ERASMUS UNIVERSITY ROTTERDAM
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Bachelor Thesis Financial Economics

IPO underpricing and underperformance: The dependence of the venture capitalists' effect on the share class structure

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Abstract

In this thesis, I studied the effect of venture capitalists on IPO underpricing and underperformance and the difference in this effect between single-class and dual-class companies. For this study, data was used from IPOs in the US in the period 2012 to 2020. Multiple benchmarks and methodologies were used to calculate abnormal returns. To investigate the effect, t-tests, non-parametric tests and multiple linear regressions were performed. It was found that IPOs are significantly underpriced and that there is a significant positive effect of venture capitalists on underpricing. This positive effect is stronger in dual-class companies. The results of the underperformance of IPO companies are highly dependent on the benchmark and methodology used. However, no significant effect of venture capitalists on IPO underperformance has been found and this effect does not significantly differ between single-class and dual-class companies.

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1. Introduction

On March 21, 2024 19-year-old internet company Reddit made his debut on the New York Stock Exchange (NYSE), after a successful Initial Public Offering (IPO). With an IPO offer price of $34 and a first day closing price of $50.44, the stock had an initial return of 48 percent (Yahoo, 2024). Ritter (1991) found that US IPO companies between 1975 and 1984 underperformed non-IPO companies by 27.39 percentage points over a three-year time period after the IPO. Underpricing, or the percentage increase in stock price on the first day of trading, and underperformance, or the underperformance of a newly listed stock compared to a benchmark, are two broadly investigated phenomena in the literature on IPOs. For example, Espenlaub et al. (2000) found that firms in the UK, that went public between 1985 and 1992, substantially underperformed irrespective of the benchmark in the first three years after the IPO, but the results are less dramatic after five years. Ljungqvist (2007) found that US companies in the 1990s had an average of more than 20 percent first-day increase in stock prices after their IPO.

The most common explanation for IPO underpricing in the literature is the information asymmetry between issuers and investors. Because of the information asymmetry, investors spend more time finding the required data for investing in a company or do not even find all the required data, which results in a lower willingness to pay for a stock (Megginson and Weiss, 1991). Brav and Gompers (1997) argue that this is less of an issue when a firm is backed by a venture capitalist. Venture capitalists bring private portfolio companies to the public market on an ongoing basis, hence they have an incentive to establish a trustworthy reputation, and thus will be able to access the IPO market on more favorable terms. The effect of venture capitalists on IPO underpricing and underperformance was examined by Belghitar and Dixon (2012). To conduct the study, two samples were constructed with IPO data of companies in the UK that listed on the London Stock Exchange (LSE) between 1992 and 1996. One sample consisted of VC-backed companies and the other of non-VC-backed companies. They find that in both samples IPOs were significantly underpriced. However, they also find that VC-backed IPOs are less underpriced compared to non-VC-backed IPOs. They argue that venture capitalists' experience and capability in monitoring companies signal information to investors, hence reducing information asymmetry at the time of the IPO. Using the same samples, they find that both VC-backed and non-VC-backed IPOs significantly underperform a constructed size-matched portfolio. However, they find no evidence that VC-backed IPOs show less underperformance compared to non-VC-backed IPOs. This last finding is contradictory to Brav and Gompers' (1997) finding, who studied the underperformance of IPOs in the US from 1972 to 1992. They find that non-VC-backed IPOs significantly underperform VC-backed IPOs. However, they conclude that underperformance is not particular for IPOs as they find that it is more a characteristic of small, low book-to-market firms.

Another factor that explains IPO underpricing in some situations, is the desire of pre-IPO shareholders to retain control. Smart and Zutter (2003) investigated this effect by examining the difference in IPO underpricing between single-class and dual-class companies. For this study, they collected IPO data of issues from January 1990 to September 1998 in the US and distinguished single-class and dual-class companies. Controlling for other characteristics, they find that dual-class companies are underpriced 2.9 percentage points less than single-class companies, which is both a statistically and economically significant difference. Brennan and Frank (1997) argue that managers in single-class companies use underpricing as a mechanism to create a more dispersed ownership after the IPO in order to retain sufficient voting rights for themselves. In dual-class companies, managers have superior voting rights, hence they have no incentive to use underpricing in order to retain control. Often, venture capitalists stay on the board of directors after the IPO and retain voting rights as they want to stay involved in the decision making of the company (Brav & Gompers, 2012). Therefore, in contrast to existing literature on IPO underpricing and underperformance, this study examines whether there is a difference in the effect of venture capitalists on IPO underpricing and underperformance between single-class and dual-class companies. In contrast to Belghitar and Dixon's (2012) study on the effect of venture capitalists on IPO underpricing and underperformance, this study focuses on the IPO market in the US in the period 2012-2020. As it is expected that the VC-industry has modernized and changed over the years, and the fact that the VC-industry in the UK is known to be less risky compared to the industry in the US (Belghitar & Dixon, 2012), different results are expected. Thus, the second goal of this study is to show that the results of Belghitar and Dixon's (2012) study are not generalizable to a different context. Therefore, the research question that will be examined is as follows: How do venture capitalists influence underpricing and underperformance in the US IPO market in the 2012-2020 period, and how does this effect differ between single-class and dual-class companies?

Multiple linear regressions with time fixed effects are carried out to study the effect of venture capitalists on underpricing and underperformance of IPOs. In the first regression, the dependent variable is underpricing. Underpricing is measured as the initial market-adjusted return of a stock after the IPO. This is the difference between the initial return of the stock, or the difference between the stock price at the end of the first trading day and the offer price, and the return of a benchmark portfolio on that same day. In the second regression, the dependent variable is underperformance. Underperformance is measured as the 36-month market-adjusted performance of the stock. In both regressions, the main variable of interest is the dummy-variable that takes on the value 1 for VC-backed companies and 0 otherwise. An interaction term is included to measure the difference in the effect of venture capitalists on IPO underpricing and underperformance between single-class and dual-class companies. Variables are included to control for the size of the target, the industry of the IPO company, the age of the target,

market volatility and other target-, deal- and market-specific factors. The study is conducted using a sample of data of VC-backed and non-VC-backed IPOs in the US for the 2012-2020 period. The sample is constructed using data from the LSEG Workspace database and the total sample consists of 862 companies.

I hypothesize that VC-backed companies show less underpricing and underperformance compared to non-VC-backed companies, and that venture capitalists have more effect on underpricing and underperformance in dual-class companies compared to single-class companies. This should be visible in negative significant coefficients of venture capitalists and the interaction between venture capitalists and dual-class companies on underpricing and positive significant coefficients of venture capitalists and the interaction between venture capitalists and dual-class companies on underperformance. However, I expect that legislation and other country specific factors play a big role in the hypothesized effect. Therefore, it is questionable whether the result of this study is generalizable to other countries and time periods.

2. Theoretical framework

2.1 Venture capital

According to Wright and Robbie (1998), venture capital is typically defined as 'the investment by professional investors in long-term, unquoted, risk equity finance in new firms where the primary reward is an eventual capital gain, supplemented by dividend yield.' Venture capital investors are characterized by their investment focus on the somewhat longer term, namely several years. Furthermore, in addition to investing money in companies, venture capitalists can also use their management expertise to help companies perform better in the long-term, which benefits the venture capitalists' investment return. Within the venture capital industry, different types of venture capital funds can be observed, based on the type of companies in which they invest. For example, there are funds that invest only in early-stage or later-stage companies, and there are also funds that select companies based on industry or, for example, the impact they make on society.

A characteristic of small, young and innovative companies is that it is difficult for them to obtain financing, because there is a lot of uncertainty surrounding these companies and a lot of information is not available to investors. It is the venture capital industry that overcome these problems by investing in these companies and providing financing and knowledge to help the companies develop further (Gompers and Lerner, 2001). This also follows from the study by Kortum and Lerner (2000), who show that venture capitalists in the US have a significant positive effect on the number of patent applications. In addition, Hellman and Puri (2000) show in their study on companies in Silicon Valley that innovative companies have a significant higher chance of obtaining financing from venture capitalists than non-innovative companies.

Furthermore, Gorman and Sahlman (1989) conducted research into what exactly venture capitalists do to improve the performance of their portfolio companies. For their study, they sent 100 surveys to venture capitalists in the US in the first week of December 1984. Of the surveys sent, 49 were completed and returned. A finding of this study is a ranking of activities that venture capitalists themselves consider most important. It follows that the main task is to assist in obtaining additional financing for their portfolio companies, at number two is strategic planning, at number three is management recruitment, at number four is operational planning, at number five is helping with acquiring new customers and suppliers and finally at number six is helping with compensation issues.

To get an idea of the real effect of the activities that venture capitalists perform, Guo and Jiang (2013) conducted research into the effect of venture capitalists on the performance of companies in the manufacturing industry in China in the period 1998 to 2007. Research is conducted with a sample consisting of 258 VC-backed companies and a control sample matched on industry and region. Using ordinary least squares regression, controlling for various company specific factors and using time fixed

effects, the results show that return on sales, return on equity, sales growth, labor productivity and R&D investment are all significantly higher for VC-backed companies compared to non-VC-backed companies.

2.2 IPO underpricing

Underpricing is the phenomenon that companies, deciding to issue their shares on the public market through an IPO, set an offer price below the value of the shares. When shares are offered on the stock market at a price below their value, there will be strong demand for the shares, causing the share price to quickly go up until the price equals the value placed on the share by the market. As the share price quickly adjusts to the value of the share, it is mainly the price change shortly after the IPO that demonstrates the underpricing. Therefore, according to the academic definition given by Ljungqvist (2007), IPO underpricing is the percentage change in stock price of a company at the end of the first trading day relative to the offer price.

The topic of the underpricing of equity issues is a topic that has attracted the attention of researchers for many decades. By examining a sample of 53 new equity offerings that occurred in the years 1964-65, Reilly and Hatfield (1969) were among the first to identify underpricing of equity issues. A few years later it was Logue (1973) who conducted research into a sample consisting of 250 equity offers in the US in the period March 1965 to February 1969, focusing on factors that could possibly explain underpricing. Although it was not yet clear why underwriters leave money on the table by underpricing equity issues, this study can be viewed as starting point for research into the factors explaining underpricing. In another early study, Ibbitson (1975) investigates underpricing in a sample consisting of issued common stock by companies in the US in the period January 1960 to December 1969. He finds that the average initial return is 11.4 percent, meaning that common stock issues are underpriced. Just like Logue (1973), Ibbitson also tries to find an explanation for the fact that equity issues are subject to underpricing. Although he suggests that each scenario either involves unknown legal constraints, needlessly complicated indirect compensation schemes, or irrational behavior, no definitive explanation for the phenomenon is found and the ‘mystery’ remains unsolved.

In contrast to previous studies, Rock (1986) managed to create a model that can be used to explain underpricing. The model consists of two important components, namely information asymmetry and rationing. Rationing had previously been observed by Ibbitson and Jaffe (1975), who determined that the demand for underpriced issued shares can be five times greater than the supply, giving investors only the right to buy part of the shares they want. According to the model, rationing leads to underpricing due to a difference in the availability of information between investors. There are informed investors, who only show interest in underpriced equity offerings, and uninformed investors, who cannot distinguish underpriced and overpriced issues. Through rationing, uninformed investors in underpriced issues are

allocated only part of the shares, while uninformed investors in overpriced issues are allocated all the shares they asked for. This effect causes uninformed investors to adjust their valuation downwards for equity issues, making underpricing necessary to sell all shares.

