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A quantitative comparative study on VC-backed and non-VC-backed companies' performance in post-IPO periods

A Study on the European markets

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Abstract

This thesis investigates the performance differences between venture capital backed companies and non-venture capital backed companies following an IPO in the European market. The study employs an OLS regression model, using change in stock price through simple buy and hold returns and change in ROA level as performance metrics, primarily focusing on the one-year period after a company's IPO. In addition, a secondary analysis was conducted, analyzing the change in stock price after 180 days and the change in ROA over 2 and 3 years, respectively. The model controls for factors such as proceeds, industries, and countries, to isolate the impact of venture capital firms.

The final data set includes 1,813 firms across Europe that went public between 2004 and 2023. The findings do not establish any significant results of outperformance among venture capital-backed IPOs. However, the results suggest a tendency of better performance among venture capital-backed companies in the post-IPO periods. These results provide an interesting discussion as they both align with and contradict previous studies on the subject.

Acknowledgment

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1 Introduction

This introductory section is divided into three parts; background, problem description, and purpose. It aims to provide the reader with general insights into the venture capital industry and the public markets. Additionally, it expands on the necessity of this thesis and articulates its purpose.

1.1 Background

Venture capital backed companies have been an essential part of driving innovation and economic growth on a global scale. There are many examples of famous companies that have gone public, including Google, Amazon, and Apple, all of which have been venture capital-backed at some point.[1]

In general, venture capital, also referred to as "VC", is a form of financing for start-up companies with long term growth potential.[2] This type of financial intermediary takes investors' capital and invests it directly in portfolio companies. Venture capitalists make investments in private companies, which is a characteristic that defines venture capital as a type of private equity. Financing is not the sole method through which a venture capital firm can add value to its investments. They frequently play an active role in monitoring and assisting their portfolio companies, granting them a competitive advantage.[3] For example, they can provide their investments with things such as technological and managerial support and expertise in various fields.[4] Venture capitalists invest in internal growth, categorizing portfolio companies into seed/startup, early-stage, and late-stage. The early stage is crucial, with venture capitalists playing a hands-on role in moving from idea to product commercialization.[5]

As most investments, an investment made by a venture capital firm aims to turn illiquid stakes into realized return. In most cases, the exit opportunity that is most profitable, and thus favorable, is an initial public offering, hereafter referred to as an IPO.[6] In an IPO, a private

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[1] Yahoo Finance. "25 Largest VC-Backed Companies". *Yahoo Finance* (webpage). Last updated 21 May 2024. Accessed 22 May 2024. https://finance.yahoo.com/news/25-largest-vc-backed-companies-192418545.html

[2] Adam Hayes, "What is Venture capital", Investopedia (webpage). Last updated 28 December 2022. Accessed 22 May 2024. https://www.investopedia.com/terms/v/venturecapital.asp

[3] Andrew Metrick and Ayako Yasuda, *Venture Capital & the Finance of Innovation,* 3 uppl. (Hoboken, NJ: Wiley [2021], s.1-11

[4] Hayes, "What is Venture capital".

[5] Metrick and Yasuda, *Venture Capital & the Finance of Innovation,* p.1-11

[6] Paul Gompers and Josh Lerner, "The Venture Capital Revolution" *Journal of Economic Perspectives*. Vol. 15, Issue 2 (Spring 2001), p. 145-168. https://pubs.aeaweb.org/doi/pdfplus/10.1257/jep.15.2.145

company makes its shares available to the public for the first time. This allows the former private company to raise equity capital from public investors while also enabling private investors of the company to realize gains from their investments.[7] In addition to extended access to capital and the opportunity to liquidate private investments, theories such as the life cycle theory and the market-timing theory suggest that there are other reasons why companies go public and when they go public. The life cycle theory suggests that companies may choose to do an IPO to facilitate acquisition at a higher value, regain control from venture capitalists, allow for more dispersion of ownership, attract competition, and inspire confidence from various stakeholders, potentially gaining a first-mover advantage in the market. On the other hand, the market-timing theory suggests that depending on the status of the market (bear or bull), a company times its IPO for more favorable pricing.[8]

After an IPO, venture capitalists typically do not dispose of all of their ownership. Performance incentives, liquidations plans, and lock-up agreements are examples of reasons that can explain VCs still retaining shares after an IPO. Furthermore, practices introduced by venture capital firms during the holding investment period, such as R&D focus, changes in management structures, and patent generation, often remain in place a certain time after a venture capital firm's full exit and as such helps the IPO company to perform better in the long run.[9] Hence, the support from venture capital firms is not entirely connected to the holding period.

The venture capital industry has experienced significant growth during the past 5 decades, especially in the 1990s during the internet bubble.[10] Modern venture capital was established as it became a crucial contributor to the economy, meeting the growing need to foster new technologies and industries.[11] As of more recent history there has been a lot of growth in the industry. Capital raised in venture capital format worldwide almost doubled from 2020 to 2021, a jump from 292.7 billion USD to 549.1 billion USD.[12]

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[7] Jason Fernando, "What is an IPO? How an initial Public Offering Works", *Investopedia* (Webpage) 2024, accessed 23 March 2024, https://www.investopedia.com/terms/i/ipo.asp#toc-advantages-and-disadvantages-of-an-ipo

[8] Jay R. Ritter and Ivo Welch. "A Review of IPO Activity, Pricing, and Allocations". *The Journal of Finance*. Vol. 57, Issue 4 (August 2002), pp. 1795-1828. https://onlinelibrary.wiley.com/doi/full/10.1111/1540-6261.00478

[9] Luca David Pauli "The impact of venture capital on the long-run performance of IPOs". *Master's Thesis in Finance*, Nova School of Business and Economics. (2021) https://run.unl.pt/bitstream/10362/143031/1/2021-22_fall_45582_luca-david-pauli.pdf

[10] Ivelina Niftyhontas, "Journey Through Time: A Comprehensive History of Venture Capital," *Going VC* (blog), (December 7, 2023), https://www.goingvc.com/post/journey-through-time-a-comprehensive-history-of-venture-capital.

[11] Jonathan Berk and Peter DeMarzo. *Corporate Finance*. 3rd ed. Boston: Pearson, 2013. p. 868-871

[12] Statista, "Venture Capital - Worldwide", *Statista*, Webpage, 2024, accessed 23. March 2024, https://www.statista.com/outlook/fmo/capital-raising/traditional-capital-raising/venture-capital/worldwide#analyst-opinion

The market-timing theory could partially account for the booming of certain industries in 2021. This period not only witnessed a significant surge in venture capital markets but also set a new record for the number of IPOs in a single year. In 2021, IPOs raised a staggering $608 billion globally, an increase of approximately 84% compared to the $330 billion raised in 2020.[13]

Other relevant market trends in recent years, also emerging around the year 2021, include the rise of "mega-deals" within the venture capital sector.[14] A mega-deal is defined as an investment round with a financing volume of 100 million dollars or more.[15] Other trends such as the large increase of SPACs, short for Special Purpose Acquisition Companies, simultaneously emerged with the increase in IPOs 2021. Number of SPACs globally went from 253 in 2020 to 671 in 2021.[16]

1.2 Problem description

The surge in activity within the VC industry has sparked greater interest among several stakeholders in understanding the performance disparities between venture capital-backed and non-venture capital-backed companies. Consequently, the thesis aims to determine whether the success stories of many venture capital-backed companies reflect the broader impact of venture capital on post-IPO company performance, rather than being merely coincidental. By conducting this analysis and striving for significant findings, this thesis aims to provide valuable insights that could assist in predicting future company performance based on their history with venture capital firms.

Additionally, as various trends emerge in both the public markets and the venture capital industry, such as the increased activity of SPACs or the increase in Mega-deals, there is a growing incentive to examine whether these trends may have had an impact on the effectiveness of venture capital, compared to time periods in previous studies.

[13] PricewaterhouseCoopers LLP (PwC), "PwC Global IPO Watch 2021". *PwC Global IPO Watch* (webpage). Accessed 22 May 2024. https://www.pwc.com/gx/en/audit-services/ipo-centre/assets/pwc-global-ipo-watch-2021.pdf
[14] Statista. "Venture Capital - Worldwide".
[15] National Venture Capital Association (NVCA). *NVCA Yearbook 2020*. Accessed 22 May 2024. https://nvca.org/wp-content/uploads/2020/03/NVCA-2020-Yearbook.pdf
[16] PricewaterhouseCoopers LLP (PwC),"PwC Global IPO Watch 2021".

As is discussed further in the literature review, there has been research on similar subject matter. However, many focus on slightly different areas. For example, a few studies analyzed the US market, while other studies focused on the high tech industry. This thesis, however, has a European focus and while it does not, by any means, exclude the high-tech market, it provides a broader perspective by taking all industries into account. Additionally, some of the previous research has been analyzing older data that may not reflect today's reality. Thus, this thesis aims to serve the purpose of bringing more recent data to light, providing stakeholders with a broader perspective on the relationship between the venture capital industry and performance of public companies in a less researched market.

1.3 Purpose

The purpose of this thesis is to examine if there is any empirical evidence that venture capital backed firms perform better or worse than non venture capital backed firms in post IPO periods, thus contributing to the existing and not entirely clear research around this topic.

2 Theoretical framework

This section serves as the groundwork for discussing and analyzing the results obtained from the empirical investigation. The framework is designed to offer the reader a multifaceted view that sheds light on the findings from diverse perspectives. These perspectives are theories drawn from both financial and economic vantage points, being herding behavior, signaling theory, underpricing, and IPO market timing, and are described in that order.

2.1 Herding behavior

Herding behavior, sometimes referred to as herd instinct, is described as when people tend to follow the group's choices or actions, assuming that others have done their research instead of doing their own. This often occurs in the financial sector, usually referring to investors following what other investors are doing instead of relying on their own analysis.[17] A study conducted on the Indonesian stock market by Arisanti and Asri in 2018 found evidence of herding behavior post-IPOs between 2005 and 2015. In that study, herding behavior was measured through the relationship between the dispersion rate over the observed time frame.

[17] Adam Hayes, 'Herd instinct: Definition, Stock Market Examples, & How to avoid', *Investopedia*, Webpage, 2022, accessed 24 March 2024, https://www.investopedia.com/terms/h/herdinstinct.asp

[18]Another study conducted by Yao, Ma and Peng He in 2014, conducted on the Chinese stock market also found evidence of herding behavior to varying degrees.[19] As this thesis analyzes the performance of companies post-IPO, herding behavior might influence the results. These multiple findings indicate that herding instinct is quite common in public markets. If herding instinct exists in the European markets, it would not be unreasonable to believe that this may affect VC-backed companies differently than non-VC-backed companies, especially if the backing VC firm in question has a good reputation among investors.

2.2 Signaling theory

In finance, signaling theory is the belief that information about a company's financial health is not available to all parties in a market at the same time. Because of this imbalance, different actions taken by the company can indicate various expectations that the management may have. For example, dividends and stock buybacks can signal expected future growth for the company.[20] There have been many previous studies on this topic. A research paper by Puspitaningtyas, conducted in 2019, which also analyzed the Indonesian stock market, researched whether signaling theory holds true in the public market. The findings show that the market reacts to increases and decreases in dividends, proving that dividends can be used as a form of signaling that contains relevant information for investors.[21] In another study conducted by Guldiken in 2017, evidence was found that signaling approaches in the form of financial media coverage had a significant impact on stock returns during the first week after an IPO.[22] According to the stated findings, signaling theory is relevant when discussing the performance of companies, particularly when considering stock price changes as a metric. There is evidence indicating that signaling approaches may influence these changes following an IPO issuance.

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[18] Ike Arisanti. and Marwan Asri. (2018). "Herding Behavior of Post Initial Public Offering in Indonesia Stock Exchange". *Journal of Accounting and Investment,* 19(2), 149-159. https://download.garuda.kemdikbud.go.id/article.php?article=2358183&val=8104&title=Her

[19] Juan Yao, Chuanchan Ma, and William Peng He. "Investor Herding Behaviour of Chinese Stock Market". *International Review of Economics & Finance*. Vol. 29 (January 2014), pp. 12-29. https://www.sciencedirect.com/science/article/pii/S1059056013000191

[20] Gordon Scott, 'Signaling approach: What it is, How it Works', *Investopedia,* Webpage, 2022, accessed 24 March 2024, https://www.investopedia.com/terms/s/signallingapproach.asp

[21] Zarah Puspitaningtyas. "Empirical Evidence of Market Reactions Based on Signaling Theory in Indonesia Stock Exchange". *Investment Management and Financial Innovations*. Vol. 16, Issue 2 (2019), pp. 109-120. https://pdfs.semanticscholar.org/1b23/a95c96ec4345993f6c1e87e48fb9cd76abd8.pdf

[22] Orhun Guldiken, Christina Tupper, Anil Nair, and Huizhi Yu. "The Impact of Media Coverage on IPO Stock Performance". *Journal of Business Research*. Vol. 72 (March 2017), pp. 24-32. https://pdf.sciencedirectassets.com

2.3 Underpricing

Underpricing occurs when the share price of a company increases on the first day of trading after an IPO has been issued. In the U.S., there has been an average underpricing of 19% since the 1960s.[23] Underpricing is calculated by determining the percentage change in price from the offering price to the closing price on the first day of trading.[24] Underpricing is commonly used as a signaling approach. Managers of issuing firms typically possess more information regarding the quality of their firm than outside investors. Consequently, when information is imperfect, there is a higher likelihood that outside investors cannot distinguish between high-quality and low-quality firms. To mitigate this problem, managers may choose to underprice their offering price to signal that the firm will perform well in the future.[25] Arguments have been made saying that firms underprice their IPOs to secure higher and better valuations in future seasoned offerings. Simultaneously, firms that underprice their IPOs are more likely to proceed with a seasoned offering, raising greater proceeds compared to other firms.[26] This thesis aims to understand the performance differences in companies after their IPOs, making the concept of underpricing highly relevant. Understanding underpricing helps interpret the study's results and facilitate discussion, as these results can be compared to what is already established as a phenomenon.

