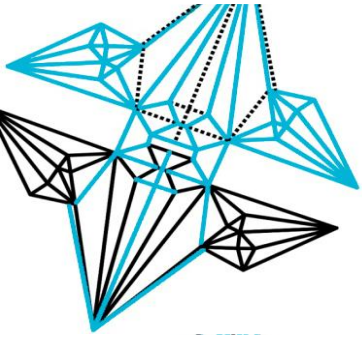
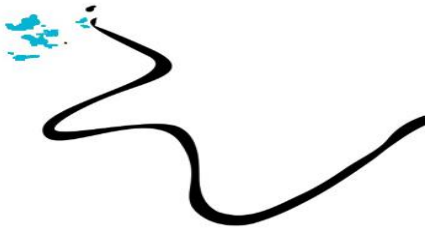


UNIVERSITY OF TWENTE.

FACULTY OF BEHAVIOURAL, MANAGEMENT AND SOCIAL SCIENCES



Master Thesis

LONG-RUN PERFORMANCE OF VENTURE-BACKED IPOS IN EUROPE AND THE EFFECT OF VENTURE CAPITAL REPUTATION

Student name	:	Mai Ngoc Nguyen
Student number	:	s1905627
Email address	:	nguyenngocmai-1@student.utwente.nl
Program	:	MSc. Business Administration
Track	:	Financial Management
Supervisors	:	Prof. Dr. Rez Kabir
		Dr. Xiaohong Huang

September 2018

ACKNOWLEDGEMENT

I would like to express my deepest gratitude to my supervisors, Prof. Dr. Rez Kabir and Dr. Xiaohong Huang. Their enthusiastic instruction and advice as well as their strong support have been invaluable to me, enabling me to overcome several difficulties to finish this thesis. I would like to sincerely thank the University of Twente to provide me with a scholarship which has allowed me to pursue my career aspiration in the Netherlands. I would send many thanks to my friends at the University of Amsterdam for their support with data collection. Finally, my appreciation goes to my family and friends for their constant courage throughout my journey.

ABSTRACT

The study aims to investigate the long-run performance of European venture-backed IPOs compared with their counterparts, as well as the effect of the reputation of venture capitalist on that performance. Using the sample of 8146 global IPOs from 2001 to 2014, I find the superior performance of European VC-backed IPOs measured by market-to-book value compared to European non-VC-backed IPOs; however, inferior performance is found when using return on assets, an operating measure. Compared with VC-backed IPOs in other regions, VC-backed IPOs in Europe have higher performance in terms of market-to-book value and lower performance measured by return on assets. Moreover, there is a positive association between the reputation of venture capitalist and the stock and market-related measures of European VC-backed IPOs, including buy-and-hold return, buy-and-hold abnormal return, and market-to-book value.

Table of Contents

1. INTRODUCTION

Venture capital (VC) firms provide an intermediate source of external funding mostly to innovative firms at the early stage of development. The contributions of VCs to the invested companies are in terms of not only financial capital, but also monitoring, strategic and operational advice, industry and market connections. From the perspective of venture capitalists, the high risks of investing in young entrepreneurial firms can lead to the higher-than-average return they can gain if the performance of their portfolio companies is positive, for example, such companies can go public after a few years of being invested (Manigart et al., 2002). VC firms are also capable of bringing considerable support to the Initial Public Offering (IPO) process. Research in the US market found that companies benefit from the expertise of VC firms in making pivotal decisions such as choosing ideal time for IPO (Lerner, 1994), or from the certification role of venture capitalists in IPOs as shown by lower underpricing and greater economic performance (Megginson and Weiss, 1991).

There are several ways that a venture capitalist can exit from its venture, e.g. through IPO, trade sale, secondary sale, or through liquidation in the worst case. The exit that is able to bring the greatest value to VC firms is through an IPO (Gompers and Lerner, 2001). However, the afterward interests of the VC-backed companies' shareholders are a matter of concern. VCs tend to retain considerable ownership in their portfolio companies for a certain of time after IPOs because of factors such as lock-up agreements, performance incentives and liquidation plan. The research of Barry, Muscarella, Peavy & Vetsuypens (1990) shows that for 89% of the VCs examined, concentrated stakes of VCs in their portfolio companies remain one year or more after the IPO. On average, VCs are reported to possess 36.6% of the company before IPO, and 26.3% after. The advantages that VCs bring not only accumulate during the time that VCs still hold ownership. The management structures, operating and financial practices we well that were formed and developed with guidance of VCs will also likely remain effective in the firm for a considerable length of time after exit. Such strong basis allow the companies to effectively utilize post-IPO opportunities for continued development (Jain & Kini, 2000). Therefore, it is empirically important to examine the post-IPO performance of venture-backed firms.

The majority of studies in this line of research still focus on the US context. Loughran and Ritter (1995) found the overall underperformance in the long-run of IPOs. However, taking venture capital into account, Brav and Gompers (1997) found that venture backing is associated with higher long-run performance of IPOs, especially to smaller companies. Such outperformance suggests that the benefits of VC monitoring, as mentioned above, can alleviate

the disadvantages of going public deriving from agency cost, information asymmetry, signaling.

The findings in the US may not be applicable to the characteristics of the stock market as well as the VC industry in other countries. The number of research on performance of venture-backed IPOs in European appears to be more limited, and the findings are also inconsistent. Examining the European market in the period from 1996 to 2011, Bessler and Seim (2011) found that the VC-backed IPOs outperforms both the market and non-VC-backed IPOs. However, the abnormal returns is positive for only two years after going public and turns negative afterwards. Examining European IPOs, Bergström, Nilsson and Wahlberg (2006) finds the outperformance of PE-backed IPOs backed over non-PE-backed IPOs over all time horizons. However, Bottazzi and Da Rin (2002) there is no significant discrepancy in long-run operating performance between those with VC backing and those without by investigating multiple European technology companies.

Overall, the VC industry in Europe is less mature than that in the US (Pommet, 2016). According to Grilli and Murtinu (2014), the size of European VC industry is roughly a quarter of that of the United States. Moreover, most countries in continental Europe have either demonstrated low activity level for VC, such as France or Italy, or even almost non-existence, such as Poland, Romania or Greece (Grilli, Mrkajic & Latifi, 2017). As a result, Europe as a whole is still viewed as a developing and growing VC market. With regards to Asian VC industry, even though this is also an emerging market, the speed of development as well as the size of the market are larger than in the EU, especially in major financial centers of China and Japan. Therefore, the performance of venture-backed firm in Europe can be different, and studying this region can lead to interesting insights.

In addition, there is a lack of research that takes into account how the reputation of VC, which signifies the quality of financing and monitoring of venture capital firms, may pose divergent impact on the long-run performance of IPOs that they back. A number of research have investigated the influence of venture capital characteristics on IPO performance. Nahata (2008), Hamza and Kooli (2011), Krishnan, Ivanov, Masulis & Sing (2011) found a positive impact of VC reputation on portfolio companies' long run performance. Focusing on French VC-backed IPOs, Pommet (2016) discovered that the quality of venture capitalist monitoring, as measured by investing time before IPO, is positively associated with company survival rate. There has not been a research that examines the impact of the reputation of VC on the long-run performance IPO at the aggregate level in European countries. This thesis will address that research gap.

The thesis will investigate the period from 2001 to 2014. Overall, in this thesis, the following research questions will be addressed:

1st: What is the long-run performance of European IPOs backed by venture capital compared to that of non-venture-backed IPOs in Europe, and to that of venture-backed IPOs outside of Europe?

2nd: What is the impact of the reputation of venture capital firms on the long-run performance of European venture-backed IPOs?

Hypotheses are developed based on the foundation of agency theory, information asymmetry and resource-dependence theory. In order to measure performance, we employ different types of performance indicators, including stock returns (three-year buy-and-hold return and three-year buy-and-hold abnormal return, operating efficiency (return on assets), and growth prospects (market-to-book value), and survival rate, in order to investigate performance from several perspectives. With regards to methodology, OLS regression is adopted when the performance indicator is metric and probit regression is employed when we use a binary performance measure.

By examining the difference between the performance of European VC-backed IPOs and their counterparts, the study can, to a certain extent, facilitate the portfolio management decisions of investors, by suggesting whether investing in European VC-backed IPOs would produce higher and more sustainable profits in the long-run. In addition, if the study can reveal the significantly positive influence of VC reputation on long-run performance of IPOs, it will have considerable practical implications to entrepreneurial companies when they have the option to choose between several funding opportunities. Taking into account the positive impact on long-term performance, they should choose VCs with higher reputation, even if contract terms are less favorable. Moreover, the emphasized importance of reputation suggests VCs to put more effort into developing and maintaining their prestige.

The results of implementing regression models provide empirical findings to answer the above-mentioned research questions. Regarding the first question, we find no significant differences between European VC-backed IPOs and European non-VC-backed IPOs when using stock returns, while European VC-backed IPOs show significantly higher MTBV and lower ROA compared to European non-VC-backed IPOs. European VC-backed IPOs show significantly lower return on assets (ROA), but higher market-to-book value (MTBV) and survival probability, than non-European VC-backed IPOs. When buy-and-hold return (BAR) and buy-and-hold abnormal return (BHAR) are used to represent performance, no significant discrepancy between European VC-backed IPOs and non-European VC-backed IPOs is

detected. With regards to the second question, we find highly significant positive impact of VC reputation on long-run performance, measured by BHR, BHAR and MTBV. This impact is significant even after controlling for selection bias using the Heckman two-stage selection model.

The study is organized as follows. Section 2 provides the literature reviews of the past research on themes relating to the objective of this study. It is followed by Section 3 with the development of hypothesis as well as methodology and data. Section 4 describes and discusses the results of the econometric models. The study ends with the conclusion discussing the findings as well as suggestion for future research.

2. LITERATURE REVIEW

2.1. Initial Public Offering

This part provides a review of past research on the process of going public as well as the short-run and long-run performance of Initial Public Offerings in general.

2.1.1. Overview

Initial public offering ("IPO") is a public event that companies hold to open their stocks for purchase for the first time. Ritter (2003) and Berk and DeMarzo (2013) have put the formats of pricing and allocating IPOs into three categories: Best effort, firm commitment and auctions. IPOs following the best effort model have underwriters carry out the IPO process. The underwriters in this case make a promise to optimize the benefit of the issuing company. However, firms still run the risk of not completely filling the volume of their IPOs. The firm commitment model reduces this risk by having the underwriters purchase all shares with a small discount, then resell them. The last form of executing an IPO is by organizing an auction, where share prices follow the public's demand.

Going public by performing an IPO gives companies a number of benefits. According to Ritter and Welch (2002), IPO is one of the go-to processes for companies to raise additional funding. In general, private funding is easier for firms to raise, as opposed to public equity. However, when a company reaches a certain level of maturity, raising capital from diverse public investors becomes more desirable. An IPO also enables current shareholders to sell their shares to the public, for diversification or exit purpose. Another advantage of going public through an IPO is that firms can improve their liquidity profile and reduce funding cost. There are a number of requirements coming from the stock exchange to follow if a company aims to be publicly listed. By complying with these constraints, companies can have better credibility to potential investors. Furthermore, as Draho (2004)'s study has shown, it is a benefit for the company management when IPOs influence prices for their stock-based incentives.

IPOs do not only bring advantages, however, as they come with significant costs in different respect, either direct or indirect. According to Chen and Ritter (2000), one prominent direct cost of IPOs is the underwriting fee which is approximately 7% of IPO proceeds. A number of indirect costs also present themselves when a company goes public. When stocks are issued, shareholders' control gets spread out and the firm has to operate under the public's supervision. Moreover, firms' previously private information can now be disclosed, leading to potentially decreased competitive edge. As Draho (2004) has studied, IPO is an expensive process in many cases. This is especially true for smaller companies or those still in their early stages.

2.1.2. Performance of Initial Public Offering

2.1.2.1. Initial Returns

Underpricing of IPO, the situation when a significant increase in price happens immediately after listing, has been identified in various markets.

IPOs' short-term performances have considerable variance between markets. Loughran, Ritter & Rydqvist (1994) have observed IPO underpricing in 25 different countries, with underpricing more noticeable in developing markets. Ljunqvist (2005) shows that underpricing of IPOs in the United States, on average, has been at 19%. Eckbo (2005) analyzes statistics on the average initial returns of IPOs between 1990 and 2003 for multiple countries, 19 in Europe and 16 in Asia-Pacific and Latin America regions. Poland yields the highest average initial IPO returns in Europe at more than 60%, which is followed by Greece, Germany and Ireland at approximately 40% each. On the contrary, Luxembourg and Denmark see lowest average initial returns at 5% and slightly less than 10% respectively. Among other regions, Malaysia at 90%, Thailand and Singapore at more than 30% are the three countries holding the highest average returns. Lowest average returns are found in Latin American countries, namely Chile, Mexico, Brazil and Uruguay at less than 5% each.

Loughran and Ritter (2004) and Ljungqvist and Wilhelm (2003) analyze how the variance of underpricing across the time dimension. Their studies indicate that IPO underpricing is dependent on the health of the overarching economy. For instance, during the Internet bubble period 1997 – 2000, IPO underpricing sees an abnormal increase of 65%.

There has been relatively little research in underpricing for non-US markets, especially those analyzing the timeframes that contain and go further than the bubble period of 1990s. Oehler, Rummer, and Smith (2005) look into the impact of optimism of the investors on underpricing of IPOs taking place between 1997 and 2001 in Germany. Chan, Wang & Wei (2004) report significant underpricing and medium long-term underperformance of China A-shares from 1993 to 1998. Their findings suggest that underpricing is present mainly due to the nature of the IPO landscape in China, and not because of the public's over-optimism.

Theoretical models analyzing IPOs' initial returns include: (1) information asymmetry and agency costs between companies, third-party intermediaries and investors, (2) investors' sentiment and optimism. The negative correlation between IPO underpricing and information uncertainty found in a number of studies, including Beatty and Ritter (1986), indicates that information asymmetry is an important factor constituting underpricing. According to conventional studies of information asymmetries, such as Rock (1986), issuers have a tendency

to underprice shares to boost investors' demand. Most research up until 2000 makes the conclusion that information asymmetry is the main reason for underpricing (Ritter and Welch, 2002).

2.1.2.2. Long-run performance

Stock prices are studied not only through initial returns in the first day, but also over an extended time period in order to properly judge the performance of IPOs as well as differences between different IPO types. Typically, periods ranging between three to five years are considered to be long-term. Such analyses are achievable by assessing the price movement of a company's shares against a benchmark (Ritter, 1991; Van Fredericksslust and van der Geest, 2001; and Yi, 2001) or by employing operating measures measures (Jain and Kini, 1994, Mikkelson, Partch, and Shah, 1997).

There has been extensive research on the long-run performance of IPOs up to 5 years after going public, and researchers have been focusing more on stock price performance. A significant number of research have reported IPO underperformance, where the long-run performance of IPOs is lower than market benchmarks. Ritter (1991) studies multiple US IPOs from 1975 and 1984, and has found out that IPOs perform worse than their peers with regards to stock performance: 34.47% versus 61.86% in terms of expected holding return. Newly established firms tend to underperform, with respect to market indices such as NASDAQ and Amex-NYSE, during the period of three years after their public offerings. One explanation from Ritter for this underperformance is because of the public's sentiment. Investors have a tendency to become very optimistic about the future performance of a firm when IPO happens, and most companies prefer to go public when the sentiment is almost at its peak. Another study from Loughran and Ritter (1995) demonstrates similar results. Brav, Geczy and Gompers (2000) also present a similar finding where IPOs in the period 1975-1992 performs 44% worse than S&P 500 over the five years following the offerings. Yi (2001) looks into the US market and finds out that IPO firms in general underperform below the benchmark throughout a period of three years after going public, with underperformance as well as the public's over-optimistic sentiment the highest among companies previously having negative earnings.

However, when the long-run performance of IPOs is compared to firms with similar size and book-to-market ratio, instead of benchmark indexes, different result has been found. Two independent studies, Brav and Gompers (1997) and Brav et al. (2000), find out that in terms of size and book-to-market ratio, firms having IPOs do not perform worse than those without.

A few studies have examined long-run operating performance post-IPO. Jain and Kini (1994) and Mikkelson, Partch, and Shah (1997) report that IPO companies demonstrate sharp declines in financial and accounting performances after their IPOs have finished.

A considerable effort has been put into researching the phenomenon of the long-run underperformance of IPOs, also known as the "IPO effect". The above-mentioned research has focused in the US market, but this effect is confirmed to occur very often in other securities markets.

In the EU market, Gregory, Guermat & Al- Shawawreh (2010) performs a thorough study of the IPO market in the United Kingdom between 1975 and 2004, and have found a remarkable level of underperformance when compared to other firms having similar sizes. Bessler & Thies (2007) have also discovered that IPOs the German market have underperformed when compared to market average in the long term. Particularly, underperformance usually begins after one year following the public offering, and reaches -12.7% when using 3-year Buy-and-hold Abnormal Return (BHAR) against the DAX index. Alvarez & Gonzalez (2005) perform a similar study into the Spanish market between 1987 and 1997 and find negative BHARs. Schuster (2003) makes the conclusion that the European IPO market homogeneous, because companies basing in different countries demonstrate similar performance in both short and long terms. Therefore, Schuster (2003) analyzes the European market as a whole. It is notable that in the three years after the initial issue, IPOs show superior performance to all of the market indices, except for the large-capitalization benchmark. However, in the subsequent two years, IPOs' performances significantly decline and BHARs becomes much lower than the returns of the general market.

In the Asian market, Cai & Wei (1997) report long-term underperformance of IPOs against benchmark index in Japan while Moshirian, Ng & Wu (2010) found similar results for IPOs in advanced and emerging markets of Asia from 1991 to 2004.

The study of Ritter (1998) shows three potential explanations for the long-run underperformance of IPOs. The first reason, as previously discussed, is the public offering timing with respect to the market sentiment. Companies typically organize their IPOs when their performance and investors' optimism are at their peaks. Therefore, it is natural that performance decline will then follow. Secondly, buyers are the ones to determine market price, and they also tend to have high expectations for IPO performance. As a result, it is very difficult for firms to keep up with public investors' biased anticipations. When information asymmetry fades away, companies run into the winner's curse problem. The last reason stems from underwriters, as they can manipulate IPO to create inflated demand in order to achieve quick

initial return, and to fill the necessary IPO volume. In this case, the long-term value is negatively affected, and firms with better initial performance end up having the lower returns over a longer period.