Loughran and Ritter (2004) note that the degree of underpricing in the US has developed over time. They find that underpricing was 7 percent in the period 1980-1989, but increased to 15 percent in the period 1990-1998. In the period 1999-2000, underpricing was as much as 65 percent, after which it fell again to 12 percent in the period 2001-2003. This change could possibly be related to the changing composition of companies in the US over the years. This can be understood as the increase in the number of technological companies and companies with negative returns, whose shares are traded on the market. In addition, it is stated that over time the way in which companies are brought to the market has changed and that side payments have also influenced the incentives of managers, which makes managers more likely to accept a lower price for the issued shares.

2.3 Relationship between venture capital and IPO underpricing

Megginson and Weiss (1991) were among the first to conduct research into the effect of venture capital involvement on underpricing of IPOs. For their research, they used IPO data from the US in the period January 1983 to September 1987. First, it is found that VC-backed IPOs have on average a higher offering amount and also a higher offering price than non-VC-backed firms. Furthermore, there is a significant difference in the age of the IPO companies between both samples, the average age of the VC-backed sample is 8.6 years, while for the non-VC-backed sample it is 12.2 years. The researchers' hypothesis is that VC-backed IPOs show less underpricing compared to non-VC-backed IPOs, because venture capitalists eliminate information asymmetry, this is also known as the certification theory. The results show that the average underpricing of VC-backed IPOs is 7.1 percent, while for the non-VC-backed sample it is 11.9 percent, and this difference is also significant according to the t-test. In addition, an ordinary least squares regression was performed, with underpricing as the dependent variable, an independent dummy variable that indicates if there is involvement of a venture capitalist and some control variables, to control for factors such as the firm age and the offering amount. The regression results show that there is significantly less underpricing of VC-backed IPOs compared to non-VC-backed IPOs, which confirms the researchers' hypothesis.

Lee and Wahal (2004) also conducted research into the effect of venture capitalists on underpricing of IPOs. The total sample consists of 6413 IPOs that took place in the US in the period 1980 to 2000. To measure the effect of venture capitalists on underpricing, ordinary least squares regression was used, with underpricing as the dependent variable and a dummy variable for VC investment in IPO companies. Also control variables for IPO specific factors, such as the size of the offering, firm-level

factors and characteristics of the VC investments were included. In contrast to the research by Megginson and Weiss (1991), this study shows that VC-backed IPOs are significantly more underpriced than non-VC-backed IPOs, with the difference between 5 and 10.3 percentage points. It appears that this difference in the period 1999-2000 is 25 percentage points, while in the period 1980-1998 this difference is only 2 percentage points. As an explanation for the fact that VC-backed IPOs are subject to more underpricing, reference is made to the grandstanding behavior hypothesis (Gompers, 1996). According to this theory, venture capitalists consciously opt for underpricing, because it is important for venture capitalists to demonstrate that they can successfully bring companies to the market in order to continue to attract capital in the future.

In this study, the effect of venture capitalists on IPO underpricing will be examined for IPOs during the period 2012 to 2020 in the US. This study will use a similar methodology to test the effect as was used in the study of Belghitar and Dixon (2012), where a negative effect of venture capitalists on underpricing was found. An important difference, however, is that the sample in that study consists of IPOs in the UK over the period 1992 to 1996. Based on the certification theory of Megginson and Weiss (1991) I expect that venture capitalists reduce information asymmetry, which will lead to less underpricing. I expect that this is especially the case in the US, since venture capitalists in the US invest more often in risky early-stage companies compared to venture capitalists in the UK (Belghitar and Dixon, 2012), which is why I expect that the certification theory will be particularly relevant in the US.

H1: *There is a negative effect of venture capital involvement on the underpricing of IPOs in the US in the period 2012 to 2020.*

2.4 IPO underperformance

A second phenomenon in the IPO literature is the underperformance of IPO stocks relative to a benchmark over a certain period after the date of the IPO. In contrast to the academic literature on IPO underpricing, the literature on underperformance has more variety in definitions used to investigate underperformance. First, the time frame over which IPO underperformance is measured varies in the academic literature. Second, there is a lot of variation in how the benchmark is determined to measure the relative underperformance. As there is no clear answer to the question of what the best way is to determine a benchmark, multiple benchmarks are used in various studies.

Ibbitson (1975) was the first to test if there are abnormal returns from IPO stocks over a longer period after the date of the IPO. For his research, he used US IPO data in the period January 1960 to December 1969, with one offering randomly selected in each month. Using a time horizon of 60 months after the IPO and an equally weighted arithmetic average of the returns on the New York Stock Exchange

(NYSE), it is concluded that there is no deviation from market efficiency in the aftermarket, which means that there is no underperformance of IPO stocks.

Years later and using a different sample, Ritter (1991) finds a different result. Ritter used a sample of 1526 IPOs in the US in the period 1975 to 1984 to investigate the underperformance of IPO companies. The study shows that the sample of IPO companies had an average abnormal return of 34.47 percent after three years. In this same period, the control sample, consisting of non-IPO companies, had an abnormal return of 61.86 percent. In addition, it also appears that young companies and companies going public in heavy volume years performed worse than other IPO companies.

Gompers and Lerner (2003) studied long-term IPO returns in the US over the period 1935 to 1972, using a sample of 3661 IPOs. Using the event-time approach with cumulative abnormal returns and the CRSP value-weighted market index and size- and book-to-market-matched benchmark portfolios, in accordance with the result of Ibbitson's (1975) study, the result is that it cannot be concluded that there is underperformance of IPO stocks. However, when using the event-time approach with buy-and-hold abnormal returns, this produces a result from which it can be concluded that there is indeed underperformance. Finally, if the calendar-time approach is used, the result is that IPO stocks perform as well or even better than the benchmarks. It can therefore be concluded that the result is highly dependent on the method used.

Ritter (1998) proposes three behavioral theories that can explain the long-term underperformance of IPOs. First of all, there is the 'divergence of opinions hypothesis', developed by Miller (1977). According to this theory, it is mainly the optimistic investors who buy the shares that are brought to the market through an IPO. These investors are therefore optimistic about the future of the company in question, which leads to high initial valuations. Pessimistic investors are not prepared to go along with this euphoria, because there can be a lot of uncertainty surrounding IPO companies. As time goes on, more information about the company will become public, which could cause the price to drop in the long-term. Second, there is the 'fads hypothesis', introduced by Aggarwal and Rivoli (1990). According to this theory, there is systematic overvaluation of IPO stocks in the short-term aftermarket of the IPO. In line with Miller's (1977) theory, this overvaluation ensures that as time goes on and more information becomes known, the shares perform relatively bad in the longer term. Finally, there is the 'windows of opportunity hypothesis' developed by Ritter (1991). This hypothesis is in line with the 'fads hypothesis' and states that when IPO stocks are overvalued, this gives rise to companies to issue even more shares in order to make optimal use of the overvaluation.

2.5 Relationship between venture capital and IPO underperformance

After Ritter (1991) had already found that IPOs significantly underperform in the long-term compared to a benchmark, it was Brav and Gompers (1997) who were among the first to investigate the effect of venture capitalists on long-term IPO performance. In their study, they used a sample consisting of 934 VC-backed IPOs in the US in the period 1972 to 1992 and a sample consisting of 3407 non-VC-backed IPOs in the US in the period 1975 to 1992. Buy-and-hold abnormal returns and multiple linear regression was used to test the result. Using various benchmarks, including various market indexes, Fama and French industry portfolios and matched size and book-to-market portfolios, they find that IPO companies significantly underperform over a five-year period. In addition, they also find that VC-backed IPOs perform significantly better over this period than non-VC-backed IPOs. Brav and Gompers argue that this result is due to the fact that venture capitalists have easy access to banks, making the companies less dependent on their own financing. Besides that, venture capitalists often remain on the board of directors after the IPO, through which the companies benefit from, among other things, the specialist knowledge and network of venture capitalists.

In contrast to other studies into the effect of venture capitalists on the long-term performance of IPO companies, Kirkulak (2008) conducted research into this effect in Japan. The study uses a sample consisting of a total of 433 IPOs in the period 1998 to 2001. The benchmark used to calculate the abnormal returns was the value-weighted Jasdaq index return. The results of the t-tests show that over 36 months VC-backed IPOs significantly underperform compared to the benchmark, whilst this is not the case for non-VC-backed IPOs. When buy-and-hold abnormal returns are used, VC-backed IPOs underperform non-VC-backed IPOs, based on a 10 percent significance level. However, when cumulative abnormal returns are used, the difference between VC-backed and non-VC-backed IPOs is insignificant. Kirkulak notes that the observed results differ from results in previous studies, as it was found that non-VC-backed IPOs perform better than VC-backed IPOs in the long-term. Kirkulak argues that this difference may be explained by the difference between the venture capital industry in Japan and the US. In the US, venture capitalists are actively involved in portfolio companies, while in Japan this is much more passive as venture capitalists in Japan invest in less risky companies compared to the US.

In contrast to previous studies, in this study the underperformance of VC-backed and non-VC-backed IPOs in the US is investigated for the period 2012 to 2020. In this study, a similar methodology will be used as was used in the study of Belghitar and Dixon (2012). As discussed in the introduction, they studied the underperformance of VC-backed and non-VC-backed IPOs in the UK in the period 1992 to 1996 and found that both VC-backed and non-VC-backed IPO companies underperform, but that the difference in underperformance between VC-backed and non-VC-backed IPOs is insignificant. However, based on the theory of Brav and Gompers (1997), according to which venture capitalists stay on the board

of directors after the IPO, so that they can use their specialist knowledge and network to improve the company's performance, I expect that VC-backed IPOs underperform less than non-VC-backed IPOs. Especially, because in the US venture capitalists are actively involved in their young portfolio companies (Belghitar and Dixon, 2012).

H2: *There is a negative effect of venture capital involvement on the underperformance of IPO companies' stocks in the 36-months after the IPO, for IPOs in the US in the period 2012 to 2020.*

2.6 Single-class and dual-class companies

According to Hossain and Kryzanowski (2019) ''dual-class' is a generic term used to describe a firm with two or more classes of shares where each share has its own rights (usually voting and cash-flows) and restrictions.' Therefore, a dual-class equity structure can be seen as one of the possible structures that exist to obtain public capital, without founders or controlling shareholders risking to lose decision taking control. When there is a threat that a public company will be involuntarily taken over, a dual-class structure can also serve as an anti-takeover defense strategy, in addition to other traditional strategies such as poison pills (Howell, 2017).

As already discussed in the introduction, Smart and Zutter (2003) investigated the effect of the number of share classes on underpricing in the US in the period between January 1990 and September 1998. They found that dual-class companies show significantly less IPO-underpricing than single-class companies. Brennan and Franks (1997) argue that this effect is caused by the fact that managers of single-class companies use underpricing to generate a dispersed share ownership after the IPO. The principle of rationing is important in this reasoning. When a high offer price is set, this leads to less demand for the shares, which leads to a smaller number of post-IPO shareholders, each having a greater ownership in the company. To prevent this, a lower offer price can be set. This increases the demand, meaning that each interested party is allocated only part of the requested shares, which leads to new shareholders owning a smaller part of the company. In the case of dual-class companies, this is not necessary, because managers can maintain control by owning shares with preferential voting rights.