2.4 IPO market timing

Previous research suggests that managers of a company decide to issue an IPO based on the state of the market.[27] When the market is experiencing a high volume of IPOs it is often described as "IPO waves" or characterized as "hot" IPO markets. A study examined how companies determine the timing of their IPOs, and discovered that a significant factor influencing this decision is whether their competitors are also going public. The study provided evidence indicating that companies opting to go public during an IPO wave tend to have lower productivity and profits but possess more cash compared to those outside the wave.[28] In 2014, Adam Szyszka, discovered evidence indicating that managers attempt to

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[23] Alexander Ljungqvist. "IPO Underpricing". In *Handbook of Empirical Corporate Finance*, edited by B. Espen Eckbo, 1st ed. Amsterdam: Elsevier, 2007, pp. 375-422. https://learning.oreilly.com/library/view/handbook-of-empirical/9780444532657/B9780444532657500214.xhtml#s0015

[24] Peggy M. Lee and Sunil Wahal. "Grandstanding, Certification, and the Underpricing of Venture Capital Backed IPOs". *Journal of Financial Economics*. Vol. 73, Issue 2 (August 2004), pp. 375-407. https://pdf.sciencedirectassets.com

[25] George J. Papaioannou and Ahmet K. Karagozoglu. "Theories of New Issue Pricing". In *Underwriting Services and the New Issues Market*, Academic Press, 2017, pp. 135-143 https://www.sciencedirect.com/topics/economics-econometrics-and-finance/signaling-theory

[26] Ivo Welch. "Seasoned Offerings, Imitation Costs, and the Underpricing of Initial Public Offerings". *The Journal of Finance*. Vol. 44, Issue 2 (June 1989), pp. 421-449.https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1540-6261.1989.tb05064.x

[27] Ritter and Welch. "A Review of IPO Activity, Pricing, and Allocations".pp. 1795-1828

[28] Thomas J. Chemmanur and Jie He. "IPO Waves, Product Market Competition, and the Going Public Decision: Theory and Evidence". *Journal of Financial Economics*. Vol. 101, Issue 2 (August 2011), pp. 382-412.https://www.sciencedirect.com/science/article/

time bullish markets. It is proposed that market timing is likely to deceive outside investors into overvaluing the issuing firms that conduct IPOs under these bullish market conditions, potentially harming the overall efficiency of the economy.[29] Similarly, Çolak and Günay analyzed tendencies of IPO firms that strategically wait for favorable economic conditions before entering the public markets. After evaluating different levels of quality, it was concluded that high-quality firms benefit from delaying their issuance to gain a better understanding of market conditions. The top-tier firms typically choose to issue later in a rising cycle.[30] Listed findings from these research papers indicate that there is reasoning behind the timing of companies' IPO and that it is not a question about random chance that some years have more IPOs than others. This is relevant to this thesis as it aims to analyze how macroeconomic factors may affect the performance of companies post-IPO, such as if the IPO market was "hot" or not at the time of issuing.

3 Previous research

The following section is divided into two parts. First, relevant articles and research essential to this study are presented. For clarity, Table 1 is provided, which lists all articles and research mentioned in this section, sorted by date. Second, based on the first part, the development of the hypothesis for this thesis is carried out.

3.1 Relevant articles and research

Several articles are touched upon in this section, where Table 1 below summarizes key information.

[29] Adam Szyszka. (2014). "Factors Influencing IPO Decisions. Do Corporate Managers Use Market and Corporate Timing?" *International Journal of Management and Economics (Zeszyty Naukowe KGŚ)*, No. 42, (2014), pp. 30–39. Capital Markets Department, Warsaw School of Economics. http://www.sgh.waw.pl/ijme/

[30] Gönül Çolak and Hikmet Günay. "Strategic Waiting in the IPO Markets". *Journal of Corporate Finance*. Vol. 17, Issue 3 (June 2011), p. 555-583 https://www.sciencedirect.com/science/article/

Table 1 - Summary and indicative results of previous research

Research paper	Year	Research period	Geograpchical focus	Sample size	Performance result*
Brav and Gompers (1997)	1997	1975 - 1992	U.S.	N = 4341	Positive
James Brown (2005)	2005	1980 - 1989	U.S.	N = 810	Positive
Hollacher and Holt (2018)	2018	2001 - 2014	Europe	N = 499	No significance
Brinkestam Persson and Karlsson (2021)	2021	2010 - 2019	Sweden	N = 188	No clear positive relationship
Chen and Liang (2016)	2016	1970 - 2007	U.S.	N = 3771	Inferior
Bottazzi and Da Rin (2002)	2002	1991 - 2000	Europe	N = 511	No systematic differences
Rindermann (2003)	2003	1996 - 1999	Germany, France, UK	N = 303	No clear positive relationship
Coakley and Wood (2007)	2007	1985 - 2003	UK	N = 590	Inferior
Bessler and Seim (2012)	2012	1996 - 2010	Europe	N = 384	Positive
Doukas and Gonenc (2005)	2005	1989 - 1997	U.S.	N = 2021	Positive
Megginson and Weiss (1991)	1991	1983 - 1987	U.S.	N = 640**	Inferior
Jain and Kini (1995)	1995	1976 - 1988	U.S.	N = 272	Positive
Krishnan et al (2011)	2011	1993 - 2004	U.S.	N = 1503***	Positive

** The different studies use different performance metrics. This header only gives an indication of the result of each study, where positive indicates a better performance of VC firms, and inferior a worse performance of VC firms.*
*** The study also does a comparison of VC backed IPOs and all non VC backed firms, where the sample is 320 against 991*
**** The study also uses different subsamples*

In 1997 Brav and Gompers conducted a study which has served as a foundation for subsequent research, and is as such relevant to this thesis. The study focuses on the effect of VC on long-term performance of IPOs in the U.S. market, using a sample period of IPOs conducted during 1975 to 1992 and stock returns through December 31, 1994.[31] The research in the article builds upon earlier work by Ritter in 1991 and also a study conducted by Loughran and Ritter in 1995, which documented significant underperformance of IPOs, suggesting that investors may systematically overestimate the prospects of firms issuing equity for the first time.[32,33] To begin with, Brav and Gompers examine whether VCs affect the long-run performance of newly public firms, and find that VC backed firms outperform non-VC-backed IPOs by a wide margin over a five year period following the IPO date, but only when returns are equally weighted. Further, they examine the effects of using different benchmarks and methods of measuring performance to gauge the robustness of IPO performance, and find that underperformance in the non-VC backed sample is driven primarily by companies with market capitalizations below $50 million. When returns are value-weighted to give more prominence to larger firms, this underperformance is less pronounced. Lastly, Brav and Gompers provides further evidence on the sources of underperformance, and find that returns of IPO firms are highly correlated in calendar time

[31] Alon Brav and Paul A Gompers. “Myth or Reality? The Long-Run Underperformance of Initial Public Offerings: Evidence from Venture and Nonventure Capital-Backed Companies.” *The Journal of Finance,* v 52, (1997) p. 1791-1821. https://doi.org/10.1111/j.1540-6261.1997.tb02742.x
[32] Jay R. Ritter, “The Long-Run Performance of Initial Public Offerings”, *The Journal of Finance*, vol 46, issue 1, (1991), pp. 3-27. https://doi.org/10.1111/j.1540-6261.1991.tb03743.x
[33] Tim Loughran and Ray J. Ritter, “The New Issues Puzzle”, *The Journal of Finance*, vol 50, Issue 1, (1995) pp. 23-51. https://doi.org/10.1111/j.1540-6261.1995.tb05166.x

even if firms go public in different years. Fluctuations in investor sentiment are highlighted as possible explanations for the severe underperformance of small non-VC backed IPOs, as they are more likely to be held by individuals, which arguably are more likely to be influenced by trends or lack complete information. Unexpected real shocks are also given as potential explanations that affected the small growth firms during the chosen time period. It is then noted that underperformance isn't solely an IPO effect, but a trait of small firms with low book-to-market ratios regardless whether they are IPO firms or not. When issuing firms are matched to size and book-to-market portfolios that exclude recent equity issuers, IPOs do not underperform.[34] An understanding of such general trends in IPO performance is valuable for analyzing the findings of this thesis.

An article by James Brown in 2005 examines the performance and financing of venture and non-venture-backed firms during the decade following their IPO, based on U.S. firms that went public between 1980 and 1989 in seven key high-tech industries. In terms of performance, the study focuses on survival, growth, R&D intensity, operating performance, use of external financing, and cumulative impact on the U.S. high-tech sector.[35] In addition to using a full sample analysis in order to investigate the entire data set, Brown utilizes a matched sample methodology similar to studies conducted by Megginson and Weiss in 1991 and Jain and Kini in 1995, based on industry and firm size prior to the IPO.[36,37] Brown reaches the conclusion that following the IPO, VC backed firms survive longer and have lower hazard rates. The conducted growth regressions indicate that VC backed firms grow much faster than non-VC backed firms for many years after the IPO, though the growth rates converge over time. In both the matched and unmatched samples, VC-backed firms have faster R&D spending in the post-IPO period, are more R&D intensive, and accumulate a larger stock of knowledge capital. Further, the operating performance of VC-backed firms is generally superior in the post IPO period, but the extent depends on the measure of operating performance employed. Return on assets was the only measurement with differences between VC- and non-VC backed firms being significant for both samples. Brown also mentions several possible factors to the superior long-run performance, where external financing,

[34] Brav and Gompers. "Myth or Reality? The Long-Run Underperformance of Initial Public Offerings: Evidence from Venture and Nonventure Capital-Backed Companies." pp. 1791-1821.

[35] James R Brown. "Venture Capital and Firm Performance Over the Long-Run: Evidence from High-Tech IPOs in the United States," *Journal of Entrepreneurial Finance and Business Ventures*: Vol. 10: Iss. 3, (2005) pp. 1-33, https://doi.org/10.57229/2373-1761.1049

[36] William L. Megginson and Kathleen A. Weiss "Venture Capitalist Certification in Initial Public Offerings". *The Journal of Finance*, Volume 46, Issue 3, (1991). pp. 879-903. https://doi.org/10.1111/j.1540-6261.1991.tb03770.x

[37] Bharat A.Jain and Omesh Kini, "Venture Capitalist Participation and the Post-Issue Operating Performance of IPO Firms", *Managerial and Decision Economics*, Vol.16, (1995) p. 593-606. http://dx.doi.org/10.1002/mde.4090160603

guidance and experience, and ability to select the most promising ideas are the main ones. Furthermore, Brown draws a conclusion based on the initial evidence of VC-backed firms in Europe not significantly outperforming in the years immediately following the IPO, that states that the nature of venture financing can differ considerably in different economies. [38]

Another study analyzing the high tech industry was conducted by Hollacher and Holt investigated the relation between VC-backing and long-term post IPO performance of companies, with a focus on Europe and as Brown the high-tech industry. This study, unlike the previous one, also measures performance through buy-and-hold abnormal returns. The study was conducted using data from high-tech companies on the European market issuing an IPO between 2001 and 2014. The results did not provide evidence for any significant difference in long term performance between VC-backed companies and companies with no financial sponsorship. However, the results did find evidence that the VC backed companies had better operative performance over the first year post-IPO. The mixed findings in this research-paper gives incentives to investigate further. This study did well regarding the inclusion of performance metrics, and had a relevant time frame. Furthermore the article gave good reasoning for why more research is needed on the European markets, stating that for a long time, compared to the U.S., Europe has been lagging behind.[39]

Brinkestam Persson and Karlsson have also conducted research on the performance of venture capital backed IPOs. Analyzing the Swedish stock markets (OMX Stockholm, First North Stockholm and on the Spotlight Stock market) no evidence was found to support that VC-backed firms are entailed with higher initial first day returns compared with non-VC backed firms. Neither was there any significant results that could support a comprehensive difference in long term performance. On one hand the result implied that VC-backed companies yield better return when measuring ROA. On the other hand, when measuring performance with buy and hold abnormal returns (BHAR), the results implied that VC-backed IPOs are entailed with negative long-term returns. The study also suggests that further research on the topic is of high interest, including more observations for higher significance and adding a controlling variable for different industries.[40] This study provided

[38] Brown. "Venture Capital and Firm Performance Over the Long-Run: Evidence from High-Tech IPOs in the United States", pp. 1-33

[39] Jonas Hollacher and Julia van Holt, "The Post-IPO Performance of Venture Capital-backed Companies – Evidence from the European High-Tech Industry", *Master's Thesis in Finance*, Stockholm School of Economics. (2018) http://arc.hhs.se/download.aspx?MediumId=4221

[40] Didrik Brinkestam Persson and Johanna Karlsson, "The High Risk and High Reward Game: Performance of Venture Capital Backed IPOs", *Master's Thesis in Finance*, Linnéuniversitetet. (2021) https://www.diva-portal.org/smash/get/diva2:1577189/FULLTEXT01.pdf

results in a highly relevant market to this thesis. Since the results were mixed, this study could, while researching a bigger geographical area, provide value through complementary data, using similar performance metrics.

