in-difference (DiD). This changes are quasi-natural experiments because it affects directly to the stock liquidity and exhibits variation in the cross-section of stocks (Bessembinder (2003), Furfine (2003)). Nevertheless, those changes will not affect innovation. Also, changes in expected future innovation does not influence the cross-sectional changes in liquidity that was induced by the changes in tick size.

Performance

The following table (table 4) is divided in two, the first part shows that, there is no statistically significant difference, between the control and the treatment group. Also, to make sure there is no unobservable omitted variable bias, there was taken the change of tick size from 8ths to 16ths in 1997. The second part of the table, is where the DiD is estimated, and what is found was that the number of patents and the number of citation per patent has a negative correlation with the shock in liquidity, it decrease in 4.6 and 4.7 respectively, in the three-year period immediately the shock.

Table 4[4]

Panel A: Differences in Pre-1997 Shift Characteristics				
	Treatment	Control	Difference	*t*-statistic
$ILLIQ_{-1}$	−3.628	−3.618	−0.009	−0.207
LN_MV_{-1}	4.582	4.551	0.032	0.297
$RDTA_{-1}$	0.067	0.064	0.003	0.403
ROA_{-1}	0.063	0.068	−0.005	−0.367
$PPETA_{-1}$	0.271	0.252	0.019	1.113
LEV_{-1}	0.172	0.159	0.013	0.905
$CAPEXTA_{-1}$	0.069	0.070	−0.001	−0.104
$HINDEX_{-1}$	0.126	0.111	0.015	1.211
Q_{-1}	2.111	2.239	−0.128	−0.999
$KZINDEX_{-1}$	−7.960	−7.532	−0.428	−0.253
LN_AGE_{-1}	2.070	1.963	0.106	1.584
LN_INST_{-1}	0.257	0.248	0.008	0.542
$PAT\_GROWTH_{-3 \text{ to } -1}$	0.005	−0.021	0.026	0.601
$CITE\_GROWTH_{-3 \text{ to } -1}$	0.127	0.020	0.107	1.549

Panel B: Difference-in-Differences Test				
	Mean Treatment Difference (After – Before)	Mean Control Difference (After – Before)	Mean DiD Estimator (Treat – Control)	*t*-statistic for DiD Estimator
PAT	−1.973	2.621	−4.595**	−1.976
	(0.797)	(2.185)	(2.326)	
CITE	−9.065	−4.360	−4.706**	−2.177
	(1.806)	(1.189)	(2.162)	

For table 5, there were created 3 new variables, PILOT, a dummy variable that takes the value of one if the firm is in the decimalization pilot program, and zero if not, YR_2000, a dummy variable that takes the value of one for the year 2000 and zero for 1999, and the interaction of both of them PILOTxYR_2000. This is for the case of decimalization in the year 2000. The result show that the coefficient of the interaction of variables, due to the number of patents is significant and has a negative correlation, which means that the number of patents is reduced in 48.5% for the firms in the pilot. In column 2 is found the number of citation, and the results were that the number of citation for the pilot ones is, is significant at 10% level, and 30.9% lower than the ones that don't participated in the pilot. On the other

[4] Fang W, Tian X and Tice S 2014. Does Stock Liquidity Enhance or Impede Firm Innovation? The journal of finance VOL. LXIX, NO. 5.

hand, the coefficient of PILOT is also significant, but positive which means that is a difference between the number of citation for pilot and non pilot firms before the switched to decimal pricing.

Table 5[5]

Dependent Variable	(1) $INNOV\_PAT_{t+1}$	(2) $INNOV\_CITE_{t+1}$
$PILOT_i \times YR\_2000$	−0.485**	−0.309*
	(0.213)	(0.164)
$PILOT_i$	0.289	0.313*
	(0.243)	(0.166)
YR_2000	−0.014	0.091
	(0.165)	(0.097)
Control variables	Included	Included
Industry fixed effects	Included	Included
Number of obs. used	2,160	2,160
Adjusted R^2	0.550	0.481

At the end, the authors conclude that there is a negative relationship between stock liquidity and firm innovation, there is also a negative and causal relationship between stock liquidity and future innovation by using decimalization. which is consistent with the hypothesis that due to the pressure that managers of high liquidity stock have to make profit in short-term, they do not invest in innovation, while illiquidity stocks enhance innovation.

