What Mechanisms drive the first-day Return of IPOs?

A Study of American and Canadian IPOs from 2000 through 2018

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Abstract

The mechanisms behind the positive first day market-adjusted return of IPOs on the American and Canadian markets is examined from 2000 through 2018. A set of financial variables is tested as well as the industry-specific effect and the effect of being venture capital backed. Interaction terms between industry and venture capital backing are created to identify the effect of being venture capital in each industry. EBIT, gross proceeds and the profitability multiple EBIT over total assets had significant explanatory power. In contrast, total assets, the ratio gross proceeds over total assets and profitability multiple earnings over total shares outstanding were all insignificant. Risky industries had a significantly higher first day market adjusted return (the financial industry was used as the reference). Considering the marginal effect of being venture capital-backed with respect to industry, with the inclusion of interactions terms, decreased the first day market adjusted return. In particular, in high-risk industries. The average marginal effect of VC-backing across all industries increased underpricing significantly. The increased underpricing is likely due to that VC-backing is an endogenous decision, making VC-backing more prevalent in high-risk industries. Adding interaction terms and having the financial industry as reference decreased the underpricing more in risky industries comparing to non-risky industries.

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1.0 Introduction

An Initial Public Offering (IPO) is when a private company goes public, by issuing shares in exchange for new capital. The existence of IPOs plays a crucial role in a well-functioning capital market as it is an important instrument for existing owners to realize their value in the company as well as for raising new capital (Ellis et. Al, 2000). Zutter and Smart (2003) notice that an impressive amount of time has been invested by scholars to understand both empirical and theoretical issues related to going public. The pricing of equity has attracted much more attention than the pricing of corporate and government bonds, which are monetarily larger markets. The reason is that equity is much harder to price, bonds are often uncontroversially valued to their par value and hence attract little attention by researchers (Ritter, 2011)

Some of the most important topics related to IPOs are the allocation mechanism of the shares, the IPO valuation, underpricing trends across different economies and time periods and the study of a variety of underlying motives (Gupta, 2012). The most researched IPO topic is the market anomaly of underpricing (Zutter and Smart, 2003). Market anomaly refers to the fact that under the efficient market hypothesis, one would expect the first day returns to be randomly distributed around zero. Lowry et al. (2017) claim that the underpricing of IPOs is approximately 15 percent in the United States using the percentage change between the offering price and the closing price of the first trading day. Ljungqvist (2007) found that the average underpricing since the 1960s in the United States had been 19%, but there has historically been a high degree of fluctuation. Underpricing can be seen as the amount of money "left on the table" by the issuers as the offering price evidently could have been higher (Gupta, 2012). Furthermore, new shares issued in an IPO will result in a dilution of the retained shares (Ljungqvist, 2007). IPOs are taking place more frequently in some time periods and less in others. More IPOs are conducted in "hot" market periods comparing to "cold" market periods. Traditionally, this large volatility in the number of IPOs has been explained by fluctuation in capital demand within the company and varying investor sentiment, as it influences the price of a potentially upcoming IPO. This can however not explain the dramatic fall in the number of IPOs since 2000 (Lowry et al., 2017)

Many researchers consider, in line with Fama (1970), that the financial market is efficient and that all securities are correctly priced conditional on the available information at the time. The underpricing of IPOs is contradicting the efficient market hypothesis (EMH). The IPO literature has however been able to come up with some mechanisms explaining the underpricing of IPOs, but have been unable to distinguish the explanatory power between them. It is also uncertain whether the mechanisms can explain all of the underpricing. Some of the most frequently mentioned mechanisms causing the underpricing can be categories into four groups namely asymmetric information, institutional reasons, control considerations and behavioural approaches (Ljungqvist, 2007). The asymmetric information theory is the best-established theory and takes starting point in the asymmetric information between the agents i.e. the underwriter, issuer, informed investor and uninformed investor. Venture capital backing could be an instrument to decrease the asymmetric information and hence the underpricing of IPOs, as it signals the value of the company (Megginson and Weiss, 1991). In line with the majority of the previous research, Barry et. al (1990) found less underpricing among VC-backed IPOs. Hellmann and Puri (1999) identify that venture capital backing is more common in high-risk industries, where a higher fraction of the IPO companies are innovative.

Researchers have primarily used firm-specific financial variables, like profitability, in their pursuit of explaining the extent of underpricing, which will also be the approach used in this thesis. Some financial variables have been proven to have explanatory power. It is however not clear exactly what set of variables, which drives the underpricing under given market and company-specific conditions. The financial variables could, of course, share the explanatory power with other mechanisms as well as working as a proxy for them. One advantage of using financial variables is that they are relatively easy to get access to and are in and out of themselves quantifiable unlike some of the more general theories like behavioural biases. The positive first day return remains unresolved, despite the comprehensive research conducted on the subject.

The purpose of this thesis is to determine what drives the first day market adjusted return (MAR) among American and Canadian IPO companies from 2000 through 2018 by looking at some previously proven explanatory financial variables. This thesis will, in particular, contribute to the existing literature by testing the effect of being VC-backed in different industries. The data will be split into before and after the financial crisis (2007-2008) as a robustness control to the full period, because the performance of IPOs has been proven to not just vary across markets but also across time. The research questions are:

What financial variables and other mechanisms drive the first day market-adjusted return of IPOs in the American and Canadian markets?

Do industry, VC-backing and the interaction between them have an impact on the first day MAR?

Disposition

In the upcoming chapter 2 is the theory and literature review related to primarily the underpricing of IPOs discussed. The proposed underlying mechanisms causing the underpricing of IPOs will be presented. Chapter 3 discusses the data collection, data tests and the validity of the methodology. The variables used in the regression are presented, as well as their expected impact on the first day market adjusted return. In chapter 4, the result is presented and the analysis conducted. In chapter 5 will finally the conclusion be drawn.

2.0 Theory and Literature Review

2.1 Why conducting an IPO?

The main objective in this thesis is to determine and explain the underpricing of IPOs, however in this section a brief overview of the underlying motives in conducting IPOs will be discussed. Pagano et al. (1998) point out that it is not unusual that large companies stay private and hence should not IPOs be perceived as a natural step in a firm's growth process, but rather as a rationally economic and strategic decision. The obvious reason for conducting an IPO is to raise capital by issuing new stocks to the public. The capital can then be used to make a new investment or decrease the leverage and hence the risk in the company. It's also a way for the current owner to diversify by exiting the company and create liquidity.

Pagano et al. (1998) argue that an underlying reason for going public could be to capitalize on the current overvaluation of the company. The overvaluation hypothesis was supported as the profitability and investments were shown to decrease in the post-IPO period. Brau and Fawcett (2006) collect data by conducting surveys among 336 chief financial officers (CFOs). They also find that a reason to going public is to capitalize an overvaluation and that it was more frequently happening if the IPO was VC-backed. The survey response furthermore showed that the main reason was not to minimize the cost of capital, but rather to get public shares that can be used in future acquisitions. Another essential argument for staying private is to preserve the decision-making control and ownership. McCarthy (2018) reports that there are private and public financing alternatives that give a lower cost of capital than financing by conducting an IPO. The reason for going public may therefore not primarily be to finance the company. Ritter (2011) underlines that an IPO decision should be based on the opportunity cost and direct costs. The direct costs are e.g. auditing, legal costs, the exchange listing and gross spread (fee to the underwriter). The gross spread is significant and on average 7% of the (gross) proceeds. To sum up, the main conclusion that can be drawn is that the reasons for going public are heterogeneous, but are often part of a company’s bigger strategic goals.

2.2 The efficient market hypothesis

Fama (1970) presented the paper "Efficient Capital Markets", in which he argues that information is incorporated by the market directly making the security correctly priced at any given point in time. The Efficient Market Hypothesis (EMH) implies that both technical and fundamental analysis are fruitless for investors. Malkiel (2003) agrees that the market is highly efficient but not perfectly efficient. A given security could be mispriced and the price evolvement can sometimes be predictable, which create incentives to collect information and analyse the security markets. Most of the time is the current information reflected in the security price, which is reasonable as market bubbles are unusual. Nevertheless, a misvaluation could happen for example is the dot-com bubble in 1999-2000 mentioned (Malkiel, 2003). The universally observed underpricing of IPOs doesn’t necessarily fit the prediction of the efficient market hypothesis, and underpricing has therefore been under scrutiny by researchers, who have been trying to explain it through a broad range of theories.

Ritter (2011) doesn't think ECM is applicable as the underwriters have more or less an oligopoly position, which means that the underwriters are able to affect the price of the IPOs, such as a certain degree of underpricing becomes the equilibrium. The underwriter got to be considered to have a market influence as there are a limited amount of skilled and reputational underwriters in each industry. Miller and Modigliani (1958) claim, before Fama (1970), that the source of finance is irrelevant due to the efficient and integrated capital market. One way to finance the company with equity is by issuing new shares in an IPO. Empirical research has found that financial decisions regarding the capital structure in companies seem to be based on market timing intentions (Baker and Wurgler, 2002). Critics may argue that ECM and the Miller and Modigliani theory are based on too simplified assumptions.

2.3 Underpricing

Underpricing could be a threat to a well-functioning capital market as it may intimidate firms to raise capital by conducting an IPO, at least it gets marginally less likely (Ruud, 1993). Researchers have for a long time been aware of the underpricing of IPOs and some of the first researchers to write about it was Logue (1973) and Ibbotson and Jaffe (1975). Underpricing is reflected in the first day return of a company and is defined as:

$$P_i = \frac{P_{i,1} - P_{i,0}}{P_{i,0}} \qquad \text{(Eq. 1)}$$

Where:

P_i is the price of the IPO (positive if underpriced)

$P_{i,1}$ is the closing price on the first trading day

$P_{i,0}$ is the IPO offering price.

Lowry et al. (2017) show that underpricing is standard among IPOs taking place all over the world. Brennan and Franks (1997) report that pre-IPO shareholders, on average, tend to sell their remaining shares subsequent to the IPO which indicates that they wanted to avoid the underpricing related to an IPO. There is however often a legally established period after the IPO where pre-IPO owners are not allowed to sell, a so-called lock-up period. The underwriter is, in some IPO conduction methods, bearing the risk of the share issuing. The issuer may sell to the underwriter who then is responsible for issuing to the market. To hold inventory is of course associated with risk e.g. if the "hot" market period abruptly would end. The underpricing can be seen as compensation for taking the risk, which could partly resolve the underpricing. As mentioned previously, there are some main categories of explanation to the empirical finding of underpricing, namely asymmetric information, institutional reasons, control considerations and behavioural approaches (Ljungqvist 2007). The price is also reflected by the financial performance of the company and the overall development in the economy. The mechanisms are not necessarily mutually exclusive and could rather be a complement to each other.