As for another view, Chen and Liang conducted a study in 2016, reexamines the operating performance of post-IPO firms backed by VCs, and brings up valuable results and arguments that face previous conclusions. Chen and Liang are critical to previous research conducted, and mentions that sample selection, method of ROA measurement, and industry effects appear to have critical effects on the calculation of operating performance. Chen and Lian argue that the matching methodology of IPO firms can result in an upward bias skewing the results.[41] They base this argument on methodologies in previous studies by Megginson and Weiss in 1991, Jain and Kini in 1995 and Wang et al. in 2003.[42,43,44] Further, using the level of ROA and not controlling for potential industry effect, is also motivated to generate biased inferences. Therefore they are reexamining this issue with an updated sample of U.S. IPOs by using industry-adjusted ROA and abnormal ROA, in addition to the unadjusted ROA. Using 3,771 U.S. IPOs from 1970 to 2007, they find that VC-backed firms experience operating performance inferior to that of non VC-backed firms across different ROA measures. Noteworthy is that they find that the inferior performance is more serious for VC backed IPOs with higher excess cash and lower growth opportunity. This is linked to overinvestment problems, where managers may be less prudent in investments.[45] Compared to the study by Brav and Gompers listed above, Chen and Liang reach a different conclusion.

Within Europe, the literature on post-IPO performance across multiple countries remains limited. However, Bottazzi and Da Rin conducted a study of relevance in 2002, conducted around the broader impact of venture capital. They utilize data manually collected from firms listed on Europe's newer stock markets, such as Euro.NM, and then compare VC-backed and non-VC backed firms on certain premises.. The findings indicate no systematic differences in the growth of sales and employees within three years following the IPO. Moreover, when focusing on firms engaged in R&D, presumably more innovative, the research shows that VC-backed firms experienced a smaller increase in sales post-IPO compared to their

41 Hung-Kun Chen and Woan-lih Liang, "Do Venture Capitalists Improve the Operating Performance of IPOs?", *International Review of Economics & Finance*, Volume 44, (2016). pp. 291-304. https://doi.org/10.1016/j.iref.2015.12.009
42 Megginson and Weiss, "Venture Capitalist Certification in Initial Public Offerings", pp. 879-903
43 Jain and Kini, “Venture Capitalist Participation and the Post-Issue Operating Performance of IPO Firms”, pp. 593-606.
44 Clement K. Wang., Kangmao Wang., and Qing Lu, “Effects of venture capitalists participation in listed companies”, *Journal of Banking & Finance,* Vol. 27, (2003) pp. 2015–2034. https://www.sciencedirect.com/science/article/pii/S0378426602003175
45 Chen and Liang "Do Venture Capitalists Improve the Operating Performance of IPOs?", pp. 291-304.

non-VC-backed counterparts.[46] While this study does not delve into stock market or operational performance like some others, it offers valuable insights from a unique angle.

Rindermann in 2003 explored the influence of venture capitalists on the operating and market performance of companies that go public. The study uses a dataset of venture-backed and non-venture-backed IPOs from high-growth and innovative markets in Germany, France, and the UK between 1996 and 1999. Performance metrics include BHR, Tobin's Q, ROA, and CFROA (cash flow return on assets). The research confirms prior findings that IPOs typically underperform compared to established stocks over a three-year post-IPO period. Additionally, it reveals that venture-capital-backed IPOs do not generally outperform those without venture capital backing. This suggests that the impact of venture capital on operating performance and long-term market outcomes, as documented in U.S. studies, may not fully extend to European countries. Conclusively the study mentioned a lacking degree of maturity and critical size in the relatively young European venture capital industry.[47] As the time period in the study, today, is relatively outdated there is room for further research on the topic, when considering the growth of the European VC-market especially the last decade.

Coakley et al, in 2007, investigated post-IPO performance in the UK specifically from 1985 to 2003. Their analysis contrasts U.S. research, and uses a more balanced industry distribution and a predominance of later-stage IPOs within the UK sample. Their findings initially indicated a significant decline in operating performance five years post-IPO compared to the pre-IPO year. However, this was later attributed primarily to the underperformance during the 1988 - 2000 "bubble years" with IPOs from other periods not exhibiting such underperformance. Interestingly, the operating performance difference between VC-backed and non VC-backed IPOs were not significant except for a few individual years. Coakley and Wood also presented that significant declines in operating performance were mostly confined to the bubble period, and argue that IPOs of inferior quality during these years experienced substantial decreases in operating cash flow over assets being the key metric of operating performance used in their study. They further concluded that the market-timing strategies of issuers, aiming to capitalize on favorable

[46] Laura Bottazzi, Marco Da Rin, "Venture capital in Europe and the financing of innovative companies", *Economic Policy*, Volume 17, Issue 34, 1 April 2002, Pages 229–270, https://doi.org/10.1111/1468-0327.00088

[47] Georg Rindermann "Venture Capitalist Participation and the Performance of IPO Firms: Empirical Evidence from France, Germany, and the UK". Allianz SE - Reinsurance Department (2003). https://deliverypdf.ssrn.com/delivery.php

investor sentiment, were predominantly a feature of the bubble years.[48] This insight is highly pertinent to this thesis, indicating that temporal market dynamics can significantly influence post-IPO performance.

Bessler and Seim conducted a study that investigates the performance of European VC-backed IPOs during the period from 1996 to 2010, which includes two stock market cycles and IPO waves. Focusing on long-run performance (three year period) through Buy-and-Hold-Abnormal-Return (BHAR) and underpricing, they found that VC-backed IPOs outperform non-VC backed IPOs that are listed on main markets.[49]

Other previous empirical research has demonstrated that the general benefits of VC, further discussed in the background section, positively influence post-IPO performances. VC-backed U.S. IPOs, was by Doukas and Gonenc found to have higher buy-and-hold returns after two and three years.[50] Reduced underpricing in VC backed IPOs was observed by Megginson and Weiss and attributed to the certification role played by VC firms.[51] Jain and Kini, in 1995 demonstrated, by using operating return on assets and operating cash flows deflated by total assets, that IPOs backed by venture capital (VC) outperform those without VC support, even after accounting for industry type and offering size, among other variables. The authors propose that capital markets appreciate the added value of VC oversight. However, they also note a decline in this value-added potential as venture capitalists exit and market surveillance becomes predominant. Additionally, the study suggests that VC involvement serves as a quality signal to investors.[52] Further, Krishnan et al. in 2011, considering the reputation of the VC firm, identified a positive effect of VC on abnormal stock returns, market-to-book ratio, return on assets, and the probability of survival of backed companies over a three-year period.[53] Interestingly, a number of studies, although dispersed in geographical focus, often involve reputation or a relevant proxy in the models or analysis. This is generally motivated

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[48] Jerry Coakley, Leon Hadass, Andrew Wood, "Post-IPO Operating Performance, Venture Capital and the Bubble Years", *Journal of Business Finance & Accounting*, Volume 34, Issue 9-10, (2007) pp. 1423-1446. https://doi-org.ezproxy.ub.gu.se/10.1111/j.1468-5957.2007.02055.x

[49] Wolfgang Bessler and Martin Seim, "The Performance of Venture-backed IPOs in Europe", Venture Capital, *Taylor & Francis Journal*, Volume 14, Issue 4, (Oktober 2012) pp. 215-239 https://ideas.repec.org/a/taf/veecee/v14y2012i4p215-239.html

[50] John A. Doukas, Halit Gonenc, "Long-term Performance of New Equity Issuers, Venture Capital and Reputation of Investment Bankers", *Economic Notes*, Volume 34, Issue 1, (2005) pp. 1-34. https://onlinelibrary.wiley.com/doi/abs/10.1111/j.0391-5026.2005.00142.x

[51] Megginson and Weiss, "Venture Capitalist Certification in Initial Public Offerings", pp. 879-903

[52] Jain and Kini, “Venture Capitalist Participation and the Post-Issue Operating Performance of IPO Firms”, pp. 593-606.

[53] CNV Krishnan, Vladimir I. Ivanov, Ronald W. Masulis, and Ajai K. Singh. 2011. “Venture Capital Reputation, Post-IPO Performance, and Corporate Governance.” *The Journal of Financial and Quantitative Analysis* 46 (5): pp. 1295–1333. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=910982

indirectly by its connection to economic theories such as herding behavior, signaling theory, and asymmetric information, which are often mentioned in these types of studies.

3.2 Hypothesis development

Based on previous research, the expectations for this study's results could vary depending on the geographical context and performance metrics. In the U.S. market, studies by Brav and Gompers in 1997 and Brown in 2005 found that venture capital backing generally has a positive effect on post-IPO performance, with VC-backed firms showing superior long-term returns, and for example operating performance, compared to non-VC-backed firms. However, the results in European markets are mixed. Hollacher and Holt found no significant long-term performance differences between VC-backed and non-VC-backed high-tech firms in Europe, although VC-backed firms had better operating performance in the first year post-IPO. The study on Swedish stock markets conducted by Brinkestam Persson and Karlsson found that while VC-backed firms showed better ROA, they exhibited negative long-term returns when measured with buy-and-hold abnormal returns. Rindermann in 2003 concluded that VC-backed IPOs in Germany, France, and the UK do not generally outperform non-VC-backed IPOs. Bessler and Seim found that European VC-backed firms did however find outperformance of VC-backed firms, while studying the broader market of Europe. The European venture capital industry's developing nature and market-specific factors may also, based on Chen and Liang 2016, influence outcomes of a more recent study such as this. It is also important to note that this thesis incorporates more recent data than the previous studies mentioned, which may influence the significance of the findings due to the growth of the European venture capital and public markets.

Previous research tends to indicate positive effects of VC-backing on performance metrics, forming the foundational basis for the hypotheses in this study. In addition to this, factors such as the post-IPO time period measured, behavior of performance metrics, presence of the above presented theories, and the growth of the venture capital market in Europe have been considered. Post-IPO time periods vary slightly across previous research, and it is possible that the observed effect of venture capital on performance metrics may differ depending on whether the period is longer or shorter. This is related to the choice of performance metrics and their possibly different behaviors, with operating metrics potentially taking longer to manifest compared to stock performance; although dependent on a wide range of other possible explanations - e.g. VC holding period. It is anticipated that the extent of significance and effect of the variable of interest might vary due to these reasons. Furthermore, the extent of the presence of the theories presented above, such as signaling theory, in the European market could affect the perception of VC-backed companies, where a higher presence of such theories might positively influence investor sentiment due to the involvement of a venture capital firm. However, the potential reflection of this in the results is less clear. Finally, the expansion of the venture capital market in Europe, which would be unlikely if its impacts were negative, supports the expectation of a positive effect of VC backing. Due to these reasons, this study anticipates positive effects of VC backing on performance metrics in Europe. However, the expectations of significant results align with previous research that demonstrate the possibility of no significant differences, particularly in European markets. Because of this, and to answer the purpose of the study, the null hypotheses are specified as follows:

1. H_0: Venture capital has no effect on return on assets (ROA).

2. H_0: Venture capital has no effect on stock performance.

4 Method

Initially, this section provides an overview of the methodological approach, followed by a detailed specification of the regression model selected for analysis. Subsequently, the section discusses all variables incorporated into the model, including the rationale for their selection.

4.1 The method in general

Ordinary Least Squares (OLS) multiple regression has been chosen as the appropriate method, partly because the dependent variables in the selected models are continuous. The method is supported by its prevalent use in related research, including studies by Krishnan et al., Barry et al., and Brinkestam Persson and Karlsson, across the last decades.[54,55,56] OLS is preferred for its straightforward application, its well-documented effectiveness in estimating parameters in linear regression models, and the allowance for controlling various factors that could influence post-IPO performance beyond the potential impact of venture capital backing.

[54] Krishnan et al, “Venture Capital Reputation, Post-IPO Performance, and Corporate Governance.”, pp.1295–1333.

[55] Christopher B. Barry, Chris J Muscarella, John W. Peavy, Michael R. Vetsuypens, "The Role of Venture Capital in the Creation of Public Companies: Evidence from the Going-Public Process", *Journal of Financial Economics*, Volume 27, Issue 2, (1990), pp. 447-471. https://www.sciencedirect.com/science/article/pii/0304405X90900647

[56] Brinkestam Persson and Karlsson, "The High Risk and High Reward Game: Performance of Venture Capital Backed IPOs".

After fitting the initial regression model, diagnostic checks will be performed to validate the OLS regression analysis assumptions and ensure that the OLS estimators are the Best Linear Unbiased Estimators (BLUE) under the Gauss-Markov theorem. Specifically, these include linearity, independence, homoscedasticity, normality, no multicollinearity, as well as functional form, exogeneity, full rank, and random sampling. If these assumptions are violated, the results from the OLS regression might be biased or inefficient.