3. Innovation and institutional Ownership (Aghion, Van Reenen and Zingales 2009)

Another important factor that affect innovation of a firm, is the type of investors that own the company, focusing more on institutional investors. The main hypothesis is that institutional ownership has a positive impact on R&D and its productivity.

In this paper, the authors use two models to prove their hypothesis. The first one says that institutional investor force managers to innovate (e.g., Hart (1983), Bertrand and Mullainathan (2003)). The other one talks about the concern of the manager on the possibility of getting fired, due to the investment in R&D that leads to incurring in new risk

[5] Fang W, Tian X and Tice S 2014. Does Stock Liquidity Enhance or Impede Firm Innovation? The journal of finance VOL. LXIX, NO. 5.

for the firm, this could generate, by random circumstances, bad results in the future, however institutional investors will increase monitoring in order to incentive managers to invest in long-term projects and make them abandon their fear of getting fired, due to a short-term revenues.

Model

To approach and identify how institutional ownership affects a firm's innovation, taking into account the actual productivity of the innovation process. To do this, it was used the next model;

$$\square(\square\square\square\square\square_{\square\square} \ \square\square_{\square\square}, \square_{\square}, \square_{\square}) = \square\square\square(\square\square\square\square\square\square\square_{\square\square} + \square\square_{\square\square} + \square_{\square} + \square_{\square})$$

where $\square\square\square\square\square_{\square\square}$ is a count-based measure of innovation (i.e., future cite-weighted patents) of firm i in period t, $\square\square\square\square\square\square_{\square\square}$ is the proportion of stock owned by institutions, $\square_{\square\square}$are some control variables, $\eta_{\square}$is a firm fixed effect, and $\tau_{\square}$is a time dummies.

There was a concern about a bias due to an omitted variable, the firm value. This problem was control in several ways. First the control variables that were taken into account, are correlated with the firm's value like sales, capital intensity, and fixed effects. Also the explicitly condition of the stock market-based proxies of the firm, in this case Tobin's average q.

Another problem that is concern about this model is a endogeneity of institutional ownership, given that the correlation of this and innovation can be driven by the selection. To solve this, there was consider an instrumental variable, the firm's addition to the S&P 500 index. This dummy takes the value of one if the firm is a member of the index. The addition to the S&P 500 has an impact on the institutional ownership, given that fund managers are benchmarked against this index, increasing it. Nevertheless, is rare that this have an effect on the innovation of the firm.

Data used in this study is taking from the following sources:

- Accounting information of U.S. publicly listed firms since mid 1950s is taking from Compustat. Here we have information of R&D expenditures.
- Patents granted and citations of each patent from the NBER
- Ownership data like number of institutional owner, number of stock issue and the participation of each institutions is taking from text files of Compact Disclosure. This data was matched with Bushee (1998) classification of institutions to see if depending on the type of institutional owner there are different effects on innovation.
- Data compiled by Fisman, Khurana and Rhodes-Kroppf (2005) was used to get information about CEO exits (whether he was fired or not) and other characteristics of the management.
- Listings by the Investor Responsibility Research Center (IRRC) was used to get data related to corporate governance and state laws against hostile takeovers.

Performance

The result in table 6 shows three different methodologies, the first two columns correspond to OLS regressions, the following three columns are results from Poisson regressions, and the final part is negative binomial regression. In all three cases, the institutional ownership has a positive effects on innovation. In average, an increase in 10% in institutional ownership, will increase in 7% increases in the probability of obtaining an additional cite-weighted patent. As important of this, all the controls were significant and have a positive relationship, which mean that for an improvement due to an increase in institutional ownership, it is necessary more than that taking into account that is a small proportion of the real impact in innovation.