2.4 Asymmetric information

A fundamental difference between the price of an IPO and a traded security is that the information possessed by the informed investor is directly reflected in the price of a traded security. The uninformed investor may not have the skill or just hasn't performed an analysis, but nonetheless they know that the current market price reflects the knowledge of the informed investors (Grossman, 1976). This likely makes it irrational to privately perform an analysis of a traded security as it is costly. Benveniste and Spindt (1989) discuss how the book building process tries to deal with asymmetric information emerging in an IPO context. The purpose of the book building process is to make the institutional investors (often well-informed) to reveal their information to enable the underwriter to price the IPO shares correctly. The underwriter needs to create incentives for the institutional investors to make them reveal information about how much they are willing to pay for the shares from a given upcoming IPO. A higher revealed price from an institutional investor results in a higher allocation of shares, but at the same time, the institutional investor thereby contributes to a reduced underpricing. The price of the IPO shares, therefore, got to be underpriced to create incentives to reveal information. It was shown that underpricing was reduced if the underwriter had a recurring relationship with the institutional investors, as it creates incentives to be sincere.

Rock (1986) tries to explain the underpricing of IPOs using a theory called the winner's curse, which is based on adverse selection. The market consists of informed and uninformed investors. The informed investors are the only agents that are able to correctly determine the value of the upcoming IPO. Both the issuer and the underwriter are not able to determine the true value, and there is assumed to be no agency conflict between them (Rock, 1986). The shares are often allocated on a so-called pro-rata basis i.e. if the stock is oversubscribed by the factor of three the allocation will be one-third of the requested number of shares (Ritter, 2011). The informed investors will only subscribe to the IPOs where the valuation is below the true market value. The uninformed investors, on the other hand, are not able to distinguish whether the IPO is favourably priced and will participate in all of them. Favourably priced IPOs become more subscribed and unfavourably IPOs become less subscribed. In order to keep the uninformed investors in the market, the IPOs must on average be offered to a discounted value (Rock, 1986). The discounted value needs to at least compensate for the lowest opportunity cost i.e. the risk-free interest rate, given rational agents.

Beatty and Ritter (1985), among other authors, have looked at how the ex-ante uncertainty affects the outcome of an IPO. They find a positively monotonic relation between the ex-ante uncertainty and the size of the underpricing. They also discuss the mechanism causing the underpricing and argue that underwriters play a crucial role. Underwriters are forced to underprice, on average, as they otherwise will lose investors. Reversely, a too high underpricing will result in a loss of clients. Underwriters will only underprice if three conditions are fulfilled. Firstly, the underwriter can't perfectly forecast the price evolvement after the company has gone public. Secondly, the underwriters got to have a non-salvageable reputation at stake. Thirdly, cheating by deviating from the underpricing equilibrium will lead to a loss of clients. They find evidence for a deviation from the underpricing equilibrium resulted in a loss of clients. The IPO companies are dependent on the underwriters, if they issued the shares by themselves, it wouldn't be trustworthy as it would be a one round game with incentives to cheat (overprice). If the ex-ante uncertainty is endogenous and an underwriter is used, the issuers of the IPOs have incentives to actively reveal information to reduce the underpricing. Financial data reveals the financial standing of the company to potential investors and is consequently affecting the underpricing.

There are various proposals of how you can deal with asymmetric information. Grinblatt and Hwang (1989) present a two parameters signalling model, where signalling is intended to alleviate the uncertainty regarding the return and volatility of the upcoming IPO. In their separating equilibrium model, the issuer has to signal the value of the company, as at it is assumed that he has superior information. The issuer could signal the fundamental value of the company by retaining a higher proportion of the shares, the more shares retained the higher expected performance. Secondly, the issuer signals the confidence in the company by underpricing the IPO shares. Underpricing also attracts attention (marketing) among investors, which could create a higher price of the IPO shares as the company starts to be traded.

2.5 VC Backed Firm

Megginson and Weiss (1991) examine the certification (signalling) hypothesis of venture capital-backed IPOs. That means whether the VC-backed IPOs are able to decrease the asymmetric information between the investors and the issuer. The venture capital companies could work as a substitute but also as a complement to having a prestigious underwriter. There are some criteria that got to be fulfilled to make the certification trustworthy by outsiders. The VC-company got to have reputational capital at the stage and the benefit of cheating one period got to be worse than being honest in all periods. An indication that VC-companies actually believe in the IPO company is that they retain a significant proportion of the shares after the IPO. The cost of being VC-backed got to be a function of the benefits in terms of reduced asymmetric information etc. The willingness to pay for VC-backing gives a credible signal to the investors. Megginson and Weiss (1991) studied the period from 1984 through 1987. IPO companies were matched based on industry and size to a similar company that didn’t conduct an IPO in order to get a balanced sample. VC-backed IPOs were found to entail a lower first day return and a decreased gross spread. One reason for the decreased gross spread could be the long-term relationship between a VC-company and a given underwriter. Barry et. al (1990) also find less underpricing among VC-backed IPO companies.

The business strategy of venture capital organisations is to raise capital from individuals and institutions, and invest in private companies, often small and young companies with high growth potential but also commonly with a high corresponding risk. Venture capital companies also commonly contribute with managerial advice, often by being part of the board, and industry-specific knowledge (Sahlman, 1990). Hellmann & Puri (1999) find that venture capital is significantly more common for innovative companies comparing to imitator companies. Venture capital companies take the firm to the market faster and the success rate is higher. Jain and Kini (1995) also match VC-backed IPOs to non-VC-backed IPOs based on size and industry. The result indicates that VC-backed IPOs outperform non-VC backed in the post-IPO performance. The VC-backing also enables the underwriter to reduce the underpricing. To be VC backed could, in the absolute monetary outcome, be more important in high-tech industries.

Venture capitalist organisations are very selective in their picking of companies. They are trying to do an ex-ante analysis of the potential future cash flows and establish how they can contribute to the performance of the company. The owners of the company are at the same time trying to evaluate whether VC-backing has a positive effect, after all, they have to give up a certain degree of cash flow rights as well as control of the company. This makes the outcome of the VC-backing decision endogenous. It would, therefore, be reasonable that VC-backing has an effect on the underpricing of IPOs, the impact on the causal interpretation will be discussed in the methodology (Peggy and Wahal, 2003). Peggy and Wahal (2003) looked at 6413 IPOs from 1980 through 2000, 37% of the IPOs were VC-backed. VC-backed companies were found to experience a larger first day return. This could be due to grandstanding, meaning that less experienced VC-companies are willing to undertake more risky companies and are consequently forced to underprice more. To take a company public signals quality of the VC-company by increasing the reputation in the future (Peggy and Wahal, 2003). By looking at pre-IPO financial characteristics, it was found that VC-backed firms had lower total assets, earnings and book value equity per share.

2.6 Industry

Ritter (2011) identifies that there is a structural break after the dot-com bubble in 2000, as the number of IPOs subsequently decreased significantly. The operating profit of private companies have decreased relative to the larger, already traded, companies. The competitive advantage of having economic scope and scale among larger companies enable them to outcompete as well as acquire smaller companies (Ritter, 2011). Enache et al (2018) report that the number of publicly listed companies have decreased by 50% since 1996 in the United

States and at the same time have the total market capitalization increased dramatically. The decrease in the number of listed companies is however believed to be part of a natural process, due to the increased number of digital and knowledge intense firms with another organizational structure and in less need of getting public financing. Private funding has become more common and the number of IPOs has decreased while the number of M&As have increased. M&A could be perceived as an exit substitute for conducting an IPO.

Ang and Boyer (2009) compare IPO performance in new industries to established industries using financial data. In the method, they use a logit model with a binary classification of the dependent variable based on whether the IPO company was classified as new or established (a logit model is used as the stock return data was not following a normal distribution). They found a fundamental difference in characteristics between new- and established industries. Established industries had normally greater economic barriers to entry and hence were the IPO companies often larger. They also had more historically proven business strategies, which make the future cash flows less uncertain. In new industries were, in general, ROE lower, the principal amount smaller and VC-backing more frequent. Peggy and Wahal (2003) identify a clear clustering of VC-backing in certain industries as well as between geographical areas. VC-backing is more frequently taking place in technology intense industries e.g. in software and biological research related companies. VC-backing were also shown to be more common among companies situated in certain geographical places such as San Francisco. Barry et al. (1990) notice that VC companies often are expert within a certain industry, which may imply that it is easier to add value in high technology industries as the majority of all IPOs are taking place in those industries (see *table 8a* in appendix). The value adding advantage in high technology industries could be due to a higher reduction in asymmetric information (Chi and Padgett, 2005). Asymmetric information is often caused by uncertainty, which is more common in R&D intense companies.

2.7 Control Considerations

One potential explanation for the size of the underpricing could be related to control issues of IPO companies. Zutter and Smart (2003) examine the difference in underpricing dependent on whether it is a single or dual-class IPO. In a dual-class IPO, common shares are issued to the public while the ownership of some shares with superior voting right is retained. In contrast, a single class IPO has no difference in voting rights between shares. By looking at IPOs in the American market between 1990 to 1998, they found that dual class IPOs were significantly less underpriced than the single class IPOs, after controlling for other factors that influence the underpricing. Brennan and Franks (1997) find a negative relationship between underpricing and the extent of large blockholders subsequent to the IPO. The superior underpricing of single class IPOs could hence be an instrument to enable discrimination of large blockholders, which implies that the control of the company is kept and reduced monitoring will take place. In contrast, dual-class IPOs don't have to consider the control issues and are therefore able to underprice less.

Stoughton and Zechner (1998) notice that the offering mechanism is highly influencing the ownership structure of an IPO company. The traditional book-building process and the corresponding empirically observed underpricing enables the underwriter to actively select investors. To discriminate wouldn't be possible if you used a competitive trading mechanism such as Walrasian auction. Stoughton and Zechner (1998) agree with Brennan and Franks (1997) that underpricing is a way to enable an active selection of investors, but reach the conclusion that underwriters should prefer large blockholders as they have the resources, knowledge and incentives to analyse and give advice. In general, there is an agency problem emerging among the post-IPO shareholders as there is a relationship between the ownership stake and the incentives to monitor. If large shareholders analyse the company, it creates positive externalities to smaller shareholders who are able to free-ride. The underwriter is, therefore, going to identify large blockholders and treat them favourably in the allocation process. Loughran et al. (1994) find that more rationing preventing restrictions as in Finland and France result in less underpricing, even though the results were ambiguous.