Using IPO data in the US in the period 1984 to1988, Bohmer, Sanger and Varshney (1996) investigated the effect of the number of share classes on the long-term relative performance. In this study, the long-term is defined as the period of three years after the IPO. The first finding is that there are no significant abnormal stock returns from dual-class companies over this period. However, the researchers do find that dual-class firms' stocks perform significantly better than a location-, offering date-, industry- and size-matched portfolio, consisting of single-class IPO companies. For the explanation on why dual-class stocks perform relatively better than single-class stocks, the researchers consider it most likely that

this is due to a decrease in agency costs. They refer to Bhide's (1993) theory, according to which stocks with superior voting rights in dual-class companies are illiquid. This means that managers who own these shares cannot easily sell them in the short-term, which leads to greater commitment from managers to the company, because better company performance also yields higher returns for managers who own shares of the company. The researchers' survey among dual-class companies also shows that respondents believe that a dual-class structure motivates managers to value the long-term success of the company more.

As discussed earlier, Megginson and Weiss (1991) argue that venture capital involvement in IPOs reduces information asymmetry between the issuer and investors, resulting in less underpricing of VC-backed IPOs compared to non-VC-backed IPOs. Furthermore, according to Smart and Zutter (2003), control can also be a motivation for underpricing of IPOs. Brav and Gompers (1997) argue that venture capitalists often remain on the board of directors after the IPO and also retain part of the ownership, which means that venture capitalists also have an interest in maintaining sufficient control after the IPO. These factors together may ensure that VC-backed IPOs are less affected by underpricing, but that the effect of VCs becomes stronger when the company has a dual-class structure. Because, when a VC-backed company has a dual-class structure, investors know that the venture capitalist retains sufficient control to use its expertise to improve the future performance of the company. This leads to lower uncertainty regarding the expertise available on the basis of which important future decisions will be made.

H3: *The negative effect of venture capitalists on underpricing of IPOs in the US in the period 2012 to 2020 is stronger for dual-class companies than for single-class companies.*

Furthermore, as venture capitalists remain on the board of directors after the IPOs of portfolio companies, and therefore continue to use their expertise to improve the performance of portfolio companies, the expectation is that VC-backed IPOs perform relatively better in the long-term compared to non-VC-backed companies (Brav and Gompers, 1997). However, venture capitalists backing dual-class companies retain more control than venture capitalists backing single-class companies after the IPO. Therefore, it is expected that the effect of venture capitalists on the long-term performance is stronger in dual-class companies than in single-class companies.

H4: *The negative effect of venture capitalists on long-term underperformance of IPOs in the US in the period 2012 to 2020 is stronger in dual-class companies than in single-class companies.*

3. Data

3.1 Description of the sample and data collection method

Chapter 3 discusses the data used in this study. The LSEG Workspace database was used to construct the sample for this study and most of the company-specific and deal-specific data was obtained from this database. LSEG Workspace is a data provider that offers a lot of data on companies and deals in many different countries worldwide. In LSEG Workspace, the following selection criteria were used to compile the sample:

1. The companies in the sample went public through an IPO;
2. The IPOs took place between January 1, 2012 and December 31, 2020;
3. The companies are incorporated in the United States;
4. The companies listed on either the Nasdaq or the NYSE.

After applying these selection criteria, companies were manually removed from the sample for which there was not enough data available. After this sample selection procedure, the sample consisted of a total of 862 IPOs in the US in the period 2012 to 2020. Of these IPOs, 385 are VC-backed and 477 are non-VC-backed. Furthermore, the sample consists of a total of 211 dual-class companies, which are companies that have multiple classes of shares outstanding. The other companies only have one class of shares outstanding and are therefore single-class companies.

Figure 3.1 shows the distribution of the IPOs in the sample over the company categories and the offering years. It can be observed that most sample companies are single-class and of all dual-class companies, most are non-VC-backed. Furthermore, it can be observed that the years 2012, 2013 and 2016 were years with relatively few IPOs. (See table 10.1 in the appendix for the data)

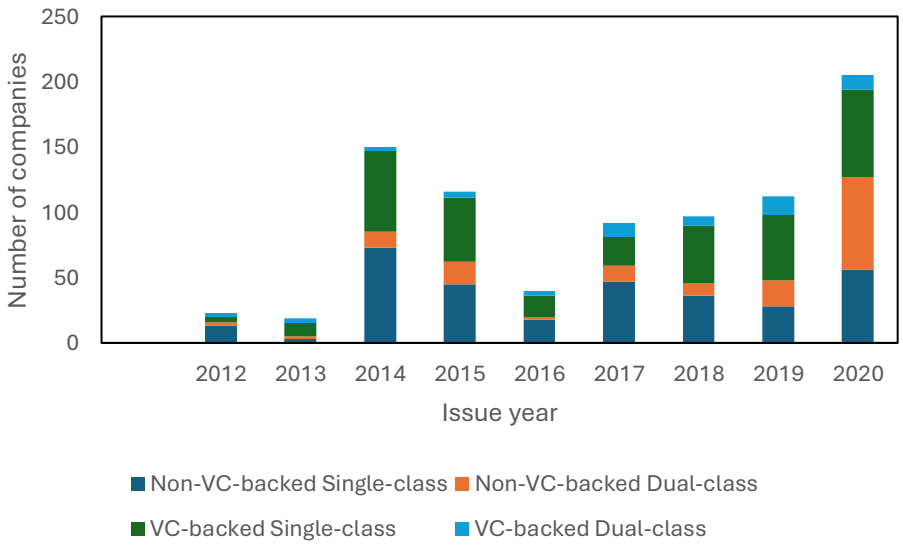

Figure 3.1. Distribution of sample companies over offering years and company characteristics

Using the CRSP database, all IPO companies have also been classified into market capitalization deciles, with number 1 being assigned to the smallest companies and number 10 to the largest companies. For each month in this study, the average return in each decile was obtained from all companies listed on the NYSE and Nasdaq. These returns have been used as a size-matched portfolio benchmark, used to calculate the initial abnormal returns and the long-term abnormal returns. This is discussed further in the methodology section. Figure 3.2 shows the distribution of the IPO companies over the ten size-deciles. This figure shows that for all company categories, most sample companies are more or less concentrated in the middle size-deciles. (See table 10.2 in the appendix for the data)

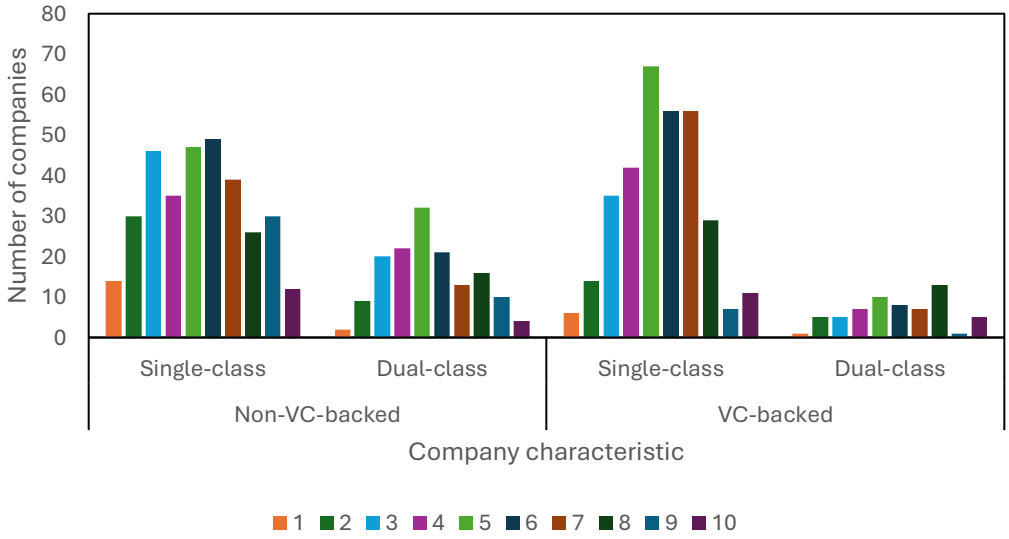

Figure 3.2. Distribution of sample companies over size-deciles and company characteristics

Using the LSEG Workspace database, data was also obtained of the industries in which the sample companies are active. Companies are classified into macro-industries, on the basis of which twelve different industries can be distinguished. Table 3.1 shows that the financial, healthcare and high technology industries have the most IPOs in the sample. Furthermore, the table shows that VC-backed IPOs have a relatively high frequency in the healthcare and high technology industry.

Table 3.1. Distribution of sample companies over macro-industries and company characteristics

Macro-industry	Non-VC-backed		VC-backed		Total
	Single-class	Dual-class	Single-class	Dual-class	
Consumer products and services	18	4	8	3	33
Consumer staples	6	1	1	0	8
Energy and power	12	20	3	0	35
Financials	97	88	6	1	192
Healthcare	59	4	239	13	315
High technology	31	9	52	39	131
Industrials	27	3	1	1	32
Materials	16	4	2	0	22
Media and entertainment	11	3	0	2	16
Real estate	28	6	1	0	35
Retail	20	7	8	3	38
Telecommunications	3	0	2	0	5
Total	328	149	323	62	862

3.2 Variable description

In this paragraph, the variables will be discussed that are used in this study. The left column in table 3.2 shows the variable names and the right column a description of the variables and how they are calculated.

Table 3.2. Variable descriptions

Variable name	Variable description
ar	This variable represents the initial abnormal return of IPO companies and is used to measure the underpricing of IPOs. The initial return of IPO stocks is calculated using the following formula: $$r_i = \frac{P_i}{OP_i} - 1$$

Where P_i is the stock price of company i at the end of the first trading day and OP_i is the offer price. To calculate the benchmark return on the first trading day of company i, the following formula is used:

$$r_{im} = \frac{I_c}{I_0} - 1$$

Where I_c is the value of the benchmark index at the end of the first trading day of company i and I_0 is the index value at the start of the first trading day of company i. Finally, the abnormal initial return of company i is calculated using the following formula:

$$ar_i = r_i - r_{i,m}$$

Size-matched portfolio benchmarks are used to calculate the initial abnormal returns. To do this, the sample companies have been assigned to market capitalization deciles, using data from CRSP. The returns of portfolios consisting of all companies listed on the Nasdaq or the NYSE that were assigned to the same market capitalization decile at the time of the IPO, have also been obtained from the CRSP database.

UP

This variable reflects the long-term underperformance of IPO companies, measured over 36-months after the IPO, starting from the first calendar month after the IPO. The long-term relative performance of company i is calculated using the event-time approach with Buy-and-Hold Abormal Returns (BHAR), using the following formula:

$$BHAR_i = \left[\prod_{i=1}^{T}(1 + R_{it}) - 1\right] - \left[\prod_{i=1}^{T}(1 + R_{pt}) - 1\right]$$

Where R_{it} is the return of company i in month t after the IPO and R_{pt} is the return of the benchmark portfolio in month t after the IPO. Long-term stock returns are obtained from the CRSP database, as well as returns from the benchmark portfolios. This is discussed further in the methodology section.

