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A Study of Buyout-, Venture Capital-, and Non-backed IPOs and the Actual Efficiency of Debt

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Abstract

Title	A Study of Buyout-, Venture Capital-, and Non-backed IPOs and the Actual Efficiency of Debt
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Authors	Ofelia Aspemyr & Rebecka Lundgren Månsson
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Key words	Private equity, buyout, venture capital, financial sponsors, initial public offerings, capital structure, long-term IPO performance
Purpose	The principal purpose of this paper is to examine whether there exist any differences in long-term performance between buyout, venture capital, and non-backed IPOs. This paper discusses if the different issuers could theoretically have any impact on the long-term IPO performance. Further, the paper's purpose is to describe the capital structure's influence on the long-term performance.
Methodology	This paper uses a quantitative methodology with a hypothetical-deductive method. In order to investigate the effect of independent variables, on the long-term stock performance, data was collected.
Theoretical perspectives	The foundation for this paper is previous research examining the impact of different sponsors on long-term performance on Nordic IPOs.
Empirical foundation	The paper consists of 193 IPOs- 20 venture capital-, 62 buyout-, and 111 non-backed IPOs. Data is collected from the Nordic stock market between 2006 and 2016.
Conclusions	The result confirmed a significant relationship between buyout-backed IPOs and long-term abnormal returns. No evidence of a statistically significant relationship between venture capital-backed IPOs and long-term abnormal performance was found. Furthermore, this paper found that the level of debt-to-equity had a significant impact on long-term abnormal returns.

PREFACE

The aim of this paper is to contribute to the current discussion about the performance of buyout-backed (BO) and venture capital-backed (VC) initial public offerings (IPOs), and compare those to the performance of an equivalent sample of non-backed IPOs. The empirical sample consists of 62 BO-backed, 20 VC-backed, and 111 non-backed IPOs listed on the Nordic stock market during the period between 2006 and 2016. The result of performed tests suggest marked differences across the three groups in terms of capital structure. Three years following the IPO, BO-backed IPOs confirmed a significant relationship in terms of long-term returns, compared to the non-backed sample. No conclusion could be drawn whether VC-backed IPOs perform better or worse long-term compared to non-backed IPOs. Furthermore, it was confirmed that a higher amount of debt in comparison to equity has a positive impact on long-term IPO performance.

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DEFINITIONS AND CONCEPTS

Initial public offering (IPO) refers to the process of offering shares of a private corporation to the public in a new share issuance. The public share issuance allows the company to raise capital from public investors.

Compounded annual growth rate (CAGR) refers to the annual growth rate of an investment over a specified period of time, longer than one year. It represents one of the most accurate ways to calculate and determine returns for individual assets, investment portfolios, or anything that can rise or fall in value over time.

Non-backed IPOs refers to IPOs without a buyout- or venture capital firm as the main issuer.

Buyout backed companies refers to companies, owned by a buyout firm, that normally takes a significant ownership stake and financing a major part of the acquisition using financial leverage (Kaplan & Strömberg, 2009).

The debt-to-equity ratio is a financial ratio illustrating the relative proportion of shareholders' equity and debt.

Long-term performance/return refers to the three-year stock performance/return.

Nordic stock market refers to a compounded market of Sweden (Nasdaq OMX Stockholm, First North Stockholm, Spotlight Stock Market, and Nordic Growth Market), Finland (OMX Helsinki and First North Finland), Iceland (Nasdaq OMX Iceland and First North Iceland), Norway (Oslo Stock Exchange and Norwegian OTC), and Denmark (OMX Copenhagen, Dansk OTC, and First North Denmark).

The Neuer Markt and the Nouveau Marché refers to growth market segments of the Frankfurt and Paris stock exchanges, respectively.

The techMARK is a tracking instrument that comprises technology firms being part of other indices of the London Stock Exchange (LSE).

BO/VC refer to buyout and venture capital.

COGS refer to the cost of goods sold.

BHAR refers to buy-and-hold abnormal return.

Table of contents

1. Introduction

This section covers the background related to the choice of topic, followed by a problem discussion with a subsequent formulation of the paper's purpose. The authors further present the paper's boundaries and outline.