2.8 Institutional reasons

Tinic (1988) uses data before and after the Securities Act of 1933 was implemented in the US. Lowry et al (2017) provide an example of the Securities Act of 1933. Assume a company went public at $10 and the closing price after the first day is $13. The company gets sued one year later for not disclosing enough information, and the share price is $8. The judgement in the lawsuit is based on the difference between $10 and $8. Underpricing implies both decreased risk of being sued and also less severe penalty if the company is found guilty (Lowry et al, 2017). The legal action could additionally damage the reputation of the issuer as well as the underwriter. The IPO data supports the hypothesis that underpricing is a way for the issuer and its agents to avoid legal liabilities associated with a lawsuit. The support is established as the underpricing was significantly higher after the Securities Act of 1933 than before, which would have been expected by this insurance hypothesis. Furthermore, they identify that prestigious underwriters have less underpricing comparing to fringe underwriters, which could be traced back to that the prestigious underwriters are capable of conducting a more reliable due diligence (Tinic, 1988).

Ruud (1993) examines the statistical distribution of the initial IPO returns. He claims that the systematically positive initial returns emerge just because there is an unobserved left (negative) tail. The reason is that underwriters often price support if necessary, in order to avoid a negative first day return. There is empirical evidence of price support because if the first day return is around zero, then the price tends to decrease in the subsequent days as the underwriter redraws his support. The underwriters may, therefore, to a higher extent value the IPO shares to its true market value, but overpricing is avoided by using price stabilization interventions. Ruud (1993) does indeed find evidence for a mean zero distribution with symmetrical tails, which would have been expected by the return of a traded stock as well.

2.9 Behavioural approaches

The behavioural approaches are the most recent way to explain underpricing. The advocates commonly argue that the extent of underpricing is unreasonably high as well as too persistent if it could only be attributed to the traditional theories. As mentioned before, an IPO has no historical share prices, is young, immature and offers, in general, less information to analyse comparing to a traded stock. This could magnify the importance of behavioural approaches in the field of IPOs. The behavioural approaches can broadly be divided into two categories. Firstly, the existence of irrational investors, who bid up the share price above its fundamental value. Secondly, the behavioural bias meaning that the issuers fail to put pressure on the underwriters, which enables the underpricing (Ljungqvist, 2007).

Ljungqvist et al. (2004) find that in the long run IPOs can arguably be considered as overpriced, unlike the clear underpricing frequently found in the short-term perspective. Investors tend particularly in “hot” market periods to be too exuberant. IPOs issued in a “hot” market periods perform on average worse in the long-term perspective i.e. one could argue that the issuer takes advantage of the irrational investors. The paradoxical difference in short- and long-term performance can hence partly be explained by irrational investors, in combination with legal restrictions in the short sale opportunities (Ritter, 1991). Loughran and Ritter (2002) argue that issuers simply have been increasingly more complacent about “leaving money on the table”. The pre-IPO owners are believed to care more about their change in wealth rather than the level i.e. even if they could have sold the company closer to its true value by putting more pressure on the underwriter the owners will be consent as their wealth increases.

3.0 Data and Methodology

3.1 Data collection

The financial data used in this thesis was collected from Bloomberg and is thereby secondary data. In the selection of the IPOs, some criteria were applied. The IPO had to be listed on the American or the Canadian stock market, the total value of the issued shares had to exceed 50 million dollars and it had to be a common stock IPO. By having the 50-million-dollar criterion and the geographical delimitation, you are able to draw conclusions from a more homogenous IPO sample. Issuance of shares with a higher total value, on average, indicates a larger firm and thereby a lower risk for the buyer. Data on 2351 IPOs were collected from 2000 through 2018. The period was partly selected to enable a comparison between the underpricing of IPOs before and after the financial crisis (2007-2008). Bloomberg had some missing data, the cross-sectional regression was therefore based on 1585 observations. To construct the first day MAR, daily return data had to be downloaded for the market index, in this case, the S&P index 500. Financial data on the following explanatory variables were also collected from Bloomberg: EBIT, the value of total assets, gross proceeds and earnings per share. Data on industry classification and VC-backing were also downloaded from Bloomberg.

3.2 Variables

3.2.1 Dependent Variable

The first day MAR is calculated using the following formula (Kiymaz, 2000):

$$MAR_i = [\frac{P_{i,1} - P_{i,0}}{P_{i,0}} - R_M] * 100 \qquad \text{(Eq. 2)}$$

Where:

MAR_i is the first day market-adjusted return of IPO i (positive if underpriced). Measured in percentage units.

$P_{i,1}$ is the closing price on the first trading day

$P_{i,0}$ is the IPO offering price.

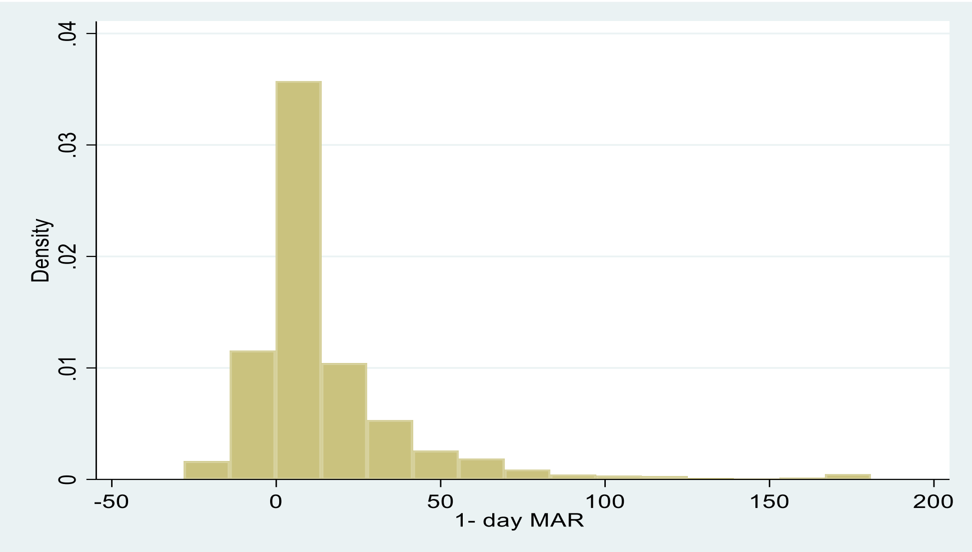
R_M is the average market return of the S&P 500 index in the year of the IPO.

The benchmark in the calculation of the first day MAR is the S&P 500, which is believed to be an accurate proxy of the market return in both the American and Canadian market. To get the correct calculation of the one-day MAR of the IPOs, the market return on the IPO specific day should be used. In this thesis, the average daily return of the market portfolio in the year of the IPO will be deducted from the first day return of the IPO. This will primarily affect the accuracy of every single IPO but on average the cross-sectional estimates shouldn't change significantly. The distribution of the first day MAR is presented in *Figure 1* below.

Figure 1

Distribution of the first day return

The graph shows the distribution of the first day market adjusted return in percentage units. The calculation is basically based on the difference between the offering price and the first day closing (see Eq. 2). The data is trimmed such that values outside the interval between the 0,5 and 99,5 percentiles are replaced by the lowest/highest value within the interval. There is, therefore, a small spike around 175.



3.2.2 Independent variables

Purnanandam and Swaminathan (2004) point out that a large first day MAR is equivalent to a highly underpriced IPO. In general, there should be a positive relationship between the ex-ante uncertainty and the level of the underpricing. The ex-ante uncertainty is not observable and is consequently going to be proxied by a number of regressors (Kiymaz, 2000). In this thesis, financial proxies will be used to explain the underpricing. The impact of industry and

VC-backing are also examined. A number of regressors expected to have explanatory power are selected based on historical research. The regressors used in this thesis and the corresponding hypothesis regarding the effect on the one-day MAR will now be presented.

Earnings Before Interest and Tax (EBIT)

Brau and Fawcett (2006) found in their survey of 336 chief financial officers (CFOs) that the most important signal, which decreases the ex-ante risk, is earnings. EBIT at the beginning of the year prior to the IPO is therefore used.

It is reasonable to expect a *negative relation* between the level of earnings and the first day MAR.

Total Assets (TA)

The total assets variable is a proxy for the size of the company. A higher value of total assets is corresponding to a lower ex-ante risk for the investor, which would decrease the underpricing and vice versa (Kiymaz, 2000).

The expectation is a *negative relation* between the total assets in the IPO company and the first day MAR.

Gross Proceeds (GP)

The gross proceeds are the total amount of capital raised by the IPO company, unlike net proceeds that deduct for costs related to the IPO issue, in particular, the gross spread (the fee charged by the underwriter) (Kiymaz, 2000).

One would expect a *negative relation* between the gross proceeds and the first day MAR.

EBIT over Total Assets (EBITTA)

EBIT over total assets measures the profitability of the IPO company. It is intuitive that higher profitability should decrease the ex-ante risk related to investing in the IPO.

A higher EBITTA has *a negative relationship* with the first day MAR

Earnings Per Share (EPS)

Chi and Padgett (2005) use Earning Per Shares (EPS) in the listing year. EPS is also a measure of profitability. It will be interesting to find out whether the result of EBIT and EBITTA point in the same direction.

A *negative relationship* between EMS and the first day MAR is expected.

Gross Proceeds over Total Assets (GPTA)

The ratio of gross proceeds over total assets is an indicator of what fraction of the company offered in the IPO. Retained shares by the issuer signal confidence in the company (Grinblatt & Hwang, 1989). Megginson and Weiss (1991) showed that the same logic applies to the VC-backing company. At the same time, it can be perceived as a way of avoiding the underpricing and instead sell additional shares at a later stage.

A *positive relationship* between GPTA and the first day MAR is expected.

Industry Dummy

Chi and Padgett (2005) and Ang and Boyer (2009) notice that high-tech industries are associated with more risk than other industries. High-tech IPO companies should hence, ceteris paribus, be more underpriced. The ratio of high-tech firms conducting IPOs has over the years increased significantly. The industry dummies are also proxies for asymmetric information (Chi and Padgett, 2005).

The expectation is a *positive relationship* between belonging to a high-tech industry and the first day MAR.