Table 6[6]

Method Dependent variable	OLS ln (*CITES*) (1)	OLS ln (*CITES*) (2)	Poisson *CITES* (3)	Poisson *CITES* (4)	Poisson *CITES* (5)	Negative binomial *CITES* (6)	Negative binomial *CITES* (7)	Negative binomial *CITES* (8)
Share of institutions	0.006*** (0.002)	0.005** (0.002)	0.010*** (0.002)	0.008*** (0.002)	0.007*** (0.002)	0.009*** (0.002)	0.008*** (0.002)	0.006*** (0.002)
ln(K/L)	0.433*** (0.094)	0.261*** (0.085)	0.483*** (0.136)	0.346** (0.165)	0.440*** (0.132)	0.613*** (0.106)	0.343*** (0.087)	0.264*** (0.076)
ln(Sales)	0.568*** (0.037)	0.310*** (0.045)	0.820*** (0.042)	0.349*** (0.117)	0.184** (0.063)	0.493*** (0.047)	0.229*** (0.058)	0.127*** (0.037)
ln (R&D stock)		0.337*** (0.040)		0.493*** (0.140)	0.009 (0.107)		0.448*** (0.039)	0.178*** (0.029)
Fixed effects	No	No	No	No	Yes	No	No	Yes
Observations	4,025	4,025	6,208	6,208	6,208	6,208	6,208	6,208

Since institutional investors actively monitor more and care about long-term investments, they make managers feel sure about their career and not be afraid to invest in R&D even if that generates low profits. In this paper was found a positive relationship between institutional ownership and innovation.

4. Do hostile takeovers stifle innovation? Evidence from antitakeover legislation and corporate patenting (Atanassov)

Continuing with factors that affects innovation, it was found that external pressure have an impact on it. In the specific how does hostile takeovers, which is the most extreme, affect innovation. In literature it is found a contrasting between two main theories, the first one induce that hostile takeovers has a positive impact on innovation, due to the threat that hostile takeovers represent for managers, it discipline the manager and focus him to invest in the more valuable project, even though that they are a long-term projects and they affect short-term results, it also make him react efficiently toward technological changes. Otherwise, there are some arguments against this position, one argue that hostile acquirer can dismissed the manager after the innovation is conceived, getting all the profits without a

[6] Aghion P, Van Reenen J, and Zingales L. 2013. Innovation and Institutional Ownership. American Economic Review 2013, 103(1): 277–304

prior investment. The other one, focus on the asymmetry in information in long-term innovatives projects, ones that are difficult to measure and can make shareholders undervalue the stock leading to an easy and cheap hostile takeover.

Model

To prove whether takeovers have a positive or negative influence on innovation, which is the main purpose of this paper, it was used the antitakeover laws to have a exogenous decreased in the threats of hostile takeovers, and measure the impact on innovation. To do so, it was used the next model;

$$\square_{\square\square\square(\square+\square)} = \square_{\square} + \square_{\square} + \square\square\square_{\square\square} + \square\square_{\square\square\square\square} + \square_{\square\square\square\square}$$

where $\square_{\square\square\square(\square+\square)}$is $\square\square\square(1+\square\square\square\square\square\square)$ or $\square\square\square(1+\square\square\square\square\square\square\square\square\square/\square\square\square\square\square\square^{\square\square\square\square})$, and $\square$is the number of years after the current period $\square$, and is equal to three or four, BC_{st} is a dummy variable equal to one if an antitakeover law has been enacted by time t in state s, X_{iskt} is a vector of control variables that are total asset, sales, industry SIC, R&D expenditures, book equity, book debt, net PPE, operating income, firm age, and book to market, also to control for time-invariant unobservable firms characteristics was used a firm fixed effect, $\beta_{\square}$, and for economy-shocks, $\alpha_{\square}$, as well i indexes firms, s indexes the state of incorporation, k indexes the state of location, and t indexes time.

To control any type of endogeneity, it was perform a test that proof that the anti takeover laws are exogenous to most of the firms. This statement was validated performing a regression that show if the decline on innovation was before the enactment of the law. For this there were introduced four dummy variables that shown the time before and after the enactment of the law.

$$\square_{\square\square\square\square} = \square_{\square} + \square_{\square} + \square\square_{\square\square\square\square}$$

$$+ \square_{1}\square\square\square\square\square\square\square_{\square\square}^{-2\square\square-1} + \square_{2}\square\square\square\square\square\square\square\square_{\square\square}^{0}$$

$$+ \square_{3}\square\square\square\square\square\square_{\square\square}^{+1} + \square_{4}\square\square\square\square\square\square_{\square\square}^{\geq+2} + \square_{\square\square\square\square}$$

Where $\square\square\square\square\square\square\square_{\square\square}^{-2\square\square-1}$ is a dummy variable equal to one if its 1 or 2 years before an antitakeover law passed, $\square\square\square\square\square\square\square\square_{\square\square}^{0}$ is a dummy variable equal to one if is the year when the law passed, $\square\square\square\square\square\square_{\square\square}^{+1}$is the dummy variable equal to one if it is one year after the law passed, and $\square\square\square\square\square\square_{\square\square}^{\geq+2}$is a dummy variable equal to one if it is two or more years after the law passed. The important result that was found, and explained why there is no endogeneity, is that the coefficient of the dummy variable $\square\square\square\square\square\square\square_{\square\square}^{-2\square\square-1}$was statistically insignificant and small for number of patents and the number of citation per patent.