VC	This is a dummy variable indicating whether an IPO company is VC-backed or non-VC-backed. If a company is VC-backed, the dummy variable takes the value 1. If an IPO company is non-VC-backed, the value of the dummy is 0. Information on venture capital involvement in IPO companies is obtained from the LSEG Workspace database.
DC	This is a dummy variable that indicates if an IPO company has multiple share classes. If an IPO company has more than one share class, this dummy variable takes a value of 1. If a company has only one share class, the dummy variable takes a value of 0. Information on whether companies in the sample are single-class or dual-class is obtained from the LSEG Workspace database.
Size	This is an indicator of the size of the IPO companies and is measured based on the market capitalization decile to which they were assigned at the time of the IPO. In the CRSP database, all companies listed on the Nasdaq and the NYSE are grouped in deciles based on market capitalization at any point in time. Companies with the lowest market capitalization are assigned number 1 and companies with the highest market capitalization are assigned the number 10.
Age	This variable indicates how old a company is at the time of the IPO. The age of the company at the time of the IPO is determined by the difference between the IPO issue year and the founding year of the company. Data on the IPO date and the founding date was obtained from the LSEG Workspace database. For some companies the founding date was not available in this database. The missing founding date values were obtained from the IPO founding date dataset constructed by Jay Ritter.
AUD	This dummy variable is an indicator of the quality of the auditor of the IPO companies. Assumed is that large audit companies provide better quality services than smaller audit companies (Belghitar and Dixon, 2012). For the purpose of this study, only the traditional 'Big Four' audit companies are considered big, these are PWC, Deloitte, KPMG and EY (Chang et al., 2008). The dummy variable takes the value 1 if a company has one of the 'Big Four' audit companies as their auditor, otherwise the dummy takes the value 0. Information on auditors of IPO companies in the sample was obtained from the CRSP database. For companies for which the auditor was not known in the LSEG Workspace database, individual annual reports were consulted.

MR	This variable represents the market return in the period prior to the IPO. Following Cassia et al. (2004), the market return is measured over the period of 100 days before the IPO date. The returns of the CRSP value-weighted market index, consisting of all companies listed on the Nasdaq and the NYSE, are used as a proxy for the market.
MV	This variable reflects the volatility of the market in the period prior to the IPO. Following Cassia et al. (2004), market volatility is measured as the standard deviation over the period of 60 days before the IPO date. The volatility of the CRSP value-weighted market index is used as a proxy for the market volatility. Volatility is calculated based on the returns of the CRSP value-weighted market index, obtained from the CRSP database.
DV	This variable reflects the deal value of IPOs in the sample. The deal value is measured as the total proceeds received from the IPO in millions of USD. Data on the total proceeds from IPOs is obtained from the LSEG Workspace database.
UQDV	This variable reflects the quality of the underwriter, measured as the relative contribution to the total offering size of all IPOs in the sample (Dimovski et al., 2010). For each underwriter in the sample, the total offering size of all IPOs in which it is the lead underwriter is divided by the total offering size of all IPOs in the sample. Information on underwriters involved in IPOs was obtained from the LSEG Workspace database, as well as the offering size of IPOs.
UQDN	This variable reflects the quality of the underwriter, measured as the relative contribution to the total number of IPOs in the sample (Dimovski et al., 2010). For each lead underwriter in the sample, the total number of IPOs in which it is the lead underwriter is divided by the total number of IPOs in the sample. Information on underwriters involved in IPOs was obtained from the LSEG Workspace database.

3.3 Summary statistics

Now we will look at summary statistics of the variables of interest in this study. Because this study examines the effect of venture capital and the number of share classes on underpricing and underperformance, statistics are compared between those company characteristics.

A) Intial abnormal returns (ar)

First of all, we find in table 3.3 the summary statistics of the initial abnormal returns. The table shows that the average initial abnormal return of VC-backed companies is approximately three times as high as for non-VC-backed companies. The median is even about nine times higher for VC-backed companies compared to non-VC-backed companies. This result is therefore contradictory to the hypothesis of Megginson and Weiss (1991) based on the certification theory, according to which venture capitalists reduce information asymmetry, which results in less underpricing. However, this result can also be due to other factors, which are possibly identified in the regression analysis later on in this study. When comparing the average underpricing of single-class and dual-class companies, no big difference is observable. However, when looking at the median, it can be observed that the initial abnormal return for single-class companies is twice as high as for dual-class companies. This is in line with the expectation that managers in dual-class companies use underpricing to generate a dispersed shareholder ownership after the IPO in order to avoid losing control (Brennan and Frank, 1997). Looking at the standard deviation of the initial abnormal returns, it can be observed that the variance of the data is approximately 1.7 times higher for VC-backed companies compared to non-VC-backed companies.

Table 3.3. Summary statistics initial abnormal returns (ar)

Company characteristic	Average	Median	Std. deviation
VC-backed	0.2880	0.1832	0.4346
Non-VC-backed	0.0949	0.0191	0.2530
Single-class	0.1807	0.0724	0.3648
Dual-class	0.1826	0.0362	0.3410
Total	0.1811	0.0658	0.3591

Note: Initial abnormal returns are calculated using a size-matched benchmark portfolio.

B) Long-term abnormal returns (UP)

Table 3.4 shows the summary statistics of the 36-month post-IPO relative performance of IPO companies compared to three different benchmarks. The table shows that, regardless of the benchmark used, underperformance is on average higher for non-VC-backed companies compared to VC-backed companies. This is in line with the theory of Brav and Gompers (2012), according to which venture

capitalists also provide their expertise and network to their portfolio companies after the IPO, which results in relatively better long-term performance of VC-backed companies compared to non-VC-backed companies. The data also shows that the relative long-term performance differs between dual-class and single-class companies, but this difference is highly dependent on the benchmark used. However, when looking at the size-matched index, which is the benchmark that will be used in the regression analysis, it can be observed that single-class companies underperform and that dual-class companies overperform the benchmark. Looking at the standard deviation statistics, the table shows that the variance of the long-term returns is higher for VC-backed companies and single-class companies compared to non-VC-backed companies and dual-class companies, respectively.

Table 3.4. Summary statistics long-term abnormal returns (UP)

	Size-matched index		Value-weighted market index		Equal-weighted market index	
Company characteristic	Average	Std. deviation	Average	Std. deviation	Average	Std. deviation
VC-backed	-0.0290	1.3603	-0.0604	1.3661	0.0125	1.3510
Non-VC-backed	-0.0796	1.0782	-0.1401	1.0207	-0.0584	1.0169
Single-class	-0.0839	1.2610	-0.1263	1.2586	-0.0544	1.2479
Dual-class	0.0258	1.0449	-0.0370	0.9346	0.0587	0.9268
Total	-0.0570	1.2126	-0.1045	1.1881	-0.0267	1.1784

Note: Long-term abnormal returns are calculated using the event-time approach with buy-and-hold abnormal returns.

C) Size of IPO companies (Size)

Table 3.5 shows the summary statistics of the size of IPO companies in the sample, measured as the market capitalization decile to which the companies belonged at the time of the IPO according to the CRSP database. The table shows that there are no big differences in the average and median of the size deciles between the different company characteristics. However, a difference in the standard deviation of the data can be observed between VC-backed companies and non-VC-backed companies. This shows that

there is a higher variance in the size deciles of non-VC-backed companies compared to VC-backed companies.

Table 3.5. Summary statistics size of companies (Size)

Company characteristic	Average	Median	Std. deviation
VC-backed	5.5558	6	2.0354
Non-VC-backed	5.3564	5	2.3182
Single-class	5.4178	5	2.1998
Dual-class	5.5308	5	2.1928
Total	5.4455	5	2.1986

D) Age of IPO companies (Age)

Table 3.6 shows the summary statistics of the age of IPO companies in the sample, measured as the difference between the year of the IPO and the founding year of the company. The table clearly shows that VC-backed companies go public at a younger age than non-VC-backed companies, based on the average and median values. This statistic corresponds to the finding of Megginson and Weiss (1991), although they found that the average age of VC-backed companies at the time of the IPO is 8.6 years and for non-VC-backed companies 12.2 years. This means that companies in their study in general went public at a younger age. The table also shows that single-class companies go public at an older age than dual-class companies. However, this difference is not as big as the difference between VC-backed and non-VC-backed companies. Furthermore, the table shows that the variance of the data is higher for non-VC-backed companies compared to VC-backed companies.

Table 3.6. Summary statistics age of companies (Age)

Company characteristic	Average	Median	Std. deviation
VC-backed	13.5091	10	13.4869
Non-VC-backed	23.3291	12	32.4471
Single-class	19.3625	10	26.2155
Dual-class	17.6493	8	26.2054
Total	18.9432	10	26.2234

E) Market return (MR)

Table 3.7 shows the summary statistics of the market return prior to the IPO. The average and the median of the market return data shows that non-VC-backed companies and dual-class companies go public in markets where the market return in the 100 days before the IPO was higher compared to markets in which VC-backed companies and single-class companies went public, respectively. The standard deviations of the data show that the variance in the data of the market returns is also higher for non-VC-backed companies and dual-class companies compared to VC-backed companies and single-class companies, respectively.

Table 3.7. Summary statistics market return (MR)

Company characteristic	Average	Median	Std. deviation
VC-backed	0.0624	0.0619	0.0712
Non-VC-backed	0.0815	0.0647	0.0753
Single-class	0.0654	0.0612	0.0695
Dual-class	0.0963	0.0843	0.0824
Total	0.0730	0.0631	0.0741

F) Market volatility (MV)

Table 3.8 shows the summary statistics of the market volatility in the 60 days prior to the IPO. It can be observed that on average VC-backed companies and dual-class companies go public in markets where the market volatility is higher compared to the markets in which non-VC-backed companies and single-class companies go public, respectively. The standard deviations show that the variance of the market volatility is higher for VC-backed companies compared to non-VC-backed companies.

Table 3.8. Summary statistics market volatility (MV)

Company characteristic	Average	Median	Std. deviation
VC-backed	0.0092	0.0076	0.0055
Non-VC-backed	0.0087	0.0076	0.0047
Single-class	0.0086	0.0074	0.0051
Dual-class	0.0098	0.0094	0.0050
Total	0.0089	0.0076	0.0051

G) Deal value of IPOs (DV)

Table 3.9 shows the summary statistics of the deal values of the IPOs in the sample. First of all, it is noticeable that the average and median deal values of non-VC-backed IPOs are higher than that of VC-backed IPOs. Furthermore, the table shows that the average and median deal value of dual-class companies is higher than that of single-class companies. When looking at the standard deviations of the data, it is noticeable that there are big differences in the variances of the data between different company characteristics. The variance of the deal values of VC-backed companies and dual-class companies is much higher than that of non-VC-backed companies and single-class companies, respectively.

Table 3.9. Summary statistics deal value of IPOs (DV)

Company characteristic	Average	Median	Std. deviation
VC-backed	273.33	117.85	979.04
Non-VC-backed	343.87	172.50	532.91
Single-class	232.47	115.00	483.42
Dual-class	558.87	273.61	1262.73
Total	312.36	142.55	765.82

Note: Deal values are denoted in millions of USD.

H) Underwriter quality (UQDN)

Table 3.10 shows the summary statistics of the underwriter quality of the lead underwriters involved in the IPOs in the sample, measured as the relative contribution to the total number of IPOs in the sample. It can be observed that both the average and the median underwriter quality are higher for VC-backed IPOs than for non-VC-backed IPOs. Furthermore, the average and median underwriter quality is higher for dual-class companies than for single-class companies. No remarkable differences can be observed in the variances of the data between different company characteristics.