The financial industry is determined to be the reference industry. The financial industry may be considered as relatively risky. *Table 8a* in the appendix shows that many observations are available for the financial industry, which makes it a good reference. One can also observe the allocation of IPOs based on year and industry as well as an indicator of whether the industry is considered risky. The judgement of the risk is based on previous research and the theory, but also on common sense regarding the risk. The risk perceived by the investors will be tested in the regression analysis by including the industry dummies. In *table 8b* in the appendix, one can get an overview of the subcategories within each industry. In *table 8a* in the appendix, it is apparent that the majority of the IPOs are taking place in risky industries. This confirms Ritter (2011), who argued that the traditional industries have high entry barriers. One can also observe that in years of crisis are the number of IPOs lower.

VC-Backed Dummy

Megginson and Weiss (1991) and Jain and Kini (1995) found a lower first day return among VC-backed IPOs. The VC-company could provide valuable advice, industry-specific knowledge and monitoring of the company. Additionally, to be selected by a VC-company signal a high quality of the IPO company, which decreases the asymmetric information. Most papers, therefore, find that VC-backing reduces underpricing. In contrast, Peggy and Wahal (2003) found a larger first day return among IPO companies. The result could partly be attributed to grandstanding. A lower limit of 50 million dollars in proceeds is used in this thesis, which should make grandstanding less relevant. In *table 9* in the appendix, one observes that the VC-backing ratio has increased significantly from 2010.

One would expect a *negative relationship* between a VC-backed IPO and the first day MAR.

Interaction Term

Interaction terms between the industry dummy and the VC backing dummy are used. Hellmann & Puri (1999) showed that venture capital is significantly more common for innovative companies comparing to companies that imitate an existing business strategy. Megginson and Weiss (1991) argue that IPO companies decrease the asymmetric information by using VC-backing, hence it is more relevant among innovative companies. From *table 10* in the appendix, one indeed observes that interaction between VC-backing and industry is more frequently happening in risky industries. The outcome of the VC-backing decision seems to be conditional on industry belonging. In addition, one observes that a majority of the interaction terms are found from 2010 and forward. In *table 9* in the appendix, you see that the VC-backing ratio significantly increased from 2010 and forward, which is logical as there should be a correlation between the number of VC-backings and interaction terms.

Hypothesis: If an interaction term is included, the parameter of the industry dummy and VC-backing dummy cannot be interpreted as marginal effects anymore. One would expect the sum of the coefficients related to the industry dummy and the interaction term to be lower than just the parameter of the industry dummy (received from the model without interaction terms), as VC-backing is believed to decrease the first day MAR

Time Specific Control and Country Specific Control

Chi and Padgett (2005) use yearly dummies to control for time-specific performance of IPOs, this will also be done in this thesis. A country-specific control dummy is also created in order to control for differences between Canada and the United States. The large amount of observations, in this thesis, ensures sufficient degrees of freedom. An absolute majority of all IPOs are taking place in the United States in comparison to Canada (see *Table 9* in the appendix). The VC-ratio is also lower in times of crises, e.g. in 2001 is the ratio zero percent, the lowest observed value.

Table I

Variables used and their expected relationship

The dependent (1) and the independent variables (2) are presented as well as the expected relationship between them (3).

(1) Dependent Variable	(2) Independent Variables	(3) Expected Relationship
1-day MAR of IPOs	Intercept	
	EBIT	-
	Total Assets (TA)	-
	Gross Proceeds (GP)	-
	EBITTA	-
	Earnings Per Share (EPS)	-
	GPTA	+
	Industry Dummy	See under “Industry dummy” above.
	VC-Backed Dummy	-
	Interaction Term	See under “Interaction Terms” above.

3.2.3 Regression

A cross-sectional regression is run based on the variables presented in *table 1*. All the variables give an indication of the ex-ante uncertainty perceived by the investors. The variables can be divided into different categories depending on through which mechanism the 1-day MAR is affected. Earnings, total assets and gross proceeds are proxies for size. EBITTA and EPS are profitability multiples which indicate how efficient the invested capital is used. GPTA reveals the ratio of the company offered in the IPO, which are related to control considerations and the issuer's confidence in the company. The industries are proxies for asymmetric information. VC-backing signals the quality of the IPO company due to VC-companies expertise and experience. The time-specific controls primarily control for market sentiment and behavioural biases. The country-specific dummy controls for institutional differences, such as regulations and tax differences. Whenever you use dummy variables in a regression, it's important to avoid the dummy variable trap, which is easily done by excluding one of the dummies (or the intercept). Otherwise, there will always be one dummy taking the value of one i.e. the sum of the dummies is always one. This is exactly what you indirectly will add to the intercept, which means that you get perfect multicollinearity between the intercept vector and the combined vector of all dummy variables. The specification of the main model is:

$MAR_i = C + EBIT_i + \ln(TA_i) + \ln(GP_i) + EBITTA_i + EPS_i + GPTA_i + \sum \text{Industry Dummy}_i + \text{VC-backed Dummy}_i + \sum \text{VC-backed Dummy}_i * \text{Industry Dummy}_i + \sum \text{Year}_i \text{ Specific Control} + \sum \text{Country}_i \text{ Specific Control}$ (Eq. 3)

3.3 Data Tests

To make sure a reliable inference is obtained a number of tests are conducted on the data. In this thesis, a large sample of observations is used which implies some beneficial attributes of the data. The data should be normally distributed due to the central limit theorem, but the first day MAR is commonly not following a normal distribution which is a bit contradicting (see Figure 1 page 15). A large number of observations alleviate the multicollinearity problem, which is important as the interaction terms most likely are going to be correlated with the single dummy terms, which make up the interaction term. Formally, this thesis will test for heteroscedasticity and multicollinearity.

2.3.1 Heteroscedasticity

Homoscedasticity means that the variance of the residuals is constant, in contrast to heteroscedasticity where the variance is not constant. Under heteroscedasticity, the OLS model is still unbiased and consistent, but the standard errors of the model become wrong. The OLS estimation is no longer the Best Linear Unbiased Estimator (BLUE) as the estimator doesn't have minimum standard errors (Torój). To detect heteroscedasticity the Breusch Pagan test is going to be conducted. In the Breusch Pagan test, you run the regression of interest and save standard errors. Then, you run an auxiliary regression with the original regressors and with optional inclusion of cross-terms, the previously estimated variance is the dependent variable (Williams, 2015). Homoscedasticity implies that an F-test on the coefficients should not be significantly different from zero i.e. the estimated variance is equal to a constant. This corresponds to a low R-squared in the auxiliary regression (Schwert, 2015). The existence of heteroscedasticity can easily be solved by using robust standard errors.

2.3.2 Multicollinearity

The regressors are not allowed to be correlated with each other to get unbiased coefficients, commonly referred to as being orthogonal to one another. Orthogonal regressors imply that the parameter of each regressor is not affected by which variables you include. In practice, there will of course always be some correlation between the regressors, however, if the correlation is too high you get a problem with the inference due to multicollinearity. In a model with multicollinearity, you still get a reliable R-squared of the model, but the standard error of each parameter will be high. This makes it harder to get significant individual variables. There are different solutions to multicollinearity e.g. to take the natural logarithm of the variable, create a ratio of the variable or drop one of the correlated variables (Brooks, 2014). Multicollinearity is going to be tested with the variance inflation factor (VIF) and a correlations matrix. One can't establish a specific boundary value in the models, which the test results are not allowed to exceed, but as a “rule of thumb” the VIF value should be below 5 and the intervariable correlation should be less than 0,8.

3.4 Reliability and Validity

In regressions, you would also like to avoid endogeneity as it distorts the inference. In a cross-sectional setting, endogeneity emerges due to measurement errors, omitted variable bias and simultaneity problems. Endogeneity is not possible to test for (Angrist and Pischke, 2008). One of the most important criteria is hence that the data is not including a significant amount of measurement errors. Bloomberg is likely providing reliable data as it is a frequently and professionally used database. To identify the causal effect, you got to have a random sample (Angrist and Pischke, 2008). In this study, IPOs were never intentionally left out given the applied selection criteria, which decrease the risk of ending up with a selection bias. Nonetheless, it could be that the IPOs lacking data, shared some underlying attribute. The VC-backed term could create a problem as it is a self-selected variable. To get VC backing and to be VC-backed are endogenous decisions based on the economic and strategic considerations. In an ideal world, one would like to observe the underpricing of a VC-backed IPO and its counterfactual (no VC-backing) to get the true causal effect of VC-backing (Peggy and Wahal, 2003). The idea can be shown with the following formula, the implication is only true if you have a random selection of VC-backing.

$$E[\ Y_1 \mid D=1, X\ ] - E[\ Y_0 \mid D=0, X] \Rightarrow$$

$$E[\ Y_1 - Y_2 \mid D=1, X\ ] = E[\ Y_1 \mid D=1, X\ ] - E[\ Y_0 \mid D=1, X] \quad \text{(Eq. 4)}$$

Where:

X = All the control (independent) variables.

Y_1 and Y_0 are potential outcomes.

D_1 and D_0 are decision indicators, where the subscript 1 corresponds to VC-backing.

$E[\ Y_1 \mid D=1, X\ ]$ = Expected MAR conditional on VC-backed and the other controls.

$E[\ Y_0 \mid D=0, X]$ = Expected MAR conditional on non-VC-backed and other controls

$E[\ Y_0 \mid D=1, X]$ = Expected MAR if the VC-backed company *wouldn’t* have been VC-backed (Counterfactual)

S&P 500 is likely a better proxy for the American than for Canadian market, but as the US stock market is highly influencing other countries and due to the geographical vicinity, it is not believed to bias the result. One of the greatest threats to internal validity is the omitted variable bias as it violates the exclusion restriction. The fulfilment of the exclusion restriction requires that the expected value of residuals is zero conditional on the explanatory variables i.e. the explanatory variables are uncorrelated with the unobserved determinants. The omitted variable also got to have explanatory power on the dependent variable (Angrist and Pischke, 2008). In this thesis, it's almost impossible to control for all the relevant variables, hopefully, the bias is not too severe. If you have an omitted variable bias the inference will not be reliable as the parameters get biased (Brooks, 2014).

The external validity deals with the issue of whether the findings are generalizable to another context (Angrist and Pischke, 2008). The American and Canadian markets are examined over a specific period with specific criteria on the selected IPOs. There are factors that make the result region and time specific for instance the market efficiency, institutional factors and the culture. The external validity is a common challenge in empirical research as you ideally would like to find a result with a corresponding analysis that can be applied across the geographical and time dimension. To get full external validity is likely very hard to achieve in social science.