2.2. Venture capital

2.2.1. Overview of venture capital industry

Investing in start-up companies is considered risky because of the high level of performance uncertainty, as well as the fact that most ideas do not materialize into fruitful businesses. As a result, it is not a trivial task for start-ups to raise capital. For this reason, there exist a number of specific sources to raise fund to address this challenge, as shown by Berk and DeMarzo (2013): venture capital, private equity, institutional, corporate and angel investors.

Wetzel (1987) defines angels as investors who are willing to invest into the very early stage of projects. Their assets and investments are exposed to extremely high risk to have a chance to reach large returns in the long term. Most start-ups are not yet well-known during their early cycle, so angels tend to be close acquaintances of the founders. Moreover, because the angel investments are typically significant compared to the total funding available, angels also have notable influence in the management of the company.

When start-ups move on from the early stages, they need additional funding. It is the moment private equity funds and venture capital enter the picture. Private equity aims at either privately-held firms, or public firms that are becoming private. As with angel investments, private equity funds also take part in the management and decision-making process of start-ups. Venture capital can be seen as either a special case of private equity or an independent type of investment. Corporate investors usually belong to the same business segment as the entrepreneurs. Besides financial interest, they base their investments also on strategic values, such as to take a hold of a unique ideas or capabilities the start-up has. Institutional investors include pension funds or insurance companies, and they can invest either directly or through another entity such as private equity.

Venture capital (VC) is a type of investment focusing on entrepreneurial and technologically innovative companies (Zacharakis & Eckermann, 2006). Da Rin, Hellman and Puri (2013) defines VC as "professional asset management activity that invests funds raised from institutional investors, or wealthy individuals, into promising new ventures with a high growth potential". A VC usually has limited partnership with another entity to manage and take responsibility for the fund. There are also multiple limited partners committing to the VC

financially at the same time. According to Gompers and Lerner (2001), American Research and Development, founded in the 20th century, is recorded to have been the first established VC fund. The first VC limited partnership was formed in 1958, which set the stone for the most commonly found type of VC funds currently existing. The expansion of VC industry took place in the years of 1970s and 1980s thanks to the advancement of technology.

VC is among the top growing industries. This is especially true for the United States since many well-known technology-driven companies, such as Microsoft or Google, were originally backed by VC. VC investment is of particular importance to entrepreneurial companies, especially those focusing on innovative technologies, because conventional financial sources are difficult to obtain, such as public equity or debt. External funding for technological companies is limited and expensive because these companies are considered risky because they typically do not have sufficient tangible assets, and the level of information asymmetry between company founders and external parties is relatively high. VCs have developed multiple mechanisms to tackle the information asymmetry problems, such as extensive company screening, layering investments over a period of time, and compensating the entrepreneurs based on the company performance. Moreover, VCs also closely monitor the companies they invest in (Gorman and Shalman, 1989). Gompers and Lerner (2001) define the three phases of VC investment as follows: fund raising, investing and exiting.

The fund raising stage involves gathering capital from investors, or VC's limited partners. The fund entrusted varies from year to year (Gompers and Lerner, 2001), mostly due to the effect of capital gain tax regulations. Economic conditions also impact the fund raising capability of VC (Black and Gilson, 1998). In a bull market, start-ups are founded more often, creating more investment opportunities. As a result, VC funding becomes more frequent. According to Jeng and Wells (2000), macroeconomic plays a pivotal role in influencing the level of activities of VC fund raising, market capitalization and labor market rigidity.

The second phase, investing, has two components: selection of the start-up companies to invest in, and monitoring the projects over their developments. Investing in entrepreneurial companies is considered risky due to the high uncertainty in performance and the agency problem. VC investments can help to control these risk factors because besides providing capital, VC also provide the entrepreneurs with expertise in management and decision making (Gompers and Lerner, 2001). From VC's perspective, even though the risk associated with each start-up is high, the overall risk level is controlled thanks to the screening procedure and the diversification strategy (Baum and Silverman, 2004).

The third and final phase of VC investment is exiting, or cashing out. This stage involves disconnecting from portfolio companies, either thanks to successful investment in the form of trade sales and IPOs, or unsuccessful one in the form of liquidation. The study of Gompers and Lerner (2001) reveals that an IPO is reportedly the most profitable type of exit from a venture investment. However, as most IPOs enforce a lock-up period, VCs usually exit through trade sales, where portfolio companies are sold to firms in the same business area. According to Giot and Schwienbacher (2007), when a certain level of maturity of a start-up has been reached, typically between 2.75 to 4 years after being founded, it becomes much more difficult for VCs to exit through IPOs, as compared to trade sale.

According to Sahlman (1990), even though venture capital (VC) firms can receive up to 1,000 project proposals per year, they are very selective with respect to their investments in these entrepreneurial companies. Kaplan, Stromberg and Sensoy (2002) use historical data to explore the due diligence and analysis processes carried out by venture capitalists to plan their financing. Their study presents how venture capitalists transform the risks associated with entrepreneurial investments into contractual agreements with the start-ups.

2.2.3. Benefits and drawbacks of venture capital

It is a common debate in the financial sector to question whether or not VC funding is automatically synonymous with multiple advantages for the backed companies over other types of funding. Benefits and drawbacks of venture capital can be analyzed from the perspective of both VC firms and the invested companies.

First, we look at the benefits from the view of VC firms. Relevant research has implied that VCs have the capability to make sound funding selection. The VCs only decide to become involved in start-ups having high chance to become the next major companies in their respective industry, and to potentially compete with existing market leaders. Historical data has shown that VC investment produces higher return than the more traditional investment formats. Cochrane (2005) states that between the years 1987 and 2000, the arithmetic average return of IPOs or other acquisitions backed by VC is 698%, excluding correction for selection bias. With correction, this value becomes 57%. Korteweg & Sorensen (2010) also present similar findings with respect to this significant return and risk due to sampling bias of VC investments. In addition, VC companies can directly supervise and intervene the invested entrepreneurs' courses of actions whenever resources are not being efficiently utilized.

From the perspective of VC firms, lack of liquidity, diversification and high probability of failure are the primary disadvantages of VC investment. Cochrane (2005) has observed that the distribution of VC's returns is very volatile, has high degree of positive skewness and contains a few extreme samples. This observation indicates that in most cases, VC investments are not successful. Venture capitalists invest in entrepreneurial companies at the very early stage, and usually keep their investments in place for a many years before exiting. Therefore, the investments are illiquid and get locked until the start-ups progress to a certain level of maturity and gain market traction. Lack of diversification and illiquidity are two closely linked problems. Venture capitalists do aim to diversify by investing in several different start-ups. However, they tend to put more focus on a few domains they have extensive knowledge in.

From the point of view of the invested companies, VC funding is desirable management expertise and the more efficient access to the market which is critical for entrepreneurs (Gompers and Lerner, 2001; Baum and Silverman, 2004). Active involvement, monitoring and participation in invested companies are the unique features of VCs investing, and separate it from traditional forms of financing, such as private or angel investments. The degree of VCs' involvements differs case by case, but they generally participate as directors, advisors or company managers (Kortum and Lerner, 2001). According to several researches (Hellmann and Puri, 2002; Kaplan and Stromberg, 2003; Campbell and Frye, 2009), VCs also contribute to increasing corporate governance quality of the IPOs that they back through mechanisms such as monitoring and board composition. The study of Gompers and Lerner (1999) shows that VCs are capable of leveraging their positions on the board of directors to make significant impacts on how the backed companies function, even to the extent of replacing the original founder with a new CEO. Hellman and Puri (2000) describes VCs as advisors who assist firms with different aspects of governance, including strategy formulation, marketing and recruitment. Megginson and Weiss (1991) show that IPOs backed by venture capitalists have lower rates of underpricing and underwriter compensation, are able to be carried out efficiently when the firm is at a much younger age than non-VC backed companies, and also attract more renowned underwriters and auditors. Hellman and Puri (2000) finds that higher VC involvement significantly decreases the time to market for companies that focus on innovation. The scale of companies that are backed by VC are observed to have faster development than that of non-VC-backed firms (Puri and Zarutskie, 2012). Hellmann and Puri (2002) report that companies backed by VCs employ a more structured organization than those without venture backing. Given the aforementioned advantages from VCs, it would mean post-IPO performance of a VC-backed firm remarkably depends on the continued support from the VCs themselves.

On the other hand, entrepreneurial firms funded by VC face some drawbacks. Venture capitalists participate actively in management, and may cause conflicts of interest (Ritter, 1998). This involvement causes the entrepreneurs to have decreased influence in the decision-making process of their own companies, and they have to stay dependent on the VCs. Interest conflicts between the VC and the entrepreneur can arise, potentially hampering the development and growth of the company (Ritter, 1998). Hellmann and Puri (2000) also emphasize that significant costs are incurred when the entrepreneurs have to spend a large amount of time aligning and catering to the demands of VCs.

Another concern with VCs is that they may be incentivized to make backed companies go public earlier than objectively desired. VCs make most of their profits when a portfolio company goes public, and getting a backed firm to have an IPO is beneficial for them in the long run, particularly for subsequent fund-raising activities. Therefore, younger VCs may grandstand the entrepreneurs and push companies to go public when they have not yet reached the adequate level of maturity. A premature IPO can be potentially expensive for the company because it leads to more underpricing and limits the firm's organic growth in the future.

2.3. Performance of IPOs backed by venture capitalists

2.3.1. Initial returns

The two studies of Megginson and Weiss (1991) and Brav and Gompers (1997), looking into the market of United States, have stated that VC-backed IPOs are generally less underpriced because the presence of VC involvement is considered by investors as a positive signal about the company. When VC-backed companies go public, having the participation of VC firms as early financial investors brings a certification for the IPO quality. Hochberg (2011) has observed that companies backed by VCs employ a more solid corporate governance process in place at the time their IPOs take place. Therefore, these IPOs are expected to have lower degree of underpricing when compared to those not backed by VCs.

In contrast, Lee and Wahal (2004)'s findings suggest that IPOs with VCs' involvements are more underpriced. These authors contend that VCs typically aim to liquidate their investment through an IPO, and they do not always wait for the optimal time frame for execution. Gompers (1996) mentions the grandstanding tactic brought by VCs, which argues that VCs will try to exit their portfolio companies when the market situation is in their favor. Such exits enable them to accumulate reputation, boost fund raising activities and bring better returns for their investors.

The initial return of VC-backed IPOs in specific countries has been researched, though not extensively. Companies in the German market having backing from reputable VCs show less underpricing at their IPOs thanks to the decreased uncertainty (Franzke, 2004). Hamao, Packer & Ritter (2000) observe that Japanese IPOs whose lead underwriter and lead VC are the same yield higher initial returns than other VC-backed IPOs.

2.3.2. Long-run performance

Researchers have found inconsistent results with respect to the long-run performance of IPOs backed by VCs.

Brav and Gompers (1997) report the superior performance of VC-backed IPOs using equally-weighted Buy-and-hold Abnormal Return (BHAR) when studying the US market. They state that the outperformance of VC-backed IPOs over non-VC-backed IPOs is likely to have been triggered by the domain expertise and prestige of venture capitalists, as well as the weaker effect of over-optimistic sentiment from investors thanks to the confirmed information from VCs. Compared to VC, private equity (PE) have similar features, and VC is considered one special type of PE investment. Bergström, Nilsson and Wahlberg (2006) put an emphasis on the long-term performance of IPOs backed by PE. They have found out that these IPOs perform significantly better across all timeframes than IPOs not backed by PE. A number of possible explanations are discussed, including the fact that PE offers a better control of optimism in the sentiment of investors, and a less opinionated decision-making process thanks to prior knowledge about firms backed by PE in general.

Prior results have shown that VCs provide effective screening and monitoring, help reduce information asymmetry, and lead to overall positive influence on IPO companies (Megginson and Weiss, 1991). In addition, the investment in stages of VC, which can be considered a substitute for monitoring devices of VCs to reduce agency problems, can have the positive influence on long-run operating performance of IPOs and survival rate, but only in cases where there is a certain distance between the VC and the company that it invests in. (Tian, 2011a).

On the other hand, not all studies report remarkable impact of VCs on their backed companies. Other studies show that no significant influence of VCs on the long-term returns exists (Doukas and Gonenc, 2001; Gompers and Lerner, 2003; Ritter and Welch, 2002; Lee and Masulis, 2011).

Other researchers employ other measures of performance, such as operating measure and survival rate. Hsu (2009) highlights that when VC-backed entrepreneurial companies are

concerned, longer incubation periods result in more registered patents, higher survival chance, and better operating and financial performance following the corresponding IPOs. The participation of VCs is reported to have correlation with survival chance of IPO companies because VCs encourage managers to focus more on R&D, improve connection with institutional investors and get acquainted with investment bankers (Jain and Kini, 2000). Tian (2011b) found that syndicate-backed companies focus more on innovation than firms backed by individuals and also have better operating performance in the first 4 years following their IPOs. However, Chen and Liang (2016) conclude that VC-backed IPOs perform worse than those without VC backing, especially when companies have high level of redundant cash. They employ measures of operating performance and use samples extending further than the year 2000 to examine the performance of VC-backed IPOs. The argument is that the excessive cash held in VC-backed companies at the time their IPOs take place will likely lead to unjustified investments.

Studying the Europe market, some researchers have found the outperformance of VC-backed IPOs over non-VC-backed IPOs. Bessler and Seim (2011) show evidence for the favorable performance of IPOs backed by VC, compared to both the market standard as well as non-VC-backed IPOs. However, their finding only demonstrates positive returns in the period of two year after a company's IPO has finished. Subsequent returns became negative. Bottazzi and Da Rin (2002) analyze multiple European technology companies, and there is no significant discrepancy in post-IPO operating performance between those with VC backing and those without. Levis (2011) found out that IPOs backed by PEs and VCs on London Stock Exchange demonstrate better performance in the post-market phase comparing to other IPOs as well as to the stock market as a whole when using equal-weighted terms. Schuster (2003) analyzes cumulative market-adjusted returns (CARs), including rebalancing for each month over a three-year period, for IPOs taking place between 1988 and 1998 in seven European countries. The investigated countries are Italy, Sweden, France, Spain, Germany, the Netherlands and Switzerland. The reported CARs are negative, ranging between minus 11.7% in Germany to minus 41.8% in Italy. Tykvova and Walz (2005) look into companies having VC backing that go public for high-tech market in Germany. The authors report remarkably better performance for these companies when compared against IPOs not backed by VCs. However, it is only the case when the VC is not dependent on financial schemes coming from the government.

Similar results are reported in Asia. Guo and Jiang (2013) have found out that VC-backed companies demonstrate better performance than those without VC backing in multiple factors, such as profitability, R&D investment or productivity. Liao, Lu and Wang (2014) report that

following the offerings, VC-backed IPO companies in Taiwan face less financial challenges than IPO firms without backing.

However, multiple studies looking into non-US IPOs have reported that the existence of VCs does not translate to better performance (Hamao et al., 2000; Coakley, Hadass, & Wood, 2007; Rindermann, 2004; Lee, 2011). Audretsch and Lehmann (2002) look into the survivability of companies in Neuer Markt and report that the survival chance goes down as the extent of VC ownership goes up, which hints at a negative influence coming from VCs. Frederikslust and van der Geest (2001) analyze the impact of PE-backed IPOs on the Amsterdam Stock Exchange and observe that PE-backed companies do not show significant outperformance with respect to the chosen benchmarks. Hamao et al. (2000) show that in Japan, IPOs backed by VCs do not necessarily perform better than those without VC backing in the long term. Lee (2011) makes a conclusion that the presence of VCs leads to a worse performance of Korean IPOs in a three-year period.

Three reasons are stated to be the causes of this observation. Firstly, the contradicting findings can potentially be explained by the differences between VCs in different countries. For instance, VCs based in the UK do not put an emphasis on the high-technology market, unlike their counterparts in the US. Secondly, the observed underperformance can be caused by a hot market where firms try to take advantage of investors' over-optimism to go public. Thirdly, new VC firms wish to boost their reputation and as a result, they have a tendency to carry out premature IPOs even if the portfolio companies are not yet in a ready state (Gompers, 1996; Lee & Wahal, 2004; Rindermann, 2004).

Overall, there are certain contradictions between research findings with regards to the impact of VC backing on long-run performance of IPOs. However, the benefits of VC investment, including the expertise from the venture capitalist, better access to auditors and credit, appear to outweigh the disadvantages of going public (Ritter, 1998). These advantages also contribute to the positive performance of IPOs backed by VC.

2.3.3. The effect of VC reputation on long-run performance

One drawback of the studies discussed so far is the homogeneous treatment of all venture capitalists. Most studies of IPOs do not differentiate VCs in terms of reputation (such as Bradley and Jordan, 2002 or Loughran and Ritter, 2004).

In these researches, reputable VCs with proven track records do not get special consideration over younger VCs with limited experience. On the contrary, the impact of underwriters'

reputation has been extensively looked into by academic studies (Johnson and Miller, 1988; Megginson and Weiss 1991; Carter and Manaster 1990; Loughran and Ritter, 2004). This discrepancy hints at a gap in literature to properly measure VC reputation. Furthermore, the recognition of reputation could enable entrepreneurs to go after experienced VCs and also allow private equity investors to more easily identify quality VCs.

Shapiro (1983) finds out that whenever there is information asymmetry, a company's reputation is among of its most valuable assets because it is what the clients will base on to estimate the quality of products and services provided. For a segmented industry like VC, reputation is even more consequential (Krishnan and Masulis, 2011). From the venture capitalists' point of view, the more reputable they are, the better offers they are able to negotiate (Hsu, 2004).

A limited number of researches have investigated the effect of VC reputation on the IPOs that they back. Reputation is found to be linked to more precise timing of an IPO (Lerner, 1994; Chang, 2004; Coakley, Hadass and Wood, 2007). Sørensen (2007) also reports that companies backed by more renowned VCs have higher chance to go public. The study of Lee and Masulis (2011) shows that reputable VCs demonstrate lower earnings management for IPO companies.