Performance

In the table 7 is found the results of the models that there were calculated. In the first three columns are the natural logarithm of one plus the number of patents, in the other three is the logarithm of one plus the number of patents divided number of citation. This results are consistent taking into account that the coefficient of Before are not statistically significant which means that the decreases in innovation where not before the enact of the law, with this it can be confirm that this shock solve the endogeneity problem. Now the important result was in the After coefficient, which are statistically significant and negative, for both of the dependent variables. It means is that innovation is negatively affected by this shock but this effect take time to affect it.

Table 7[7]

	$Ln(1+Pat)_t$ (1)	$Ln(1+Pat)_t$ (2)	$Ln(1+Pat)_t$ (3)	$Ln(1+\frac{Cit}{Pat})_t$ (4)	$Ln(1+\frac{Cit}{Pat})_t$ (5)	$Ln(1+\frac{Cit}{Pat})_t$ (6)
$Before^{-2or-1}$	0.0006	0.0005	–0.001	–0.003	–0.003	–0.003
	(.001)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)
$Current^{0}$	0.0002	–0.00003	–0.0004	–0.007**	–0.008**	–0.005
	(.002)	(0.002)	(0.002)	(0.003)	(0.004)	(0.004)
$After^{1}$	–0.002	– 0.003	–0.003	–0.014***	–0.016***	–0.015***
	(.002)	(0.002)	(0.002)	(0.003)	(0.004)	(0.004)
$After^{2+}$	–0.007***	–0.007***	–0.006***	–0.018***	–0.020***	–0.017***
	(.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)
Ln(Sales)	0.010***	0.012***	0.012***	–0.005***	0.006***	0.006***
	(.0003)	(0.0004)	(0.0004)	(0.0005)	(0.0006)	(0.0006)
Herfindahl		–0.030***	–0.031***		–0.002	–0.002
		(0.010)	(0.010)		(0.016)	(0.016)
$Herfindahl^{2}$		0.008	0.009		0.002	0.003
		(0.010)	(0.010)		(0.017)	(0.017)
MI Leverage		–0.009***	–0.009***		–0.007**	–0.007**
		(0.002)	(0.002)		(0.003)	(0.003)
Age		0.01	– 0.0015		–1.00***	–1.00***
		(0.2)	(0.2)		(0.2)	(0.2)
Profitability		–0.005***	–0.005***		–0.002	–0.002
		(0.0008)	(0.0008)		(0.001)	(0.001)
Tangibility		0.007***	0.007***		0.009**	0.009**
		(0.003)	(0.003)		(0.004)	(0.004)
Obs.	147,470	126,760	127,751	147,470	126,760	127,751
R^2	0.891	0.889	0.889	0.655	0.652	0.652
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes

In this paper it was concluded that there is a positive relationship between hostile takeovers and innovation, since it was shown that companies settled in states that have approved anti takeover laws have innovated less (measure by the number of citations per patents) than companies located in states with no such laws.

5. Credit supply and corporate innovation (Amore, Schneider and Zaldokas 2013)

Usually entrepreneurs look for venture and private capital to finance their projects when they are just starting because they try to have instruments that offer only the upside risk,

[7] Atanassov J 2013. Do Hostile Takeovers Stifle Innovation? Evidence from Antitakeover Legislation and Corporate Patenting. The journal of finance VOL. LXVIII, NO. 3

taking into account that getting a credit to finance a project that has a lot of uncertainty is not a good idea because if things go bad, they will lose more than its capital

In this paper, the authors, however, find that banking deregulation and credit supply have a positive effect on innovation, more specifically in technological development.

So to finish this discussion, we need to establish the relationship between innovation and credit supply, this topic has been controversial, because it is, by theory, with access to capital there will be more innovation, and it is needed proof to know exactly how does credit supply affects innovation. For this purpose innovation was measured by successful patent applications.