4.0 Result and Analysis

4.1 Descriptive Statistics of Data

Before running the cross-sectional regressions, it is important to look at the summary statistics of the variables to make sure the data is fine and to get an intuition of its attributes.

Table 2

Descriptive statistics of continuous variables.

		Summary Statistics				
Variables	Unit	Num. of Obs.	Mean	Sd	Min	Max
1-day MAR	Percentage units	2,351	13.31	26.83	-28.08	180.8
EBIT	Millions	1,833	33.15	121.5	-220.0	901.9
LNTA	Ln Millions	1,795	5.802	1.443	2.015	10.64
LNGP	Ln Millions	2,351	5.116	0.872	3.912	7.991
EBITTA	Ratio	1,675	0.00379	0.373	-1.235	2.577
GPTA	Ratio	1,865	0.597	1.650	-8.273	9.812
EPS	Ratio	1,789	0.658	13.97	-86.72	156.0

It’s only interesting to look at the financial variables because the other variables are dummies. The conclusions regarding them can be drawn from the tables previously referred to. The data were trimmed by using the ”winsorizing” command in Stata, this was done as some variables had extreme outliers that otherwise would have distorted the result. The results in *table 2* are based on the trimmed variables. The 0,5 and 99,5 percentiles were used, “winsorizing” replaces the extreme values with the closest value above/below the limit. The volatility of the 1-day MAR is strikingly high and confirms the challenge of pricing IPOs correctly. The mean of EBITTA is very low, reflecting that many companies actually had negative earnings. Ang and Boyer (2009) found lower ROE and more uncertain future cash flow in high-risk industries. The majority of the IPOs, in this thesis, are conducted in high-risk industries (see *table 8a* in appendix). The result may, therefore, be expected. Ang and Boyer (2009) also showed that these companies have lower total assets, which could explain the relatively high mean ratio of 0,597 related to GPTA. The volatility of EPS is also very high, which may be partly reflected in different amounts of stocks outstanding in relation to EBIT. One can also observe that EBIT is very volatile. It was not possible to take the logarithm of EBIT, as the variable includes negative values, making the interpretation of the parameter hard. There is probably not a linear relation between EBIT and the first day MAR, but the coefficient reflects the average impact of a unit change in EBIT. The coefficient may apply better to the observations in the middle comparing to the lowest and highest observations. The financial characteristics of IPO companies seem to be quite heterogeneous.

Table 3

Test for Homoscedasticity: Breusch Pagan Test

Breusch Pagan Test			
Test Period	2000-2018	2000-2006	2009-2018
Chi2 1	947	566	135
P-value	0	0	0

As mentioned in the methodology, heteroscedasticity and multicollinearity tests are conducted. The Breusch Pagan test for heteroscedasticity was first performed. The null hypothesis of homoscedasticity is clearly be rejected in all models, implying heteroscedasticity. Heteroscedasticity was expected and it is easy to resolve by using robust standard errors.

Table 4

Test for multicollinearity: Variance Inflation Factor (VIF).

Variable	VIF 2000-2018	VIF 2000-2018 No Interaction	VIF 2000-2006	VIF 2009-2018
EBIT	1,92	1,91	2,28	1,62
LNTA	5,03	4,92	5,92	3,26
LNGP	3,29	3,26	3,58	2,56
EBITTA	1,56	1,55	1,63	1,59
GPTA	3,01	2,98	2,34	1,96
EPS	1,22	1,16	M	1,12

The VIF test and the correlation matrix are used to test for multicollinearity. The VIF statistics include one additional model comparing to the Breusch Pagan test, namely the full period without interaction terms. This model will, later on, be important to draw conclusions about the interaction terms. *Table 4* conveys that multicollinearity isn't a big issue, because most values are below the rule of thumb upper limit of 5. The logarithm of total assets (LNTA) seems to cause the most severe problems, in the main regression based on the full period is the VIF value just above 5 and in the pre-financial crisis regression is it 5,92. In *table 11* in the appendix, the VIF values of all variables are presented. The time-specific controls don't suffer from multicollinearity. The high-risk industries, VC-backing and the interaction terms are suffering from multicollinearity, but it was quite expected as the terms share variables.

Table 5

Test for multicollinearity: Correlation Matrix

Correlation Matrix from 2000 through 2018.						
Correlation	EBIT	LNTA	LNGP	EBITTA	GPTA	EPS
EBIT	1					
LNTA	-0,3421	1				
LNGP	-0,2926	-0,6313	1			
EBITTA	-0,3781	0,1169	0,0679	1		
GPTA	0,0329	0,6169	-0,5418	-0,1775	1	
EPS	-0,1637	-0,0158	0,0406	-0,0667	0,0177	1

A correlation matrix is created for the financial variables in order to get a more detailed picture of the relationships between the variables. As seen in *table 5,* all intervariable correlations are below the rule of thumb value of 0,8, indicating that multicollinearity is not an issue. The intervariable correlation points in the same direction as the VIF values.

4.2 Result and Analysis

With the awareness of the descriptive statistics of the data, it is possible to proceed to the regression analysis. The regression performance of the full period, pre-financial crisis period and the post-financial crisis period are presented below.

Table 6

Regression results

This table shows the regression results of the full period, pre-financial- and post-financial crisis period. The coefficients, significance level (indicated by asterisks) and the robust standard errors (SE) are presented for each variable. The table also contains information about the number of observations and explanatory power related to each model. M indicates missing, which is due to multicollinearity.

	Regression Result Based on 2000-2018		Regression Result Based on 2000-2006		Regression Result Based on 2009-2018	
Variable	Coefficient	Robust SE	Coefficient	Robust SE	Coefficient	Robust SE
Constant	-10.69*	6.527	-1.273	13,1061	-22.07***	6,2748
EBIT	0.0320***	0.00721	0.0407***	0,0183	0.0203***	(0.00426)
LNTA	-1.228	1.054	-2.013	2,0486	-0.922	(0.945)
LNGP	5.645***	1.469	5.075**	2,3541	6.204***	(1.514)
EBITTA	4.932**	2.201	9.029**	4,3894	1.607	(2.792)
GPTA	-0.148	1.019	-2.532	1,7218	0.285	(0.501)
EPS	-0.0113	0.0505	M	M	0.0669	(0.0466)
Technology	15.55***	3.053	16.30***	6,1554	10.92***	(3.510)
VC-Backed (VCB)	17.18***	7.251	8.204	6,9046	19.57***	(4.966)
Tech*VCB	-10.75*	8.113	-18.26*	9,994	-4.102	(6.834)
Communications	14.78***	3.245	14.30**	6,578	12.36*	(7.068)
Com.*VCB	-12.76*	8.321	1.007	14,6707	-11.71	(9.139)
Con. Non-cyclical	7.996***	2.343	2.146	3,2084	12.56***	(2.622)
Con. Non-cyc*VCB	-14.37***	7.615	-6.107	8,0785	-18.36***	(5.825)
Industrial	3.802	3.007	1.211	4,6533	3.831*	(2.256)
Industrial*VCB	11.60	12.90	6.349	10,0674	20.66	(16.40)
Energy	0.990	2.976	-0.583	3,8382	0.0171	(2.112)
Energy*VCB	-2.231	12.32	-15.14**	7,2553	1.516	(7.696)
Utilities	1.695	7.251	-0.560	6,2755	5.725	(5.019)
Utilities*VCB	-1.856	20.69	M	M	M	M
Con. Cyclical	10.94***	2.667	9.024***	3,2284	11.93***	(2.533)
Con Cyclical*VCB	-11.69	11.36	-17.25*	9,3166	-2.482	(20.21)
Basic Materials	2.826	4.424	3.161	3,6765	-0.201	(2.341)
Basic Mat.*VCB	-15.94***	16.85	M	M	-10.93*	(5.623)
Diversified	-3.388	25.50	-11.75	8,8756	-0.428	(2.370)
Diversified*VCB	-11.85	37.64	M	M	M	M
D.Country	-4.695***	2.884	-5.988*	3,3899	-3.374	(2.155)
Number of Obs.	1585		631		820	
R-Squared	0,1931		0,2059		0,1861	
R-Squared -Adj.	0,1695		0,1662		0,1519	
Period FE	Yes		Yes		Yes	

***1% **5% *10%

The explanatory power of the full period model is 17% indicating significantly explanatory power of the model, although there is much left to explain. The explanatory power of the model is quite similar in all periods, slightly lower at 15,2% in the post-financial crisis period. The financial regressors also have quite similar significance level in all three periods. EBIT, GP and EBITTA (not significant 2009-2018) have significantly explanatory power in almost all the periods, in the full period 1%, 1% and 5% respectively. In contrast, TA, GPTA and EPS are insignificant in all periods. In particular, one would have expected TA to be more significant as it is a proxy for the size of the company. Beatty and Ritter (1985) discuss how the ex-ante uncertainty decides the first day MAR, higher total assets should reduce the ex-ante uncertainty. EBIT and GP are apparently better size proxies of the perceived ex-ante risk. The one-day MAR of Canadian IPOs is significantly lower at 1% level in the full period. This could partly be related to the legal rules in the United States, where underpricing is a tool to avoid legal costs related to a lawsuit and the entailed reputational loss (Tinic, 1988)

To be able to draw conclusions about the change in the marginal effect as the interaction terms are added, one has to run an additional regression without the interaction terms. It is not possible to interpret the parameter related to each interaction term in isolation, but it is clear that high-risk industries tend to imply a higher significance level i.e. there is a higher interaction effect between high-risk industries and VC-backing than low-risk industries and VC-backing. This is in line with Hellmann & Puri (1999) that found VC-backing to be more common among innovative companies. The technology industry and the communications industry were significant at 10%. Consumer non-cyclical and basic materials were significant at 1%. The significance of basic materials could initially be a little bit unexpected, but as seen in *table 10* in the appendix the result is based on only three observations. One could also notice that fewer parameters are significant in the shorter periods which could be partly attributed to multicollinearity (Brooks, 2014). The main reason is probably too little within variation due to too fewer observations. Binary variables are normally having less within variation than continuous variables.

Table 7

The marginal effect of being VC-backed in each industry

Table 7 shows the marginal effect of being VC-backed in different industries, and therefore requires input data from *table 6* (includes interaction terms) and *table 12* (doesn't include interaction terms) in the appendix. The result of the VC-backing variable is also presented. The combined marginal effect is seen in column 5 and column 6, with respect to industry and VC-backing respectively. The information at the bottom of the table is based on the regression without interaction. Note, the interaction term related to basic materials is not reliable, as the term is based on three observations.