Reputation of VC contributes to decreasing the underpricing problem of IPOs (Chahine and Filatotchev, 2008). Gompers (1996) finds out that companies going public through young VCs show lower level of maturity, are more susceptible to underpricing, and raise less capital from their IPOs then those backed by experienced VCs.

VC reputation also plays a role in improving the long-term performance (Jain and Kini, 1995; Brav and Gompers, 1997; Coakley, Hadass and Wood, 2007; Hochberg, Ljungqvist & Lu, 2007; Nahata, 2008) and reduce moral hazard as well as information asymmetry (Doukas and Gonenc, 2005). The studies of Nahata (2008) and Hamza & Kooli (2011) look into the correlation between VC reputation and its chance of successful IPO exits. They arrive at the conclusion that companies backed by more renowned venture capitalists are more likely to survive in the long run. Baker & Gompers (2003) and Krishnan et al. (2011) back up this finding by showing that reputable VCs bring better corporate governance, as indicated by the higher number of independent directors and the higher likelihood that the VCs keep their managerial roles and shareholdings in the backed firms three years after the IPO has finished.

Krishnan et al. (2011) study the impact of VC reputation on the long-run performance of VC-backed IPOs in more depth. Prestigious venture capitalists provide multiple benefits to backed firms, such as implicit VC guarantees, better credit and underwriters availability and expertise in advisory services. The authors use different methods to measure VC reputation, including

three-year market share of IPOs, VC maturity and total capital managed. Their findings show that reputation of VC correlates with the performance of backed IPOs in the long-term. After taking into account sample selection biases, the results are still valid.

In conclusion, reputation of VC provides multiple benefits to both VC firms and backed companies. According to Krishnan et al. (2011), the advantages a reputable VC firm has are many. Some examples include the possibility to negotiate better terms with entrepreneurial companies, more efficient fundraising, favorable fee structure and better performance of investments. For the backed company, getting funding from a prestigious VC firm gives them credibility, domain expertise and implicit VC guarantee. It is noticeable that there is a lack of research on this subject that focuses on specific regions or countries outside of the US.

2.4. Characteristics of IPO market and Venture Capital industry in Europe

Geographic location has been found to have effect on financial decision, particularly in VC investment (Coval and Moskowitz, 1999; Huberman, 2001). Cumming and Dai (2010) propose an explanation for this characteristic. The authors observe that VC firms tend to prefer investments made in their area and country, rather than international ones. Their reasons are that VCs have more knowledge regarding their local area and by putting more focus on domestic investments, they can keep information asymmetry to the minimum. The existence of geographical influence leads to further investigation in the performance of VCs' financial investments in a certain area and compare the results with the respective performance in other regions.

VC enables multiple innovative ideas to quickly and properly launch to the international market, and the VC environment is typically associated with the United States. While VC has thrived in the United States, it is not too widespread in other regions, in spite of a number of attempts to facilitate VC investments by the governments. The level of innovation brought by US VC investment and its recorded success have paved the way towards more international recognition of VC (Cressy, 2006). Even though the US is still the leader in terms of innovative ideas backed by VC, Europe has grown to be the second-biggest center for venture fund raising. In a similar vein, the VC environments of India and China have seen steady development as the two countries capitalize on the growth of their gross domestic product (GDP), domestic consumtion and a young and active entrepreneurial market (Ernst & Young, 2011).

However, in Europe, only a small number of countries, such as the United Kingdom or Sweden, have a relatively developed VC environment. The study of Bottazzi, Da Rin and Hellmann

(2004) shows an estimation that 1998 is the median year with respect to when European VC companies get into motion. Grilli and Murtinu (2014) show that the scale of European VC industry is approximately a quarter of that of the United States. Moreover, most continental countries in Europe have either demonstrated low activity level for VC, such as France or Italy, or even almost non-existence, such as Poland, Romania or Greece (Grilli, Mrkajic & Latifi, 2017). As a result, Europe as a whole is still viewed as a developing and growing VC market.

According to Da Rin, Nicodano and Sembenelli (2006), the initial launch of additional stock market sectors for entrepreneurial companies, especially ones focusing on innovative technology, in Europe between 1996 and 2000 is aimed at providing desirable exit opportunities for VCs and other early investors, which boosts the development of VC markets. Liquidity of capital markets is a pivotal concern for VC firms when they plan to seize opportunities to exit from backed companies. Other aspects such as the regulatory environment in a country are also brought into consideration to make sure that beneficial exits are achievable (Cumming, Fleming and Schwienbacher, 2006).

A number of stock exchanges in Europe have started to set certain standards for new listings, mostly focusing on financial situation such as having had more than four years of positive earnings prior to going public. The listing requirements for Euro. NM markets put more emphasis on governance and management, as discussed in Giudici and Roosenboom (2002). Generally, new markets demand regular audits on financial reports to ensure that global accounting standards are met. For IPOs in these markets, internal investors have a lockup period to prevent them from selling their shares upon listing, such as within six or twelve months.

The performance of VC funding outside the US is still heatly debated. For instance, the VC market in Europe has been seen heavy criticism for its poor showing with respect to expectations (Hege, Palomino, and Schweinbacher, 2009). The study of Bottazzi et al. (2004) state that most evidence has not been in favor of the VC investment model outside the US, and has supported the perception that the VC industry is tied to the culture of the US. Their main finding of the research by Hege, Palomino and Schwienbacher (2003) with the goal of comparing the US and EU markets is that on average, US-based VCs demonstrate remarkably better performance in terms of the exit type and return rates for investments. The primary reasoning is that US VCs efficiently employ contingent control rights and better screening process for projects. The performance discrepancy is further discussed in the study of Schwienbacher (2005). The author makes a conclusion that EU VCs do not exercise monitoring over their backed companies as extensively, and also work in relatively illiquid markets for primary employees and for share transactions. Aghion and Bolton (1992) and Hart and Moore

(1994) look into the contingent control rights and the even more severe "hold-up" challenge in more depth. It has been stated that the performance discrepancies between Europe and US could come from the information advantages of US-based VCs with respect to the quality of the corresponding IPO and their higher reputation.

Outside of the US, beside Europe, a region that has been receiving increasing research attention is Asia. In most Asian countries, the VC industry is still in the early phase. Regulations for these markets are still lacking, as they are either too rigid and end up limiting the development of the industry, or too loose to protect the interest of VC firms (Wang, Wang & Lu, 2002). Moreover, SMEs do not have the necessary level of maturity to understand the importance of VCs. For instance, founders of Asian companies are heavily affected by the Asian culture and are typically resistant against having external investors involved in management and giving out a part of their own equity. This observation is applicable especially in the case of family-owned businesses (Tan, 1998).

However, some research shows that the European market also exercise high professionalism when it comes to the VC investment industry. Schwienbacher (2002) and Bottazzi et al. (2004) demonstrate that European and US VCs show similar degree of commitment when it comes to management and monitoring of backed companies. Moreover, as Hege et al. (2009) show, VC firms coming from the US to invest in the European market do not necessarily show better performance than the local counterparts. Schwienbacher (2005) also points out that European VCs demonstrate the best performance when they utilize their own practices, which are different from those commonly employed by US VCs. Hege et al. (2003) make comparisons between US and Europe. The authors report that VCs based in the US demonstrate considerably better performance on average, as evident by the exit types and rates of return. They explain that this superior performance is because of US VCs' capabilities in project screening, as well as the use of control rights. Schwienbacher (2005) provides another explanation by showing that European VCs employ less monitoring and intervention over their backed companies. The European market also lacks liquidity for the transactions of shares.

The maturity discrepancy between Europe and United States is also reflected in the volume of research effort put into the two markets. Most studies have focused on the VC environment in the United States, and not much so on the European region. Research effort in the performance of European IPOs backed by VCs has been relatively lacking.

There is also a lack of studies that investigate the long-run performance of venture-backed IPOs at the aggregate level of European markets. The majority of research examine the long-run returns of IPO in general in specific European countries. It is expected that the performance of

European VC-backed IPOs would not be the same as concluded in existing literature focusing on US and Asian markets. However, the performance discrepancy between IPOs in US and Europe is believed to be caused by the stellar performance of US VCs when it comes to their experience and the ability to control IPO quality. As a result, it is pivotal to provide concrete evidences of the contributions of European VC firms to the performance of backed companies by looking into the performance of IPOs backed by VC over a relatively long period.

3. THEORETICAL FRAMEWORK AND HYPOTHESIS DEVELOPMENT

This section is dedicated to developing the hypothesis relating to the research objective of this study, based on the foundation of existing theories, comprising of agency theory, information asymmetry and signaling theory, and resource dependence theory.

3.1. Theoretical Framework

3.1.1. Agency Theory

In literature on IPO and venture capital, researchers have been using agency theory to explain the impact of venture capital on long-run performance. A number of studies indicate that VCs remove moral hazard and adverse selection. The participation of VCs is stated to boost backed firms' performance by providing certification and ex-post monitoring all key processes (Brav & Gompers, 1997; Megginson & Weiss, 1991; Doukas and Gonenc, 2005; Jain & Kini, 1995, 2000; Guo and Jiang, 2013). Basing on agency theory, Krishnan et. al (2011) found the positive influence of VC reputation on corporate governance of the issuer as well as its long-run performance after IPO.

Conflicts of interests between managers and shareholders, known as the agency problem, may impact a company's investments and courses of actions. Agency problems emerge between the VC (principal) and the entrepreneur (agent) when there are misalignments in goals and differences in risk tolerances (Eisenhardt, 1989; Bruton, Fried and Hisrich, 1997). The theory makes an assumption that both the principal and agent rational care for their own interest (Eisenhardt, 1989). As a result, behaviors to maximize personal gains are likely to occur if insufficient effort to align the goals and interests of VCs and entrepreneurs is initiated.

In a typical financial theory on corporate governance, there are multiple techniques proposed to address the agency problem. Examples include executive compensation, shareholders voting to select the director board or the inclusion of independent board members. A capital structure is considered as optimal when it addresses two issues: the interests and ownership segmentation between managers and external investors, and the involvements of debt and equity holders (Jensen and Meckling, 1976). When VCs invest in a venture, they are seen as external stakeholders who monitor the company to leverage its potential position, and limit agent behaviors from opportunists.

In addition, according to this theory, concentration of prolonged ownership can be a consequential governance technique to address many of the agency conflicts previously mentioned. Block ownership of equity is a commonly used solution to steer the behaviors of managers. Cronqvist and Fahlenbrach (2009) emphasized the role of blockholders like VCs in

enhancing the performance of companies. Comparing to institutional investors' portfolios, VCs' are often under-diversified. It partly explains why VCs generally take a more active participation in invested companies. Moreover, VCs generally keep a sizable portion of their equity holdings following the IPOs (Hochberg, 2008) to further engage in management of the firms, and continually offer other value-adding services. The research of Barry, Muscarella, Peavy & Vetsuypens (1990) shows that concentrated stakes of VCs in their portfolio companies remain one year or more after the IPO for 89% of the VCs examined, and there is the continuance of the seats held by VCs on the board of directors. On average, VCs are reported to possess 36.6% of the company before IPO, and 26.3% after. Due to the long-term concentrated ownership, they will be more committed to contributing to the monitoring the activities of the companies, such as by playing active roles in internal decision processes.

In their added-value activities at their portfolio companies, VCs tend to adopt actions to tackle challenges relating to agency conflicts in accordance with the agency theory. The due diligence conducted by VCs provides a layer of assurance against probable adverse selection and moral hazard coming from the entrepreneurs (Doukas and Gonenc, 2005). In addition, staging is a method employed by VC to limit agency problems. The main reason for this approach is because VC investors will have the choice to stop the involvement in a project if it is unable to deliver expected results for each stage, which as a whole results in better investment outcomes (Tian, 2011a).

VCs' active involvements in the monitoring and the decision-making process ensure that moral hazard is significantly mitigated, contributing to better performance. Complementing the motivation to engage in monitoring as described above is the domain experience that VCs have acquired. VCs often have accumulated more expertise than other type of investors since they have invested in multiple companies specialized in certain industries, carried out rigorous market research as well as strategic, financial and operational planning (Barry, 1994). Sapienza (1992) show that VCs are generally less involved in low-risk monitoring activities, or those which are sufficiently developed, but focus on where their expertise can be leveraged most effectively.

3.1.2. Information Asymmetry

Multiple renowned researchers have used information asymmetry theory to explain the effects that venture capital exert on long-run performance of IPOs (Brav and Gompers, 1997, Brav and Gompers, 2003, Lee & Wahal, 2004).

There are considerable discrepancies between VC and other types of commonly known finances. VC focuses on financing young and innovative firms. These firms involve multiple differences compared to the more mature companies on a stock market, particularly the challenge of information asymmetry.

An IPO serves as one of the initial opportunities to generate liquidity for a growing company. At the same time, founders and early investors aim to materialize their management stake in the firm (Brav and Gompers, 2003). IPOs, however, do contain potential agency problems for all the different parties involved. For instance, adverse selection can be encountered if managers withhold information about the firm. Because firms at their IPOs have limited track records, investors are unable to depend on prior performance to estimate the company's future performance (Brav and Gompers, 2003; Mason and Stark, 2004). Managers therefore have the incentive to inflate the value of the company by announcing optimistic views on the potential revenues, giving them more favorable returns from the IPO.

The involvement of VCs in the company, together with their constant monitoring to mitigate potential agency problems, contributes to decreasing the information asymmetry cost by giving positive signals to investors when the firm becomes public. Within the domains where VCs have competitive edges, they are still more inclined to collaborate with companies showing low selection costs, or relatively less impactful information asymmetry. Even inside an industry that VCs are specialized in, they are still expected to put more preferences in companies having solid track records, rather than those with high uncertainties such as completely new start-ups. Therefore, their participations indicate the belief they have for the potential value of the firm (Field and Hanka, 2001; Brav and Gompers, 2003), reducing information asymmetry.

Even though VC firms can generate returns through IPOs of portfolio companies or through acquisitions, returns are typically realized by taking companies public. Therefore, it is important for a VC firm to signal a reputation of being capable to take portfolio companies public and to maintain good performance post-IPO. Gompers (1996) shows examples where VC firms are unable to gather capital due to their inability to have a portfolio of IPOs with high performance. The author also demonstrates the contrary, meaning they are able to quickly obtain additional funding if they have back a high-quality IPOs in terms of both short- and long-run performance.

There are multiple elements to explain the impact on performance of firms in the post-IPO phase by VCs. Certification is the component most commonly discussed and agreed upon. It assumes that VC firms have the ability to accredit in the context of high information asymmetry and perform monitoring. On one hand, VCs are typically perceived as insiders by other

investors because they possess stock shares and engage in management activities of the IPOs. As a result, the fact that VCs hold shares when the market lacks concrete information to judge an IPO's true value is a positive signal to investors. Thanks to this accreditation ability, backed firms have less need for earnings management, which can result in more positive long-run performance after IPOs.

3.1.3. Resource Dependence Theory

Even though resource dependence theory has not been a popular theory in this branch of literature, it is the potential theory to explain how venture capital's financial backing as well can exert positive influence on the long-run performance of IPOs. Resource dependence theory considers an organization as a socially open body, having tight connection with its outside environment. Companies require multiple types of vital resources of from external settings to augment performance (Pfeffer & Salancik, 2003). Effective link to socially sophisticated assets not only provide the organization with significant means for growth, but also exposes them to diverse circumstances and risks that enable them to better manage uncertainty (Pfeffer & Salancik, 2003).

Resource-based theory has raised the awareness of the importance of possessing heterogeneous assets in building and realizing a company's long-term competitive advantages. Alvarez & Busenitz (2001) argue that entrepreneurship revolves around discovery, perception, seizing opportunities, and making use of relevant expertise resulting in heterogeneous outputs.

From this theoretical perspective, VCs play an important role in linking these social resources with companies they invested in. VCs can facilitate the process which enables the discovery of these resources, turns defined inputs into heterogeneous outputs, and makes use of assets for further benefits. With their acquired experience, expertise and network, VCs have higher level of links to the external environment, and thus, higher capability to provide their portfolio companies the access to key resources. The most significant categories of resources to the companies that have been perceived by prior research comprise of financial capital, strategic and market information, human resource such as competent mangers and consultants, link to key suppliers and potential customers, as well as other important stakeholders (Baysinger and Zardkoohi, 1986; Frooman, 1999). Experienced VCs are capable of providing these resources, which in turn assist the companies in improving their growth prospects as well as long-run performance.

On the other hand, the provision of better connection to the external environment provided by

VCs can result in stronger dependencies of the portfolio companies on VCs, which is in accordance with resource-dependence theory (Pfeffer & Salancik, 2003). Greater power of VCs in the companies can strengthen the influence of their consultancy and decision-support functions in various strategic, managerial and operational activities.

3.2. Hypothesis Development

3.2.1. Long-run performance of European VC-backed IPOs in comparison with counterparts

Agency theory suggests that the amount of effort put into supporting the invested companies correlates with the size of the VCs' equity holdings. The large extent of the ownership stake of the VCs can help mitigate the agency problem. Researchers have considered the concentration of ownership as a governance indicator that can potentially mitigate agency costs (Barry et al., 1990; Shleifer and Vishny, 1997). VCs are external owners, therefore, their active participation in monitoring the entrepreneurs for any important decisions related to the venture is more likely to be subjective and effective. The rigorous selection of investments and continuous monitoring of VCs can enhance the long-run performance of IPOs that they back. On the whole, agency theory gives support to the over-performance of VC-backed IPOs to non-VC-backed IPOs after going public.

VCs can reduce the level of ***information asymmetry*** inherent in the nature of young firms going public. VCs focus more on growing companies having disruptive technologies where information asymmetries are highest. In addition to the rigorous screening and thorough due diligence procedure to choose the most promising ventures in terms of performance prospects, VCs occasionally collect information to keep open an option to terminate funding for projects having slim chance of going public (Gompers and Lerner, 2001; Tian, 2011a). Overall, the risks associating with the large amount of stakes that VCs hold in their portfolio companies, along with their professional monitoring and consultancy, provide a reliable signal to investors about the quality of the IPOs both in the short and long-run after the IPO event.