Model

To determine the relation between credit supply and innovation, it was needed to solve some problems that are related to the characteristics of the markets or the industry which could affect firm's innovation and credit supply availability. To solve this, it was taken an exogenous shock in the market, that will affect only credit supply and did not affect innovation. This shock was the expansion of the U.S. banking industry across states, this due to interstate banking deregulation during the 80s and 90s. Now, to know how does credit supply affects innovation, it was used the next model;

$$□[□_{□□□} □□□□□□□□□□□ □□□□□□□□□□□□□□_{□□}] = □□□(□ + □□□□□□□□□□□ □□□□□□□□□□□□□□_{□□□} + □_{□} + □_{□})$$

Where interstate deregulation$_{jt}$ is a dummy variable that equal one if a firm is headquartered in a state j that has passed an interstate banking deregulation by time t. Also the variable $\tau_{□}$ was included in order to control for aggregate trends, taking into account that US patenting activity had a high increased in the mid- 1980s. In their study, they also try to

control for other different like firm age, asset tangibility, access to bank credit and return to asset among other.

Data was taken from the NBER to get information of the granted patents between 1976 and 1995 and firm-level data was taken from Compustat. it is important to note that firms from Delaware and South Dakota, firms with negative or zero book value of assets and firms headquartered outside the U.S. were excluded. Companies from the financial sector, utilities and software industry were also excluded.

Performance

In table 8, we can see the results of this paper, having patent counts as a dependant variable and a poisson regression

Table 8[8]

	(1)	(2)	(3)	(4)
Interstate deregulation	0.1293**	0.1168**	0.1169***	0.1188***
	(0.0639)	(0.0472)	(0.0450)	(0.0397)
Ln (sales)		0.7096***	0.4980***	0.5360***
		(0.0626)	(0.0782)	(0.0901)
Ln (K/L)		0.2566***	0.2443***	0.1969**
		(0.0632)	(0.0764)	(0.0789)
Ln (R&D stock)			0.3629***	0.3264***
			(0.1194)	(0.1196)
Firm fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Industry trends	Yes	Yes	Yes	Yes
Additional controls	No	No	No	Yes
Number of obs.	18,066	18,066	18,066	18,066

The author run several regression controlling for different factors in each one, for example in the 1st column we can see, it was only taken into account firm and year fixed effects, in the 2nd regression Logarithm of sales and Capital to labor ratio were also controlled

[8] Amore M, Schneider C, and Zaldokas A 2013. Credit supply and corporate innovation. Journal Financial Economics 109 835-855

variables, while in the 3rd and 4th regressions Logarithm of the stock of R&D was also taking into account.

It is seen that deregulation coefficient is significant, and it is statistically and economically relevant. This means that there is a positive effect of deregulation on innovation. It is also seen that R&D have a positive relationship with innovation (measure by patents).

Conclusion

In all the papers studied, we have seen that innovation plays an important role in companies. Innovation was measured mainly by the number of patents and number of citations of each patent that a company has obtained.

We can concluded that different financial factors can affect in either, positive or negative, way innovation in a firm. Since, a company that goes public and companies with high stock liquidity face more pressure from the market, these factors have a negative relationship with innovation. However, when the company is owned mainly by institutional investors who monitor actively and care for long-term investments, innovation would improve as the managers can invest more in R&D.

We have also seen that when there is no laws and regulation related to take overs and credit supply, corporate innovation is higher than in companies that face high and strict regulations.

References

- Amore M, Schneider C, and Zaldokas A 2013. Credit supply and corporate innovation. Journal Financial Economics 109 835-855
- Atanassov J 2013. Do Hostile Takeovers Stifle Innovation? Evidence from Antitakeover Legislation and Corporate Patenting. The journal of finance VOL. LXVIII, NO. 3
- Bernstein H 2015. Does Going Public Affect Innovation? The journal of finance VOL. LXX, NO. 4
- Fang W, Tian X and Tice S 2014. Does Stock Liquidity Enhance or Impede Firm Innovation? The journal of finance VOL. LXIX, NO. 5.
- Aghion P, Van Reenen J, and Zingales L. 2013. Innovation and Institutional Ownership. American Economic Review 2013, 103(1): 277–304