4.2 Structure of analysis and model specification

Drawing on the frameworks established by studies from Krishnan et al. in 2011, Chen and Liang in 2016 and Brinkestam Persson and Karlsson in 2021, the dependent variable $Performance_i$ is assessed using two distinct metrics.[57,58,59] The first metric, Simple Buy-and-Hold Return (SBHR) is used as a stock market-related measure, while the second, return on assets (ROA) evaluates operating performance. The approach to the model specification was to adjust for key covariates, likely to have an impact on the dependent variable. The rationale behind each covariate is detailed under the variable description section.

To mitigate issues of multiplicity and selection biases, the study is structured into a hierarchical analysis framework, comprising a primary analysis and a secondary analysis, with the former assigned greater importance. The primary analysis is based on two regressions, specified as:

- The change, measured in percentage points, in Return on Assets (ROA) from the year of $company_i$'s IPO to the ROA in the following year.

- The percentage change in $company_i$'s closing stock price from the first trading day to the closing stock price 360 days laPerssonter, referred to as SBHR.

The secondary analysis is based upon three regressions, specified as:

[57] Krishnan et al, “Venture Capital Reputation, Post-IPO Performance, and Corporate Governance.” pp. 1295–1333.
[58] Chen and Liang "Do Venture Capitalists Improve the Operating Performance of IPOs?", pp. 291-304.
[59] Brinkestam Persson and Karlsson, "The High Risk and High Reward Game: Performance of Venture Capital Backed IPOs".

- The change, measured in percentage points, in Return on Assets (ROA) from the year of company_i's IPO to the ROA two years later.

- The change, measured in percentage points, in Return on Assets (ROA) from the year of company_i's IPO to the ROA three years later.

- The percentage change in company_i's closing stock price from the first trading day to the closing stock price 180 days later, referred to as SBHR.

Consequently, five regressions are conducted where the dependent variables vary and the independent variables are the same. It is important to highlight that this study deliberately does not consider the specific dates within a year when IPOs were completed, thus standardizing the evaluation period for each IPO. For instance, two firms with different IPO issue dates in 2009 are treated the same, without accounting for the exact timing of their IPOs when calculating performance. As a result, models with longer study periods may better capture performance patterns by averaging out short-term fluctuations and providing a more comprehensive view of long-term trends.

Regression model:

$$\begin{aligned} Performance_i = \beta_0 + \ \beta_1 VCdummy_i + \ \beta_2 UnderPricingPerc_i + \ \beta_3 \log(Proceeds_i) + \ \beta_4 IPOS_i \\ + \vec{\beta_5} GroupedIndustry_i + \ \vec{\beta_6} NewCountryCoding_i + u_i \end{aligned}$$

where $\vec{\beta_5} = \left(\beta_{5,j}\right)_{j=1}^{7}$ is the vector of coefficients corresponding to the different industries (with one level being "Small"), and $\vec{\beta_6} = \left(\beta_{6,j}\right)_{j=1}^{6}$ is the vector of coefficients corresponding to the different countries (with one level being "MinorCountry"). See the model output for more information. *Performance$_i$* is the dependent variable in the regression model, which will be substituted with either Return on Assets (ROA) or SBHR for firm *i* over the different time periods. β_0 is the intercept and $\beta_1, \beta_2, \beta_3$ and β_4 are the coefficients for the rest of the control variables, respectively.

4.3. Variable description

Below are dependent, independent, and control variables motivated and detailed.

4.3.1. Dependent variables

Simple Buy-and-Hold Return (SBHR):

Buy and hold return (BHR) as a measure has been widely utilized in previous studies examining (long-term) aftermarket performance of IPOs, such as by Brav and Gompers, Ritter, and Loughran and Ritter.[60,61,62] BHR represents a passive investment strategy where an investor purchases a stock and holds it for a specified period, and has been chosen as the appropriate metric for market performance in this study. In contrast to previous studies, such as those by Brav and Gompers, this study does not employ compounding when calculating returns. Instead, the BHR strategy is considered in its purest form, disregarding additional earnings or reinvestment that would typically necessitate compounding, and the method is henceforth referred to as Simple BHR (SBHR). Consequently, the return calculation solely considers the closing prices at IPO issue date and the final prices at the end of the selected periods, thereby measuring the simple percentage growth of the investment.

Notably, underpricing, which has been previously discussed and is detailed as a variable further below, can introduce biases in performance measurement and it is essential to exclude it from this analysis. Consequently, SBHR calculations are based on the stock's closing price on the IPO issue date and the closing prices 180 days and 360 days after the IPO.

The SBHR is computed as follows:

$$SBHR = \frac{P_{end} - P_{start}}{P_{start}} \times 100$$

where P_{end} denotes the closing stock price at the end of the holding period, and P_{start} denotes the closing stock price at the end of the first trading day.

This formula calculates the percentage change in the stock price over the specified period, indicating the return on investment from the initial stock price to the final stock price, expressed as a percentage. Previous research frequently calculates buy-and-hold abnormal returns (BHAR) as an extension of compounded BHR to incorporate benchmarks, thereby enabling the analysis of whether a stock outperforms selected benchmarks. The choice of

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60 Brav and Gompers, "Myth or Reality? The Long-Run Underperformance of Initial Public Offerings: Evidence from Venture and Nonventure Capital-Backed Companies", pp. 1791-1821.
61 Ritter, "The Long-Run Performance of Initial Public Offerings", p. 3-27.
62 Loughran and Ritter, "The New Issues Puzzle", pp. 23-51.

benchmarks varies depending on the focus of the studies; however, a well-suited market index is commonly used. While this adjustment allows researchers to account for potential market fluctuations, it is not essential when the sole objective is to compare the performance of VC-backed IPOs against non-VC-backed IPOs. Additionally, the data sampling limitations of this study justifies this simplification further.

Return on Assets (ROA):

The use of ROA as a dependent variable to measure operating performance is well-established in existing literature, where Krishnan et al. in 2011 and Chen and Lian in 2016 are two examples.[63,64] This metric effectively complements BHR by providing a distinct perspective on performance, and is therefore utilized as the second dependent variable. Taking inspiration from Chen and Lian's 2016 study, ROA is defined as EBIT divided by the book value of total assets. EBIT is, instead of net income, used to circumvent potential concerns related to capital structures.

It is important to note that other research leveraging ROA as a measurement, such as that by Barber and Lyon in 1996, suggests that ROAs are mean-reverting and may vary across industries.[65] Failing to adjust ROA for performance and industry effects directly in the measure could introduce bias. To mitigate this, prior studies often employ industry-adjusted ROA and abnormal ROA as primary metrics or supplementary measures, such as Chen and Liang.[66] Conversely, other significant works from Rindermann, Jain and Kini and Wang et al. utilize the raw level of return-on-assets (ROA) without explicitly controlling for potential industry effects in their ROA measurements.[67,68,69] Given the feasibility constraints and the diversity of ROA specifications in the existing literature, the chosen approach to ROA remains both appropriate and justifiable.

[63] Krishnan et al, "Venture Capital Reputation, Post-IPO Performance, and Corporate Governance.", pp. 1295–1333.

[64] Chen and Liang, "Do Venture Capitalists Improve the Operating Performance of IPOs?", pp. 291-304.

[65] Brad M. Barber and John D.Lyon. "Detecting Abnormal Operating Performance: The Empirical Power and Specification of Test Statistics". *Journal of Financial Economics*, Volume 41, Issue 3, (1996), pp. 359-399. https://doi.org/10.1016/0304-405X(96)84701-5

[66] Chen and Liang, "Do Venture Capitalists Improve the Operating Performance of IPOs?", pp. 291-304.

[67] Rindermann, "Venture Capitalist Participation and the Performance of IPO Firms: Empirical Evidence from France, Germany, and the UK".

[68] Jain and Kini, "Venture Capitalist Participation and the Post-Issue Operating Performance of IPO Firms", pp. 593-606

[69] Wang.,Wang., Lu, "Effects of venture capitalists participation in listed companies", pp. 2015–2034.

4.3.2 Independent variables

Dummy for venture capital backing:

The primary independent variable in this study, referred to as *VCdummy*, is a binary dummy variable. It is assigned a value of 1 if the IPO is VC-backed at the time of the IPO and 0 if it is not. The variable only accounts for the VC-backing status at the time of the IPO and does not take companies that received VC-backing at any other stage into consideration, which is in line with Brav and Gompers study in 1997.[70]

4.3.3 Control variables

As previously presented, several control variables are implemented to isolate the effect of VC-backing on IPO performance and to mitigate bias from otherwise omitted variables. This set of control variables is consistently included in all regression analyses, irrespective of the dependent variable under consideration. The motivations and details for each control variable, often inspired by prior research, are provided below.

Underpricing:

Underpricing (UP), as defined in studies by Lee and Wahal, and Loughran and Ritter in 2004, is calculated as the percentage change from the offer price to the closing price on the first trading day. Given the prominence of the variable in both the reviewed literature and the theoretical framework of this study, its inclusion in the regression analysis is deemed essential.[71,72] Due to data availability constraints, the opening price on the first trading day has been utilized as a substitute for offer price. While this measure does not capture pre-market dynamics, overall market sentiment, or investor initial reactions to the offer price, it serves as a plausible approximation.

Underpricing is therefore calculated as:

$$UP_i = \frac{P_{i,CP} - P_{i,OP}}{P_{i,OP}}$$

[70] Brav and Gompers. “Myth or Reality? The Long-Run Underperformance of Initial Public Offerings: Evidence from Venture and Nonventure Capital-Backed Companies.” pp. 1791-1821.

[71] Lee and Wahal, "Grandstanding, Certification and the Underpricing of Venture Capital Backed IPOs", pp. 375-407.

[72] Tim Loughram and Jay R Ritter “Why Has IPO Underpricing Changed over Time?” *Financial Management*, vol. 33, no. 3, 2004, pp. 5–37. *JSTOR*, http://www.jstor.org/stable/3666262

where $P_{i,CP}$ is the closing stock price of the first trading day of $company_i$, and $P_{i,OP}$ is the opening stock price on the first trading day of $company_i$. In the models, UP is defined by the variable *UnderpricingPerc.*

Proceeds:

Larger IPOs are likely to attract more investors due to increased media attention and publicity, which also can make them less susceptible to information asymmetry. Firm size is found to be associated with maturity, and prior research suggests that mature firms require less underpricing since investors perceive lower risk and thus demand less compensation. Since the size of an IPO is related to maturity, it should also correlate with age.[73,74] Further, as mentioned under the literature review, Brav and Gompers found that underperformance among non-VC-backed IPOs is primarily driven by companies with smaller market capitalizations.[75] Other studies also touch upon this subject, where some argue that financially strong and established IPO issuers tend to make larger issuance offers, and publish more information to investors.[76,77,78] Lastly, Beatty and Ritter in 1986 found that smaller IPOs tend to underperform larger IPOs in the long run, although smaller IPOs yield higher initial returns due to a higher risk profile.[79] Referring back to the theoretical framework in this study, it could be argued that such instances might affect investor behavior around IPOs. Therefore, the variable *Proceeds* is added as a control variable, short for proceeds amount of issue. Being a continuous variable potential skewness is handled, as is standard, by a log transformation; log(*Proceeds*).

IPO market activity:

As outlined in the background section, the level of economic activity and IPO activity has varied significantly over the years, with 2009 and 2021 serving as stark examples, the former experiencing notably low IPO activity and the latter exceptionally high.

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[73] Mario Levis, “The Performance of Private Equity-Backed IPOs”, *Financial Management*, vol. 40 , issue 1, (2011), pp. 253 – 277. https://doi.org/10.1111/j.1755-053X.2010.01141.x

[74] Vladimir Mogilevsky and Zoltan Murgulov, “Underpricing of private equity backed, venture capital backed and non-private-equity-backed IPOs”, *Investment Management and Financial Innovations*, Vol. 9 Issue. 3, (2012). https://research.monash.edu/en/publications/underpricing-of-private-equity-backed-venture-capital-backed-and-

[75] Brav and Gompers, “Myth or Reality? The Long-Run Underperformance of Initial Public Offerings: Evidence from Venture and Nonventure Capital-Backed Companies”, pp. 1791-1821.

[76] R.Carter, F.Dark. and Singh, A. K, "Underwriter Reputation, Initial Returns, and the Long-Run Performance of IPO Stocks", *The Journal of Finance*, Volume 53, (1998) pp. 285-311. https://www.scirp.org/reference/referencespapers?referenceid=2157009

[77] Doukas and Gonenc, “Long-term performance of new equity issuers, venture capital and reputation of investment bankers”, pp. 1-34.

[78] Chen Su and Kenbata Bangassa, "The Impact of Underwriter Reputation on Initial Returns and Long-Run Performance of Chinese IPOs", *Journal of International Financial Markets, Institutions and Money*, Volume 21, (2011) pp. 760-791. https://doi.org/10.1016/j.intfin.2011.06.002.