In accordance with ***resource-based theory***, VCs provide their portfolio companies with the infusion of resources that are of critical importance for their long-term success. These resources include financial capital, management expertise, strategic and operational advice, human resources (competent mangers and advisors, underwriters, auditors, creditors), information, as well as strong and broad networks of potential customers and suppliers, etc. The possession of this access to resources in turn lead to stronger interdependence between VCs and companies,

and hence, consolidate the power of VCs, enhancing the positive influence that their value-added services exert on the performance of the held companies. The study by Casamatta (2003) argues that VCs carry out activities to bring additional values to the entrepreneurs. Because both the VCs and the invested companies get values from these actions, entrepreneurs tend to be open to them, which is in accordance with resource-dependence theory.

Despite an assumption that the advantages that VCs bring mainly accumulate during the time that VCs still provide their added-value services to the firm, the management structures as well as operating and financial practices shaped with the consultation and assistance of VCs will likely remain effective in the firm for a considerable length of time after exit. That foundation enable the companies to efficiently capitalize on post-IPO opportunities to promote growth and ensure survival (Jain & Kini, 2000). Moreover, VCs generally retain considerable ownership in their portfolio companies and do not terminate their involvement after the IPOs due to factors such as lock-up agreements, performance incentives and liquidation plan. Therefore, we argue that the positive impact of VCs from several theoretical perspectives will retain for a long time after the IPO, helping improve long-run performance. The positive effect of VC backing on both stock and operating performance of the companies has also been reported by prior research in several markets.

With regards to the performance of VC-backed companies between different regions, there has been inconsistency in prior studies. However, extant research has more strongly supported the idea that the VC industry is tightly connected to the US culture, and the effectiveness of VC monitoring and consulting is the highest in the US (Bottazzi et al., 2004). Therefore, the advantages supposedly delivered by VCs are most effective in the US, and inferior in other regions, including the EU. It has been reported that the intensity and quality of monitoring as well as guidance and resource provision in the EU is less than those in the US (Schwienbacher, 2005). There is the dominance of VC industry in the US compared to other regions, including the EU, both in terms of the number of companies backed by VCs and the quality of value-added services provided by VCs. Therefore, it is expected that the VC-backed IPOs in Europe will underperform VC-backed IPOs in other regions in general.

On the foundation of the above theoretical reasoning and prior empirical findings, the first hypothesis of the study is proposed as follow:

Hypothesis 1: European VC-backed IPOs (i) overperform European non-VC-backed IPOs and (ii) underperform VC-backed IPOs in other geographical regions.

3.2.2. The impact of VC reputation on long-run performance of VC-backed IPOs in Europe

Reputation is a valuable asset in situations where quality is not guaranteed, and information asymmetries are present. It provides firms with significant competitive advantages, and gives customers pivotal information (e.g. Kreps and Wilson 1982; Milgrom and Roberts 1982; Shapiro 1983). Reputation is especially important in cases there is a large number of players in the competition. There been multiple studies show that reputation is indispensable for the financial service industry (e.g. Holmstrom and Tirole, 1997; Titman and Trueman, 1986).

Gompers (1996) provides insights into the importance of reputation. An intermediary's reputation can have an impact of its clients. The reputation of a financial service provider is a key consideration for companies that are in the fund-raising phase. In cases where information about a company is insufficient, investors mainly base their decisions on the company's associates as an indication of its potential quality.

Reputation of VCs is particularly pivotal when the quality of companies that they back is not easily assessable by outsiders, which is usually the case for the entrepreneurial firms and IPO landscape. Opportunity cost to go public is correlated with the degree of ***information asymmetry*** connected to the issuing company. VCs are expected to reduce this asymmetry thanks to their capabilities to certify that prices represent all relevant and currently known information. Additionally, VC certification enhance the credibility of the portfolio companies with customers, suppliers and partners, enabling smoother business development. This is one of the ways that better reputation of VCs can contribute to the improvement of middle- and long-run post-IPO performance of backed companies.

In general, the stronger reputation is indicative of greater experience and expertise, which can presumes the higher quality of guidance and added-value services of VCs on which the backed companies reply on for growth and survival. In accordance with ***agency theory***, it can help reduce moral hazard and adverse selection issues, contributing to better long-run performance (Krishnan et al, 2011). Implementing more intensive screening process, more reputable VCs are able to invest in firms with better quality and performance prospects. Besides, portfolio companies yield multiple benefits from the backing of more reputable VCs. The experience accumulated from investing in, supporting, developing, and bringing ventures to public makes VCs specialists in the industries and technologies that they focus in. It enables more reputable VCs to provide better guidance and implement the actions to reduce agency conflicts more effectively. VCs with more reputation also have greater abilities to facilitate the formation of business relationship with higher-quality customers and suppliers, as well as the creation of

strategic alliances with more established firms (Cumming, 2007). The deployment of such important assets can help companies produce better performance post-IPO.

Consistent with ***resource-dependence theory***, superior quality of access to critical resources provided by more reputable VCs strengthen the dependence of backed firms on VCs. As a result, there is higher likelihood for more reputable VCs to be the lead VCs in the syndicate, allowing their advisories to have greater power in decision-making activities, and in turn, on performance (Cumming, 2007).

Barry (1994) notes that VCs' involvement in a project can be biased if there exist incentives to provide fund owners with too early IPO timing. VC firms of lesser reputation are under the pressure of taking their portfolio companies public too prematurely (Lee & Wahal, 2004). This reverse principal and agent problem occurs when less reputable VCs look for quick IPOs to build up a track record, making it easier for them to raise future funding rounds (Jain & Kini, 2000). By choosing the optimal timing to assure that only well-prepared companies are going public, a more reputable and experienced VC can add more values to improving long-run performance of its portfolio company.

From the above arguments, we form the second hypothesis as follows:

Hypothesis 2: The reputation of venture capital firms is positively associated with the long-run performance of venture-backed IPOs in Europe.

4. METHODOLOGY AND DATA

This section is dedicated to explaining the methodology employed in this study and the data collected to estimate the proposed models. First, we will elaborate on the selected quantitative methods and the development of model specification. Second, we will describe the data collection process from two databases, Thomson One and Datastream, to obtain the data on the required variables.

4.1. Methodology

Multiple linear regression and logit regression are the methods we use in this research. Two main econometric models are built to test the two hypotheses specified in the previous section, and the dependent variables in both is post-IPO long-run performance. The choice of regression technique depends on whether the proxy for long-run performance is metric or binary.

When the primary dependent variable is continuous, Ordinary Least Square (OLS) multiple linear regression is the appropriate method. This is also the most widely used method extant research in this particular theme, including those of Barry et al (1990), Krishnan et al. (2001), given its simplicity and proven effectiveness in estimating parameters in linear regression model.

When we attempt to model the relationship between numerical or categorical independent variables and a binary dependent variable, logit or probit regression is certainly the most prevalent method. The main different of the two techniques lies in the link function, with logit regression using logit link function and probit regression using inverse normal link function. Logit regression has slightly flatter tails of distribution than probit technique (Dey & Astin, 1993). Interpretation is easier in logit regression, since coefficients can be interpreted in terms of odds ratio, but the two methods generally produce very similar results (Dey & Astin, 1993).

Using logit or probit regression would be consistent with studies that use Survival, a dichotomous measure, as the proxy for long-term performance, such as Jain et al. (2000), Krishnan et al. (2001), Pommet (2017). An alternative and more advanced method is Cox proportional hazard, employed in by Jain et al. (2000), Pommet (2017). Considering the fact that survival rate is only the complementary and not the principal measure of post-IPO performance in this study, we decide to employ logit regression taking into account its simplicity and ease of interpretation.

In our study, the long-run performance is captured by four alternative measures, three are continuous (Buy-and-Hold return, Buy-and-Hold Abnormal Return, Return on Asset, Market-to-book ratio) and one is binary (Survival). As a result, both OLS regression and logit

regression are adopted in accordance with the data type of the proxy for the dependent variable.

4.2. Model specification

4.2.1. Regression Models

4.2.1.1. First hypothesis

The 1st hypothesis is: *European VC-backed IPOs (i) overperform European non-VC-backed IPOs and (ii) underperform VC-backed IPOs in other geographical regions.* The following model is used to test this hypothesis:

$$Performance_i = \beta_0 + \beta_1 VC_i + \beta_2 Region_i + \beta_3 VC_i \times Region_i + Control_i + u_i$$

The representation of the model with details on the control variables is as follows:

$$Performance_i = \beta_0 + \beta_1 VC_i + \beta_2 Region_i + \beta_3 VC_i \times Region_i + \beta_4 IssuerM/B_i + \beta_5 LnSize + \beta_6 Underpricing_i + \beta_7 LnOffersize_i + \beta_8 NumberofUnderwritters_i + u_i$$

This model is developed by including the independent variables we aim to investigate, namely venture-backed status and location, along with the control variables adopted from Krishnan et al. (2011).

To implement this model, we use the sample of data including all global IPOs in the examined period. In this model, $\boldsymbol{Performance_i}$ is one of the measures of post-IPO long-run performance. $\boldsymbol{VC_i}$ is equal to 1 if the IPO is backed by VC and 0 otherwise. $\boldsymbol{Region_i = 1}$ indicates that headquarter of the company that goes public is located in a European country, and $\boldsymbol{Region_i}$ = 0 denotes that the IPO is outside of Europe. $\boldsymbol{VC_i \times Region_i}$ is the interaction term between $\boldsymbol{VC_i}$ and $\boldsymbol{Region_i}$.

We apply OLS regression when the performance is measured by Buy-and-Hold return, Buy-and-Hold Abnormal Return, Return on Asset, Market-to-book ratio (continuous measures), and apply logit regression when the performance indicator is Survival rate (binary measure).

To test the first hypothesis, we examine the statistical significance of the linear combinations of relevant coefficients. If $\boldsymbol{\beta_1 + \beta_3}$ is significantly larger than 0, we can infer that the performance of European VC-backed IPOs is better than that of European IPOs not backed by a VC. To examine the second part of the 1st hypothesis, we look at $\boldsymbol{\beta_2 + \beta_3}$ in the estimation result. The significantly negative value of this sum indicates the underperformance of VC-backed IPOs in Europe to VC-backed IPOs in other locations.

This list of control variables will be explained in the later section. IPO observations in the dataset that are in the same industry, country or have the same year of going public are likely to have correlated returns, since they may have similar traits and be exposed to similar risks and economic conditions. Therefore, we cluster standard errors by year of IPO and industry to ensure the compliance with the assumption of homoscedasticity when implementing OLS regression.

4.2.1.2. Second Hypothesis

For testing the second hypothesis regarding the impact of venture capital reputation on long-run performance of VC-backed IPOs, focusing only on European countries, we employ the model as below, which is in line with extent literature (Krishnan et. al, 2011):

$$Performance_i = \beta_0 + \beta_1 VCreputation_i + Control_i + u_i$$

The model with details on all control variables is as follows:

$$Performance_i = \beta_0 + \beta_1 VCreputation_i + \beta_2 IssuerM/B_i + \beta_3 LnSize + \beta_4 Underpricing_i + \beta_5 LnOffersize_i + \beta_6 NumberofUnderwritters_i + u_i$$

To test this model, we reduce the data sample to only European VC-backed IPOs. In this model, $\boldsymbol{Performance_i}$ – post-IPO long-run performance is regressed on the proxy for $\boldsymbol{VCreputation_i}$ and the control variables. We also cluster standard errors by year of IPO, industry and country as well as control for industry and year fixed effects.

Similar to the first model, when we measure performance by Buy-and-Hold return, Buy-and-Hold Abnormal Return, Return on Asset, Market-to-book ratio, we employ OLS regression; and logit regression is used when the performance indicator is Survival rate.

To address selection bias, beside this main model, we implement an additional model based on Heck-man two-stage selection method, which will be explained in section 4.2.3.

4.2.2. Variables

4.2.2.1. Dependent variables

The dependent variable of interest in both models is the $\boldsymbol{Performance_i}$ – post-IPO long-run performance. Following prior research (Krishnan et al, 2011), we adopt four measures of long-run performance, including **Buy-and-hold Abnormal Return** (stock return measure), **ROA**

(accounting measure), **Market to Book ratio** (market-based measure), and **Survival**. All of them are measured over the 3-year period after the IPO. The rationale for using four measures of different types is to reflect multiple aspects of long-run performance. The strength of the impact is considered larger if its direction is the same for many proxies of long-term performance. If the firm is delisted before the 3-year benchmark, their performance is measured until it is removed from the stock exchange to eliminate survivorship bias. Of these measures, the most prevalent one in existing literature is Buy-and-Hold Abnormal Return. We will implement the regression models separately for each of the following proxies for performance.

- **Buy-and-hold Return (BHR) & Buy-and-hold Abnormal Return (BHAR):**

Following the vast majority of prior research (e.g. Brav & Gompers (1997), Krishnan et al. (2001), we use buy-and-hold abnormal return (BHAR) of stock as the main proxy for post-IPO long-run performance. It is computed as follows:

$$BHAR_i = \prod_{t=1}^{T}\left(1 + R_{i,t}\right) - \prod_{t=1}^{T}\left(1 + R_{b,t}\right)$$

BHAR is calculated on the monthly basis, from the 1st month until the 36th month after the IPO. In this formula, $1 + R_{i,t}$the return of company i's stock at time t and $1 + R_{b,t}$ is the return of the benchmark index in the same month. $\prod_{t=1}^{T}\left(1 + R_{i,t}\right)$ is known as buy-and-hold return (BHR), or the cumulative return on the buy-and-hold investment in stock i. When the investor buys the stock and holds them for a long horizon of time, it is considered buy-and-hold investment strategy. Therefore, return on the buy-and-hold return is the widely applicable measure when it comes to measuring long-run performance in the stock market. BHAR is defined as the difference between normal BHR and the cumulative return of the benchmark over the same period.

As global data is used to conduct the regression model in the first hypothesis, the index of choice is MSCI World. With regards to the second hypothesis, we focus solely on VC-backed European IPOs, therefore, MSCI Europe is the benchmark index chose.

- **Return on Asset (ROA):**

Return on Assets of a firm is computed by dividing its Net Income by the book value Total Assets, which indicates the efficiency of the company in utilizing its assets. The calculation of ROA is similar to the research of Krishnan et al. (2011). ROA is measured at the 36-month point of time after the IPO. It can capture financial performance of a firm in a comprehensive way, by taking into account both a performance indicator in the income statement and the total

assets of the business, an item in the balance sheet. However, it is not directly relevant with regards to gauging the performance of the IPO in the stock market.

- **Market to Book ratio (MTBV):**

This value-based measure is a proxy for Tobin's Q and represents growth prospects and real options value of the firm. This is a metric to gauge an issuer's long-term financial position.

- **Survival rate:**

Survival is a binary variable that takes the value of 1 if the company remains listed in the exchange 3 years after the IPO and 0 otherwise. Survival profile is considered a basic measure of performance, and convey less information about performance than a metric variable. However, it also brings the benefit of completely avoiding the problem of survivorship bias in the regression model. According to Jain et al. (2000), researchers have largely neglect the examination of the survival of IPO firms after going public, yet this is a critical aspect worth receiving further studies.

4.2.2.2. Independent variables

First hypothesis

VC_i is a binary variable, equal to 1 if the IPO is backed by VC and 0 otherwise.

$Region_i$ is a binary variable, equal to 1 when the headquarter of the company that goes public is located in a European country and 0 otherwise.

$VC_i \times Region_i$ is the interaction term between VC_i and $Region_i$**.**

Second hypothesis

Our independent variable of interest to test the second hypothesis is $\boldsymbol{VCreputation_i}$**.** The primary proxy for VC reputation is **IPO market share**. This is also the most prevalent measure for VC reputation in prior research, including those of Megginson and Weiss (1991), Nahata (2008), Krishnan et al. (2011). Krishnan et al. (2001) define IPO market share as the proportion of dollar size of IPOs backed by a VC to the total size of all IPOs in the prior 3 years before the IPOs. In this study, we will calculate IPO market share in the 5-year period preceding the IPOs. As an illustration, to calculate IPO market share of a VC backing a firm that go public in June 2011, we take the aggregate gross proceeds (exclusive of overallotment options) of

completed IPOs that are funded by that specific VC from June 2006 until before the IPO date and divide that amount by the total gross proceeds of all IPOs in the same period. As all VCs are supposed to add value to their investees, they are granted full credit for each completed IPOs that they back in our calculation of IPO market share.

With regards to IPOs that are backed by two or more VC firms, we would concentrate on the impact of VC reputation of the most reputable VC in the syndicate. The reason is that the lead VC in terms of reputation is more likely to play an active monitoring role in the portfolio company than other VCs in the period after the IPOs, and thus may have a more considerable impact on post-IPO performance (Krishnan et. al, 2001)

For robustness check, **VC Age** will be employed as the alternative measure of VC reputation. VC Age is calculated as the number of months between IPO date and the date of incorporation of the VC. 1980 VC age as a proxy of VC reputation has been adopted in the research of Gompers (1996), Hsu (2004), Krishnan et.al (2011), as it is argued to reflect the level of establishment of the VC as well as its experience of VC in investment. However, in our view, longer duration of existence is not necessary associated with market share and reputation. Due to this limit, this proxy is only to serve the purpose of robustness check.

4.2.2.3. Control variables

The same set of control variables is included in both models of this study. Basing on the foundation of prior literature, a number of control variables, which provide general information about an IPO deal and may have individual impact on long-run performance beside the primary independent variables of interest, are included in the regression models. The inclusion of these variables help reduce potential bias deriving from the omission of relevant variables.

- $\boldsymbol{IssuerM/B_i}$**:**

$IssuerM/B_i$ is the variable that measure market-to-book ratio of the issuer at issuing time. Market-to-book is a typical indicator of growth prospects of a company. We include market-to-book ratio of the company at the time of issue as a variable to control for the impact of growth opportunities as perceived by the market at the IPO time on post-IPO performance (see Brav and Gompers, 1997).

- $\boldsymbol{LnSize_i}$**:**

$Size_i$ is the variable measuring the natural logarithm of the issuer's asset at the time of IPO.

Brav and Gompers (1997) found the relationship between firm size and long-run performance of IPOs. As total assets are highly skewed to the left, we transform this variable by taking its natural logarithm.