Industry	(1) Dummy without Interactions.	(2) Dummy with Interactions.	(3) Interaction Term Parameter	(4) = (2 + 3) Sum Interaction model Parameters	(5) = (4 - 1) Diff. Between Models (Industry)	(6) Diff. Between Models (VCB)
Tech.	15,33***	15,55***	-10,75*	4,8	-10,53	0,652
Com.	13,67***	14,78***	-12,76*	2,02	-11,65	-1,358
Con. non-cyc.	6,404***	6,404***	-14,37***	-7,966	-14,37	-2,968
Industrial	4,495*	3,802	11,6	15,402	10,907	23,002
Energy	0,929	0,99	-2,231	-1,241	-2,17	9,171
Utilities	2,272	1,695	-1,856	-0,161	-2,433	9,546
Con. Cyc.	10,4***	10,4***	-11,69	-1,29	-11,69	-0,288
Basic Mat.	2,018	2,826	-15,94***	-13,114	-15,132	-4,538
Diversified	-4,28	3,388	-11,85	-8,462	-4,182	-0,448
VC-Backed	5,778***	17,18***				
Number of Obs.	1585					
R-Squared	0,1878					
R-Squared - Adj.	0,1689					
Period FE	Yes					
Country FE	Yes					

The result of all the variables in the regression without interaction terms is presented in *table 12* in the appendix. In *table 7* above, the industry dummy without interaction (column 1) and the industry dummy with interaction (column 2) as well as the value of the interaction term (column 3) are presented. You can draw the conclusion that high-risk industries can explain the first day MAR better than low-risk industries from column 1. The technology industry, communications industry, consumer non-cyclical and consumer cyclical (not considered risky) are all significant at 1%. Industrial is significant at the 10% level. The significance level is in relation to the financial industry. The significance level of the industry dummies is compatible with the significance level of the interaction terms in *table 6*.

To get the difference in the marginal effect between the models, one has to compare the marginal effect in the model without interaction terms to the model with interaction terms. The result is found in column 5, where you observe the marginal change in one day MAR with respect to industry given that the IPO is VC-backed. The value is calculated by taking column 4 and subtract column 1. Column 4 is the addition of column 2 and 3 because that is the marginal effect in the model with interaction terms. The result indicates a decreased underpricing within all of the industries as the interaction terms are included and given that the company is VC-backed. The highest decrease in underpricing is found in the consumer non-cyclical industry and is -14,37 percentage units. A negative contribution to MAR, conditional on VC-backing, is also expected based on the majority of the previous studies.

The VC-backing coefficient, in the model without interaction terms, is significant at 1% and equal to 5,778, which is the average effect of VC-backing considering all industries. The VC-backing effect of 17,18, in the model including interaction terms, is the effect of the financial industry (reference industry). To get the difference in the marginal effect between the models, one has to compare the marginal effect in the model without interaction terms to the model with interaction terms in each industry. This is done by adding the interaction term parameter to 17,18 and deduct 5,778. The result is found in column 6. Controlling for the interaction term has different effects on underpricing. The highest decrease is -2,968 (note, the basic material industry is based on too few observations) and is found in the consumer non-cyclical industry. Controlling for interaction terms is decreasing the underpricing more in risky industries comparing to non-risky industries. Peggy and Wahl (2003) found a larger first day return among VC-backed companies and speculated whether it could be attributed to grandstanding. Grandstanding is more common for smaller companies, in this thesis a lower boundary of 50 million dollars is used. The effect of grandstanding should hence be significantly reduced. Most researchers including Jain and Kini (1995), Barry et. al (1990) and Megginson and Weiss (1991) find a reduced first day return. T*able 8a* in the appendix shows that a majority of all IPOs take place in risky industries with a corresponding higher underpricing. IPOs in risky industries are also more frequently VC-backed, which could be the underlying reason for the positive coefficient related to the effect of VC-backing on the first day MAR.

It is hard to argue that the EMH is valid when it comes to the pricing of IPOs, due to the systematic underpricing in the market. One of the reasons may be that there are not enough incentives to reveal one’s knowledge of the market. Benveniste and Spindt (1989) discuss how the book building process is trying to create incentives for institutional investors to reveal their knowledge by rewarding a higher offered price with higher allocation. The underpricing, however, indicates that the institutional investors are too conservative in their price offerings. The institutional investors don’t know the true value because then the IPO would have been less underpriced. Underwriters could also underprice too much in order to avoid under subscription, after all, the price offerings from institutional investors are not binding. Many of the theories trying to deal with the underpricing of IPOs take a starting point in the intrinsic uncertainty of IPO companies. IPO companies are often operating in risky industries, have innovative business strategies and little available historical data e.g. regarding price evolvement. These characteristics will likely increase the asymmetric information, and thereby raise the importance of such theories. Rock (1986) introduced the Winner’s curse theory, in which underpricing is necessary to keep uninformed investors in the market. Beatty and Ritter (1985) also notice that underwriters got to underprice to be requested among investors, but too high underpricing results in a loss of issuers.

The issuers have the greatest incentives to keep up the price because underpricing directly affect their private wealth negatively. Ritter (2011) identifies the market power of the underwrites in their oligopoly position. If a company wants to go public by conducting an IPO, there are a limited number of high reputational underwriters in a given industry. Additionally, selection of a less experienced underwriter may result in even more underpricing, due to the positive signalling effect created by a high reputational underwriter. The issuers are likely aware of the historical underpricing and are hence expecting it from the moment they decide to go public. This is supported by Brennan and Franks (1997) who found that pre-IPO owners tend to sell to a higher extent in the post-IPO period, even though there is commonly a lock-up period. If they wouldn’t expect underpricing those shares could have been part of the IPO.

Loughran and Ritter (2002) believe that issuers care more about their change in wealth and therefore fails to put enough pressure on the underwriter. Issuers are too little involved in the pricing process and may don’t even have the negotiation position to reduce the underpricing. Given the assumption of risk averseness, the marginal effect of reducing the underpricing may not be significant in comparison to the bulk of income they receive. Furthermore, to be able to diversify one’s wealth and create future liquidity may also increase the perceived utility among the investors, which could outweigh the cost of underpricing. Another exit strategy such as being acquired is not always optional and is coming with a high fee to the underwriter. Given rational owners, the cost of underpricing probably affect the number of companies going public on the margin, which could arguably be detrimental to a capital market. But the question is whether it is possible to create a more efficient IPO market.

In line with Pagano et al. (1998), it is reasonable that the issuers try to conduct the IPO at a time where the company can be considered to be overvalued, or perform temporary better than expected. More IPOs are also taking place in “hot” market periods, indicating companies are trying to utilize exuberant investors to raise more capital (Ljungqvist et al, 2004). In fact, there are also some theories suggesting that the issuer have incentives to underprice, disregarding what the true market value is at the time. Both Zutter and Smart (2003) and Stoughton and Zechner (1998) argue that underpricing is an instrument to be able to discriminate in the allocation process. Zutter and Smart (2003) propose that discrimination should take place against potential large blockholders to preserve control and avoid monitoring. In contrast Stoughton and Zechner (1998) consider large blockholders to be beneficial as they have resources, knowledge and incentives to analyse and give advice. Stoughton and Zechner (1998) conclusion may be more accurate for an innovative IPO company, as large blockholders are able to contribute more in such an environment.

The outcome of IPOs can favourably be analysed by “game theory”, assuming rational agents. It seems like all agents have incentives to underprice, some more than others, and one would therefore not be surprised by the outcome. The underwriter, institutional investors, uninformed investors and low-quality issuers have incentives to underprice. The underwriters get a larger market, institutional investors get underpricing, the uninformed investors are able to participate and low-quality companies are able to go public. The high-quality issuers may not have an influence on the market conditions and consequently have to accept the underpricing, even though they would benefit from a market without low-quality issuers and uninformed investors.

5.0 Conclusion

A majority of the underpricing seems to emerge as all agents are trying to optimize their own outcome under the asymmetric information. How to behave in order to optimize one's behaviour is likely influenced by control considerations, the institutional structure, market regulations and behavioural biases. A significantly lower first day MAR was found in the Canadian market in the full period. The financial characteristics of the IPO company have a significant effect on the first day MAR. However, investors pay more attention to some financial variables and multiples than others. EBIT, GP (not a financial variable though) and EBITTA had a significant impact on the underpricing of IPOs in the full, pre-IPO and post-IPO period. The only exception was EBITA which was insignificant in the post-IPO period. TA, GPTA and EPS were insignificant in all periods.

The industry-specific risk had a significant explanatory power of the first day MAR. The riskiest industries are the technology industry, communications industry, consumer non-cyclical industry and consumer cyclical industry. These industries are also most frequently VC-backed, which indicates that it is easier to decrease the asymmetric information as well as contributing to the performance in these industries. The marginal effect on underpricing with respect to a given industry, decreased when the interaction terms were included. The highest decrease was in the consumer non-cyclical industry and was 14,37 percentage units. The interaction terms had, in general, significance problems especially in the pre- and post-financial crisis periods, which is probably mainly due to too little within variation in the dummy variables. The significant interaction terms in the 2000-2018 period were technology*VCB and communications*VCB at 10%. Consumer non-cyclical*VCB and basic materials*VCB at 1%, but basic materials*VCB is disregarded due to that the result is based on three observations. The negative contribution of the interaction terms, with respect to industry, is unambiguous. The average marginal effect of VC-backing increased the underpricing by 5,778 percentage units and was significant at the 1% level. The increased underpricing is likely due to that VC-backing is an endogenous decision, making VC-backing more prevalent in high-risk industries. Adding interaction terms and having the financial industry as reference decreased the underpricing more in risky industries comparing to non-risky industries.

5.1 Further research

It would have been interesting to examine whether the IPO performance would have been worse if one instead looked at the long-term performance, as it is commonly found in previous studies. One could look at different geographical areas and time periods, as well as having another set of financial variables. The impact of having institutional investors on the underpricing would also be an interesting topic.