[79] Randolph P. Beatty and Jay R. Ritter, "Investment Banking, Reputation, and the Underpricing of Initial Public Offerings", *Journal of Financial Economics*, Volume 15, Issues 1–2, (1986) pp. 213-232. https://www.sciencedirect.com/science/article/pii/0304405X86900553

As evidenced by the findings of Ibbotson and Jaffe in 1975, although their study did not cover recent years, IPOs tend to be oversubscribed and yield higher initial returns during economic periods of heightened IPO volume. [80] Additionally, it has been documented that the number of IPOs generally increases during economic booms. The sample in this study confirms fluctuations in IPO activity, where certain years have substantially higher activity. Based on the original data sample for this study, after cleaning of duplicates but without cleaning of observations with missing data, Figure 3 in the Appendix shows the distribution of all IPOs conducted in Europe in each year of the studied period. To account for the broader economic conditions impacting the activity of the IPO market, the variable *IPOS* is incorporated into this study. It is defined as the number of IPOs conducted during the year of a company's IPO, and acts as a control variable for the activity of the IPO markets.

Industry:

The venture capital landscape tends to vary in terms of industry focus, where some industries that have been trending recently include healthcare, information technology, and business and financial services.[81] Bessler and Bittelmeyer in 2008 observed that companies within the high-tech sector typically encounter greater risks due to uncertainty; however, they also offer potentially higher returns in combination with high-quality patents, compared to other industries.[82] To account for the potential impact of industry differences, which could include amount of funding or media attention, this is controlled for in the models. Given the constrained number of observations across the 12 industries in the data sample and potential model fitting issues, individual control for each industry is not feasible. Instead, industries with fewer than 100 observations were aggregated into a single category, *Small*, while those with more than 100 observations were left intact. Consequently, the control variable *GroupedIndustry* is composed of seven unique levels consisting of Consumer Cyclicals, Basic Materials, Financials, Healthcare, Industrials, Technology, and Small. Prior studies, e.g.

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[80] Roger G. Ibbotson and Jeffrey F. Jaffe "'Hot Issue' Markets." *The Journal of Finance* vol. 30, no. 4 (1975): 1027–42. https://doi.org/10.2307/2326721

[81] Kim Wacker, "Top VC Fundraising Trends of 2024", *Hubspot*, Accessed 1 may 2024, https://www.hubspot.com/startups/vc-fundraising-trends

[82] Wolfgang Bessler, "Patents and the Performance of Technology Firms: Evidence from Initial Public Offerings in Germany", *Financial Markets and Portfolio Management*, Volume 22, Issue 4, (2008), pp. 323-356. https://www.researchgate.net/publication/225341670_Patents_and_the_performance_of_technology_firms_Evidence_from_initial_public_offerings_in_Germany

Ritter in 1991, Brown in 2005, Krishnan et al in 2011 and Gompers, Kovner, and Lerner in 2009 also control for industry, although through SIC codes. [83,84,85,86]

Country:

This study concentrates on IPOs completed in Europe during a specific timeframe, and identifies the different countries as a crucial variable requiring control. Given the scarcity of prior research on this topic where focus generally tends to be limited to individual countries or specific stock exchanges this approach is primarily motivated by the characteristics of the sample. As indicated in Figure 1 in the Appendix, the dataset for analyzing ROA and SBHR is unevenly distributed across countries. There is a noticeable skewness in the number of IPOs per country. To address this imbalance, countries are categorized based on their IPO volume where the United Kingdom, France, Sweden, Germany, and Italy, each with a significantly larger number of data points and more prevalent in the venture capital sector, are analyzed individually. In contrast, the rest of the countries, having far fewer observations, are grouped together for analytical purposes. This method of grouping ensures a more balanced and controlled assessment in the model. In the regressions, this variable is referred to as *NewCountryCoding,* which through dummy factor coding in the software accounts for the categories detailed above.

5. Data

The subsequent section is divided into two parts. First, the data collection and cleaning process is outlined, including the rationale behind specific choices and the measurement period. Then, a range of descriptive statistics is presented to provide further context and enhance understanding.

5.1 Data collection and cleaning

The data for the study was collected from Refinitiv Eikon and Capital IQ. Using the "Deals" universe in Refinitiv Eikon and filtering for live IPOs with issue dates between 01 Jan 2004 and 31 Dec 2023 with issuer nation being a european country, 5924 raw observations of companies were obtained. Simultaneously, all independent variables presented in the

[83] Ritter, "The Long-Run Performance of Initial Public Offerings", pp. 3-27.

[84] Brown, "Venture Capital and Firm Performance Over the Long-Run: Evidence from High-Tech IPOs in the United States" pp. 1-33

[85] Krishnan et al, "Venture Capital Reputation, Post-IPO Performance, and Corporate Governance.", p. 1295–1333.

[86] Paul Gompers, Anna Kovner and Josh Lerner, "Specialization and Success: Evidence from Venture Capital", *Journal of Economics & Management Strategy*, Volume 18, Issue 3,(July 3 2009). pp. 817-844. https://doi.org/10.1111/j.1530-9134.2009.00230.x

method's chapter, except for underpricing, and all necessary stock prices were directly downloaded as columns for those IPO's in Refinitiv Eikon.

Due to low availability of financial metrics on the gathered IPO firms in Eikon, Capital IQ was utilized. EBIT and total assets, in terms of mUSD, for each firm was collected with Capital IQ as an Excel-plugin through matching the company tickers collected from Refinitiv Eikon. Through a data cleaning process, duplicates, firms without data on the dependent variables, and other incomplete information were deleted in order to receive a complete data set ready for analysis. No systematic deletion was made, nor selection in certain data, and the data cleaning process was thus random. The final sample consists of data for 1813 European firms having completed an IPO between 01 Jan 2004 and 31 Dec 2023. 1585 of these were not VC-backed and 228 were VC backed at the time of the IPO.

The final sample is constructed as panel data, where each row represents a unique firm and each column presents unique information for that specific company. The column in the final sample are issue year, country, proceeds, industry, a dummy for venture capital backing at the time of IPO (renamed to VCdummy), company ticker, stock price at open and close of the first trading day, closing stock price 180 days after IPO, closing stock price 360 days after IPO, EBIT measured once each year, and total assets measured once year. Thereafter, ROA was manually computed in and which added a ROA level column for each year as well.

It is important to note that the dataset size for each regression analysis varies according to the characteristics of the dependent variable. Although all regressions begin with a sample of 1813 firms, the actual number of observations for each regression differs depending on the specific timeframe that the dependent variable represents. For example, the number of observations for ROA change one year after IPO differs from ROA change two years after IPO due to diminishing data availability. Outlier controls are done for each sub-dataset, removing cases where the dependent variable was outside the 1-99% range. Additionally, the software ranked observations in terms of its leverage, and the ten worst were removed.

Furthermore, the treatment of outliers through pre-testing as explained in the method-chapter further reduces the dataset size used in subsequent regressions. Adjustments of outliers are, whenever applied, detailed explicitly in the results section.

5.2 Descriptive statistics

The dataset contains 1813 companies in total, with the majority of observations distributed on the following countries; 713 being from the UK, 179 from France, 146 from Sweden, 106 from Germany, 86 from Italy. Figure 1 in the Appendix gives a visual of the distribution.

Figure 2 in the Appendix covers the number of observations in the dataset per industry, in addition the grouping of countries with less than 100 observations into *Small*. As such, there are 314 observations in *Small*, 309 in Technology, 278 in Industrials, 277 in Consumer Cyclicals, 273 in Financials, 229 in Healthcare, and 133 in Basic Materials. Figure 3 in the Appendix represents the number of IPOs for each year from 2004 to the end of 2023, and is based on the original dataset prior to cleaning of missing data.

6 Empirical results

This section is divided into two main parts, primary and secondary analysis. In the primary analysis section, an initial model used prior to statistical diagnostics tests is presented. In the same section, the tests' implications are discussed and evaluated, followed by the results of the refined model. The secondary analysis contains the rest of the results, all based on the refined model.

6.1 Primary analysis

The primary analysis was constructed in regards to percentage point change in ROA level over one year, and SBHR over 360 days, where the results of the regressions are presented below. Initial regressions and diagnostics were performed, which later led to the construction and results of the refined models.

6.1.1 Initial model

Using the panel data described in the data section, Table 2 shows the results from estimating the effect of VC-backing on the ROA performance metric for a one-year period, with the selected control variables.

Table 2: Regression results from using OLS linear model on ROA baseline change in a one-year period from the IPO issue year

Residuals:

Min	1Q	Median	3Q	Max
-106.631	-3.156	1.374	5.292	142.294

Coefficients:

	Estimate	Std. Error	t value	Pr(>|t|)	
(Intercept)	-2.584318	2.266118	-1.140	0.25431	
log(Proceeds)	0.338889	0.236854	1.431	0.15271	
UnderPricingPerc	0.067686	0.035261	1.920	0.05512	.
NewCountryCodingItaly	4.787469	2.217729	2.159	0.03104	*
NewCountryCodingGermany	0.739825	1.968210	0.376	0.70706	
NewCountryCodingSweden	-2.387043	1.721945	-1.386	0.16589	
NewCountryCodingFrance	-0.946905	1.675725	-0.565	0.57212	
NewCountryCodingUnitedKingdom	3.107310	1.130114	2.750	0.00604	**
IPOS	-0.003274	0.003018	-1.085	0.27814	
GroupedIndustryFinancials	-1.876211	2.084216	-0.900	0.36817	
GroupedIndustryHealthcare	-6.785774	2.135908	-3.177	0.00152	**
GroupedIndustryConsumerCyclicals	0.066393	2.015563	0.033	0.97373	
GroupedIndustryIndustrials	0.536853	2.005070	0.268	0.78893	
GroupedIndustrySmall	-0.116626	1.970818	-0.059	0.95282	
GroupedIndustryTechnology	-2.932446	1.993797	-1.471	0.14158	
VCdummy	0.599625	1.477981	0.406	0.68502	

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 17.11 on 1393 degrees of freedom
Multiple R-squared: 0.03965, Adjusted R-squared: 0.0293
F-statistic: 3.834 on 15 and 1393 DF, p-value: 9.547e-07

All values in this regression model, except the independent variable log(Proceeds), provide estimates predicting an average change in ROA as percentage points, influenced by each independent variable respectively, while controlling for all other independent variables in the model one year after a company's IPO issuing year. Outliers in the dependent variable below the 1st and above the 99th percentile have been removed to improve the reliability of the result.

6.1.2 Robustness and validity

Following the results from the initial model, post test diagnostics were performed to validate regression assumptions. Specifically, these diagnostics included the QQ-plot, residuals versus fitted values plot, Durbin-Watson test, and variance inflation factor (VIF) tests. Complete results of these diagnostics are provided in the Appendix.

A plot of the residuals versus the fitted values from the regression analysis was used to assess potential patterns in the residuals, thereby indicating heteroscedasticity, and can be found in Figure 4 in the Appendix. The red line suggests a systematic pattern in the residuals, indicating that the model may not fully capture the underlying relationship between the predictors and the response variable, potentially due to issues such as heteroscedasticity, non-linearity, or omitted variables. Additionally, the gvlma (Global Validation of Linear

Model Assumptions) function in R was utilized to determine whether the linear model meets the key assumptions required for valid inference. The results indicated problems with normality and heteroscedasticity, suggesting that the model does not meet all the assumptions necessary for OLS regression. Related to the potential complication from the residuals pattern, the Durbin-Watson test was performed, yielding a significant statistic of approximately 2.167, which indicates the presence of autocorrelation among the residuals. An explanation for the autocorrelation was not found, although it can be speculated that this is due to an omitted variable not present in the data set.

Non-normality among the residuals, identified through both the gvlma function and the QQ-plot may indicate issues such as non-linearity or other model inadequacies. To explore this, exploratory modeling with Random Forest machine learning was used to assess if a non-linear model might better capture the data's structure. Specifically, a super covariate from the available predictor variables in the data set (but not VC backing) was attempted to be built (using default settings in the software), and this was then included as another adjustment variable in the OLS regression. The results still indicated continued violations of model assumptions, suggesting that the problem might not be the wrong functional forms in the linear model but rather omitted information that is not present in the data set. Per the limitations detailed under the discussion section, the absence of certain mentioned variables could be a key factor in these issues. Furthermore, the lack of similar issues in previous research strengthens the argument that the solution might be related to data availability and not to misspecification of the model. In addition to the above, a ranking of potential outliers was performed (Bonferroni corrected). These outliers were later excluded in a subsequent analysis, but did not quantitatively change the regression assumptions; meaning they were still being violated. Consequently, these outliers were retained in the final analysis.

In addition to the planned diagnostics tests for the models, further investigation into the potential issues of the models was conducted. In the modeling attempts, rank-deficiency issues were encountered, i.e. despite avoiding too many and sparsely populated categories via grouping of smaller counties and industries into larger categories, the models did not have full rank. By manual extracting of the dummy variable coded model matrix, it could be noted that it had 16 instead of 18 columns (i.e. number of observations per factor level combination was not adequate). In particular, the distribution of VC was explored across all such combinations, and it was noted that there were many with a strong imbalance with regard to

VC (sometimes at zero observations for particular combinations). As such, the software inherently handled this through the dropping of the Basic Materials industry. This is due to the nature of the available data, where there are many possible combinations of the different levels of the factors (for example *GroupedIndustry*). Unless constructing more crude groupings of the categorical variables for country and industry, overcoming these rank issues are difficult. More crude groupings, however, come with the consequence of loss of information, and as presented under the results section the initial grouping was kept intact despite these issues. After exploration of different groupings (all still presenting rank problems) this was not further studied. The models hence were left intact with the motivation that the initial grouping is based on financial considerations rather than random details of the data.