- $\boldsymbol{LnOffersize_i}$**:**

Offer size is computed by taking the natural logarithm of IPO gross proceeds, exclusive of overallotment options. Carter et al. (1998) argues that larger IPO gross proceeds are made by companies in a more solid financial position, which in turn, can have an impact on the performance of that company subsequent to going public.

- $\boldsymbol{Underpricing_i}$**:**

Underpricing is defined as initial returns of IPOs, calculated as the difference between the close price of the first day and the offer price divided by the offer price. Some past research has investigated the association between higher pricing level and lower long-run performance of IPOs. The two studies Ritter (1991) and Loughran and Ritter (1995) show that the misaligned view in terms of pricing of IPOs backed by VCs is one important reason why these IPOs tend to have higher initial returns, but underperform over the longer period when compared to IPOs not invested by VCs. Another reason is shown by Miller (1977) as early investors who support IPOs are generally the ones most optimistic about their performance. More often than not, however, IPOs are unable to meet the investors' high expectations. Purnanandam and Swamithanan (2004) report that overvalued IPOs have the highest returns in the first few days then slowly come back down to the fair price in the long term.

- $\boldsymbol{NumberofUnderwritters_i}$

According to the research of Carter et al. (1998), lower level of negative returns in the long-run is found for companies having more reputable underwriters in their book-building process. Recognizing the importance of the influence of underwriters, this study includes the number of underwriters as a control variable for such impact.

- **Other control variables**

Besides the above-mentioned variables, we also include fixed effects control for year of IPO and industry. To give an instance with regards to year of IPO, most significant underperformance is found by Ritter (1991) to be of companies going public in heavy-volume years, for example, the years right prior to financial recess. Additionally, companies in different industries are under the influence of divergent market conditions, which can expose to IPOs in different European countries to relatively dissimilar environments. As a result, it is essential to include fixed effects control for these variables in the estimation model.

4.2.3. Additional analysis

To address selection bias in the model to test the second hypothesis, which examines the effect of VC reputation on long-run performance of VC-backed IPOs in Europe, we implement Heckman two-step selection model as an additional analysis. The original model is as follows:

$$Performance_i = \beta_0 + \beta_1 VCreputation_i + \beta_2 IssuerM/B_i + \beta_3 LnSize_i + \beta_4 Underpricing_i + \beta_5 LnOffersize_i + \beta_6 NumberofUnderwritters_i + u_i$$

4.2.3.1. Methodology and Model specification

There is a need to address selection bias. More reputable VC firms may choose in invest in, or have better access to, intrinsically higher-quality companies, which is in line with the result found by Sørensen (2007). In this case, the error term of the regression will be correlated with VC reputation, an independent variable, leading to the violation of one of the assumptions of OLS regression and therefore, less reliable estimate of the regression coefficients. Consequently, it is critical to separate that selection effect and the impact of VC reputation on the long-run performance of the IPO.

Therefore, we implement Heckman two-step selection model as an additional model to control for endogeneity, besides the main model. This is the same approach as employed by Krishnan et. al (2001).

First step:

$$Probability(Reputable\ VC = 1) = \beta_0 + \beta_2 VCregion_i + \beta_3 NumberofBackers_i + Control_i + u_i$$

Second step:

$$Performance_i = \beta_0 + \beta_1 VCreputation_i + \beta_2 inverseMillsratio_i + Control_i + u_i$$

In the first step, a probit model is conducted to estimate $Probability(Reputable\ VC = 1)$ the probability that a firm receives the funding of a reputable VC investor. A reputable VC is defined as a VC with IPO market share (in the 5-year period before the IPO) higher than the median market share value of all VC firms.

To enable the implementation of this technique, we need instrumental variables that are correlated with $VCreputation_i$, the explanatory variable, but must not be correlated with

$Performance_i$, the dependent variable. In this probit model specification, the same control variables as in the standard OLS regression model above are also included. This model will generate the Inverse Mills ratio for reputable VCs, which capture the probability that a more reputable VC firms will select to invest in companies of higher quality.

In the second step of Heckman model, the Inverse Mills ratio obtained from step one is included in the model regressing long-term performance on VC reputation and other control variables.

4.2.3.2. Instrumental variables

Following the earlier research of Krishnan et al. (2001), the following instrumental variables in Heck-man two-step selection model are adopted:

- $\boldsymbol{VCregion_i}$**:**

$VCregion_i$ is the binary variable, with 1 indicating that VC's headquarter is in the same country with the funded company's headquarter and 0 otherwise. More reputable firms have better ability to select portfolio companies meeting criteria of their preference. Nearby location of investees is one of the popular preferences of VC firms, since VC firms generally have better knowledge and experience of the close-by region, as well as travelling cost can be reduced if they invest in a geographically closer company. Therefore, VC region is related to VC reputation. On the other hand, it is unlikely to be related to post-IPO performance.

- $\boldsymbol{NumberofBackers_i}$**:**

A more reputable VC backing may appeal other VCs to invest in the firm, leading to the increase in the number of VCs in the syndicate (Hochberg et al., 2007). Accordingly, there is a link between the number of VCs invested in the company and VC reputation.

In order to confirm our theoretical arguments, we check the requirements of the instrumental variables by running a regression with the instrumental variables, VC reputations and control variables as explanatory variables, and post-IPO long-run performance as dependent variable. The result shows that none of the above instrumental variables have statistically significant impact on the proxies of long-run performance. Therefore, they qualify to be included in the first step of Heckman selection model.

4.3. Data sampling

The two databases from which data is collected to estimate the regression models in this research are Thomson One (for data on IPO deals) and Datastream (for data on long-run performance of IPOs).

This study investigates the performance of IPOs that took place from 2001 to 2014. We require post-IPO performance in the three-year moving window and the latest year on which we can gather performance data is 2017, therefore, the final studied year is 2014. As testing the first hypothesis requires global IPO data, IPO deals from all regions, including Europe, Asia Pacific, Americas, Middle East and Africa, are gathered from ThomsonOne.

For the second hypothesis, IPO market share, the proxy for VC reputation, is computed by dividing the gross proceeds of IPOs backed by a VC by the total proceeds of all IPOs in the five-year period before the trading date of an examined IPOs. As a result, besides IPOs from 2001 to 2014, it is essential to obtain data on IPOs deal from 1996 to 2000 for calculation of IPO market share. VentureXpert provided by Thomson One is the database we utilize to extract data on the name, nation and founding year of VC firms that invest in examined IPOs. Missing values relating to the nation and year of establishment of VC firms are then hand-collected using public information.

All things considered, data on independent and control variables of both the first and second hypothesis, such as trading date, company name and nation, gross proceeds, underpricing, venture-related data, etc., is extracted from Thomson One for the period from 1996 to 2014.

Data obtained from ThomsonOne is then matched with data on long-run performance stored in the Datastream database. Three identifiers, ISIN, CUSIP and SEDOL 9-digit are utilized for the matching process. For companies that lack all of these three identifiers, we cannot match the ThomsonOne data and Datastream data, therefore, data on performance cannot acquired. These companies are consequently dropped from the sample.

In Datastream, Total Return Index (RI) is the datatype extracted to get raw data for stock returns, since it is readily adjusted for dividends and stock splits. Returns of the benchmark indices, including MSCI World (for the first hypothesis using the sample of global IPOs) and MSCI Europe (for the second hypothesis using the sample of European VC-backed IPOs), are also gathered for the purpose of calculating BHAR. MTBV is the datatype used to acquire market-to-book value. We divide the datatype representing net income (WC01751) by that representing total assets (DWTA) to obtain ROA. Moreover, missing values of stock prices in Thomson One data, such as offer price and close price at the first day of trading is complimented by Datastream.

After having all the data required from databases, we clean the dataset by removing duplicated rows. In addition, only observations with available data for all variables in the model are used for the statistical tests.

From the above the data collection, we construct a sample of global IPOs for testing the first hypothesis. To examine the second hypothesis, we focus on only IPOs in European countries that were funded by VC. Venture-backed IPOs that lack data on VC firms are eliminated from the sample.

5. EMPIRICAL RESULTS

5.1. Descriptive Statistics

Table 1 provides the descriptive statistics of variables in **the sample of all global IPOs**, which is used to test the first hypothesis regarding the long-run performance of European VC-backed IPOs compared with their counterparts, including European non-VC-backed IPOs and VC-backed IPOs outside of Europe.

Table 1: Summary statistics of variables in the sample of all global IPOs

This table provides descriptive statistics of all global IPOs from 2001 to 2014

Variable	Observations	Mean	Std. Dev.	Median	Min	Max
Dependent variables						
BHR (%)	8146	5.99	77.39	-14.11	-90.39	275.24
BHAR (%)	8146	-16.46	76.69	-31.87	-180.63	292.82
ROA (%)	7544	-2.63	22.61	2.88	-195.62	30.83
MTBV	8076	2.40	2.45	1.69	-5.49	20.02
Survival	8146	0.97	0.17	1	0	1
Independent variables						
VC_i	8146	0.27	0.45	0.00	0.00	1.00
$Region_i$	8146	0.10	0.30	0.00	0.00	1.00
Control variables						
$IssuerM/B_i$	8146	6.05	6.54	3.98	-6.40	34.71
$LnSize_i$	8130	4.03	2.13	4.01	-2.30	9.68
$Underpricing_i$ (%)	6541	23.27	47.03	11.00	-100.00	271.00
$LnOffersize_i$	8143	3.19	1.80	3.29	-1.61	7.33
$NumberofUnderwritters_i$	8146	1.43	0.95	1.00	1.00	7.00

From 2001 to 2014, there are 8146 companies going public globally, of which 822 companies (10%) are from European countries. The number of European VC-backed companies is 254, which accounts for 31.2% of all European IPOs.

Over the examined period, BHR have the positive mean of 5.99% while the mean of BHAR is negative at -16.46%. The standard deviations of BHR (77.39%) and BHAR (76.69%) show relatively wide spreads. In the sample of US IPOs used by Krishnan et al. (2011), the average BHAR is higher, at -0.025%. It suggests the outperformance of US IPOs compared to other regions due to its developed capital market.

ROA, the operating measure, has smaller fluctuation, having standard deviation at 22.61%. ROA has relatively low correlations with other performance indicators, so it does provide

insights into performance from a different perspective. Krishnan et al. (2011) found the mean value of ROA in their US sample to be 0.43%, which is slightly higher than the figure of -2.63% in our global sample. Chen and Liang (2016) found the mean ROA of -1.10% in the sample of global IPOs over the longer period spanning from 1970 to 2007, which is more comparable to our sample.

The mean value of MTBV is 2.4, while in the US sample, Krishnan et al. (2011) found the higher value of 3.69. MTBV does show small correlations with BHA and BHAR (correlation value approximately 0.3 for both measures), but these correlations are higher than the correlation between ROA and BHAR. This is reasonable since BHA, BHAR and MTBV are market-related measures, while ROA is used to indicate operating performance.

Regarding survival rate, on average, 97% of all IPO companies remain listed after their initial offerings, which is higher than the value of 90% found by Krishnan et al (2011) in the US sample. The prior four examined measures show little correlation with IPOs' survivability.

For control variables, the statistics of market-to-book value, natural logarithm of firm size, underpricing, natural logarithm of offer size and the number of underwriters are described. The figures of offer size and underpricing are overall comparable to what found by Chen and Liang (2016), who also use the sample of global IPOs.

Table 2 describes the mean values of all variables in three subsamples: European VC-backed IPOs, European non-VC-backed IPOs, and non-European VC-backed IPOs. The data shows that in Europe, the number of IPOs without VC involvement (568) exceeds the number backed by VCs (254).

Table 2: Mean and median value of variables in three subsamples of the sample of global IPOs

This table provides descriptive statistics of three subsamples: European VC-backed IPOs, European non-VC-backed IPOs, and non-European VC-backed IPOs from 2001 to 2014.

Panel A: Mean and median value of variables in three subsamples of the sample of global IPOs

The mean value is outside the bracket in each cell, and the median value is placed inside the brackets.

	European VC-backed IPOs	European non-VC-backed IPOs	Non-European VC-backed IPOs
Number of observations	254	568	2016
BHR (%)	-18.61 (-38.24)	3.73 (-13.35)	4.13 (-15.56)
BHAR (%)	-24.75 (-37.97)	-8.08 (-21.58)	-16.42 (-34.15)
ROA (%)	-11.79 (-3.69)	1.31 (3.06)	-2.70 (2.69)
MTBV	3.31 (2.21)	2.25 (1.65)	2.94 (2.08)
Survival	1.00 (1.00)	0.99 (1.00)	0.95 (1.00)
$IssuerM/B_i$	12.85 (8.58)	6.90 (4.44)	5.70 (4.00)
$LnSize_i$	3.87 (3.57)	4.78 (4.67)	4.53 (4.27)
$Underpricing_i$ (%)	3.93 (1.52)	5.23 (4.00)	24.02 (12.00)
$LnOffersize_i$	1.60 (1.41)	3.69 (3.97)	3.89 (4.11)
$NumberofUnderwritters_i$	1.63 (1)	1.62 (1.00)	1.59 (1.00)

Panel B: Comparison of average performance indicators between Euro and other subsamples of the sample of global IPOs

t-statistics are placed in parentheses.*, ** and *** denote significance levels at 10%, 5% and 1%, respectively

	European VC-backed IPOs and European non-VC-backed IPOs	European VC-backed IPOs and Non-European VC-backed IPOs
BHR (%)	-22.34*** (-3.9342)	-22.74* (-1.7395)
BHAR (%)	-16.67*** (-3.1207)	-8.33*** (-4.5935)
ROA (%)	-13.1*** (-5.9745)	-9.09*** (-4.5348)
MTBV	1.06*** (3.1603)	0.37 (0.92058)

As we can see from *Table 2*, the mean BHR and BHAR of European VC-backed IPOs are lower than those of European non-VC-backed IPOs. This is not consistent with prior research that found the higher performance of VC-backed IPOs when using stock measures, for example, Brav and Gompers (1997) and Doukas and Gonenc (2005). It again emphasizes the need to include VC backing and Region as dummy variables in the regression to examine this phenomenon particularly in the European market. Similarly, with respect to the operating measure, ROA, the performance of VC-backed IPOs is lower than non-VC-backed IPOs in Europe. However, this is consistent with Chen and Liang (2016), who use ROA as the performance measure. Only when performance is measured by MTBV, we observe the higher mean performance of VC-backed IPOs compared to non-VC-backed IPOs in Europe.

In comparison with VC-backed IPOs outside of Europe, in this sample, the mean performance of VC-backed IPOs measured by BHR, BHAR and ROA is lower, while the mean performance measured by MTBV is higher.

Panel A *of Table 2* also presents the mean and median value of control variables representing IPO characteristics at the time of offering. In this sample of Europe, the level of underpricing of VC-backed IPOs is lower than non-VC-backed IPOs. This aligns with a number of earlier studies, including those of Megginson and Weiss (1991), Brav and Gompers (1997), and Hochberg (2012). In line with Lee and Wahal (2004), VC-backed IPOs are underwritten by many more bookrunners compared with non-VC-backed IPOs, and these bookrunners also tend to be more prestigious. Looking at Panel B of Table 2 which shows the result of t-test in difference between means, we can see that the mean performance of European VC-backed IPOs measured by BHR, BHAR and ROA is significantly lower than that of both European non-VC-backed IPOs and non-European VC-backed IPOs. In contrast, the mean MTBV of European VC-backed IPOs is significantly higher than that of their two counterparts.

Table 3: Correlation matrix between variables in the sample of global IPOs

	BHR	BHAR	ROA	MTBV	Issuer M/B	Ln of Firm Size	Under-pricing	Ln of Offer Size	Number of Underwriters
BHR	1								
BHAR	0.929	1							
ROA	0.001	0.006	1						
MTBV	-0.009	-0.012	0.0001	1					
Issuer M/B	-0.086	-0.080	-0.024	-0.006	1				
Ln of Firm Size	0.149	0.157	0.014	0.016	-0.153	1			
Underpricing	0.018	0.010	0.0002	0.0001	-0.013	0.014	1		
Ln of Offer Size	0.110	0.121	0.012	0.015	0.070	0.672	-0.009	1	
Number of Underwriters	0.046	0.043	0.005	0.033	-0.053	0.450	0.009	0.418	1

Table 3 looks into the correlation of the variables, with the main purpose of examining the issue of multi-collinearity in the samples. BHR and BHAR illustrate almost perfect correlation, meaning one can be replace with the other. Number of Underwriters and Offer Size do have a small degree of correlation with the value of 0.418, but the extent is not significant enough to warrant special treatment. The natural logarithms of Firm Size and Offer Size have a noticeable correlation value of 0.672, but it is still below the threshold of 0.7. We see that no other pairs of independent and control variables have the value of Pearson correlation of more than 0.3. With these low correlations between independent and control variables, no multi-collinearity is detected.

Table 4 presents descriptive statistics of all variables in the reduced **sample of European VC-backed IPOs**, which is used to test the effect of VC reputation on long-run performance of VC-backed IPOs in Europe.

Table 4: Summary statistics of variables in the sample of European VC-backed IPOs

This table provides descriptive statistics of only European VC-backed IPOs from 2001 to 2014

Variable	Observations	Mean	Std. Dev.	Median	Min	Max
Dependent variables						
BHR	254	-16.16%	66.56%	-38.24%	-89.67%	268.83%
BHAR	254	-23.02%	63.64%	-37.97%	-132.00%	245.48%
ROA	205	-11.79%	23.44%	-3.69%	-103.82%	34.08%
MTBV	254	3.31	4.26	2.21	-6.50	30.31
Survival	254	1.00	0.00	1	1	1
Independent variables (VC Reputation)						
$VC\ market\ share$	254	5.22	4.45	3.97	0.01	30.33
$VC\ age$	254	11.00	4.68	10.00	6.00	37.00
Control variables						
$IssuerM/B_i$	254	12.85	12.83	8.56	-7.19	40.58
$LnSize_i$	254	3.87	1.65	3.57	0.92	8.06
$Underpricing_i$	254	3.93	16.17	1.52	-47.07	54.91
$LnOffersize_i$	254	1.60	0.98	1.41	-0.10	6.07
$NumberofUnderwritters_i$	254	1.63	0.80	1.00	1.00	5.00

The mean values of all long-run performance indicators is lower than those found be the research of Krishnan et al. (2011), who uses the sample of VC-backed IPOs in the US. This result is in line with earlier research showing that the long-run performance of European VC-

backed IPOs is lower than their counterparts in the US. The value of average BHAR found by Bessler and Seim (2011), who also examine European IPOs from 1996 to 2010, is -6.35% in the horizon of 2 years after IPO, while in our sample, average BHAR is -23.02% at the point of 3 years post-IPO.