Literature

ARTICLES

Ang, J. & Boyer, C. (2009). Performance differences between IPOs in new industries and IPOs in established industries. Managerial Finance, Vol. 35, No. 7, pp. 606-623. Available Online: https://www.researchgate.net/publication/247622212_Performance_differences_between_IPOs_in_new_industries_and_IPOs_in_established_industries

Baker, M. & Wurgler, J. (2002). Market Timing and Capital Structure. The Journal of Finance, Vol. 57, No. 1, pp. 1-32. Available Online: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1972125

Barry, C., Muscarella, C., Peavy, J. & Vetsuypens, M. The Role of Venture Capital in the Creation of Public Companies. Journal of Financial Economics, Vol. 27, No. 2, pp. 447-471. *Available Online:* https://www.researchgate.net/publication/4784652_The_Role_of_Venture_Capital_in_the_Creation_of_Public_Companies

Beatty, R. & Ritter, J. (1986). INVESTMENT BANKING, REPUTATION, AND THE UNDERPRICING OF INITIAL PUBLIC OFFERINGS. Journal of Financial Economics, Vol. 15, pp. 213-232. Available Online: http://student.bus.olemiss.edu/files/fuller/ipo/beattyritter.pdf

Benveniste, L. & Spindt, P. (1989). How investment bankers determine the offer price and allocation of new issues. Journal of Financial Economics, vol. 24, Issue. 2, pp. 343-361. Available Online: https://econpapers.repec.org/article/eeejfinec/v_3a24_3ay_3a1989_3ai_3a2_3ap_3a343-361.htm

Brau, J. & Fawcett, S. (2006). Initial public offerings: An analysis of theory and practice. The Journal of Finance, Vol. 56, No. 1, pp. 399-436. Available Online: https://www.researchgate.net/publication/299186505_Initial_public_offerings_An_analysis_of_theory_and_practice

Brennan, M. & Franks, J. (1997). Underpricing, ownership and control in initial public offerings of equity securities in the UK. Journal of Financial Economics, Vol. 45, Issue. 3, pp. 391-413. Available Online: https://econpapers.repec.org/article/eeejfinec/v_3a45_3ay_3a1997_3ai_3a3_3ap_3a391-413.htm

Ellis,K., Michaely, R. & O'Hara. M. (2000). When the Underwriter Is the Market Maker, An Examination of Trading in the IPO Aftermarket. The Journal of Finance, Vol. 45, No. 3, pp.1039-1074. Available Online: http://pages.stern.nyu.edu/~eofek/InvBank/papers/UWMarketmaker_JF.pdf

Fama, E. (1970). Efficient Capital Markets: A Review of Theory and Empirical Work. The Journal of Finance, Vol. 25, No. 2, pp. 383-417. Available Online: https://www.jstor.org/stable/2325486?seq=1#metadata_info_tab_contents

Grinblatt,M. & Hwang,C-H. (1989). Signalling and the Pricing of New Issues. The *Journal of Finance, Vol.44, No. 2, pp. 393-420.* Available Online:
https://www.jstor.org/stable/2328596?seq=1#metadata_info_tab_contents

Grossman, S. (1976). On the Efficiency of Competitive Stock Markets Where Trades Have Diverse Information. Vol. 31, No. 2, pp. 573-585. Available Online:
https://www.jstor.org/stable/2326627?seq=1#metadata_info_tab_contents

Gupta, K. (2012). Determinants of Underpricing of Indian Initial Public offering (IPOs) and Attitude of Investor, PhD Thesis, Globe Business College, Germany, Community pp. 40-98. Available Online:
https://shodhganga.inflibnet.ac.in/handle/10603/175863?mode=full

Hellmann, T. & Puri, M. (1999). The Interaction between Product Market and Financing Strategy: The Role of Venture Capital. Stanford University. Available Online:
https://papers.ssrn.com/sol3/papers.cfm?abstract_id=173655

Ibbotson, R. & Jaffe, J. (1975). "Hot Issue" Markets. Vol. 30, Issue. 4, pp. 1027-42. Available Online:
https://econpapers.repec.org/article/blajfinan/v_3a30_3ay_3a1975_3ai_3a4_3ap_3a1027-42.htm

Jain. B. & Kini, O. (1995). Venture capitalist participation and the post-issue operating performance of IPO firms. Managerial and Decision Economics, Vol. 16, pp. 593-606. Available Online:
https://www.researchgate.net/publication/228023508_Venture_capitalist_participation_and_the_post-issue_operating_performance_of_IPO_firms

Kiymaz, H. (2000). The initial and aftermarket performance of IPOs in an emerging market: evidence from Istanbul stock exchange. Journal of Multinational Financial Management, Vol. 10, Issue. 2, pp. 213-227. Available Online:
https://econpapers.repec.org/article/eeemulfin/v_3a10_3ay_3a2000_3ai_3a2_3ap_3a213-227.htm

Li, L. & Hovey, M. (2009). Corporate Governance, IPO Underpricing and Long-Term Performance of listed firms in China. 22nd Australasian Finance and Banking Conference 2009, Available Online:
https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1466636

Ljungqvist, A. (2007). IPO Underpricing: A Survey. Part of: Handbook in Corporate Finance: Empirical Corporate Finance. Available Online:
https://papers.ssrn.com/sol3/papers.cfm?abstract_id=609422

Ljungqvist, A., Nanda, V. & Singh, R. (2006). Hot Markets, Investor Sentiment, and IPO Pricing. The Journal of Business, Vol. 79, Issue. 4, pp. 1667-1702. Available Online:
https://econpapers.repec.org/article/ucpjnlbus/v_3a79_3ay_3a2006_3ai_3a4_3ap_3a1667-1702.htm

Logue, D. (1973). On the Pricing of Unseasoned Equity Issues: 1965–1969. Vol. 8, Issue. 1, pp. 91-103, Available Online:
https://econpapers.repec.org/article/cupjfinqa/v_3a8_3ay_3a1973_3ai_3a01_3ap_3a91-103_5f01.htm

Loughran, T. & Ritter, J. (2002). Why Has IPO Underpricing Increased Over Time?. Available Online:
http://www.econ.yale.edu/~shiller/behfin/2002-04-11/loughran-ritter.pdf

Loughran, T., Ritter, J. & Rydqvist, K. (1994). Initial public offerings: International insights. Pacific-Basin Finance Journal, Vol. 2, Issue. 2-3, pp. 165-199. Available Online: https://econpapers.repec.org/article/eeepacfin/v_3a2_3ay_3a1994_3ai_3a2-3_3ap_3a165-199.htm

Lowry, M., Michaely, R. & Volkova, E. (2017). Initial Public Offerings: A synthesis of the literature and directions for future research. Available Online: http://leeds-faculty.colorado.edu/bhagat/lowry-michaely-ipos.pdf

Malkiel, B. (2003). The Efficient Market Hypothesis and Its Critics. Journal of Economic Perspectives, Volume. 17, No. 1, pp. 59– 82. Available Online: https://eml.berkeley.edu/~craine/EconH195/Fall_14/webpage/Malkiel_Efficient%20Mkts.pdf

Megginson, W. & Weiss, K. (1991). Venture Capitalist Certification in Initial Public Offerings. Journal of Finance, Vol. 46, Issue. 3, pp. *879-903. Available Online:* https://econpapers.repec.org/article/blajfinan/v_3a46_3ay_3a1991_3ai_3a3_3ap_3a879-903.htm

Modigliani, F. & Millier, M. (1958). The Cost of Capital, Corporation Finance and the Theory of Investment. The American Economic Review, Vol. 48, No. 3, pp. 261-297. Available Online: https://www.jstor.org/stable/1809766?seq=1#metadata_info_tab_contents

Omran, M. (2005). Underpricing and Long-run Performance of Share Issue Privatizations in the Egyptian Stock Marke. Journal of Financial Research, Vol. 33, No2, pp. 215-234. Available Online: https://www.researchgate.net/publication/227652859_Underpricing_and_Long-run_Performance_of_Share_Issue_Privatizations_in_the_Egyptian_Stock_Market

Padgett, C. & Chi, J. (2005). The Performance and Long-Run Characteristics of the Chinese IPO Market. Pacific Economic Review, Vol. 10, No. 4, pp. 451-469. Available Online: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=871270

Pagano, M., Panetta, F. & Zingales, L. Why Do Companies Go Public? An Empirical Analysis. The Journal of Finance, Vol. 53, No.1, pp. 27-64. Available Online: http://www.csef.it/pagano/jf-1998.pdf

Paudyal, K., Saadouni, B. & Briston, R.J. (1998). Privatisation initial public offerings in Malaysia: Initial premium and long-term performance. Pacific-Basin Finance Journal, Vol.6, Issue. 5, pp. 427-451. Available Online: https://www.sciencedirect.com/science/article/pii/S0927538X98000183

Peggy, M. & Wahal, L-S. (2004). Grandstanding, Certification and the Underpricing of Venture-

Backed Ipos. Journal of Financial Economics 73, pp. 375–407. Available Online: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=318360

Purnanandam, A. & Swaminathan, B. (2004). Are IPOs Really Underpriced?. The Review of Financial Studies, Vol. 17, No. 3, pp. 811-848. Available Online: https://www.jstor.org/stable/3598013?seq=1#metadata_info_tab_contents

Ritter, J. (2011). Equilibrium in the IPO Market, Annual Review of Financial Economics, Vol. 3, Issue. 1, pp. 347-374, Available Online: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1822542

Rock, K. (1986). WHY NEW ISSUES ARE UNDERPRICED. Journal of Financial Economics, Vol. 15, pp. 187-212. Available Online: https://www2.bc.edu/thomas-chemmanur/phdfincorp/MF891%20papers/rock%201986.pdf

Ruud, J. (1993). Underwriter price support and the IPO underpricing puzzle. Journal of Financial Economics. Vol. 34, Issue. 2, pp. 135-151, Available Online: https://econpapers.repec.org/article/eeejfinec/v_3a34_3ay_3a1993_3ai_3a2_3ap_3a135-151.htm

Sahlman, W. (1990). The structure and governance of venture capital organizations. *Journal of Financial Economics, Vol. 27, Issue. 2, pp.* 473-521. Available Online: https://econpapers.repec.org/article/eeejfinec/v_3a27_3ay_3a1990_3ai_3a2_3ap_3a473-521.htm

Smart, S. & Zutter, C. (2003). Control as a motivation for underpricing: a comparison of dual and single-class IPOs. Journal of Financial Economics, Vol. 69, Issue 1, pp. 85-110. Available Online: https://www.sciencedirect.com/science/article/pii/S0304405X03001090

Stoughton, N. & Zechner, J. (1998). IPO-mechanisms, monitoring and ownership structure. Journal of Financial Economics, Vol. 49, Issue. 1, pp. 45-77. Available Online: https://econpapers.repec.org/article/eeejfinec/v_3a49_3ay_3a1998_3ai_3a1_3ap_3a45-77.htm