Furthermore, a Variance Inflation Factor (VIF) test was conducted to assess multicollinearity. The results, detailed in the Appendix, reveal no significant evidence of collinearity, suggesting that each predictor independently approximately contributes to explaining the variability of the dependent variable. This is slightly in contradiction to the rank issue, but can be related to the VIF tests not being powerful enough on limited data. Consequently, the VIF diagnostic does not reject that the parameter estimates are likely to be reliable and interpretable. Despite the persistence of the mentioned assumption violations, these have been considered in the discussion. To downplay some of the violations of the assumptions (heteroscedasticity), robust standard errors computed using the sandwich estimator were relied on for the refined models below.

The diagnostic tests were conducted on all regressions involving all variations of the dependent variables, and consistent results were observed across each variation. Despite the attempts above, it was not possible to develop a strong well-fitted model which met all the standard assumptions for OLS regression. Specifically, each model encountered issues with the residuals versus fitted values plot and non-normality of residuals (although the latter appeared to relate more to heavy tails in the QQ plot rather than asymmetry).

6.1.3 Sensitivity analysis

In addition to the measures taken above, the *IPOS* variable was experimented with as an attempt of potentially solving some of the OLS violations. As the majority of the other variables are specified in line with previous research in the sense of assuming a linear relationship with the dependent variable, they were not given as much focus in terms of model re-specification. However, it was considered a possibility that the IPOs variable could have a non-linear effect due to large variations in IPO activity over certain years, and absence of focus on the specification of the variable in previous research. Hence, instead of treating the variable as continuous, further detailed in the method section, a binary grouping was constructed where the total number of IPOs conducted in Europe for the years 2005, 2006 2007, and 2021 were grouped together, as a proxy of markets being “hot” versus not. (Also, a 3-level grouping was considered, but this ran into sparsity issues - i.e. too few cases where there were observations with VC-backing and non VC-backing). Specifically, the binary variable was specified as having a *HighRange* (equal to 1) and *NormalRange* (equal to 0). However, this did not solve the OLS violations. Additionally, when conducting a VIF test on the grouped (binary) IPOS variable substantial multicollinearity was discovered. Hence, this exploratory attempt of variable regrouping was abandoned.

6.1.4 Refined model

After the initial model, and its regression results and diagnostics tests detailed in the section above, the results of the refined model for the primary analysis are presented in this section. The only change from the initial model is the addition of using robust standard errors for the final model.

To briefly summarize the results in the primary analysis, the regressions found no results that yield an estimate for the variable of interest, *VCdummy,* at a significance level of five percent. All p-values for this variable in the primary analysis exceed the ten percent significance level.

Table 3: Regression results from using OLS linear model on ROA baseline change in a one-year period from the IPO issue year, with robust standard errors.

Residuals:

Min	1Q	Median	3Q	Max
-106.631	-3.156	1.374	5.292	142.294

Coefficients:

	Estimate	Std. Error	t value	Pr(>|t|)	
(Intercept)	-2.5843177	1.6935143	-1.5260	0.1272347	
log(Proceeds)	0.3388888	0.2057316	1.6472	0.0997348	.
UnderPricingPerc	0.0676863	0.0571066	1.1853	0.2361155	
NewCountryCodingItaly	4.7874693	1.9658691	2.4353	0.0150045	*
NewCountryCodingGermany	0.7398249	1.4358410	0.5153	0.6064563	
NewCountryCodingSweden	-2.3870431	1.8107860	-1.3182	0.1876414	
NewCountryCodingFrance	-0.9469053	1.7033147	-0.5559	0.5783554	
NewCountryCodingUnitedKingdom	3.1073095	1.0987923	2.8279	0.0047520	**
IPOS	-0.0032739	0.0027873	-1.1746	0.2403705	
GroupedIndustryFinancials	-1.8762110	1.4376817	-1.3050	0.1920998	
GroupedIndustryHealthcare	-6.7857740	1.9495221	-3.4807	0.0005155	***
GroupedIndustryConsumerCyclicals	0.0663930	1.3031156	0.0509	0.9593731	
GroupedIndustryIndustrials	0.5368527	1.3614339	0.3943	0.6933986	
GroupedIndustrySmall	-0.1166257	1.4109455	-0.0827	0.9341355	
GroupedIndustryTechnology	-2.9324458	1.5358651	-1.9093	0.0564271	.
VCdummy	0.5996250	1.9031018	0.3151	0.7527498	

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 17.11 on 1393 degrees of freedom
Multiple R-squared: 0.03965, Adjusted R-squared: 0.0293
F-statistic: 3.834 on 15 and 1393 DF, p-value: 9.547e-07

All values in this regression model, except the independent variable log(Proceeds), provide estimates predicting an average change in ROA as percentage points, influenced by each independent variable respectively, while controlling for all other independent variables in the model one year after a company's IPO issuing year. Outliers in the dependent variable below the 1st and above the 99th percentile have been removed to improve the reliability of the result.

In Table 3 the results from estimating the effect of VC-backing on the ROA performance metric one year after the IPO are presented. It shows that there are only three variables out of all sixteen (including the intercept) that are significant to a level of five percent; having a p-value less than 0.05. These variables include two different countries and one industry. The variable of interest, the dummy *VCdummy*, was not significant at the five percent level. The interpretation of the estimate however predicts that if a company is VC-backed the ROA increases by 0.5996 percentage points.

The first significant estimate is derived from the *NewCountryCodingItaly* variable, which includes all the observed companies from Italy. The estimate predicts that a company from Italy increases ROA by 4.7875 percentage points. The second significant estimate is also derived from a variable controlling for a country, *NewCountryCodingUK*. This includes all the observed companies from the United Kingdom and the estimate predicts that a company from the United Kingdom increases its ROA by 3.1073 percentage points. The third and final significant estimate of this model is derived from the *GroupedIndustryHealthcare* variable, which includes all observed companies within the healthcare industry. It predicts that a company within the healthcare industry decreases its ROA by 6.7858 percentage points.

Furthermore, there are two more variables of this regression model that are significant to a level of ten percent, having a P-value less than 0.1. These include the proceeds variable, log(*Proceeds*) and one more industry variable, *GroupedIndustryTechnology*. The variable log(*Proceeds*) estimate suggests that when proceeds increase by one percent, ROA increases by 0.0034 percentage points one year after the IPO issuing year, controlling for all the other variables. The estimate of the *GroupedIndustryTechnology* variable indicates that the effect of being a company within the technology industry, while controlling for all the other variables in the model, decreases the ROA by 2.9324 percentage points one year after the IPO issuing year.

The regression model has produced eleven estimates that are not significant to a degree of a P-value less than 0.1. These estimates cannot statistically be used to explain any relationship between independent variables and performance metric (depending variable). However, they can still be interpreted nonetheless.

The controlling variables of the countries Sweden and France give an estimate, predicting that companies from those countries decrease their ROA. On the other hand the controlling variable for the country Germany gives an estimate predicting an increase in ROA for all companies from Germany. Looking at the variables controlling for industries, estimates for the financial and all the smaller industries predicts a decrease in their ROA. On the other hand, estimates for the Industrial and Consumer Cyclicals industries predict an increase in ROA.

Lastly, the variable *UnderPricingPerc* has an estimate that indicates that a one percent increase in underpricing increases a company’s ROA with 0.0676 percentage point. The variable *IPOS* estimate predicts that for every extra IPO issued in Europe during the same year as a company’s own IPO, ROA decreases by 0.0033 percentage points.

Table 4: Regression results from OLS linear model on SBHR from the first trading day to 360 days after, with robust standard errors.

Residuals:

Min	1Q	Median	3Q	Max
-94.54	-31.66	-8.66	21.19	322.10

Coefficients:

	Estimate	Std. Error	t value	Pr(>|t|)	
(Intercept)	7.1561547	6.5757952	1.0883	0.27663	
log(Proceeds)	0.6795907	0.6683634	1.0168	0.30939	
UnderPricingPerc	0.0143647	0.1265265	0.1135	0.90962	
NewCountryCodingItaly	4.3822695	5.0842012	0.8619	0.38884	
NewCountryCodingGermany	-9.4330808	5.3548307	-1.7616	0.07831	.
NewCountryCodingSweden	-4.0608087	5.6348353	-0.7207	0.47121	
NewCountryCodingFrance	-8.6690160	4.4275527	-1.9580	0.05039	.
NewCountryCodingUnitedKingdom	-0.0383063	3.1982583	-0.0120	0.99045	
IPOS	-0.0328109	0.0083388	-3.9347	8.654e-05	***
GroupedIndustrySmall	6.0244802	5.5727477	1.0811	0.27982	
GroupedIndustryHealthcare	0.2497965	6.2731756	0.0398	0.96824	
GroupedIndustryFinancials	-1.7738945	5.3923136	-0.3290	0.74222	
GroupedIndustryConsumerCyclicals	0.5116066	5.6025446	0.0913	0.92725	
GroupedIndustryIndustrials	7.0394657	5.4812704	1.2843	0.19921	
GroupedIndustryTechnology	2.6072032	5.5994094	0.4656	0.64154	
VCdummy	4.0999139	4.3350159	0.9458	0.34440	

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 53.3 on 1759 degrees of freedom
Multiple R-squared: 0.01632, Adjusted R-squared: 0.007927
F-statistic: 1.945 on 15 and 1759 DF, p-value: 0.01589

All variables in the regression model in Table 4 provide estimates predicting an average percentage change in stock price (SBHR), influenced by each independent variable respectively, while controlling for all other independent variables in the model 360 days after a company's first day of trading publicly. Outliers in the dependent variable below the 1st and above the 99th percentile have been removed to improve the reliability of the result.

The results of Table 4 shows that the VC dummy did not yield a significant estimate in this regression either. However the interpretation of the variable is that the estimate predicts that VC-backed companies at the time of its IPO increase its share price by 4.0999 percent. Only one variable, *IPOS*, was significant to a level of five percent with a P-value less than 0.05. The estimate of *IPOS* predicts that for every extra IPO issued in Europe during the same year as a company's own IPO, there is a 0.0328 percentage decrease of the company's stock return. Two variables, both controlling for a country, *NewCountryCodingGermany* and *NewcountryCodingGermany*, show significant estimates to a level of ten percent with p-values less than 0.1. The estimates predict a decrease in stock price by 9.4331 and 8.6690 percent for companies from either Germany or France respectively.

This regression model yielded many insignificant estimates for the controlling variables and once again these estimates cannot statisically be used to explain a relationship between independent variable and dependent variable. This includes all variables controlling for an Industry, whom all, except the financial industry, gave a positive estimate. Looking at the variable controlling for countries, companies from Italy have positive estimates while the variables controlling for companies from Sweden and the United Kingdom have negative estimates. All the estimates with a positive value indicate an increase, while the negative estimates indicate a decrease in stock price.

A one percent increase in both the variable Log(*Proceeds*) and the variable *UnderPricingPerc* respectively, predicts an increase in stock price.

6.2 Secondary analysis

The secondary analysis was constructed in regards to ROA development with respect to a time period of two and three years after the IPO, and in regards to SBHR with respect to a time period of 180 days after the IPO. The results from regressing on ROA level development over a two and three year period after the IPO are specified in Table 5 and 6 in the Appendix, and the results from the SBHR 180 days after IPO are found in Table 7 in the Appendix**.** For all regression results, robust standard errors are used.

In the two year ROA model, the adjusted R-squared at approximately 0.0310 suggests low explanatory power and that other factors could influence the ROA changes during the period. This is in line with the previous mentions of such issues in the performed tests regarding the models reliability further above. The VC-backing variable *VCdummy* shows a positive but not statistically significant effect on ROA change with an estimate at 4.9272 and p-value at 0.0502. However, at a ten percent significance level, the variable is statistically significant. The variable for the healthcare industry *GroupedIndustryHealthcare* shows a negative impact on ROA change with an estimate of roughly -11.6123 and a p-value of around 0.0022.

For the three-year ROA baseline change model, the adjusted R-squared is slightly lower at 0.0132, still indicating limited explanatory power. However, this is not a surprise as the available data ROA change in a three year period was lower than for the one and two year periods. Consistent with the two year-model, the healthcare industry variable *GroupedIndustryHealthcare* has a significant negative impact on ROA change, now with a less negative estimate at approximately -8.0392 and p-value at approximately 0.0399.

Additionally, the variable *IPOS* shows a significant negative effect with an approximate estimate and p-value of -0.0102 and 0.0456 respectively, indicating that companies undergoing an IPO during a year with a higher number of IPOs tend to experience worse ROA performance in a two year post-period. Significance on this variable was also found in Table 4, although there with a more negative estimate and higher degree of significance. The VC-variable *VCdummy* still shows a positive but non-significant effect with an estimate of approximately 1.3698 and p-value of roughly 0.6488, continuing to show the positive directional effect.

The 180 day stock market performance regression in Table 7 is different from the 360 day stock market performance regression in Table 4 in the sense of significant variables. In table 7, only the variable accounting for France, *NewCountryCodingFrance,* was found significant at the 5% significance level, with an estimate of approximately -6.2827, indicating that stock returns in a 180 day post-IPO period tend to be lower in France. Further, the *VCdummy* shows a positive estimate of around 1.0073, although this finding is not significant. The estimate is however lower than in the regression for 360 days, in Table 4. The intercept has changed from being positive to now negative, together with the UK dummy *NewCountryCodingUnitedKingdom*, IPO dummy *IPOS*, healthcare dummy and consumer cyclicals industry dummies, *GroupedIndustryHealthcare* and *GroupedIndustryConsumer Cyclical*s, changing sign from either positive to negative or vice versa.