The mean IPO market share of VCs in our European sample is higher than found by Krishnan et al. (2011) in the US sample. It can indicate that the VC industry in Europe is less fragmented than that in the US. The average age of VCs backing European IPOs is lower than that of their counterparts in the US as reported in the sample used by Krishnan et al. (2011). This agrees with prior research discussing the immaturity of European VC industry compared with the established VC industry in the US (Bottazzi, Rin and Hellmann, 2004; Grilli and Murtinu, 2014).

Table 5: Correlation between variables in the sample of European VC-backed IPOs

	BHR	BHAR (MSCI Europe)	ROA	MTBV	VC Market share	VC Age	Issuer M/B	Ln of Firm Size	Under-pricing	Ln of Offer Size	Number of Under-writers
BHR	1										
BHAR (MSCI Europe)	0.953	1									
ROA	0.177	0.195	1								
MTBV	0.187	0.139	-0.046	1							
VC Market share	0.421	0.405	0.068	0.459	1						
VC Age	0.101	0.101	-0.015	0.237	0.295	1					
Issuer M/B	-0.162	-0.128	-0.032	0.015	0.044	0.010	1				
Ln of Firm Size	0.037	0.066	0.108	-0.079	0.015	0.007	-0.115	1			
Underpricing	0.019	0.033	-0.095	-0.010	0.010	-0.016	0.093	-0.016	1		
Ln of Offer Size	-0.016	0.0143	0.104	-0.028	0.032	0.021	-0.020	0.688	-0.067	1	
Number of Underwriters	0.139	0.122	0.090	-0.032	0.127	-0.016	-0.088	0.446	-0.027	0.450	1

Table 5 shows the correlation between all variables in the model to test hypothesis 2, using the sample European VC-backed IPOs. Besides the strong correlation between BHR and BHAR, the rest of the variables do not present significant correlations. VC Age and Market share, two alternative measures of VC reputation, show small correlation at 0.295. We observe the noticeable positive correlation between VC market share with BHR, BHAR and MTBV (at 0.421, 0.405 and 0.459, respectively). On the other hand, there is little correlation between VC market share and ROA.

Number of Underwriters and Offer Size have a correlation value of 0.4498. However, it is still under the threshold for multi-collinearity between variables, which is 0.7. Similarly for Offer Size and Firm Size, which have a correlation of 0.688. No other pairs of independent and control variables have the Pearson correlation value of over 0.3. Overall, there is no multi-collinearity detected.

5.2. Regression Results

5.2.1. Long-run performance of VC-backed IPOs in Europe compared with counterparts

General regression results:

The regression results of the first model (as below) are presented in *Table 6*. The results are reported for all five different performance measures (BHR, BHAR, ROA, MTBV and Survival).

$$Performance_i = \beta_0 + \beta_1 VC_i + \beta_2 Region_i + \beta_3 VC_i \times Region_i + \beta_4 VC_i \times Region_i + \beta_5 IssuerM/B_i + \beta_6 LnSize_i + \beta_7 Underpricing_i + \beta_8 LnOffersize_i + \beta_9 NumberofUnderwritters_i + u_i$$

Table 6: The effect of VC participation and location on long-run performance of IPOs

The sample data used is **global IPOs** from 2001 to 2014. OLS regression is used in the models when BHR, BHAR, ROA and MTBV are independent variables. Probit regression is used when Survival is the independent variable. Year of IPOs and industry are controlled for.

* Significant at the 0.1 level ** Significant at the 0.05 level *** Significant at the 0.01

	BHR	**BHAR**	**ROA**	**MTBV**	**Survival**
VC	-0.023 (-1.130)	-0.023 (-1.032)	0.025*** (-3.212)	0.459*** (5.067)	-0.234*** (-3.144)
Region	-0.019 (-0.463)	0.001 (0.021)	-0.010 (-0.745)	0.426*** (2.643)	0.454** (2.358)
*VC*Region*	-0.067 (-0.932)	-0.042 (-0.602)	-0.064** (-2.480)	0.472* (1.648)	0.487 (1.180)
Issuer M/B	-0.005*** (-6.033)	-0.005*** (-3.357)	0.004*** (7.069)	0.027*** (4.678)	0.008 (1.486)
Natural Logarithm of Size	0.045*** (5.481)	0.043*** (5.284)	0.062*** (20.527)	-0.329*** (-9.883)	0.034 (1.179)
Underpricing	-0.054 (-3.063)	0.044** (-2.544)	0.044*** (7.192)	0.846*** (11.960)	0.227*** (3.106)
Natural Logarithm of Offer Size	0.045** (5.481)	0.027*** (2.868)	-0.012*** (-3.435)	0.403*** (10.404)	-0.046 (-1.294)
Number of Underwriters	-0.0374*** (-4.350)	-0.036*** (-4.324)	-0.022*** (-7.139)	0.076** (2.221)	-0.043* (-1.772)
Constant	-0.0531 (-0.493)	-0.177* (-1.654)	-0.250*** (-6.323)	2.936*** (6.817)	5.520 (0.069)
Adjusted R-Squared	0.096	0.081	0.200	0.102	0.014

It can be seen from *Table 6* that at 1% significance level, the $\boldsymbol{VC_i}$ variable has statistically significant positive effect on performance when ROA, MTBV and Survival are performance proxies. It indicates that outside of Europe (since $Region_i$ is equal to 0 in this case), in comparison to IPOs that are not backed by VCs, VC-backed IPOs have average ROA and MTBV that are 2.5% lower and 45.9% higher, respectively, as well as higher probability of surviving.

The above-mentioned significant result when ROA is the performance indicator supports prior research reporting the superior operating performance of VC-backed IPOs to non-VC-backed IPOs outside of Europe (Jain and Kini, 2005; Hsu, 2009). Better survival chance of VC-backed IPOs is also the result found by Jain and Kini (200) and Hsu (2009).

The $\boldsymbol{Region_i}$ variable is statistically significant when performance is measured by MTBV and Survival rate. It proves that the performance measured by MTBV of non-VC-backed IPOs in Europe is significantly higher than non-VC backed IPOs outside of Europe (at 5% significance level), by 47.2% (since VC_i is equal to 0 in this case). The survival rate of European non-VC-backed IPOs is also significantly higher than that of non-VC backed IPOs outside of Europe.

We notice that some characteristics of IPO deals exert statistically significant impact on long-run performance in this model. The market-to-book value of the issuer at the time of IPO has negative impact on BHAR and BHR, and positive impact on ROA and MTBV, however, the magnitude of the effect is very small. There is a positive association between the level of underpricing and long-run performance measured by BHAR, ROA, MTBV and Survival Rate, which is consistent with Ritter (1998). In line with Carter et al. (1998), the number of underwriters positively influenced long-run performance, but this finding is valid only when MTBV indicates performance; negative impact is found for other indicators. Finally, firm size shows significantly positive impact on market-related measures including BHR, BHAR and MTBV, while negative effect is found when performance is indicated by ROA.

Above is the general observation of the regression result. We proceed with testing our first hypothesis by examining the linear combination of relevant regression coefficients.

Hypothesis testing:

To test the first hypothesis which concerns the performance of European VC-backed IPOs compared with two counterparts (European non-VC-backed IPOs and VC-backed IPOs outside of Europe), we implement the linear combination of regression coefficients test. We apply the Wald test to examine the join significance of relevant coefficients. If $\boldsymbol{\beta_1 + \beta_3}$ is significantly larger than 0, we can infer that the performance of European VC-backed IPOs is better than that of European IPOs not backed by a VC. If $\boldsymbol{\beta_2 + \beta_3}$ is significantly smaller than 0, we can conclude that the performance of European VC-backed IPOs is worse than that of European IPOs not backed by a VC.

Table 7: Comparison of the long-run performance of European VC-backed IPOs with their counterparts

The data sample includes **global IPOs** in the period from 2001 to 2014. The table presents the p-value, t-statistic (in parenthesis) and significance results of the test of the linear combination of regression coefficients.

* Significant at the 0.1 level ** Significant at the 0.05 level *** Significant at the 0.01

Panel A: Comparison of European VC-backed IPOs and European non-VC-backed IPOs					
	BHR	BHAR	ROA	MTBV	Survival
Difference ($\beta_1 + \beta_3$)	-9%	-6.5%	-3.9%	93.1%	25.3%
P-value	0.172 (-1.365)	0.326 (-0.982)	0.0002*** (-3.719)	0.0006*** (3.435)	0.533 (0.623)
Conclusion (1% significance level)	Not significant	Not significant	**Significant**	**Significant**	Not significant
Panel B: Comparison of VC-backed IPOs in Europe and VC-backed IPOs outside Europe					
	BHR	BHAR	ROA	MTBV	Survival
Difference ($\beta_2 + \beta_3$)	-8.5%	-4.1%	-7.4%	89.8%	94.1%
P-value (t-statistic)	0.159 (-1.41)	0.486 (-0.697)	0.001*** (-3.205)	0.0002*** (3.713)	0.010*** (2.58)
Conclusion (1% significance level)	Not significant	Not significant	**Significant**	**Significant**	**Significant**

Table 7 reports the result of the statistical significance result with regards to the comparison of European VC-backed IPOs with European non-VC-backed IPOs and non-European VC-backed IPOs.

We test the first part of the hypothesis by looking at the sum of the coefficients associating with $\boldsymbol{VC_i}$ and the interaction term $\boldsymbol{VC_i \times Region_i}$. As displayed in panel A of *Table 7*, there is no statistical significance when BHR and BHAR are performance proxies. When MTBV is the performance indicator, the performance of VC-backed IPOs is higher than non-VC-backed IPOs by 93.1%, at 1% significance level. It means that the first hypothesis is confirmed when we use MTBV to indicate performance. However, contrary to the first hypothesis, significant underperformance of European VC-backed IPOs is found when ROA, which is in line with Chen and Liang (2016), who also use the sample of global IPOs.

The finding when using stock returns does not align with several studies who investigate IPOs backed by VC in the US market and find the overperformance of VC-backed IPOs. However, it supports the finding of Bessler and Seim (2011), who also explore European market, and report that the superior performance of VC-backed IPOs over non-VC-backed IPOs is invalid when the three-year horizon after IPO is considered. It is also in line when multiple research

investing the regions outside of the US and report no better performance of VC-backed IPOs compared to non-VC-backed IPOs when (Coakley, Hadass, & Wood, 2007; Hamao, Packer, & Ritter, 2000; Rindermann, 2004; Wang, Wang, & Lu, 2003)

It suggests that the discrepancy in research findings between the US and other regions, including Europe, may be attributable to the heterogeneous characteristics of VC industry and IPO market in diverse locations. For example, Schwienbacher (2005) provides evidence that the level of monitoring exercised by as well as the experience in providing advisory of European VCs are lower than VCs in the US. In addition, Schwienbacher (2008) argues that the signaling of VC quality in the US is superior to that of the EU since the VC industry is more established and reputable in the US. From the arguments in accordance with agency, information asymmetry and resource dependence theory, these factors may lead to the result that there is no different in long-run performance between VC-backed and non-VC-backed IPOs in Europe when stock returns are used to measure performance.

MTBV is a less popular, and our finding suggests that venture participation can improve long-run growth prospects of IPOs.

We continue with testing the second part of the hypothesis by looking at the sum of the coefficients associating with $\boldsymbol{Region_i}$ and the interaction term $\boldsymbol{VC_i \times Region_i}$. The result is presented in Panel B of *Table 7*.

When **ROA** is the performance measure, VC-backed IPOs significantly underperform VC-backed IPOs in other regions by 7.4%. It confirms the hypothesis that the long-run performance of VC-backed IPOs in Europe is worse than VC-backed IPOs in other locations. When **MTBV** serves as the proxy for performance, statistically significant overperformance of European VC-backed IPOs compared to non-European VC-backed IPOs (at 1% significance level) is detected, and the difference in performance is 89.8%.

This is a relatively novel finding since there has been a lack of research that aims to compare the performance of VC-backed IPOs in Europe and the rest of the world although there has been a number of important research that dives into the differences in IPO markets (Ritter, 2003) and the practice of VC industry (Schwienbacher, 2005, 2008) between Europe and the US. Since the global market is dominated by VC-backed IPOs in the US, the superior quality of the monitoring devices of US VC is likely to lead to the underperformance of European VC-backed IPOs.

Another significant difference is found with regards to survival rate, European VC-backed IPOs show higher survival probability than VC-funded IPOs outside of Europe. It is different

from the findings of Audretsch and Lehmann (2002), who found the negative influence of VC ownership participation on the probability of survival when examining the German market. However, it is consistent with the research of Pommet (2017), focusing on the French market. To the best of our knowledge, there has been no research that studies the long-run survival of VC-backed IPOs of the aggregate European market.

When we measure performance by stock returns, including BHR and BHAR, no significant result is found.

Overall, the first part of our hypothesis is confirm when MTBV is the performance indicator. The second part is supported when we measure performance by ROA. Significant result is also found when using ROA for the first hypothesis, and MTBV for the second hypothesis, but the direction of causality is reversed compared to our hypotheses.

5.2.2. The effect of VC reputation on long-run performance of VC-backed IPOs in Europe

5.2.2.1. Main model

Table 8: The effect of VC reputation on the long-run performance of VC-backed IPOs in Europe

The data sample includes **European VC-backed IPOs** from 2001 to 2014. OLS regression is used in the models when BHR, BHAR, ROA and MTBV are independent variables. Probit regression is used when Survival is the independent variable. Standard errors are clustered by year of IPO and industry.

* Significant at the 0.1 level ** Significant at the 0.05 level *** Significant at the 0.01

	BHR	**BHAR**	**ROA**	**MTBV**	**Survival**
VC market share	0.089*** (7.320)	0.085*** (7.180)	0.005 (1.120)	0.078*** (9.326)	1.069 (0.002)
Issuer M/B	-0.010*** (-2.621)	-0.010*** (-2.617)	-0.0003 (-0.262)	0.001 (0.036)	-0.361 (-0.001)
Natural Logarithm of Size	0.049 (1.036)	0.044 (0.947)	0.038** (2.325)	-0.196 (-0.599)	-4.693 (-0.001)
Underpricing	0.111 (0.437)	0.103 (0.412)	-0.259*** (-3.055)	-2.972* (-1.680)	7.289 (0.000)
Natural Logarithm of Offer Size	-0.040 (-0.738)	-0.027 (-0.507)	-0.007 (-0.381)	0.390 (1.035)	-4.683 (-0.001)
Number of Underwriters	0.021 (0.378)	0.029 (0.549)	-0.010 (-0.535)	-0.749 (-1.949)	1.998 (0.000)
Constant	-1.387** (-2.178)	-1.521** (-2.433)	-0.093 (-0.336)	-3.003 (-0.682)	0.265 (0.000)
Adjusted R-Squared	0.260	0.191	0.183	0.281	-0.872

Table 8 reports the regression results with five different measures of the dependent variable. The results reveal that when BHR, BHAR and MTBV are adopted to indicate performance, VC reputation places statistically significant and positive effect on performance. In details, when VC's IPO market share increases by 1%, BHR, BHAR and MTBV grow by 8.9%, 8.5% and 7.8%, respectively. No significant effect is observed when ROA and Survival are the performance measures. Besides, no control variables are found to have significant effect on performance.

It is noticeable that these are all market-related measures. The operating performance measure by ROA is not significantly affected by VC reputation measured by IPO market share. The predictive power of the models measured by adjusted R-Square is moderate at 19.1% for the model using BHAR and 28.1% for the model using MTBV.

This result is consistent with extant literature that report the contribution of VC reputation to enhancing long-run performance of IPOs that they back, using stock measures (Brav and Gompers, 1997; Coakley, Hadass and Wood, 2007; Hochberg, Ljungqvist & Lu, 2007; Krishnan et al, 2011). The finding supports our theoretical arguments developed based on agency, information asymmetry and resource-dependence theory. More reputable VCs are associated with more superior quality of monitoring activities to reduce moral hazard and adverse selection, as well crucial resources and capabilities to support their portfolio companies in strategic decisions (Cumming, 2007), contributing to enhancing the long-run performance of the IPOs that they back.

However, Krishnan et al (2011), using the sample of VC-backed IPOs in the US, found the significant result in all measures of performance, namely BHAR, ROA, MTBV and Survival. In this study, more reputable firms have positive impact only when performance is measured by BHAR and MTBV, which are market-related indicators. It suggests that in the EU market, signaling theory may have slightly greater power in explaining in explaining the positive association of reputation with long-run performance of IPOs. The backing of more reputable VCs can compensate the lack of track record of IPOs and provide positive signal to the market, resulting in improved long-run performance indicators.

5.2.2.2. Additional Analysis: Heckman two-step selection model

To correct for selection bias, we employ the Heckman two-stage selection model. In the first step, a probit model is conducted to estimate the probability that a firm receives the funding of a reputable VC investor. From this model, we calculate the Inverse Mills ratio, and in the second step, include it as an independent variable in the standard regression models as described above.

The result of the second step is presented in *Table 9* below.

Table 9: The effect of VC reputation on the long-run performance of VC-backed IPOs in Europe (control for selection bias by Heckman model)

The data sample includes **European VC-backed IPOs** from 2001 to 2014. This table reports the second step of Heckman two-step selection model to control for selection bias.