Table 3.10. Summary statistics underwriter quality (UQDN)

Company characteristic	Average	Median	Std. deviation
VC-backed	0.0802	0.0626	0.0543
Non-VC-backed	0.0674	0.0580	0.0554
Single-class	0.0710	0.0592	0.0550
Dual-class	0.0796	0.0626	0.0557
Total	0.0731	0.0592	0.0553

I) Underwriter quality (UQDV)

Table 3.11 shows the summary statistics of the underwriter quality of the lead underwriters involved in the IPOs in the sample, measured as the relative contribution to the total deal value of all IPOs in the sample. From the average and median values it can be observed that VC-backed IPOs have a higher quality lead underwriter than non-VC-backed companies. Furthermore, the average and median values show that dual-class companies have higher quality underwriters than single-class companies. No big differences can be observed in the variance of the data between the company characteristics. It can be concluded that the statistics of this variable are similar to the statistics of the UQDN variable.

Table 3.11. Summary statistics underwriter quality (UQDV)

Company characteristic	Average	Median	Std. deviation
VC-backed	0.0928	0.0982	0.0696
Non-VC-backed	0.0775	0.0513	0.0704
Single-class	0.0814	0.0513	0.0703
Dual-class	0.0936	0.0982	0.0703
Total	0.0844	0.0930	0.0705

4. Methodology

A) Testing for underpricing of IPOs

The first step in this study will be to examine if there is underpricing of IPOs. To do this, it will be tested if the values of the variable ar are significantly different from 0. As stated in the variable description, the variable ar represents the initial abnormal return of IPOs, based on a size-matched benchmark portfolio. This test will be performed using a t-test and a non-parametric Wilcoxon Signed-Rank test (WSR-test) in STATA. If the Kolmorgov-Smirnov test (KS-test) indicates that the data is not normally distributed, only the outcome of the WSR-test will be taken into account, as the t-test assumes a normal distribution of the data. T-tests and rank-sum tests will be used to examine if there is a significant difference in underpricing between VC-backed and non-VC-backed companies and dual-class and single-class companies.

B) Testing for the effect of venture capitalists on IPO underpricing

In the second step of this study, it will be tested if there is an effect of venture capitalists on IPO underpricing. To do this, the following multiple linear regression will be performed in STATA:

$$ar_i = \beta_0 + \beta_1 * VC_i + \beta_2 * VC_i * DC_i + \beta_3 * DC_i + \beta_4 * Size_i + \beta_5 * Age_i + \beta_6 * AUD_i + \beta_7 * MR_i + \beta_8 * MV_i + \beta_9 * UQDN_i + \beta_{10} * UQDV_i + \beta_{11} * Industry_i + \varepsilon_i$$

This regression analysis will be performed with year fixed effects to control for year specific factors influencing underpricing. Based on the variances of the standard errors in table 10.3 and table 10.4 in the appendix, correlated standard errors within industries and years are suspected, respectively. To overcome the problem of correlated standard errors and heteroscedasticity, standard errors are clustered within industries and within years.

If the regression analysis shows a significant negative or positive value of the variable VC, then it will be concluded that there is a significant negative or positive effect of venture capitalists on IPO underpricing, respectively. There is also an interaction term between VC and DC included in the regression formula. If this variable has a significant negative or positive value, this means that the effect of venture capitalists on IPO underpricing differs between dual-class and single-class companies.

C) Testing for underperformance of IPO companies

In this step, it will be tested if there is long-term underperformance of IPO companies. In this study, the long-term performance is defined as the 36-month performance after the IPO, where the first month is the first calendar month after the IPO. If a company in the sample delisted within 36 months after the IPO, the remaining period is truncated. The relative performance will be calculated using three different benchmarks: size-matched benchmark based on market capitalization deciles, CRSP value-weighted market index and CRSP equal-weighted market index. Similar to the study of Belghitar and Dixon (2012), two different approaches will be used to calculate the 36-month abnormal returns of IPO companies, namely the event-time approach and the calendar-time approach.

1. Event-time approach

For the event-time approach, Buy-and-Hold Abnormal Returns (BHAR) will be calculated according to the following formula:

$$BHAR_{it} = \left[\prod_{i=1}^{T}(1 + R_{it}) - 1\right] - \left[\prod_{i=1}^{T}(1 + R_{pt}) - 1\right]$$

Where $BHAR_{it}$ is the abnormal return for IPO company i up to month t after the IPO, R_{it} is the return of the stock of IPO company i in month t and R_{pt} is the return of the benchmark portfolio in month t. The next step is to calculate the average BHAR of all companies up to month t after the IPO using the following formula:

$$\overline{BHAR_t} = \frac{\sum BHAR_{it}}{n_t}$$

Where $\overline{BHAR_t}$ is the average BHAR of all sample companies up to month t after the IPO, $\sum BHAR_{it}$ is the sum of all individual companies' BHAR up to month t after the IPO and n_t is the total number of companies of which the BHAR was included in the summation. Once this is calculated, t-tests and WSR-tests will be performed in STATA to test if there are significant long-term abnormal returns from IPO companies' stocks. If the KS-test indicates that the data is not normally distributed, again only the outcome of the WSR-test will be taken into account. T-tests and rank-sum tests will be used to examine if there is a significant difference in underpricing between VC-backed and non-VC-backed companies and dual-class and single-class companies.

2. Calendar-time approach

For the calendar-time approach, in every calendar month t from January 2015 to December 2020, the abnormal return will be calculated for each IPO company that went public in one of the 36 calendar months prior to calendar month t. Abnormal returns are calculated using the following formula:

$$CTAR_{it} = r_{it} - r_{pit}$$

Where $CTAR_{it}$ is the abnormal return of company i in calendar month t, r_{it} is the return of company i in calendar month t and r_{pit} is the return of the benchmark portfolio in calendar month t. In the next step, the average abnormal return of all companies that went public in one of the 36 months prior to month t will be calculated for each calendar month t, using the following formula:

$$\overline{CTAR_t} = \frac{1}{n}\sum_{i=1}^{n} CTAR_{it}$$

Where $\overline{CTAR_t}$ is the average abnormal return in calendar month t of all companies that went public in the 36 calendar months prior to calendar month t and that were still listed in calendar month t. $\sum_{i=1}^{n} CTAR_{it}$ is the sum of the abnormal returns in calendar month t of all n companies that went public in the 36 calendar months prior to month t and were still listed in calendar month t. The next step is to calculate the average abnormal return over all months from January 2015 to December 2020, using the following formula:

$$Mean\ CTAR = \left(\frac{1}{T}\right)\sum_{t=1}^{T} \overline{CTAR_t}$$

Where $Mean\ CTAR$ is the average abnormal return over all months, $\sum_{t=1}^{T} \overline{CTAR_t}$ is the sum of the average abnormal returns in the months January 2015 to December 2020 and T is the total number of months from January 2015 to December 2020. Once $Mean\ CTAR$ is calculated, t-tests and WSR-tests will be performed in STATA to test if $Mean\ CTAR$ is significantly different from 0. If the KS-test indicates that the data is not normally distributed, again only the outcome of the WSR-test will be taken into account. T-tests and rank-sum tests will be used to examine if there is a significant difference in underperformance between VC-backed and non-VC-backed companies and dual-class and single-class companies.

D) Testing the effect of venture capitalists on the long-term performance of IPO companies

To test for the effect of venture capitalists on IPO underperformance, a multiple linear regression will be performed, using the following regression formula:

$$UP_i = \beta_0 + \beta_1 * VC_i + \beta_2 * VC_i * DC_i + \beta_3 * DC_i + \beta_4 * Size_i + \beta_5 * Age_i + \beta_6 * AUD_i + \beta_7 * MR_i + \beta_8 * MV_i + \beta_9 * UQDN_i + \beta_{10} * UQDV_i + \beta_{11} * Industry_i + ar_i + \varepsilon_i$$

This formula includes all variables that are also included in the regression formula that will be used to test for the effect of venture capitalists on the underpricing of IPOs and will also include time fixed effects. Based on the variances of the standard error values in table 10.5 and table 10.6 in the appendix, correlated standard errors within industries and years are suspected, respectively. To overcome the problem of correlated standard errors and heteroscedasticity, standard errors are clustered within industries and within years. A difference is that in this formula the dependent variable is underperformance instead of underpricing. Underperformance is measured as the 36-month buy-and-hold abnormal return, relative to a size-matched benchmark portfolio. A second difference is that in this formula a variable has been included to control for the underpricing of the IPOs. If the regression analysis shows a significant value of the variable VC, then it will be concluded that there is a significant effect of venture capitalists on IPO underperformance. If the interaction term between VC and Dual-class has a significant value, it will be concluded that the effect of venture capitalists on IPO underperformance differs between single-class and dual-class companies.

5. Results

A) Testing for underpricing of IPOs

First, it has been tested if there is underpricing of IPO offerings. The most-right column in table 5.1 shows that the average abnormal initial return is 18.11 percent and that the median is 6.58 percent. The t-test shows that the results are significantly different from 0, from which it can be concluded that there is underpricing of IPO offerings. However, the KS-test shows that the data is not normally distributed. Therefore, the t-test is not a suitable test in this case. However, the non-parametric WSR-test also indicates that there is significant underpricing of IPO offerings, this test does not assume a normal distribution of the data.

Table 5.1 also shows the statistics of the initial abnormal returns for VC-backed and non-VC-backed companies separately. First of all, it is noticeable that the mean and median abnormal initial returns differ strongly between VC-backed and non-VC-backed IPOs, namely 28.80 percent versus 9.49 percent and 18.32 percent versus 1.91 percent, respectively. This difference is remarkable as it was predicted that venture capitalists reduce underpricing, because venture capitalists reduce information asymmetry between issuers and investors according to the certification theory. Both the t-tests and the WSR-tests show that the initial abnormal returns are strongly significant for both VC-backed and non-VC-backed IPOs. However, the KS-test results show that the data for both VC-backed and non-VC-backed IPOs is not normally distributed. Therefore, the WSR-test gives a more reliable result than the t-tests. However, just like the t-tests, the WSR-tests show that there is significant underpricing of VC-backed and non-VC-backed IPOs. Both the t-test and the non-parametric rank-sum test indicate that underpricing is significantly higher for VC-backed companies compared to non-VC-backed companies.

Lastly, from table 5.1 statistics can be observed of the initial abnormal returns of single-class and dual-class companies. Looking at the average initial abnormal returns, there is no big difference observable and both values are slightly higher than 18 percent. However, the median initial abnormal return is twice as high for single-class companies compared to dual-class companies. Looking at the t-test results and the outcomes of the WSR-test, we find that the initial abnormal returns for both dual-class and single-class companies are significantly higher than 0. Because the KS-test indicates that the distribution of the data of single-class companies is not normally distributed, the result of the WSR-test is more reliable for this group of companies than the t-test result. Both the t-test and the rank-sum test indicate that there is no significant difference between the initial abnormal returns of single-class and dual-class companies.