7 Discussion

This section primarily focuses on analyzing, describing, and discussing the results presented earlier. By comparing this study's findings with those of previous studies and evaluating how well the selected theories align with the results, the discussion aims to clarify the impact of the venture capital industry on the performance of companies in public markets. Additionally, this section addresses the study's limitations.

7.1 The results

The results section confirms that no model achieved substantial adjusted R-squared, and that the models are subject to violations of some regression assumptions. While this necessitates the inclusion of disclaimers in this discussion section due to possible biases in the results, it does not mean that no scientific insights can be made. It could be speculated that the data set available is limited in the sense of further key variables being of importance for the key assumptions of OLS to be upheld. Having presented these disclaimers, it is still the case that "Remember that all models are wrong; the practical question is how wrong do they have to be to not be useful." as famously stated by George Box, and there is still moderate confidence that key findings qualitatively point in a reasonable direction.[87] The explicit acknowledgment of the model limitations in the results section aims to demonstrate transparency and a foundation for further research.

Based on the regression models provided in the results for the primary analysis, there is no significant evidence suggesting that companies, VC-backed at the time of their IPO, perform better or worse than non-VC-backed firms. This includes the regression models measuring both the change in ROA and the change in stock price after one year. Referring back to previous literature, these results are not totally unexpected. Hollacher and Holt, who investigated the relationship between VC-backed companies and their long-term performance after an IPO, focusing on the high-tech industry in the European market, did not find evidence of any significant difference in long-term performance. Similarly, Bottazzi and Da Rin were not able to find evidence supporting a systematic difference in the growth of sales and employees within three years after an IPO. However, not all research aligns with the results of this thesis. Several studies have found significant evidence suggesting a difference in performance between companies that were VC-backed and those that were not. Jain and Kini's research found that VC-backed companies perform better than non-VC-backed companies in terms of operating ROA and adjusted operating cash flows. Furthermore, three studies conducted by Doukas and Gonenc in 2005, Krishnan et al. in 2011, and Bessler and Seim in 2012 all found that VC-backed companies have higher buy-and-hold returns compared to non-VC-backed companies over a three-year period.

Even though the estimates for the VC dummy variable were not statistically significant, they suggest a trend similar to the findings in some previous research, predicting that VC-backed companies tend to perform better within a one-year timeframe. This includes both performance metrics, the regression for ROA estimating an increase of 0.5996 percentage points one year after the issuing year of the IPO, and the regression for SBHR estimating an increase of 4.0999 percent after 360 days, controlling for all other independent variables in

[87] Georgi Georgiev, '"All Models Are Wrong" Does Not Mean What You Think It Means', *The Startup*, (5 November 2019) https://medium.com/swlh/all-models-are-wrong-does-not-mean-what-you-think-it-means-610390c40c9c

the dataset. The results of this thesis' regression analysis, aside from the previously discussed model diagnostic limitations, are not fully comparable to those of prior studies. For example, some of the cited studies examine stock holding periods of two to three years. It is possible that the dataset used in this thesis could provide significant estimates for the VC variable if it included data for a longer period after the companies' IPOs.

Analyzing the thesis findings through the framework of the selected theories indicates no statistically significant evidence supporting a correlation between herding behavior or signaling theory and the impact of VC firms on the observed companies. Herding behavior theory suggests that investors may follow the decisions of others, believing that the collective actions of other stakeholders reflect superior and more informed judgments. Therefore, if VC firms possess a strong reputation, their involvement should enhance investor confidence and positively affect stock prices. Similarly, signaling theory posits that backing by a reputable VC firm should send positive signals to the market, indicating quality and potential growth opportunities, thereby attracting more investment and positively influencing stock prices. However, according to the models in this thesis, signaling theory does not appear to play a significant role. The lack of significant differences in the performance of VC-backed versus non-VC-backed firms post-IPO suggests that investors do not blindly follow the involvement of VC firms, nor does it indicate that the market perceives VC involvement as a reliable signal of future success. However, herding behavior and signaling theory cannot be conclusively disproven for several reasons. First, this thesis did not control for the reputation of the VC firms, which is crucial for both theories to hold true. Second, herding behavior might have influenced external investors' decisions in contradictory ways not captured by the regression model. Additionally, there could have been other, more influential signals to the market that overshadowed the potential signaling effect of VC backing.

As discussed in the background section, 2021 was a hot IPO market, evidenced by the high number of IPOs issued. This context necessitated controlling for the impact of the volume of IPOs in a given year on performance metrics. Looking at the results from the regression measuring stock price changes after 360 days, the variable “IPOS” is significant at the five percent level with a p-value of 8.65e-05. The estimate suggests that for each extra IPO issued the same year as a company’s IPO, the stock price decreases by 0.0328 percent 360 days after the company’s first day of public trading. From the theory section, IPO market timing was presented, and can now be discussed. The findings of this thesis can be compared to the results found by J.Chemmanur and He in 2011. They found evidence indicating that companies going public under so called “IPO waves” tend to have lower profits and productivity but possess more cash compared to those outside the wave. This could mean that if more IPOs are issued, bringing the market closer to a hot IPO market, companies would tend to become less efficient and have lower profits. This would indicate worse performance, which aligns with the findings of this thesis. Arguably, this proposal is further strengthened by the findings conducted in the study made by Szyszka in 2014, reviewed in the theoretical framework, who discovered that managers of companies try to time bullish markets and then further argues that this could harm the efficiency of the economy since it devices investors to overvalue the issuing firms. The results from this thesis regression model implies that outside macro effects affect the stock price performance over one year.

When analyzing the same variable, *IPOS*, in the secondary analysis and comparing it to the primary analysis above, the results show similarities. Both regressions measuring for ROA after two and three years respectively in the secondary analysis implies significance to some degree (5 percent and 10 percent significance level) on the *IPOS* variable estimate. All significant estimates of the IPO variable imply that every extra IPO issued the same year as a company’s own IPO decreases performance in both ROA and stock price. Even if there is no conclusive evidence, through not having significance at the five percent level on all IPOS variables in all regressions, the findings in the secondary analysis further strengthen the arguments made previously about IPOs, implying that a company issuing its own IPO in a hot IPO market tends to have lower performance within the first three years.

Analyzing the secondary analysis, which examines the same performance metrics over different time spans, reveals a difference in the estimate regarding the VC dummy variable. The model analyzing the change in ROA after two years provides an estimate significant at the 10 percent level, with a p-value of 0.0501. The estimate predicts that being backed by a VC firm at the time of issuing an IPO increases a company’s ROA by 4.9272 percentage points. Conversely, the results from the model measuring ROA change over a three-year period show that the estimate for the VC dummy is not significant at the same level, with a p-value of 0.6488. Referring back to previous literature, the results align with the findings of Jain and Kini, who concluded that VC-backed companies have a higher operating ROA than non-VC-backed companies. However, these results do not align with the findings of Chen and Liang, who found that VC-backed firms' performance is inferior to non-VC-backed firms across different ROA measures. The reason as to why, is however not clear. A possibility could be the different time frames analyzed.

The third regression model in the secondary analysis, which measures the change in stock price (SBHR) 180 days after a company's IPO, did not yield significant estimates for the VC dummy. The significance of the VC dummy estimate for this regression model has a p-value twice as high as the estimate of the VC dummy in Table 4 of the primary analysis, which examines stock price changes over 360 days. This may indicate that the difference in stock price performance between VC-backed companies and non-VC-backed companies is not significantly visible in the model until a few years after the IPO. The results from studies mentioned in the primary analysis suggest likewise, as all three studies conducted by Doukas and Gonenc, Bessler and Seim, and Krishnan et al. found significant results implying that VC-backed companies have higher buy-and-hold returns after two to three years compared to non-VC-backed firms.

Although the regression results for SBHR 180 and 360 days are insignificant at a five percent level, and no definite conclusions can be made, the concept of venture capital lock-up periods is interesting to discuss. As mentioned in Krishnan et al, 2011, it is fairly common that lock-up periods for venture capitalists extend to 180 days after an IPO. After this, venture capitalists may exit their investments more freely, which in turn could affect investor sentiment in various ways - and through signaling theory or herding behavior possibly see market reactions quite considerable. This could be an explanation for the differences in SBHR for the time periods studied, although it would be more reasonable to have a less positive estimate after 360 days if lock-up agreements would have substantial effects, with the reason being venture capitalists usually having a certification of quality-role on their invested companies. This argument is however largely based on speculation, as a number of other factors could affect the SBHR development over time - such as the IPO market, stock market, or general macroeconomic situation.

7.2 Limitations

Regarding limitations of this study, one could be the nature of the variable of interest in the study, *VCdummy*. The variable solely indicates the presence of venture capital at the time of an IPO, without capturing aspects such as the duration of venture capital backing prior to the

IPO, or type of venture capital firm in terms of focus of characteristics behind the IPOs. Naturally, a more suitable variable that further considers the characteristics of venture capitalist involvement in each IPO, has been identified as a matter to be aware of. However, this was not necessarily by choice as it was simply the most appropriate variable that the study had access to. Usage of another possibly more extensive database could contain a more suitable variable for the purpose of the study.

Another limitation of this study is the dataset itself, which consists of observations spread across Europe. The broad geographical scope complicates the identification of control variables, potentially introducing bias into the dependent variables of interest. Economically, there is sound rationale for many possible control variables, such as those for industry and country. However, a larger number of potential variables to control for can in consequence lead to full rank issues, particularly when including multiple categorical variables. A more geographically focused data set could instead yield more significant results - although this would require more data points on that geographical focus. It could be argued that the broad geographical scope might not be as effective as intended, as a few countries in Europe experience far higher IPO activity levels, and sparse data as such can be observed in certain countries. A potential solution of this limitation could simply be a larger data set with less information loss during the data cleaning phase, leading to improved fitting of the regression models.

A last limitation of the study, although related to the limitation of number of observations, could be the impossibility of collecting certain variables of potential interest for the data set. Such variables could be venture capitalist reputation, that can be related to the theories presented in the study, or age of the firm at IPO. Further, the selection of performance metrics performance periods could be identified as a limitation. Being able to study stock market performance during longer times, and potentially directly adjusting for market movements, could vary the results given. In addition to this, to address for venture capitalist characteristics of an IPO further, the percentage of ownership held by venture capitals, or length of time of venture capitalists remaining involved post-IPO before a full exit could be of interest. The exclusion of such variables was however not a decision of choice, but rather a limitation in the sense of data availability.

8 Conclusion

This section summarizes the most important findings from the discussion above. Furthermore, it highlights the key relevance of this study to various stakeholders in society and suggests directions for future research.

The original aim of this study was to contribute to extant research on the matter around post-IPO performance of VC-backed companies, specifically evaluated against non VC-backed companies, and thus answering the two null hypothesis' developed under the literature section. While doing this, the study controlled for factors such as country, industry, and market conditions through the number of IPOs issued in a given year. Unfortunately, it was not possible to reject either null hypothesis, and as such can no definitive statements regarding outperformance of VC-backed IPOs be made. Although the variable of interest was agreeing with a number of previous studies on the matter, with various geographical focuses, in the sense of directional effect, the study could not determine this with statistical significance in either post-IPO period studied. Specifically, The study found no significant evidence that companies backed by venture capital at the time of their IPO perform better or worse than non-VC-backed firms, aligning with some previous research and contrasting with others. However, the study did for example find that an increase in the number of IPOs negatively affected stock prices one year post-IPO, which is consistent with theories suggesting that companies going public during hot IPO markets tend to perform worse. Further, a number of complications of the validity and robustness of the models were faced, e.g. with full rank, although thoroughly presented with the intent of full transparency for future research on the area.

This study offers stakeholders further insights into the structure of the European venture capital markets. Despite yielding few significant findings, it offers a directional framework for external investors to consider when evaluating newly listed companies. Venture capital firms may also find value in this study, as it encourages the examination of portfolio company performance post-IPO, which could affect their reputation. Improved performance from their portfolio companies, regardless of the financial stake left in them, may strengthen the VC's standing, thereby attracting future companies to seek their engagement. Lastly, this thesis contributes to existing studies around this topic, by evaluating a geographical and time perspective that this far has been relatively unexplored.

The study's limitations highlight areas for future research. There is potential in focusing on more geographically specific datasets, which could reduce the problems of categorical combinations, and allow for inclusion of variables that were not possible to include in this thesis; e.g.variables that capture the duration and extent of venture capital involvement, and/or age of a firm at IPO. This thesis, along with previous research, observed a tendency for more significant estimates when analyzing data over a longer period of time following the IPO, particularly when examining changes in stock price. Therefore, a suggestion is that future researchers adopt a longer-term perspective when investigating performance differences between VC-backed companies and non-VC-backed companies.