* Significant at the 0.1 level ** Significant at the 0.05 level *** Significant at the 0.01

	BHR	**BHAR**	**ROA**	**MTBV**	**Survival**
VC market share	0.087*** (7.071)	0.085*** (6.919)	0.005 (0.510)	0.074*** (6.406)	1.251 (0.003)
Issuer M/B	-0.007* (-1.942)	-0.007* (-1.835)	0.002 (0.531)	0.005 (0.115)	-0.001 (0.000)
Natural Logarithm of Size	0.054 (1.122)	0.049 (1.036)	0.004 (0.115)	-0.323 (-0.722)	-3.951 (-0.001)
Underpricing	0.002 (0.831)	0.001 (0.558)	-0.002* (-1.850)	-0.026 (-1.492)	0.007 (0.000)
Natural Logarithm of Offer Size	-0.003 (-0.041)	0.007 (0.117)	0.068 (1.558)	0.760 (1.344)	-1.017 (0.000)
Number of Underwriters	-0.054 (-0.651)	-0.040 (-0.489)	-0.076 (-1.284)	-1.063 (-1.379)	-1.451 (0.000)
Inverse Mills ratio	-0.825 (-1.212)	-0.774* (-1.844)	-0.996** (-0.996)	-2.939 (-0.462)	-0.652 (-0.001)
Constant	-0.917* (-1.915)	-1.044* (-1.731)	0.563 (0.833)	-0.872 (-0.122)	0.713 (0.001)
Adjusted R-Squared	0.265	0.194	0.087	0.137	-0.6714

As we can see from *Table 9*, the effect of IPO market share, which represents VC reputation, on post-IPO long-run performance, remains significant at 1% significance level even after controlling for selection bias. The degree of economic significance, reflected by the value of regression coefficients, only change very negligibly. It confirms the association of more reputable VCs with more superior long-run performance measured by BHR, BHAR and MTBC.

This result is consistent with the finding obtained by Krishnan et al. (2011), who followed the same approach, using Heckman two-step selection model to correct for endogeneity. It

indicates that in addition to selecting higher-quality firms to invest, VCs do contribute to improving the long-run performance of their portfolio companies after going public.

5.2.2.3. Robustness check: using VC age to represent reputation

In the robustness check for hypothesis 2, we use VC age as the alternative measure of VC reputation, which is used in a number of extent studies (Gompers, 1996, Lee and Wahal, 2004). The result is described in *Table 10* (see Appendix C). Similar to the regression results where IPO market share is employed to indicate VC reputation, VC age shows significant positive impact on BHR, BHAR and MTBV. However, the general observation is that the levels of both statistical and practical significance are reduced when we substitute IPO market share by VC age as the proxy for VC reputation. In details, the positive association between VC age and BHR as well as BHAR is significant at 10% level, while the figure is 1% when IPO market share is used. When VC age increases by 1%, BHR, BHAR and MTBV increases by 2.1%, 2.3% and 3.5%, respectively, while the magnitudes of the increase when IPO market share is used are 8.9%, 8.5% and 7.8%, respectively.

This robustness check using VC Age to proxy for further reinforces our confirmation of hypothesis 2, since using two alternative proxies for VC reputation demonstrate similar results. This result is also consistent with the finding of Krishnan et al (2011), who use VC age as one of the measures for VC reputation besides IPO Market Share of VC.

6. CONCLUSIONS

6.1. Findings and implications

6.1.1. Summary of findings

This study performs an investigation of the post-IPO long-run performance of European VC-backed IPOs from 2001 to 2014. The first objective is to examine the performance of European VC-backed IPOs compared with its counterparts, including non-VC-backed IPOs in Europe, and VC-backed IPOs outside of Europe. The second goal is to look at the influence of VC reputation on the long-run performance of European VC-backed IPOs.

We find no significant differences between European VC-backed IPOs and European non-VC-backed IPOs after controlling for IPO characteristics that can have relation with performance. The finding is different from the important research of Brav and Gompers (1997), which studies the US market and finds the outperformance of VC-backed IPOs relative to IPOs not funded by VC. More recent research on the US market also found similar results, including Coakley, Hadass and Wood (2007); Hochberg, Ljungqvist & Lu (2007); Nahata (2008).

However, this result is consistent with the studies of Bessler and Seim (2011), who investigate the European market. Possible reasons are that the quality of monitoring and consulting provided is not sufficiently strong and professional to create a significant over-performance of VC-backed IPOs compared to non-VC-backed IPOs in Europe. Prior researchers (Schwienbacher, 2005, 2008) have provided supporting evidence on the lower quality of the monitoring devices and consulting services of VCs in Europe.

When using MTBV, a performance measure relating to growth prospects of firms, we found the significant overperformance of European VC-backed IPOs compared with European non-VC-backed IPOs, which confirmed our first hypothesis. This is a relatively novel result since the most popular while MTBV is much less popular. On the contrary, in Europe, VC-backed IPOs perform worse than non-VC backed IPOs in terms of ROA; but this result is in line with Chen and Liang (2016) who adopt the same level of performance.

Comparing with VC-backed IPOs in other regions, European VC-backed IPOs show significantly lower buy-and-hold abnormal return (BHAR), but higher survival rates. Inferiority in the quality of monitoring and consultancy, and the less established reputation of European VCs, as found by a few previous researches may provide the explanation for this under-performance. It is a surprising finding that when the survival rate is used to measure performance, contradictory result is found. However, probit model is quite simple and can be less accurate, a more advanced model should be implemented to be more certain about the

impact of VC backing on survival rate. When buy-and-hold return (BHARR) and market-to-book value (MTBV) are used to represent performance, no significant discrepancy between European VC-backed IPOs and non-European VC-backed IPOs is detected.

Even though the involvement of VCs is not sufficiently strong to create the difference between VC-backed and non-VC-backed IPOs, we find highly significant positive impact of VC reputation on long-run performance in the group of VC-backed firms, measured by BHR, BHAR and MTBV. This impact is significant even after correcting for selection bias using the Heckman two-stage selection model, which confirms that more reputable VCs exert positive influence on the long-run performance of their portfolio firms, in addition to originally decide to fund firms of higher quality. This result is consistent with the prior research of Krishnan et al (2011), as well as the theoretical framework developed by agency, information asymmetry and resource-dependence theory. In accordance with information asymmetry theory, a firm's prestige can have the power of signaling the quality of products and services provided by the firm. In addition, venture capitalists of higher quality and reputation can bring several advantages to their portfolio companies, including higher effectiveness of corporate governance (Baker & Gomers, 2003), stronger access to credit, valuable strategic consulting, etc, which can lead to its positive association with long-run performance according to agency and resource-dependence theory. The significant impact is reinforced since in the robustness test using VC Age as the alternative measure for VC reputation, we achieve the same result, which further consolidates our acceptance of the hypothesis.

6.1.2. Implications

This study contributes to literature by investigating Europe, an emerging market for VC. While extensive studies have been conducted focusing on the US market, there has been less attention paid to less mature VC markets, including Europe. Therefore, this study adds to the literature by examining whether the results found by research on the US market is applicable to the context of European countries. It finds that the superior stock performance of VC-backed IPOs found in the US is not the case in the European market. This result can be attributable to the lower level of development of VC industry in Europe and the more inferior quality of VCs with regards to the monitoring and advisory they provide their portfolio companies. This research therefore complements existing studies focusing on IPOs with VC backing in Europe who also found similar results (Bessler and Seim, 2011). In addition, the significant impact of VC reputation on long-run performance measured by stock and market measures is supportive of agency, information asymmetry and resource dependence theory. As a final point, the study

enriches the literature by employing different indicators of long-run performance, including stock, operating and market prospect measures, so that performance is examined from diverse perspectives. When using MTBV, a relatively less popular means of measuring performance, we found the superior performance of European VC-backed IPOs over European non-VC-backed IPOs. It suggest than VC backing can contribute to improving the growth prospects of IPOs. Besides, consistent with the recent research of Chen and Liang (2016) who also use operating measures of performance employ the sample of global IPOs instead of focusing on US IPOs as the majority of existing studies, we discovered the lower ROA of VC-backed IPOs compared to non-VC-IPOs in Europe.

From its empirical findings, this research can bring a number of practical implications for both VCs and entrepreneurial firms in Europe. By revealing the role of VC reputation in the long-run performance of portfolio companies in Europe, this study can shed light on the importance of reputation of VCs as one of the factors to consider for entrepreneurial firms that have several funding options. In some cases, the terms and conditions offered by more reputable VCs are less favorable, but entrepreneurial firms in Europe should weigh these disadvantages against the better long-run performance brought by the prestige, experience and capabilities of VCs with higher reputation.

6.2. Limitations and Future Research

There are certain areas to improve the quality of this research. Firstly, data availability is an issue to improve, since there are several missing values in the dataset, leading to reduced sample size. We include multiple variables in our model, and IPO observations with missing value even in just one variable is not included in the sample for running the regression. Therefore, results can be better if the completeness of data from databases is enhanced.

Secondly, to examine the effect of VC backing on survival rate, more advanced models, such as Cox proportional hazard, should be employed for better result. Finally, one other possible improvement is the selection of the proxy for VC reputation. Inspired by the work of Krishnan and Masulis (2011), this study makes use of two measures for reputations, VC age and IPO market share. The disadvantage of this approach is the proposed measures are not always able to holistically represent the reputation of VCs, as demonstrated by the relatively low correlation value between them. A VC company may be highly concentrated and make small number of investments, yet it can achieve higher resulting returns than a larger one does. A better approach is to represent reputation as a weighted average of different features describing a VC such as

total investment value, mean years to exit or seniority of managers. In this case, however, availability of data on the European VC landscape remains the biggest challenge.

Future research can examine further factors that can possibly explain the comparison of performance of European IPOs in general, and European VC-backed IPOs in particular, with their counterparts. European markets possess a set of distinct characteristics, including culture, institutional factors, legal environments, political systems, and corporate governance regimes. In addition, the divergence in two corporate governance models, Continental European version Anglo Saxon, may lead to differences in the VC participation as well as VC-back IPOs' performance. These factors can explain divergence in performance of VC-backed IPOs in different regions, and worth future research effort. Besides Europe, research can explore the impact of VC backing on performance in other emerging VC markets such as Asian countries.

APPENDICES

Appendix A. Summary of main prior studies

VC involvement and the long-run performance of IPO		
Paper	**Sample**	**Main Findings**
Brav and Gompers (1997)	US IPOs from 1972 to 1992	The performance of VC-backed IPOs is more superior to that of non-VC-backed IPOs over the five-year period following the IPO date, using equally weighted returns
Gompers and Lerner (1999)	US IPOs from 1972 to 1994	No influence of VC participation on long-run performance of IPO
Hamao et al. (2000)	Japanese IPOs from 1989 to 1994	IPOs backed by VCs do not necessarily perform better than those without VC backing in the long term.
Bottazzi and Da Rin (2002)	European technology IPOs from 1990 to 1999	No significant discrepancy in post-IPO operating performance between those with VC backing and those without.
Schuster (2003)	IPOs taking place between 1988 and 1998 in seven European countries: Italy, Sweden, France, Spain, Germany, the Netherlands and Switzerland.	analyzes cumulative market-adjusted returns (CARs), The reported CARs are negative, ranging between minus 11.7% in Germany to minus 41.8% in Italy
Tykvova and Walz (2005)	IPOs in high-tech market in Germany from 1997 to 2002	Better performance for these companies when compared against IPOs not backed by VCs.
Doukas and Gonenc (2005)	US IPOs from 1989 to 2000	VC backing is associated longer-term gains of IPOs, measured by stock returns
Hsu (2009)	IPOs from 1980 to 2004	Firms backed by VCs have shorter incubation periods, earn more patents, are more likely to survive and exhibit better performance after their IPOs.

Tian (2011b)	IPOs from 1980 to 2005	Syndicate-backed companies focus more on innovation than firms backed by individuals and also have better operating performance in the first 4 years following their IPOs
Bessler and Seim (2011)	European IPOs from 1996-2010	IPOs backed by VC show better performance compared to both the market standard as well as non-VC-backed IPOs. Positive returns are found in the period of two year after a company's IPO has finished. Subsequent returns became negative.
Levis (2011)	IPOs backed by PEs and VCs on London Stock Exchange from 1992 to 2005	IPOs backed by PEs and VCs demonstrate better performance in the post-market phase comparing to other IPOs as well as to the stock market as a whole when using equal-weighted terms.
Guo and Jiang (2013)	Chinese IPOs from 1998 to 2007	VC-backed companies demonstrate better performance than those without VC backing in multiple factors, such as profitability, R&D investment or productivity
Chen and Liang (2016)	IPOs from 1970 to 2007	In terms of operating performance VC-backed IPOs perform worse than those without VC backing, especially when companies have high level of redundant cash.
VC reputation and the long-run performance of IPOs		
Nahata (2008)	US IPOs from 1991 to 2001	US companies invested by more reputable VCs exhibit higher probability of

		successful exit and have high asset productivity after
Hamza and Kooli (2011)	US IPOs from 1985 to 2005	There is a positive relationship between VC reputation, measured by VC Quality Index, and survival probability of IPOs
Krishnan et al. (2011)	US IPOs from 1993 to 2004	VC reputation, measured by IPO market share, positively affects IPO performance measure by stock, market and operating measures

Appendix B. Description of variables

Dependent variables	
$Performance_i$	Measured by alternative proxies: Buy-and-hold return, Buy-and-hold abnormal return, Return on Asset, Market-to-Book value, Survival rate
Independent variables	
VC_i	Binary variable, equal to 1 if the IPO is backed by VC and 0 otherwise
$Region_i$	Binary variable, equal to 1 when the headquarter of the company that goes public is located in a European country and 0 otherwise.
$VC_i \times Region_i$	Interaction term between VC_i and $Region_i$.
$IPO\ Market\ Share$	Proportion of dollar size of IPOs backed by a VC to the total size of all IPOs in the prior 5 years before the IPOs.
$VC\ Age$	The number of months between IPO date and the date of incorporation of the VC
Control variables	
$IssuerM/B_i$	Market-to-book ratio of the issuer at issuing time
$LnSize_i$	The natural logarithm of total assets of the issuer at the time of IPO
$Underpricing_i$	Initial returns of IPOs, calculated as the difference between the close price of the first day and the offer price divided by the offer price
$LnOffersize_i$	The natural logarithm of IPO gross proceeds, exclusive of overallotment options
$NumberofUnderwritters_i$	Number of underwriters of the IPO

Appendix C. Table 10: Robustness check - The effect of VC Age on the long-run performance of VC-backed IPOs

Table 10: Robustness check - The effect of VC reputation (measure by VC Age) on the long-run performance of VC-backed IPOs

in Europe

The data sample includes **European VC-backed IPOs** from 2001 to 2014. OLS regression is used in the models when BHR, BHAR, ROA and MTBV are independent variables. Probit regression is used when Survival is the independent variable.

* Significant at the 0.1 level ** Significant at the 0.05 level *** Significant at the 0.01

	BHR	**BHAR**	**ROA**	**MTBV**	**Survival**
VC age	0.021* (1.750)	0.023* (1.925)	0.002 (0.372)	0.035*** (4.102)	1.446 (0.001)
Issuer M/B	-0.009** (-2.196)	-0.009** (-2.209)	-0.0002 (-0.205)	0.007 (0.219)	-0.353 (-0.002)
Natural Logarithm of Size	0.031 (0.600)	0.026 (0.522)	0.037** (2.258)	-0.375 (-1.004)	-9.893 (-0.003)
Underpricing	0.125 (0.441)	0.115 (0.418)	-0.259*** (-3.040)	2.899* (-1.937)	-2.492 (0.001)
Natural Logarithm of Offer Size	-0.043 (-0.712)	-0.030 (-0.508)	-0.007 (-0.398)	0.355 (0.826)	0.343 (0.000)
Number of Underwriters	0.084 (1.384)	0.091 (1.533)	-0.006 (-0.351)	-0.169 (-0.390)	-2.748 (-0.001)
Constant	-0.873 (-1.234)	-1.047 (-1.517)	-0.072 (-0.260)	0.030 (0.006)	6.441 (0.001)
Adjusted R-Squared	0.089	0.015	0.1779	0.064	-1.752

REFERENCES

Aghion, P., & Bolton, P. (1992). An incomplete contracts approach to financial contracting. The Review of Economic Studies, 59(3), 473-494.

Alvarez, S. A., & Busenitz, L. W. (2001). The entrepreneurship of resource-based theory. Journal of Management, 27(6), 755-775.

Álvarez, S., & González, V. M. (2005). Signalling and the long- run performance of Spanish initial public offerings (IPOs). Journal of Business Finance & Accounting, 32(1- 2), 325-350.

Amit, R., Glosten, L., & Muller, E. (1990). Does venture capital foster the most promising entrepreneurial firms?. California Management Review, 32(3), 102-111.

Audretsch, D. B., & Lehmann, E. E. (2002). Debt or equity? The role of venture capital in financing the new economy in Germany.

Baginski, S. P., Hassell, J. M., & Neill, J. D. (1999). Predicting subsequent management forecasting behavior at the date of an initial public offering. Review of Quantitative Finance and Accounting, 12(1), 5-21.

Baker, M., & Gompers, P. A. (2003). The determinants of board structure at the initial public offering. The Journal of Law and Economics, 46(2), 569-598.

Barry, C. B. (1994). New directions in research on venture capital finance. Financial Management, 3-15.

Barry, C. B., Muscarella, C. J., Peavy Iii, J. W., & Vetsuypens, M. R. (1990). The role of venture capital in the creation of public companies: Evidence from the going-public process. Journal of Financial Economics, 27(2), 447-471.

Baum, J. A., & Silverman, B. S. (2004). Picking winners or building them? Alliance, intellectual, and human capital as selection criteria in venture financing and performance of biotechnology startups. Journal of Business Venturing, 19(3), 411-436.

Baysinger, B. D., & Zardkoohi, A. (1986). Technology, residual claimants, and corporate control. Journal of Law, Economics, & Organization, 2(2), 339-349.

Beatty, R. P., & Ritter, J. R. (1986). Investment banking, reputation, and the underpricing of initial public offerings. Journal of Financial Economics, 15(1-2), 213-232.

Bergström, C., Nilsson, D., & Wahlberg, M. (2006). Underpricing and long-run performance patterns of European private-equity-backed and non-private-equity-backed IPOs. The Journal of Private Equity, 16-47.

Berk, J. B., & DeMarzo, P. M. (2013). Corporate Finance. Pearson Education.

Bessler, W., & Seim, M. (2011). European Venture-backed IPOs: An Empirical Analysis. Working Paper, European Venture Capital Association.

Bessler, W., & Thies, S. (2007). The long-run performance of initial public offerings in Germany. Managerial Finance, 33(6), 420-441.

Black, B. S., & Gilson, R. J. (1998). Venture capital and the structure of capital markets: banks versus stock markets. Journal of Financial Economics, 47(3), 243-277.