Table 5.1. Statistics of initial abnormal returns

	VC	Non-VC	Difference	Dual-class	Single-class	Difference	All IPOs
Mean (%)	28.80	9.49	19.31	18.26	18.07	0.19	18.11
Observations	385	477		211	651		862
t-test	12.9865***	8.1846***	-8.1345***	7.7584***	12.6271***	-0.0661	14.8004***
Median (%)	18.32	1.91	16.41	3.62	7.24	-3.62	6.58
WSR-test	12.464***	9.648***		8.194***	13.425***		15.695***
Rank sum test			-7.757***			0.064	
KS-test	0.1273***	0.1878***		0.0090	0.3132***		0.1708***
Kurtosis	6.04	28.22		8.99	11.03		10.66
Skewness	1.31	3.51		2.07	2.11		2.10

*Note: *** p < 0.01, ** p < 0.05, * p < 0.10.*

B) Testing for the effect of venture capitalists on IPO underpricing

Model 1 in table 5.2 shows that the average initial abnormal return for VC-backed IPOs is 15.96 percentage points higher than for non-VC-backed IPOs, and that this result is significant at the 5 percent significance level. When the company has a dual-class structure, the effect of venture capitalists on the initial abnormal return significantly increases with 31.24 percentage points. The R-squared shows that 11.02 percent of the variance in the initial abnormal returns can be explained by the model. In model 2, control variables for firm- and deal-specific factors have been added to the model. In this model, the effect of venture capitalists and the interaction between venture capitalists and the share class structure is somewhat smaller, but still highly significant. The R-squared shows that 15.43 percent of the variance in the initial abnormal returns can be explained by the model. In model 3, we find the complete model in which control dummy variables for macro-industries have been added. In this model, the initial abnormal return for VC-backed companies is 11.74 percentage points higher than for non-VC-backed companies and the initial abnormal return is another 21.61 percentage points higher when the VC-backed company has a dual-class share structure. The R-squared of this model is 0.1902, which means that 19.02 percent of the variance in the initial abnormal returns can be explained by the model. (Full model in table 10.7 in the appendix)

Table 5.2. Regression results effect of venture capitalists on initial abnormal returns (ar)

	Initial abnormal return (ar)		
Variable	(1)	(2)	(3)
VC	0.1596**	0.1459***	0.1174**
	(0.0482)	(0.0424)	(0.0453)
VC*DC	0.3124***	0.2854***	0.2161**
	(0.0833)	(0.0760)	(0.0928)
DC	-0.0504	-0.0513	-0.0340
	(0.0408)	(0.0491)	(0.0424)
Firm and deal controls	No	Yes	Yes
Industry controls	No	No	Yes
Year fixed effects	Yes	Yes	Yes
Constant	Yes	Yes	Yes
Observations	862	862	862
R-squared	0.1102	0.1543	0.1902
Adjusted R-squared	0.0986	0.1352	0.1610

*Note: Standard errors are denoted between brackets; effects of industries are relative to the consumer products and services industry; complete table can be found in the appendix; *** p < 0.01, ** p < 0.05, * p < 0.10.*

C) Discussion of hypothesis 1 and 3

The first hypothesis was that there is a negative effect of venture capital involvement on underpricing of IPOs. In section A of this chapter, it was found that the initial abnormal return for VC-backed IPOs is 28.80 percent, whereas this is only 9.49 percent for non-VC-backed IPOs, and that this difference is significant according to both a t-test and a rank-sum test. In the regression results in section B of this chapter, model 3 shows that the initial abnormal return is 11.74 percentage points higher for VC-backed companies compared to non-VC-backed companies. From these results it can be concluded that there is a significant positive effect of venture capitalists on IPO underpricing. Therefore, I will reject the first hypothesis. In the regression results of model 3 in section B of this chapter, it was found that the positive effect of venture capitalists on IPO underpricing increases with 21.61 percentage points if the VC-backed company has a dual-class structure, compared to when the company has a single-class structure. This last finding is the opposite of the hypothesized effect in hypothesis 3. Therefore, the third hypothesis will also be rejected.

D) Testing for underperformance of IPO companies

In this section, both parametric and non-parametric tests will be used to investigate if IPO companies underperform compared to three different benchmark portfolios. These tests will also be performed for VC-backed, non-VC-backed, single-class and dual-class companies separately. In part 1 the event-time approach is used and in part 2 the calendar-time approach, as was described in chapter 4. The results of the calendar-time approach, which can be found in table 10.8 and 10.9 in the appendix, will be discussed more briefly than those of the event-time approach. This is because the abnormal returns calculated using the event-time approach are also used for the regression analysis.

1. Event-time approach

Table 5.3 shows statistics of the relative underperformance of the sample companies based on the event-time approach. What is striking is that the mean long-term abnormal return strongly depends on the benchmark used. When using the size-matched benchmark, the average underperformance is 5.88 percent, however, when using the value-weighted market index benchmark portfolio, the average underperformance is about twice as high. On average sample companies overperform the equal-weighted market index by 2.67 percent. Although the t-test indicates that the underperformance relative to the size-matched benchmark is significant at a 10 percent significance level, it is more relevant to look at the WSR-test as the KS-test indicates that the data is not normally distributed. From the WSR-test it can be concluded that there is no significant underperformance of the sample companies compared to a size-matched benchmark. Sample companies significantly underperform the value-weighted market index at the 1 percent significance level, this follows from both the t-test and the WSR-test. Although the average relative performance of the sample companies compared to an equal-weighted market portfolio indicates that there is long-term overperformance of the sample

companies, from both the t-test and the WSR-test it follows that the overperformance is not significant.

Table 5.3. Statistics underperformance all IPOs using the event-time approach

	Size-matched index	Value-weighted market index	Equal-weighted market index
Mean (%)	-5.88	-10.45	2.67
Observations	862	862	862
t-test	-1.4218*	-2.5805***	-0.6648
Median (%)	-0.49	-7.54	3.42
WSR-test	-0.980	-2.681***	-0.115
Kolmorgov-Smirnov	0.0764***	0.0761***	0.0787***
Kurtosis	5.71	5.62	5.73
Skewness	0.01	-0.06	-0.03

*Note: *** p < 0.01, ** p < 0.05, * p < 0.10.*

In table 5.4 the t-test and the WSR-test both indicate that there is no significant underperformance of VC-backed companies relative to a size-matched benchmark. The WSR-test also indicates that the underperformance of non-VC-backed companies is not significant, which is the most reliable test as the data is not normally distributed. According to both the t-test and the rank-sum test, there is no significant difference in underperformance between VC-backed and non-VC-backed companies. The average underperformance of VC-backed and non-VC-backed companies relative to a value-weighted market index is 19.62 percent and 3.05 percent, respectively. Both the t-test and the WSR-test indicate that the underperformance of VC-backed companies is highly significant. For the non-VC-backed companies, the tests indicate that there is no significant underperformance. The difference in the underperformance between VC-backed and non-VC-backed companies is significant at the 5 percent significance level according to the t-test, however, it is only significant at the 10 percent significance level according to the rank-sum test. Finally, the average underperformance relative to an equal-weighted market index is 11.68 percent for VC-backed companies and there is an average overperformance of non-VC-backed companies of 4.60 percent. The WSR-test, which is the most reliable test in this case, indicates that the underperformance of VC-backed companies is not significant. Both the t-test and the WSR-test indicate that there is no significant under- or overperformance of non-VC-backed companies. Both the t-test and the rank-sum test indicate that there is no significant difference in underperformance between VC-backed and non-VC-backed companies.

Table 5.4 also shows statistics of the underperformance of dual-class and single-class companies in the sample. The average underperformance of single-class companies is 8.39 percent,

whereas dual-class companies overperform by 1.85 percent, relative to a size-matched benchmark. The t-test and the WSR-test indicate that there is no significant under- or overperformance of dual-class companies. The WSR-test, which is the most suitable test in this case, indicates that there is no significant underperformance of single-class companies. There is no significant difference in underperformance between dual-class and single-class companies according to both the t-test and the rank-sum test. The average underperformance of single-class companies is 12.25 percent, whereas this is only 4.89 percent for dual-class companies, relative to a value-weighted market index. Both the t-test and the WSR-test indicate that there is no significant underperformance of dual-class companies. According to these same tests, the underperformance of single-class companies is highly significant. Finally, the t-test and the rank-sum test indicate that there is no significant difference in underperformance between single-class and dual-class companies. According to both the t-test and the WSR-test, there is no significant under- or overperformance of dual-class and single-class companies, compared to an equal-weighted market index. The t-test and the rank-sum test also indicate that there is no significant difference in relative performance between dual-class and single-class companies.

Table 5.4. Statistics of the relative performance of sample companies

	Size-matched benchmark			Value-weighted market benchmark			Equal-weighted market benchmark		
	VC	Non-VC	Difference	VC	Non-VC	Difference	VC	Non-VC	Difference
Mean (%)	-2.90	-8.29	5.39	-19.62	-3.05	-16.57	-11.68	4.60	-16.28
Observations	385	477		385	477		385	477	
t-test	-0.4179	-1.6733**	-0.6471	-3.0822***	-0.5867	2.0388**	-1.8493**	0.8948	2.0199**
Median (%)	-0.57	-0.41	-0.16	-11.39	-5.22	-6.17	-2.50	6.60	-9.10
WSR-test	-0.377	-0.924		-3.110***	-0.790		-1.386	1.098	
Rank sum test			-0.482			1.838*			1.760*
KS-test	0.0380	0.1087***		0.0831***	0.0733***		0.0832***	0.0486	
Kurtosis	3.43	9.45		6.36	4.65		6.49	4.72	
Skewness	0.01	-0.03		-0.08	0.00		-0.07	0.04	
	Dual-class	Single-class	Difference	Dual-class	Single-class	Difference	Dual-class	Single-class	Difference
Mean (%)	1.85	-8.39	10.24	-4.89	-12.25	7.36	2.31	-4.28	6.59
Observations	211	651		211	651		211	651	
t-test	0.2546	-1.6954**	-1.0636	-0.7093	-2.5131***	-0.7818	0.3399	-0.8853	-0.7061
Median (%)	5.87	-2.85	8.72	-4.52	-8.47	3.95	6.51	1.84	4.67
WSR-test	0.496	-1.323		-0.714	-2.669***		0.653	-0.487	
Rank sum test			-0.860			-0.822			-0.746
KS-test	0.1328***	0.0650***		0.0707	0.0935***		0.0773*	0.0827***	
Kurtosis	6.58	5.43		4.69	5.58		4.66	5.70	
Skewness	0.35	-0.03		-0.19	-0.02		-0.21	0.01	

*Note: *** p < 0.01, ** p < 0.05, * p < 0.10.*

2. Calendar-time approach

Table 10.8 and 10.9 in the appendix show the statistics of the underperformance of the sample companies when the calendar-time approach is used. What is striking is that the statistics deviate strongly from the results that were found when the event-time approach was used. For example, table 10.8 shows that IPO companies on average overperform all three benchmarks, but there is no strong evidence that this difference is significant.

Table 10.9 shows that VC-backed companies overperform all three benchmarks on average, however, the overperformance is only significant at the 10 percent significance level relative to the size-matched and equal-weighted market index. For non-VC-backed companies an average overperformance was found relative to the size-matched benchmark and underperformance was found relative to the value-weighted and equal-weighted market index. However, none of these abnormal returns were found to be significant. For all three benchmarks, VC-backed companies overperform non-VC-backed companies at the 10 percent significance level according to the t-test. From this table it can also be observed that there is an average overperformance of both dual-class and single-class companies, irrespective of the benchmark. However, for single-class companies the overperformance is not found to be significant. The overperformance of dual-class companies is found to be significant at the 5 percent significance level relative to the value-weighted and equal-weighted market index and at the 10 percent significance level relative to the value-weighted market index. However, there is no evidence that there is a significant difference in the relative performance between single-class and dual-class companies.