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10 Appendix

Figure 1: No. IPOs per country in the dataset

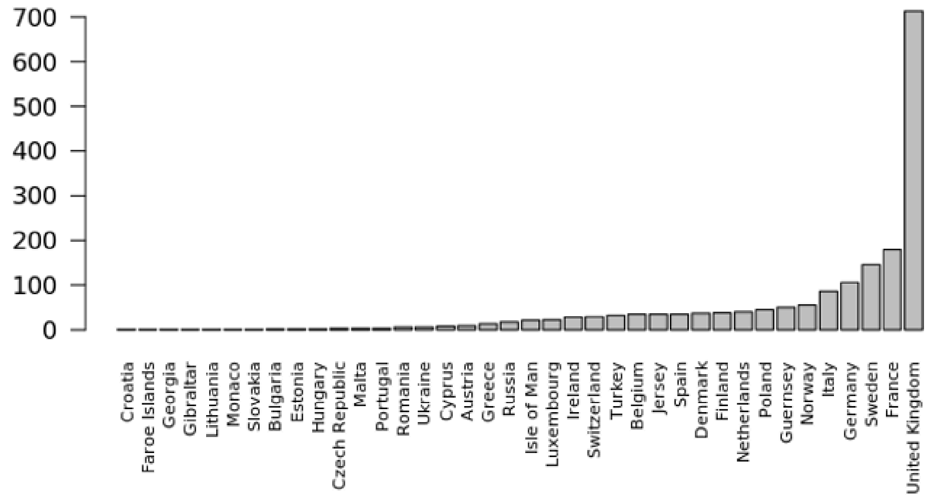

Figure 2: No. IPOs per industry in the data set, Small corresponding to a grouping

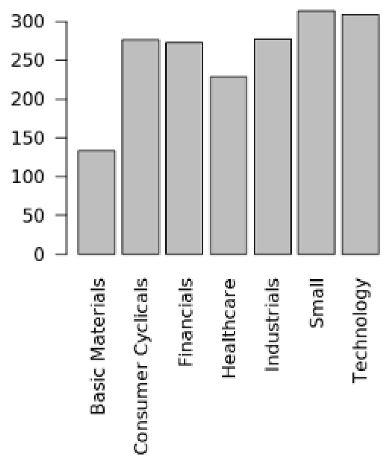

Figure 3: No. IPOs per year in the data set - a histogram

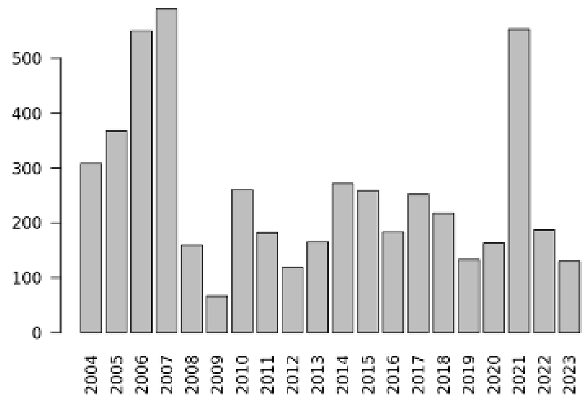

Figure 3.1 No. IPOs per year in the data set

Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
No. IPOs	308	368	550	590	159	67	261	182	119	166	272	259	183	252	218	133	163	553	187	130

Figure 4: Residuals vs Fitted values plot on the regression results from using OLS linear model on ROA baseline change in a one-year period from the IPO issue year

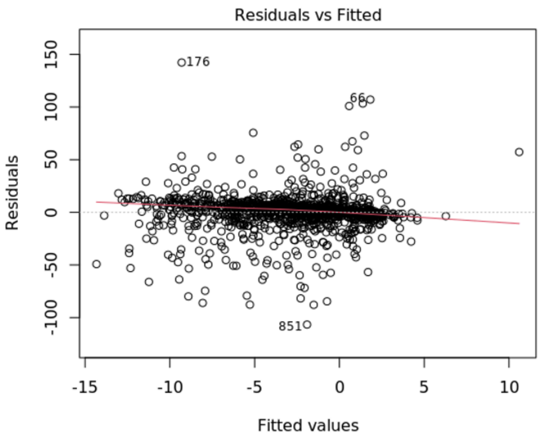

Figure 5: Results of the gvlma function in R - assessment of linear model assumptions

```
ASSESSMENT OF THE LINEAR MODEL ASSUMPTIONS
USING THE GLOBAL TEST ON 4 DEGREES-OF-FREEDOM:
Level of Significance =  0.05

Call:
 gvlma(x = m.ROA.1y)

                       Value   p-value                   Decision
Global Stat        9.580e+03 0.0000000 Assumptions NOT satisfied!
Skewness           1.003e+01 0.0015385 Assumptions NOT satisfied!
Kurtosis           9.558e+03 0.0000000 Assumptions NOT satisfied!
Link Function      6.382e-03 0.9363279    Assumptions acceptable.
Heteroscedasticity 1.136e+01 0.0007512 Assumptions NOT satisfied!
```

Figure 6: QQ-plot

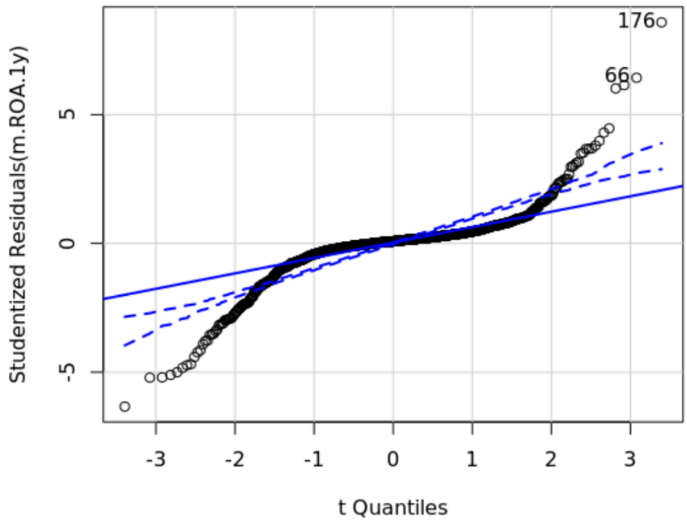

Figure 7: Durbin-Watson test

```
>     durbinWatsonTest(m.ROA.1y) ## not IID. res if p-val small
 lag Autocorrelation D-W Statistic p-value
   1     -0.08337483      2.166643   0.002
 Alternative hypothesis: rho != 0
```

Figure 8: VIF-test

```
                     GVIF Df GVIF^(1/(2*Df))
log(Proceeds)    1.106550  1        1.051927
UnderPricingPerc 1.025317  1        1.012579
NewCountryCoding 1.284748  5        1.025373
IPOS             1.031793  1        1.015772
GroupedIndustry  1.243022  6        1.018294
Trt              1.199851  1        1.095377
```

Table 5: Regression results from using OLS linear model on ROA baseline change in a two-year period from the IPO issue year, with robust standard errors.

Residuals:

Min	1Q	Median	3Q	Max
-173.250	-4.156	1.890	6.835	128.868

Coefficients:

	Estimate	Std. Error	t value	Pr(>|t|)	
(Intercept)	-2.8368875	3.2768620	-0.8657	0.386792	
log(Proceeds)	-0.0853263	0.2929880	-0.2912	0.770922	
UnderPricingPerc	0.0663677	0.0833997	0.7958	0.426302	
NewCountryCodingItaly	2.1217210	2.6922890	0.7881	0.430794	
NewCountryCodingGermany	-1.3835904	3.1917288	-0.4335	0.664727	
NewCountryCodingSweden	-1.0791511	2.5826869	-0.4178	0.676131	
NewCountryCodingFrance	0.8927853	1.9163404	0.4659	0.641377	
NewCountryCodingUnitedKingdom	1.8134464	1.6084135	1.1275	0.259744	
IPOS	-0.0071862	0.0043028	-1.6701	0.095127	.
GroupedIndustryFinancials	2.7464255	2.6552541	1.0343	0.301166	
GroupedIndustryHealthcare	-11.6122943	3.7803926	-3.0717	0.002171	**
GroupedIndustryConsumerCyclicals	4.1649614	2.5925961	1.6065	0.108405	
GroupedIndustryIndustrials	1.0857338	2.7316828	0.3975	0.691092	
GroupedIndustrySmall	2.7572101	2.7171398	1.0147	0.310410	
GroupedIndustryTechnology	0.2162509	2.8294064	0.0764	0.939089	
VCdummy	4.9272126	2.5133939	1.9604	0.050159	.

Signif. codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 23.93 on 1334 degrees of freedom
Multiple R-squared: 0.04137, Adjusted R-squared: 0.03059
F-statistic: 3.838 on 15 and 1334 DF, p-value: 9.472e-07

All values in this regression model, except the independent variable log(Proceeds), provide estimates predicting an average change in ROA as percentage points, influenced by each independent variable respectively, while controlling for all other independent variables in the model two years after a company's IPO issuing year. Outliers in the dependent variable below the 1st and above the 99th percentile have been removed to improve the reliability of the result.

Table 6: Regression results from using OLS linear model on ROA baseline change in a three-year period from the IPO issue year, with robust standard errors.

Residuals:

Min	1Q	Median	3Q	Max
-211.679	-3.482	1.726	6.738	113.911

Coefficients:

	Estimate	Std. Error	t value	Pr(>|t|)	
(Intercept)	-2.7669540	3.9584297	-0.6990	0.48468	
log(Proceeds)	-0.0065136	0.3703451	-0.0176	0.98597	
UnderPricingPerc	0.0481564	0.0612872	0.7857	0.43217	
NewCountryCodingItaly	3.6740410	2.9220017	1.2574	0.20886	
NewCountryCodingGermany	1.5297724	3.0719627	0.4980	0.61859	
NewCountryCodingSweden	3.8974486	2.9644457	1.3147	0.18885	
NewCountryCodingFrance	0.5714854	2.2353898	0.2557	0.79826	
NewCountryCodingUnitedKingdom	0.8450417	1.9244917	0.4391	0.66067	
IPOS	-0.0101916	0.0050923	-2.0014	0.04557	*
GroupedIndustryFinancials	3.7326548	3.0186272	1.2365	0.21649	
GroupedIndustryHealthcare	-8.0391662	3.9095989	-2.0563	0.03997	*
GroupedIndustryConsumerCyclicals	4.4391927	3.1540385	1.4075	0.15954	
GroupedIndustryIndustrials	3.2413181	3.2469391	0.9983	0.31835	
GroupedIndustrySmall	2.2990583	3.6674542	0.6269	0.53085	
GroupedIndustryTechnology	2.1087014	3.3132918	0.6364	0.52461	
VCdummy	1.3698214	3.0072112	0.4555	0.64882	

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 25.52 on 1230 degrees of freedom
Multiple R-squared: 0.02505, Adjusted R-squared: 0.01316
F-statistic: 2.107 on 15 and 1230 DF, p-value: 0.007844

All values in this regression model, except the independent variable log(Proceeds), provide estimates predicting an average change in ROA as percentage points, influenced by each independent variable respectively, while controlling for all other independent variables in the model three years after a company's IPO issuing year. Outliers in the dependent variable below the 1st and above the 99th percentile have been removed to improve the reliability of the result.

Table 7: Regression results from OLS linear model on SBHR from the first trading day to 180 days after, with robust standard errors.

Residuals:

Min	1Q	Median	3Q	Max
-79.091	-21.795	-4.081	14.864	175.087

Coefficients:

	Estimate	Std. Error	t value	Pr(>|t|)	
(Intercept)	-1.3756825	5.0300838	-0.2735	0.78451	
log(Proceeds)	0.8119201	0.4498155	1.8050	0.07124	.
UnderPricingPerc	0.1527907	0.0962582	1.5873	0.11262	
NewCountryCodingItaly	5.6747178	3.9003140	1.4549	0.14586	
NewCountryCodingGermany	-5.9439653	3.7874603	-1.5694	0.11674	
NewCountryCodingSweden	-0.0612411	3.8541060	-0.0159	0.98732	
NewCountryCodingFrance	-6.2827281	2.9264728	-2.1469	0.03194	*
NewCountryCodingUnitedKingdom	1.6203410	2.1170670	0.7654	0.44415	
IPOS	0.0027712	0.0058431	0.4743	0.63536	
GroupedIndustryHealthcare	-4.2333328	4.6004350	-0.9202	0.35759	
GroupedIndustryFinancials	-3.1667015	4.2022269	-0.7536	0.45120	
GroupedIndustryConsumerCyclicals	-2.7005069	4.2369880	-0.6374	0.52397	
GroupedIndustryIndustrials	5.0765601	4.3497033	1.1671	0.24333	
GroupedIndustrySmall	1.9239727	4.2068295	0.4573	0.64748	
GroupedIndustryTechnology	2.0373880	4.3549999	0.4678	0.63997	
VCdummy	1.0073383	2.8610098	0.3521	0.72481	

Signif. codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 35.78 on 1759 degrees of freedom
Multiple R-squared: 0.01771, Adjusted R-squared: 0.009334
F-statistic: 2.114 on 15 and 1759 DF, p-value: 0.007414

All variables in the regression model in Table 4 provide estimates predicting an average percentage change in stock price (SBHR), influenced by each independent variable respectively, while controlling for all other independent variables in the model 180 days after a company's first day of trading publicly. Outliers in the dependent variable below the 1st and above the 99th percentile have been removed to improve the reliability of the result.