Bottazzi, L., & Da Rin, M. (2002). Venture capital in Europe and the financing of innovative companies. Economic Policy, 17(34), 229-270.

Bottazzi, L., Da Rin, M., & Hellmann, T. (2004). The changing face of the European venture capital industry: Facts and analysis. The Journal of Private Equity, 26-53.

Bradley, D. J., & Jordan, B. D. (2002). Partial adjustment to public information and IPO underpricing. Journal of Financial and Quantitative Analysis, 37(4), 595-616.

Brav, A. and Gompers, P. (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.

Brav, A., & Gompers, P. A. (2003). The role of lockups in initial public offerings. The Review of Financial Studies, 16(1), 1-29.

Brav, A., Geczy, C. and Gompers, P. (2000). Is the abnormal return following equity issuances anomalous?. Journal of Financial Economics, 56(2), 209-249.

Brealey, R., Leland, H. E., & Pyle, D. H. (1977). Informational asymmetries, financial structure, and financial intermediation. The Journal of Finance, 32(2), 371-387.

Bruton, G. D., Filatotchev, I., Chahine, S., & Wright, M. (2010). Governance, ownership structure, and performance of IPO firms: The impact of different types of private equity investors and institutional environments. Strategic Management Journal, 31(5), 491-509.

Bruton, G., Fried, V., & Hisrich, R. D. (1997). Venture capitalist and CEO dismissal. Entrepreneurship Theory and Practice, 21(3), 41-54.

Cai, J., & Wei, K. J. (1997). The investment and operating performance of Japanese initial public offerings. Pacific-Basin Finance Journal, 5(4), 389-417.

Carter, R. B., Dark, F. H., & Singh, A. K. (1998). Underwriter reputation, initial returns, and the long- run performance of IPO stocks. The Journal of Finance, 53(1), 285-311.

Carter, R., & Manaster, S. (1990). Initial public offerings and underwriter reputation. the Journal of Finance, 45(4), 1045-1067.

Chahine, S., & Filatotchev, I. (2008). The effects of venture capitalist affiliation to underwriters on short-and long-term performance in French IPOs. Global Finance Journal, 18(3), 351-372.

Chan, K., Wang, J., & Wei, K. J. (2004). Underpricing and long-term performance of IPOs in China. Journal of Corporate Finance, 10(3), 409-430.

Chang, S. J. (2004). Venture capital financing, strategic alliances, and the initial public offerings of Internet startups. Journal of Business Venturing, 19(5), 721-741.

Chen, H. K., & Liang, W. L. (2016). Do venture capitalists improve the operating performance of IPOs?. International Review of Economics & Finance, 44, 291-304.

Chen, H. C., & Ritter, J. R. (2000). The seven percent solution. The Journal of Finance, 55(3), 1105-1131.

Coakley, J., Hadass, L., & Wood, A. (2007). Post- IPO operating performance, venture capital and the bubble years. Journal of Business Finance & Accounting, 34(9- 10), 1423-1446.

Cochrane, J. H. (2005). The risk and return of venture capital. Journal of Financial Economics, 75(1), 3-52.

Corporate Finance, and Takeovers. American Economic Review, 76(2), 323–339.

Coval, J. and Moskowitz, T. (1999). Home Bias at Home: Local Equity Preference in Domestic Portfolios. The Journal of Finance, 54(6), pp.2045-2073.

Cressy, R. (2006). Venture capital. In The Oxford Handbook of Entrepreneurship.

Cumming, D. (2007). Government policy towards entrepreneurial finance: Innovation investment funds. Journal of Business Venturing, 22(2), 193-235.

Cumming, D. and Dai, N. (2010). Local bias in venture capital investments. Journal of Empirical Finance, 17(3), pp.362-380.

Cumming, D., Fleming, G., & Schwienbacher, A. (2006). Legality and venture capital exits. Journal of Corporate Finance, 12(2), 214-245.

Da Rin, M., Hellmann, T., & Puri, M. (2013). A survey of venture capital research. In Handbook of the Economics of Finance (Vol. 2, pp. 573-648). Elsevier.

Da Rin, M., Nicodano, G., & Sembenelli, A. (2006). Public policy and the creation of active venture capital markets. Journal of Public Economics, 90(8-9), 1699-1723.

Dey, E. L., & Astin, A. W. (1993). Statistical alternatives for studying college student retention: A comparative analysis of logit, probit, and linear regression. Research in higher education, 34(5), 569-581.

Doukas, J. A., & Gonenc, H. (2005). Long- term performance of new equity issuers, venture capital and reputation of investment bankers. Economic Notes, 34(1), 1-34.

Draho, J. (2004). The IPO decision: Why and how companies go public. Edward Elgar Publishing.

Eckbo, B. E. (2005). Initial underpricing of IPOs. Consultado en, 2(15), 07.

Eisenhardt, K. M. (1989). Agency theory: An assessment and review. Academy of management review, 14(1), 57-74.

Ernst & Young, (2001). Globalizing venture capital. Retrieved from: https://www.ey.com/Publication/vwLUAssets/Globalizing_venture_capital_VC_insights_and_trends_report_CY0227/%24FILE/Globalizing%20venture%20capital_VC%20insights%20and%20trends%20report_CY0227.pdf.

Franzke, S. A. (2004). Underpricing of venture-backed and non venture-backed IPOs: Germany's Neuer Markt. In The rise and fall of Europe's new stock markets (pp. 201-230). Emerald Group Publishing Limited.

Field, L. C., & Hanka, G. (2001). The expiration of IPO share lockups. the Journal of Finance, 56(2), 471-500.

Frooman, J. (1999). Stakeholder influence strategies. Academy of management review, 24(2), 191-205.

Galbraith, J. K. (1977). The age of uncertainty. Houghton Mifflin Harcourt (HMH).

Giot, P., & Schwienbacher, A. (2007). IPOs, trade sales and liquidations: Modelling venture capital exits using survival analysis. Journal of Banking & Finance, 31(3), 679-702.

Giudici, G., & Roosenboom, P. (2004). Pricing initial public offerings on Europe's new stock markets. In The Rise and Fall of Europe's New Stock Markets (pp. 25-59). Emerald Group Publishing Limited.

Gompers, P. A. (1996). Grandstanding in the venture capital industry. Journal of Financial economics, 42(1), 133-156.

Gompers, P., & Lerner, J. (1998). Venture capital distributions: Short- run and long- run reactions. The Journal of Finance, 53(6), 2161-2183.

Gompers, P., & Lerner, J. (2001). The venture capital revolution. Journal of economic perspectives, 145-168.

Gompers, P. A., & Lerner, J. (2003). The really long- run performance of initial public offerings: The pre- Nasdaq evidence. The Journal of Finance, 58(4), 1355-1392.

Gorman, M., & Sahlman, W. A. (1989). What do venture capitalists do?. Journal of Business Venturing, 4(4), 231-248.

Gregory, A., Guermat, C., & Al- Shawawreh, F. (2010). UK IPOs: long run returns, behavioural timing and pseudo timing. Journal of Business Finance & Accounting, 37(5- 6), 612-647.

Grilli, L., & Murtinu, S. (2014). Government, venture capital and the growth of European high-tech entrepreneurial firms. Research Policy, 43(9), 1523-1543.

Grilli, L., Mrkajic, B. & Latifi, G. (2017). Venture capital in Europe.Working paper. Retrieved from: http://www.projectfires.eu/wp-content/uploads/2018/02/D2.3-REVISED.pdf.

Guo, D., & Jiang, K. (2013). Venture capital investment and the performance of entrepreneurial firms: Evidence from China. Journal of Corporate Finance, 22, 375-395.

Hamao, Y., Packer, F., & Ritter, J. R. (2000). Institutional affiliation and the role of venture capital: Evidence from initial public offerings in Japan. Pacific-Basin Finance Journal, 8(5), 529-558.

Hamza, O. and Kooli, M. (2011). Does Venture Capitalists Reputation Improve the Survival Profile of IPO Firms? Working paper. Retrieved from: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1857012.

Hart, O., & Moore, J. (1994). Debt and seniority: An analysis of the role of hard claims in constraining management (No. w4886). National Bureau of Economic Research.

Hege, U., Palomino, F., & Schwienbacher, A. (2009). Venture capital performance: the disparity between Europe and the United States. Finance, 30(1), 7-50.

Hellmann, T., & Puri, M. (2000). The interaction between product market and financing strategy: The role of venture capital. The Review of Financial Studies, 13(4), 959-984.

Hellmann, T., & Puri, M. (2002). Venture capital and the professionalization of start- up firms: Empirical evidence. The journal of finance, 57(1), 169-197.

Hochberg, Y. V., Ljungqvist, A., & Lu, Y. (2007). Whom you know matters: Venture capital networks and investment performance. The Journal of Finance, 62(1), 251-301.

Holmstrom, B., & Tirole, J. (1997). Financial intermediation, loanable funds, and the real sector. the Quarterly Journal of economics, 112(3), 663-691.

Hochberg, Y. V. (2011). Venture capital and corporate governance in the newly public firm. Review of Finance, 16(2), 429-480.

Hsu, D. H. (2004). What do entrepreneurs pay for venture capital affiliation?. The Journal of Finance, 59(4), 1805-1844.

Huberman, G. (2001). Familiarity Breeds Investment. Review of Financial Studies, 14(3), pp.659-680.

Hölmstrom, B. (1979). Moral hazard and observability. The Bell journal of economics, 74-91.

Jain, B. A., & Kini, O. (1994). The post- issue operating performance of IPO firms. The journal of finance, 49(5), 1699-1726.

Jain, B. A., & Kini, O. (1995). Venture capitalist participation and the post- issue operating performance of IPO firms. Managerial and decision economics, 16(6), 593-606.

Jain, B. A., & Kini, O. (2000). Does the presence of venture capitalists improve the survival profile of IPO firms?. Journal of Business Finance & Accounting, 27(9- 10), 1139-1183.

Jeng, L. A., & Wells, P. C. (2000). The determinants of venture capital funding: evidence across countries. Journal of Corporate Finance, 6(3), 241-289.

Jensen, M. C. (1986). Agency cost of free cash flow, corporate finance, and takeovers.

Jensen, M. C., & Meckling, W. H. (1976). Theory of the firm: Managerial behavior, agency costs and ownership structure. Journal of financial Economics, 3(4), 305-360.

Kaplan, S. N., Strömberg, P., & Sensoy, B. A. (2002). How well do venture capital databases reflect actual investments?.

Korteweg, A., & Sorensen, M. (2010). Risk and return characteristics of venture capital-backed entrepreneurial companies. The Review of Financial Studies, 23(10), 3738-3772.

Kortum, S., & Lerner, J. (2001). Does venture capital spur innovation?. In Entrepreneurial inputs and outcomes: New studies of entrepreneurship in the United States (pp. 1-44). Emerald Group Publishing Limited.

Kreps, D. M., & Wilson, R. (1982). Reputation and imperfect information. Journal of economic theory, 27(2), 253-279.

Krishnan, C. N. V., Ivanov, V. I., Masulis, R. W., & Singh, A. K. (2011). Venture capital reputation, post-IPO performance, and corporate governance. Journal of Financial and Quantitative Analysis, 46(5), 1295-1333.

Krishnan, C. and Masulis, R. (2011). Venture Capital Reputation: A Survey. The Oxford handbook of Venture Capital, Chapter 4, Douglas J. Cummings, ed., Oxford University Press.

Lee, J. (2011). The Impact of Venture Capital Participation and Its Affiliation with Financial Institutions on the Long-Term Performance of IPO Firms: Evidence from Korea in Hot and Cold Market Periods. The Oxford Handbook of Venture Capital, Chapter 25, Douglas J. Cummings, ed., Oxford University Press.

Lee, G., & Masulis, R. W. (2011). Do more reputable financial institutions reduce earnings management by IPO issuers?. Journal of Corporate Finance, 17(4), 982-1000.

Lee, P. M., & Wahal, S. (2004). Grandstanding, certification and the underpricing of venture capital backed IPOs. Journal of Financial Economics, 73(2), 375-407.

Lerner, J. (1994). The syndication of venture capital investments. Financial management, 16-27.

Levis, M. (2011). The performance of private equity- backed IPOs. Financial Management, 40(1), 253-277.

Liao, W. M., Lu, C. C., & Wang, H. (2014). Venture capital, corporate governance, and financial stability of IPO firms. Emerging Markets Review, 18, 19-33.

Lin, T. H., & Smith, R. L. (1998). Insider reputation and selling decisions: the unwinding of venture capital investments during equity IPOs. Journal of corporate finance, 4(3), 241-263.

Ljungqvist, A. (2005). IPO underpricing. Handbook of Empirical Corporate Finance, 2, 375-422.

Ljungqvist, A., & Wilhelm Jr, W. J. (2003). IPO pricing in the dot- com bubble. The Journal of Finance, 58(2), 723-752.

Loughran, T., Ritter, J. R., & Rydqvist, K. (1994). Initial public offerings: International insights. Pacific-Basin Finance Journal, 2(2-3), 165-199.

Loughran, T. and Ritter, J. (1995). The New Issues Puzzle. The Journal of Finance, 50(1), 23- 51.

Loughran, T., & Ritter, J. (2004). Why has IPO underpricing changed over time?. Financial Management, 5-37.

Mason, C., & Stark, M. (2004). What do investors look for in a business plan? A comparison of the investment criteria of bankers, venture capitalists and business angels. International small business journal, 22(3), 227-248.

Megginson, W. L., & Weiss, K. A. (1991). Venture capitalist certification in initial public offerings. The Journal of Finance, 46(3), 879-903.

Mikkelson, W. H., Partch, M. M., & Shah, K. (1997). Ownership and operating performance of companies that go public. Journal of financial economics, 44(3), 281-307.

Milgrom, P., & Roberts, J. (1982). Predation, reputation, and entry deterrence. Journal of economic theory, 27(2), 280-312.

Miller, E. M. (1977). Risk, uncertainty, and divergence of opinion. The Journal of finance, 32(4), 1151-1168.

Moshirian, F., Ng, D., & Wu, E. (2010). Model specification and IPO performance: New insights from Asia. Research in International Business and Finance, 24(1), 62-74.

Nahata, R. (2008). Venture capital reputation and investment performance. Journal of Financial Economics, 90(2), 127-151.

Oehler, A., Rummer, M., & Smith, P. N. (2005). IPO pricing and the relative importance of investor sentiment-Evidence from Germany.

Pfeffer, J., & Salancik, G. R. (2003). The external control of organizations: A resource dependence perspective. Stanford University Press.

Pommet, S. (2017). The impact of the quality of VC financing and monitoring on the survival of IPO firms. Managerial Finance, 43(4), 440-451.

Pryshchepa, O., & Stehle, R. (2011). Long-Run Stock Performance of German Initial Public Offerings: Survey and Update.

Purnanandam, A. K., & Swaminathan, B. (2004). Are IPOs really underpriced?. The Review of Financial Studies, 17(3), 811-848.

Rindermann, G. (2004). Venture capitalist participation and the performance of IPO firms: empirical evidence from France, Germany, and the UK.

Ritter, J. (1991). The Long-Run Performance of Initial Public Offerings. The Journal of Finance, 46(1), 3-27.

Ritter, J. R., & Welch, I. (2002). A review of IPO activity, pricing, and allocations. The Journal of Finance, 57(4), 1795-1828.

Ritter, J.R. (1998), Initial public offerings. Contemporary Finance Digest, 2, 5-30.

Ritter, J. R. (2003). Differences between European and American IPO markets. European Financial Management, 9(4), 421-434.

Rock, K. (1986). Why new issues are underpriced. Journal of financial economics, 15(1-2), 187-212.

Sahlman, W. A. (1990). The structure and governance of venture-capital organizations. Journal of Financial Economics, 27(2), 473-521.

Sapienza, H. J. (1992). When do venture capitalists add value?. Journal of Business Venturing, 7(1), 9-27.

Sapienza, H. J., Manigart, S., & Vermeir, W. (1996). Venture capitalist governance and value added in four countries. Journal of Business Venturing, 11(6), 439-469.

Schuster, J. A. (2003). The cross-section of European IPO returns.

Schwienbacher, A. (2005). An empirical analysis of venture capital exits in Europe and the United States.

Shapiro, C. (1983). Premiums for high quality products as returns to reputations. The Quarterly Journal of Economics, 659-679.

Shapiro, C. (1983). Premiums for high quality products as returns to reputations. The quarterly journal of economics, 98(4), 659-679.

Shleifer, A., & Vishny, R. W. (1997). A survey of corporate governance. The journal of finance, 52(2), 737-783.

Sørensen, M. (2007). How smart is smart money? A two- sided matching model of venture capital. The Journal of Finance, 62(6), 2725-2762.

Tan, W. T. (1998) Venture capital in Asia Pacifc: an overview, Asia Business Law Review, 20, 40±47.

Tian, X. (2011a). The causes and consequences of venture capital stage financing. Journal of Financial Economics, 101(1), 132-159.

Tian, X. (2011b). The role of venture capital syndication in value creation for entrepreneurial firms. Review of Finance, 16(1), 245-283.

Titman, S., & Trueman, B. (1986). Information quality and the valuation of new issues. Journal of accounting and economics, 8(2), 159-172.

Tykvová, T., & Walz, U. (2007). How important is participation of different venture capitalists in German IPOs?. Global Finance Journal, 17(3), 350-378.

Van der Geest, R., & Van Frederikslust, R. (2001). Initial returns and long-run performance of private equity-backed initial public offerings on the Amsterdam Stock Exchange.

Wang, C. K., Wang, K., & Lu, Q. (2002). Do venture capitalists add value? A comparative study between Singapore and US. Applied Financial Economics, 12(8), 581-588.

Wetzel, W. E. (1987). The informal venture capital market: Aspects of scale and market efficiency. Journal of Business Venturing, 2(4), 299-313.

Wright, M., Robbie, K., & Ennew, C. (1997). Venture capitalists and serial entrepreneurs. Journal of business venturing, 12(3), 227-249.

Yi, J. H. (2001). Pre-offering earnings and the long-run performance of IPOs. International Review of Financial Analysis, 10(1), 53-67.

Zacharakis, A., & Eckermann, M. (2006). Venture capital financing. Entrepreneurship: The engine of growth, 2, 109-34.