E) Testing the effect of venture capitalists on the long-term performance of IPO companies

Table 5.11 shows the results of three multiple linear regression models with underperformance, calculated using the event-time approach with buy-and-hold abnormal returns relative to a size-matched benchmark portfolio, as the dependent variable. Model 1 shows that the relative performance is 20.41 percentage points higher for dual-class companies compared to single-class companies, at a 10 percent significance level. The R-squared of model 1 is 0.0575, meaning that 5.75 percent of the variance in the underperformance can be explained by the model. Model 2 shows that the effect of dual-class companies is no longer significant when firm- and deal-specific control variables are included. The R-squared of model 2 is 0.0769, which means that 7.69 percent of the variance in the underperformance can be explained by the model. Model 3, where industry control variables have been included, shows no significant effect of VC and the interaction term between VC and DC on the long-term underperformance of IPO companies. The R-squared of model 3 is 0.0912, which means that 9.12 percent of the variance in the underperformance can be explained by the model. (Full model in table 10.10 in the appendix)

Table 5.11. Regression results effect of venture capitalists on IPO underperformance (UP)

	Underperformance (UP)		
Variable	(1)	(2)	(3)
VC	0.0337	-0.0398	0.0529
	(0.1448)	(0.1157)	(0.0817)
VC*DC	0.3023	0.2400	0.1978
	(0.2531)	(0.2786)	(0.2867)
DC	0.2041*	0.1966	0.1699
	(0.1062)	(0.1307)	(0.1247)
Firm and deal controls	No	Yes	Yes
Industry controls	No	No	Yes
Year fixed effects	Yes	Yes	Yes
Constant	Yes	Yes	Yes
Observations	862	862	862
R-squared	0.0575	0.0769	0.0912
Adjusted R-squared	0.0568	0.0549	0.0573

*Note: Standard errors are denoted between brackets; effects of industries are relative to the consumer products and services industry; *** p < 0.01, ** p < 0.05, * p < 0.10.*

F) Discussion of hypothesis 2 and 4

Table 5.4 in section D of this chapter and table 10.9 in the appendix show that the relative performance of sample companies depends strongly on the benchmark and the methodology used to calculate the abnormal long-term returns. When using the event-time approach, it was found that there is on average underperformance of almost all company groups and benchmarks. However, there was some deviation in the significance of the outcomes between company groups and benchmarks. When the calendar-time approach was used, the outcomes showed that there is an average overperformance of almost all company characteristics and benchmarks. However, no strong evidence was found that the overperformance is significant. In the regression results in table 5.11 it was found that there is no significant effect of VC and the interaction between VC and DC on the underperformance of the sample companies. Therefore, I reject both hypothesis 2 and 4.

6. Discussion

The first finding of this study is that there is significant underpricing of IPO offerings, resulting in an average 18.11 percent initial abnormal return. This finding is in line with most literature on IPO underpricing, see for example the findings of Loughran and Ritter (2004) and Belghitar and Dixon (2012). The second important finding in this study is that there is a big difference in underpricing between VC-backed and non-VC-backed IPOs. This finding contradicts my hypothesis and the findings of Megginson and Weiss (1991) and Belghitar and Dixon (2012), where a negative effect of venture capitalists on underpricing was found. In this study, a positive effect of venture capitalists on IPO underpricing is found, meaning that VC-backed IPOs are more underpriced than non-VC-backed IPOs. This finding is in line with the finding of Lee and Wahal (2004). They argue that this finding can be explained by the grandstanding behavior hypothesis (Gompers, 1996), according to which venture capitalists opt for underpricing to demonstrate that they can successfully bring portfolio companies to the market, in order to secure future capital investments in their funds. It is plausible that theories explaining the effect of venture capitalists on IPO underpricing differ in time and regions, resulting in different findings in different studies. It could also be that the outcome is not robust to different benchmarks, as the studies of Megginson and Weiss (1991) and Belghitar and Dixon (2012) did not use a size-matched benchmark to calculate the initial abnormal returns.

Furthermore, when using the event-time approach, it was found that the relative performance of IPO companies depends strongly on the benchmark portfolio used, however, no significant underperformance was found compared to a size-matched benchmark. When using the calendar-time approach, also no strong evidence was found of abnormal long-term returns of IPO companies. In the regression analysis, no significant effect of venture capitalists or share class structure was found on the long-term abnormal performance of IPO companies. All in all, this means that there does not seem to be clear abnormal long-term returns from IPO companies' stocks, and venture capitalists also do not seem to influence the long-term abnormal returns. Belghitar and Dixon (2012), who used a similar approach, did find evidence of underperformance of IPO companies. However, they conducted their study in the UK between 1992 and 1996, meaning that country- and time-specific factors may contribute to different results. Just like in this study, they found no evidence of an effect of venture capitalists on IPO underperformance.

7. Conclusion

In this thesis, I have investigated the effect of venture capitalists on IPO underpricing and underperformance in the US. In previous studies, this effect has been studied in different countries, in different time periods and using different methodologies. This resulted in varying outcomes. Previously, also research has been conducted into the effect of share class structure on IPOs. However, until this study, no research has been conducted into the moderating role of share class structure in the effect of venture capitalists on IPO underpricing and underperformance. Next to that, taking into account the changing composition of companies over the years, with an increasing number of technological companies, it is also relevant to investigate if outcomes from previous studies are robust to changing market conditions. Therefore, the research question that was investigated in this study was: How do venture capitalists influence underpricing and underperformance in the US IPO market in the 2012-2020 period, and how does this effect differ between single-class and dual-class companies?

To find an answer to this question, a sample consisting of 862 US companies with an IPO in the period 2012 to 2020 was constructed. Using parametric tests, non-parametric tests and multiple linear regressions, it was found that venture capitalists have a positive effect on the initial abnormal returns from IPO offerings, with this effect being stronger in dual-class companies compared to single-class companies. No significant effect was found of venture capitalists on IPO underperformance.

From this study, it can therefore be concluded that, in line with most literature on IPO underpricing, there is significant underpricing of IPO offerings in the US in the period 2012 to 2020. However, in contrast to the certification theory but in line with the grandstanding behavior hypothesis, venture capitalists have a significant positive effect on IPO underpricing. Next to that, in contrast to the third hypothesis, the positive effect of venture capitalists on IPO underpricing is stronger in dual-class companies compared to single-class companies. This suggests that there are other factors than control and information asymmetry that can possibly explain IPO underpricing. Furthermore, it was found that the results of IPO underperformance depend strongly on the benchmark and the methodology used. When using the event-time approach, there is significant underperformance of IPO companies compared to the value-weighted market index. No strong evidence was found of underperformance relative to a size-matched benchmark and equal-weighted market benchmark. When using the value-weighted and equal-weighted benchmarks, it was found that there is significant higher underperformance of VC-backed companies compared to non-VC-backed companies. When using the calendar-time approach, weak evidence was found of IPO overperformance. Finally, from the regression results it follows that there is no significant effect of venture capitalists or the interaction between venture capitalists and dual-class structure on IPO underperformance.

8. Limitations

In this study, data was used from the period 2012 to 2020. The goal was to include IPOs in the sample both from years in which market conditions for IPOs were good and in which market conditions were not so good. From figure 3.1 it can be observed that especially in 2012 and 2013 the market conditions where not so good, resulting in a very low number of IPOs. This is a limitation of this study, as the number of IPOs in 2012 and 2013 is so low relative to the total sample size that it is unlikely that these IPOs have a significant contribution to the findings of this study. Potentially, future research could focus more on the difference in the effect of venture capitalists on IPOs between good and bad IPO years, by including more years in which market conditions were bad.

Furthermore, when looking at the literature on IPO underperformance, it can be observed that it is hard to find studies that use the exact same methodology and benchmark portfolios. The methodologies and benchmarks used in this study are also not identical to that of previous studies. Therefore, we should be careful with assigning differences in the findings between this study and previous studies to country- and time-specific factors. This is emphasized by the fact that it follows from this study that the outcomes depend strongly on the methodology and the benchmark used.

9. References

Aggarwal, R., & Rivoli, P. (1990). Fads in the initial public offering market? *Financial management*, 45-57.

Belghitar, Y., & Dixon, R. (2011). Do venture capitalists reduce underpricing and underperformance of IPOs? *Applied Financial Economics*, *22*(1), 33–44. https://doi.org/10.1080/09603107.2011.597720

Bhide, A. (1993). The hidden costs of stock market liquidity. *Journal Of Financial Economics*, *34*(1), 31–51. https://doi.org/10.1016/0304-405x(93)90039-e

Bohmer, E., Sanger, G. C., & Varshney, S. B. (1996). The effect of consolidated control on firm performance: the case of dual-class IPOs. *Empirical Issues in Raising Capital, Advances in Finance, Investment, and Banking. Elsevier, Amsterdam*, *95*.

Brav, A., & Gompers, P. A. (1997). Myth or Reality? The Long-Run Underperformance of Initial Public Offerings: Evidence from Venture and Nonventure Capital-Backed Companies. *The Journal Of Finance*, *52*(5), 1791–1821. https://doi.org/10.1111/j.1540-6261.1997.tb02742.x

Brennan, M. J., & Franks, J. (1997). Underpricing, ownership and control in initial public offerings of equity securities in the UK. *Journal Of Financial Economics*, *45*(3), 391–413. https://doi.org/10.1016/s0304-405x(97)00022-6

Cassia, L., Giudici, G., Paleari, S., & Redondi, R. (2004). IPO underpricing in Italy. *Applied Financial Economics*, *14*(3), 179–194. https://doi.org/10.1080/0960310042000187333

Chang, E., Chen, C., Chi, J., & Young, M. (2008). IPO underpricing in China: New evidence from the primary and secondary markets. *Emerging Markets Review*, *9*(1), 1–16. https://doi.org/10.1016/j.ememar.2007.06.002

Dimovski, W., Philavanh, S., & Brooks, R. (2010). Underwriter reputation and underpricing: evidence from the Australian IPO market. *Review Of Quantitative Finance And Accounting*, *37*(4), 409–426. https://doi.org/10.1007/s11156-010-0211-2

Espenlaub, S., Gregory, A., & Tonks, I. (2000). Re-assessing the long-term underperformance of UK Initial Public Offerings. *European Financial Management (Print)*, *6*(3), 319–342. https://doi.org/10.1111/1468-036x.00127

Gompers, P. A. (1996). Grandstanding in the venture capital industry. *Journal Of Financial Economics*, *42*(1), 133–156. https://doi.org/10.1016/0304-405x(96)00874-4

Gompers, P.A., & Lerner, J. (2001). The venture capital revolution. *The Journal Of Economic Perspectives*, *15*(2), 145–168. https://doi.org/10.1257/jep.15.2.145

Gorman, M., & Sahlman, W. A. (1989). What do venture capitalists do? *Journal Of Business Venturing*, *4*(4), 231–248. https://doi.org/10.1016/0883-9026(89)90014-1

Guo, D. and Jiang, K. (2013). Venture Capital Investment and the Performance of Entrepreneurial Firms: Evidence from China. The Journal of Corporate Finance, 22, 375-395. https://doi.org/10.1016/j.jcorpfin.2013.07.001

Hossain, A. T., & Kryzanowski, L. (2019). A review of the literature on dual-class firms. *Managerial Finance*, *45*(9), 1199–1218. https://doi.org/10.1108/mf-10-2018-0505

Howell, S. T. (2017). Financing Innovation: Evidence from R&D Grants. *The American Economic Review*, *107*(4), 1136–1164. https://doi.org/10.1257/aer.20150808

Ibbotson, R. G. (1975). Price performance of common stock new issues. *Journal Of Financial Economics*, *2*(3), 235–272. https://doi.org/10.1016/0304-405x(75)90015-x

Kirkulak, B. (2008). The initial and long-run returns of Japanese venture capital-backed and non-venture capital-backed IPOs. *International Journal Of Managerial Finance*, *4*(2), 112–135. https://doi.org/10.1108/17439130810864014

Kortum, S., & Lerner, J. (2000). Assessing the Contribution of Venture Capital to Innovation. *The RAND Journal Of Economics*, *31*(4), 674. https://doi.org/10.2307/2696354

Lee, P. M., & Wahal, S. (2004). Grandstanding, certification and the underpricing of venture capital backed IPOs. *Journal Of Financial Economics*, *73*(2), 375–407. https://doi.org/10.1016/j.jfineco.2003.09.003

Ljungqvist, A. (2007). IPO Underpricing. In *Elsevier eBooks* (pp. 375–422). https://doi.org/10.1016/b978- 0-444-53265-7.50021-4

Logue, D. E. (1973). On the Pricing of Unseasoned Equity Issues: 1965-1969. *Journal Of Financial And Quantitative Analysis*, *8*(1), 91. https://doi.org/10.2307/2329751

Loughran, T., & Ritter, J. R. (2002). Why has IPO underpricing changed over time? *Social Science Research Network*. https://doi.org/10.2139/ssrn.331780

Megginson, W., & Weiss, K. (1991). The certification role of venture capitalists in bringing new issues to the market. *Journal of Finance*, *46*, 879-903.