Tinic, S. (1988). The Anatomy of Initial Public Offerings of Common Stock. The Journal of Finance, Vol. 43, No. 4, pp. 789-822. Available Online: https://www.researchgate.net/publication/4992184_The_Anatomy_of_Initial_Public_Offerings_of_Common_Stock

Internet sources

Torój, A. Lecture 4: Heteroskedasticity. Warsaw School of Economics
Available Online: http://web.sgh.waw.pl/~atoroj/econometric_methods/lecture_4_het.pdf

Schwert, W. (2015). APS 425 - Advanced Managerial Data Analysis: Heteroskedasticity. Available Online: http://schwert.ssb.rochester.edu/a425/a425_het.pdf

Williams, R. (2015). Heteroskedasticity. The University of Notre Dame. Available Online: https://www3.nd.edu/~rwilliam/stats2/l25.pdf

McCarthy, B. (2018). IPOs are too expensive and cumbersome. Financial Times. Available Online: https://www.ft.com/content/60cd1bb8-9970-11e8-88de-49c908b1f264

Enache, S., Govindarajan, V., Rajgopal, S. & Srivastava, A. (2018). Why We Shouldn't Worry About the Declining Number of Public Companies. Harvard Business Review. Available Online: https://hbr.org/2018/08/why-we-shouldnt-worry-about-the-declining-number-of-public-companies

Books

Brooks, C. (2014). Introductory Econometrics for Finance, 3.uppl., Cambridge: Cambridge University Press

Angrist, J. & Pischke, J-S. (2008). Mostly Harmless Econometrics: An Empiricist's Companion, Princeton University Press

DATABASE

Bloomberg Terminal

APPENDIX

Table 8a

Number of IPOs based on industry between 2000-2018

Year	Financial	Tech	Com.	Con. Non-cyc.	Industrial	Energy	Utilities	Con. Cyc.	Basic Mat.	Funds	Diversified	Sum
2000	8	43	50	51	11	11	5	3	1	0	0	183
2001	13	9	3	26	3	7	1	4	0	0	0	66
2002	60	7	1	12	5	2	0	13	1	8	0	109
2003	76	8	5	12	6	1	0	8	2	2	0	120
2004	110	14	8	43	10	6	1	17	4	1	0	214
2005	80	11	12	25	12	14	2	14	5	9	0	184
2006	43	21	11	25	11	14	0	18	4	2	1	150
2007	63	23	20	33	12	11	3	9	6	1	0	181
2008	9	2	0	5	3	1	2	2	3	0	0	27
2009	21	3	7	10	5	4	1	5	1	0	0	57
2010	43	14	8	17	5	8	1	11	9	4	0	120
2011	38	8	13	14	2	14	0	6	1	0	0	96
2012	44	16	10	19	4	10	0	10	1	1	1	116
2013	52	11	18	45	5	7	0	17	2	2	0	159
2014	37	15	11	72	8	10	0	17	2	0	0	172
2015	23	5	5	56	5	1	1	11	2	2	1	112
2016	19	7	2	23	5	5	0	6	1	0	0	68
2017	34	9	2	34	4	10	0	8	4	0	0	105
2018	17	9	4	63	7	4	1	6	1	0	0	112
Sum	790	235	190	585	123	140	18	185	50	32	3	2351
Risky	Ref.	Yes	Yes	Yes	No	No	No	No	No	No	No	

Table 8b

Subcategory classifications to the used industries

Industry	***Subcategories***
Financial	Savings and Loans, Financial Services, Insurance, Close-end Funds, REITs, Banks and Investment Companies
Tech.	Computers, Software, Insurance and Semiconductors
Com.	Telecommunications, Internet, Media Electrical Components and Equipment and Advertising
Con. Non-Cyc.	Biotechnology, Healthcare Products, Pharmaceuticals and Commercial Services
Industrial	Electronics, Electrical Compo&Equip, Machinery-Constr&Mining, Transportation, Aerospace/Defense, Packaging&Containers and Metal Fabricate/Hardware
Energy	Oil&Gas, Oil&Gas Services, Energy-Alternate Sources, Coal, Pipelines
Utilities	Electric, Water and Gas
Con. Cyc.	Auto Parts&Equipment, Retail, Entertainment, Apparel, Distribution/Wholesale, Home Builders and Furnishings, Lodging and Leisure Time
Basic Mat.	Mining, Chemicals, Iron/Steel andForest Products&Paper
Funds	Debt Fund, Equity Fund, Commodity Fund and Asset Allocation Fund
Diversified	Holding Companies-Divers

Table 9

IPO characteristics for each year

Year	Num. of IPOS	Num. of IPOs Canada	Num. of IPOs US	Num. of VCB per Year	VCB Ratio
2000	183	3	180	11	0,060
2001	66	3	63	0	0,000
2002	109	4	105	6	0,055
2003	120	5	115	8	0,067
2004	214	11	203	19	0,089
2005	184	15	169	10	0,054
2006	150	11	139	20	0,133
2007	181	14	167	28	0,155
2008	27	5	22	5	0,185
2009	57	5	52	4	0,070
2010	120	16	104	23	0,192
2011	96	9	87	26	0,271
2012	116	5	111	40	0,345
2013	159	6	153	57	0,358
2014	172	7	165	74	0,430
2015	112	12	100	47	0,420
2016	68	3	65	23	0,338
2017	105	12	93	24	0,229
2018	112	6	106	45	0,402
Sum	2351	152	2199	470	0,200

Table 10

Number of interaction terms for each industry and year

Year	Financial	Tech	Com.	Con. Non-cyc.	Industrial	Energy	Utilities	Con. Cyc.	Basic Mat.	Funds	Diversified	Sum
2000	0	3	4	4	0	0	0	0	0	0	0	11
2001	0	0	0	0	0	0	0	0	0	0	0	0
2002	0	2	1	1	1	0	0	1	0	0	0	6
2003	3	4	1	0	0	0	0	0	0	0	0	8
2004	1	4	4	10	0	0	0	0	0	0	0	19
2005	0	3	4	0	1	0	0	2	0	0	0	10
2006	2	8	2	6	0	1	0	0	0	0	1	20
2007	0	9	9	7	0	0	2	0	1	0	0	28
2008	0	1	0	3	0	0	0	1	0	0	0	5
2009	0	2	2	0	0	0	0	0	0	0	0	4
2010	1	8	6	4	0	1	0	2	1	0	0	23
2011	1	7	9	7	0	1	0	1	0	0	0	26
2012	1	14	10	11	1	2	0	1	0	0	0	40
2013	3	6	11	33	1	1	0	1	1	0	0	57
2014	2	11	9	50	1	0	0	1	0	0	0	74
2015	0	4	4	37	1	1	0	0	0	0	0	47
2016	0	5	2	15	0	1	0	0	0	0	0	23
2017	2	6	0	16	0	0	0	0	0	0	0	24
2018	1	4	3	36	1	0	0	0	0	0	0	45
Sum	17	101	81	240	7	8	2	10	3	0	1	470

Table 11

Test for multicollinearity: VIF results of all variables in each model.

Variable	VIF 2000-2018	VIF 2000-2018 No Interaction	VIF 2000-2006	VIF 2009-2018
EBIT	1,92	1,91	2,28	1,62
LNTA	5,03	4,92	5,92	3,26
LNGP	3,29	3,26	3,58	2,56
EBITTA	1,56	1,55	1,63	1,59
GPTA	3,01	2,98	2,34	1,96
EPS	1,22	1,16	M	1,12
Tech.	2,61	1,93	2,43	3,62
VC-Backed VCB	24,57	1,54	19,64	20,97
Tech.*VCB	8,82	-	8,01	9,46
Com.	2,48	1,79	2,14	3,69
Com.*VCB	7,34	-	5,65	8,46
Con. Non-cyc.	2,92	2,61	2,65	3,27
Con. Non-cyc.*VCB	15,63	-	7,53	16,54
Industrial	1,45	1,37	1,5	1,42
Industrial*VCB	1,55	-	1,78	1,54
Energy	1,57	1,48	1,51	1,68
Energy*VCB	1,65	-	1,37	1,79
Utilities	1,3	1,14	1,21	1,16
Utilities*VCB	1,34	-	M	M
Con. Cyc.	1,63	1,54	1,66	1,65
Con Cyc.*VCB	1,8	-	2,13	1,6
Basic Mat.	1,34	2,24	1,23	1,36
Basic Mat.*VCB	1,33	-	M	1,34
Diversified	2,03	1,07	1,38	1,02
Diversified#VCB	2,21	-	M	M
D.Country	1,22	1,21	1,15	1,27
2000	2,72	2,7	2,18	
2001	1,52	1,51	1,4	
2002	1,52	1,51	1,37	
2003	1,54	1,54	1,38	
2004	2,31	2,3	1,8	
2005	2,22	2,2	1,75	
2006	2,2	2,19	Reference	
2007	2,21	2,18		
2008	1,26	1,25		
2009	1,47	1,46		1,27
2010	2,01	1,99		1,26
2011	1,76	1,74		1,46
2012	1,96	1,92		1,37
2013	2,17	2,16		1,47
2014	2,43	2,43		1,5
2015	2,36	2,35		1,57
2016	1,57	1,57		2,32
2017	1,86	1,85		1,25
2018	Reference	Reference		Reference
Average	3,05	1,92	3,09	3,27

Table 12

Regression Result based on 2000-2018: No Interaction terms

	Coefficient	Robust SE	P-Value
Constant	-10.52*	6.079	0,0836
EBIT	-0.0326***	0.00604	0,0000
LNTA	-1.014	0.904	0,2618
LNGP	5.436***	1.281	0
EBITTA	5.153**	2.209	0,0198
GPTA	-0.0987	1.016	0,9227
EPS	-0.0152	0.0405	0,7072
VC-Backed	5.778***	1.875	0,0021
Tech.	15.33***	2.642	0
Com.	13.67***	3.024	0
Con. Non-cyc.	6.404***	1.750	0,0003
Industrial	4.495*	2.350	0,0559
Energy	0.929	1.869	0,6193
Utilities	2.272	3.693	0,5485
Con. Cyc.	10.40***	1.920	0
Basic Mat.	2.018	2.036	0,3219
Diversified	-4.280	3.818	0,2625
DCountry	-4.628***	1.616	0,0042
Number of Obs.	1585		
R-Squared	0,1878		
R-Squared - Adj.	0,1689		
Period FE	Yes		