Miller, E. M. (1977). RISK, UNCERTAINTY, AND DIVERGENCE OF OPINION. *The Journal Of Finance*, *32*(4), 1151–1168. https://doi.org/10.1111/j.1540-6261.1977.tb03317.x

Reilly, F. K., & Hatfield, K. (1969). Investor Experience with New Stock Issues. *Financial Analysts Journal*, *25*(5), 73–80. https://doi.org/10.2469/faj.v25.n5.73

Ritter, J. R. (1991). The Long-Run Performance of initial Public Offerings. *The Journal Of Finance*, *46*(1), 3–27. https://doi.org/10.1111/j.1540-6261.1991.tb03743.x

Ritter, J. R. (1998). Initial public offerings. *Contemporary finance digest*, *2*(1), 5-30.

Smart, S. B., & Zutter, C. J. (2003). Control as a motivation for underpricing: a comparison of dual and single-class IPOs. *Journal Of Financial Economics*, *69*(1), 85–110. https://doi.org/10.1016/s0304-405x(03)00109-0

Wright, M. & Robbie, K. (1998). Venture Capital and Private Equity: A Review and Synthesis. *Journal Of Business Finance & Accounting*, *25*(5–6), 521–570. https://doi.org/10.1111/1468-5957.00201

10. Appendix

Table 10.1. Distribution of sample companies over the years and company categories

	Non-VC-backed		VC-backed		
Year	Single-class	Dual-class	Single-class	Dual-class	Total
2012	13	3	4	3	23
2013	3	2	10	4	19
2014	73	12	62	3	150
2015	45	17	49	5	116
2016	18	2	16	4	40
2017	47	12	22	11	92
2018	36	10	44	7	97
2019	28	20	50	14	112
2020	56	71	67	11	205
Total	328	149	323	62	862

Table 10.2. Distribution of sample companies over size deciles and company categories

	Non-VC-backed		VC-backed		
Size decile	Single-class	Dual-class	Single-class	Dual-class	Total
1	14	2	6	1	23
2	30	9	14	5	58
3	46	20	35	5	106
4	35	22	42	7	106
5	47	32	67	10	156
6	49	21	56	8	134
7	39	13	56	7	115
8	26	16	29	13	84
9	30	10	7	1	48
10	12	4	11	5	32
Total	328	149	323	62	862

Table 10.3. Variance of standard errors initial abnormal returns (ar) per industry

Industry	Std. deviation
Consumer products and services	0.3019
Consumer staples	0.2295
Energy and power	0.1498
Financials	0.1509
Healthcare	0.3985
High technology	0.3901
Industrials	0.2963
Materials	0.1159
Media and entertainment	0.3378
Real estate	0.1678
Retail	0.4080
Telecommunications	0.5575

Table 10.4. Variance of standard errors initial abnormal returns (ar) per issue year

Issue year	Std. deviation
2012	0.2548
2013	0.2330
2014	0.3087
2015	0.3414
2016	0.3315
2017	0.2136
2018	0.2783
2019	0.3682
2020	0.3775

Table 10.5. Variance of standard errors long-term abnormal returns (UP) per industry

Industry	Std. deviation
Consumer products and services	0.9875
Consumer staples	1.3285
Energy and power	0.6902
Financials	0.8696
Healthcare	1.5065
High technology	0.9531
Industrials	0.8430
Materials	0.7548
Media and entertainment	1.0014
Real estate	0.6964
Retail	1.0245
Telecommunications	1.9240

Table 10.6. Variance of standard errors long-term abnormal returns (UP) per issue year

Issue year	Std. deviation
2012	0.7131
2013	0.9807
2014	0.9874
2015	1.0844
2016	1.1226
2017	1.2082
2018	1.2160
2019	1.3024
2020	1.2631

Table 10.7. Regression results effect of venture capitalists on initial abnormal returns (ar)

	Initial abnormal return (ar)		
Variable	(1)	(2)	(3)
VC	0.1596**	0.1459***	0.1174**
	(0.0482)	(0.0424)	(0.0453)
VC*DC	0.3124***	0.2854***	0.2161**
	(0.0833)	(0.0760)	(0.0928)
DC	-0.0504	-0.0513	-0.0340
	(0.0408)	(0.0491)	(0.0424)
Size		0.0328**	0.0307*
		(0.0137)	(0.0137)
Age		-0.0002	-0.0006
		(0.0004)	(0.0006)
AUD		0.0203	0.0025
		(0.0519)	(0.0567)
MR		0.1788	0.1372
		(0.1858)	(0.1643)
MV		2.2154	2.3530
		(3.3634)	(3.5869)
Ln(DV)		0.0007	0.0073
		(0.0234)	(0.0258)
UQDV		-0.1248	-0.0193
		(0.7295)	(0.7372)
UQDN		0.1981	-0.0640
		(0.8449)	(0.8216)
Consumer staples			0.1290
			(0.0744)
Energy and power			-0.0763*
			(0.0381)
Financials			-0.0798
			(0.0470)
Healthcare			-0.0066
			(0.0343)
High technology			0.0679
			(0.0490)
Industrials			0.0341

			(0.0613)
Materials			-0.0847**
			(0.0356)
Media and entertainment			-0.1238*
			(0.0642)
Real estate			-0.1171**
			(0.0502)
Retail			0.1965**
			(0.0646)
Telecommunications			-0.2914***
			(0.0808)
Constant	0.1076***	-0.1133	-0.0789
	(0.0278)	(0.1112)	(0.1066)
Observations	862	862	862
R-squared	0.1102	0.1543	0.1902
Adjusted R-squared	0.0986	0.1352	0.1610

*Note: Standard errors are denoted between brackets; effects of industries are relative to the consumer products and services industry; *** p < 0.01, ** p < 0.05, * p < 0.10.*

Table 10.8. Statistics underperformance all IPOs using the calendar-time approach

	Size-matched benchmark	Value-weighted market benchmark	Equal-weighted market benchmark
Mean (%)	0.54	0.35	0.48
Observations	72	72	72
t-test	1.6330*	0.7599	1.3894*
Median (%)	0.76	0.48	0.62
WSR-test	1.801*	0.881	1.605
KS-test	0.0399	0.0514	0.0302
Kurtosis	3.04	2.81	3.27
Skewness	-0.27	-0.19	-0.37

*Note: *** p < 0.01, ** p < 0.05, * p < 0.10.*

Table 10.9. Statistics of underperformance using the calendar-time approach

	Size-matched benchmark			Value-weighted market benchmark			Equal-weighted market benchmark		
	VC	Non-VC	Difference	VC	Non-VC	Difference	VC	Non-VC	Difference
Mean (%)	0.99	0.10	0.89	0.89	-0.16	1.05	1.02	-0.03	1.05
Observations	72	72		72	72		72	72	
t-test	1.5878*	0.4396	1.4142*	1.2178	-0.4587	1.6366*	1.5568*	0.1510	1.6366*
Median (%)	1.23	0.03	1.20	0.73	-0.09	0.82	0.91	0.01	0.90
WSR-test	1.723*	0.342	1.167	1.341	-0.275	1.369	1.599	0.213	1.369
Kolmorgov-Smirnov	0.0538	0.0777		0.0452	0.1011		0.0436	0.0694	
Kurtosis	3.06	4.43		3.34	6.28		3.29	4.15	
Skewness	-0.18	0.07		-0.09	-0.67		-0.15	-0.38	
	Dual-class	Single-class	Difference	Dual-class	Single-class	Difference	Dual-class	Single-class	Difference
Mean (%)	0.97	0.42	0.55	0.70	0.26	0.44	0.83	0.39	0.44
Observations	72	72		72	72		72	72	
t-test	2.3126**	1.1766	1.2540	1.4929*	0.5207	0.9925	1.9514**	1.0436	0.9925
Median (%)	0.77	0.29	0.48	0.46	0.44	0.02	0.80	0.46	0.34
WSR-test	2.239**	1.201	1.145	1.336	0.595	0.870	1.869*	1.178	0.870
Kolmorgov-Smirnov	0.0780	0.0387		0.0580	0.0410		0.0997	0.0308	
Kurtosis	3.62	2.82		3.71	2.84		4.73	3.07	
Skewness	0.31	-0.14		0.36	-0.10		0.51	-0.23	

*Note: *** p < 0.01, ** p < 0.05, * p < 0.10.*

Table 10.10. Regression results effect of venture capitalists on IPO underperformance (UP)

	Underperformance (UP)		
Variable	(1)	(2)	(3)
VC	0.0337	-0.0398	0.0529
	(0.1448)	(0.1157)	(0.0817)
VC*DC	0.3023	0.2400	0.1978
	(0.2531)	(0.2786)	(0.2867)
DC	0.2041*	0.1966	0.1699
	(0.1062)	(0.1307)	(0.1247)
Size		-0.0075	-0.0005
		(0.0246)	(0.0281)
Age		-0.0022	-0.0024
		(0.0017)	(0.0021)
AUD		0.3426**	0.4203**
		(0.1337)	(0.1518)
MR		-0.2124	-0.3331
		(0.3642)	(0.4642)
MV		-14.9068	-15.9403
		(8.4709)	(10.1874)
Ln(DV)		0.0044	-0.0252
		(0.0747)	(0.0761)
UQDV		0.6540	0.6682
		(1.4149)	(1.3332)
UQDN		-1.5270	-1.5252
		(2.0477)	(1.7981)
ar		-0.2210	-0.2230
		(0.1399)	(0.1310)
Consumer staples			-0.0066
			(0.4872)
Energy and power			-0.1186
			(0.2021)
Financials			0.3149**
			(0.1182)
Healthcare			-0.0399
			(0.1242)
High technology			0.2553*

			(0.1356)
Industrials			0.2037
			(0.2423)
Materials			0.2469
			(0.1949)
Media and entertainment			0.3702
			(0.2460)
Real estate			-0.0360
			(0.1140)
Retail			0.0130
			(0.1087)
Telecommunications			-0.4061
			(0.5050)
Constant	-0.1285*	-0.0265	-0.0826
	(0.0598)	(0.4219)	(0.4050)
Observations	862	862	862
R-squared	0.0575	0.0769	0.0912
Adjusted R-squared	0.0568	0.0549	0.0573

*Note: Standard errors are denoted between brackets; effects of industries are relative to the consumer products and services industry; *** p < 0.01, ** p < 0.05, * p < 0.10.*