1.1 Background

The recent surge in IPO activity in the Nordic region has generated considerable media attention. It has fuelled the debate about the financial performance of IPOs in general and of private equity backed IPOs, particularly backed by BO firms (Bråse, 2011; Högberg, 2012; Andersson, 2013). In parallel, private equity has become a more convenient way of investing. Twenty years ago, the global buyout deal value of private equity firms was < $100bn. The corresponding figure today is $582bn (Bain report, 2019). For Nordic private equity, 2018 was a busy year with record amounts invested in both VC and BO companies. Nordic VC firms secured €0.5bn in fresh capital, bringing the total volume of capital raised over the past three years to €3.7bn- more than double than what was amassed between 2013 and 2015 (Argentum report, 2018).

1.2 Problem discussion

A majority of previous papers discussing BO- and the VC firms' role in an IPO primarily focus on the US market (Levis, 2011). There also exists a variety of papers conducted on the European market (Jelik et al., 2005). However, the authors believe there is not enough research concerning the Nordic market. There are vast differences between the US-, European-, and Nordic stock markets that will influence the IPO environment and thus they cannot be easily compared. The Nordic market model includes social benefits such as free education, free healthcare, and guaranteed pension payments, e.g., the Nordic countries display similar characteristics in the form of economic and technological development (Eurostat, 2017). Furthermore, choosing a broader selection, including the whole European market or the US market would bring complications in terms of differences regarding jurisdiction, management culture, and political focus (Spliid, 2013). Jelik et al. (2005) studied the IPO market in the UK and found no difference between BO-backed and non-backed IPOs, while Levis (2011) argues that BO-backed IPOs on the London Stock Exchange (LSE) perform better than its non-backed IPO counterparts in the long term. Because of this contradiction and lack of comprehensive,

up-to-date empirical data, the authors understand a research gap regarding the long-term performance of Nordic IPOs. This paper focuses on addressing the existing gap in the previous research about the differences in the long-term performance of BO-, VC-, and non-backed IPOs within the Nordic stock market. The focus on sponsorship was chosen primarily due to the recent surge of BO- and VC-backed transactions mentioned in *1.1*. An essential part of the companies executing an IPO is the capital structure. The amount of debt in comparison to total assets might differ between BO-, VC-, and non-backed companies, and might have an impact on long-term performance. Thus, this paper will investigate the different capital structures at the time of the IPO and its following effect on long-term stock performance.

1.3 Purpose

The principal purpose of this paper is to examine whether there exist any differences in terms of long-term performance between BO-, VC-, and non-backed IPOs. This paper examines the three groups of issuers and discusses whether the difference in the issuers' investment strategies could have any impact on the returns. Furthermore, the purpose is to describe the capital structure's influence on long-term stock performance. Moreover, it aims to contribute new knowledge to the already explored topic of IPOs and different capital structures.

1.4 Research questions

- Do BO-backed or/and VC-backed IPOs generate higher long-term stock returns after the IPO than non-backed IPOs in the Nordic region?
- Does capital structure influence the long-term stock performance?

1.5 Delimitations

The paper is limited to IPOs completed between January 1, 2006 and December 31, 2016 and covers 193 IPOs across the Nordic market, e.g., Sweden, Denmark, Norway, Iceland, and Finland. These nations are known for high living standards and low-income disparity. It is further delimited to IPOs within the *Bloomberg Terminal*, where the empirical data is collected, thus, a requirement is that the IPOs are available on the database. Finally, the IPOs must have data covering the entire period of three years.

1.6 Target audience

This paper is primarily proposed for university students reading a bachelor's in economics and for academics with a fundamental understanding of the field. Hopefully, the result will come to favour the individual investor's knowledge of IPO performance based on the ownership structure. Finally, the authors hope that this paper will generate valuable insights within the financial sector and be a foundation for future research.

1.7 Disposition

The paper is structured in the following way:

Chapter 2 - Previous research, theory, and hypothesis formulation:
This section highlights previous research with essential results and insights within the framework as well as the foundation for the hypotheses- expressed at the end of the chapter. Further, it presents financial theories contributing to model theory relevant to the purpose of this paper.

Chapter 3 - Methodology:
This section includes the various steps required to complete the paper and its reliability. The chapter also presents, motivates, and critically examines the data, which is one of the most comprehensive parts of this paper.

Chapter 4 - Results:
This section presents the paper's results from the data collected and the tests conducted. The t-tests are presented in an attempt to illustrate whether there are any statistical differences between the three IPO-groups and different capital structures. Regression analysis is conducted to determine whether the selected independent variables have an impact on long-term performance. Furthermore, the results of the OLS assumptions are presented.

Chapter 5 - Analysis and discussion:
This section analyses the empirical results of previous chapters presented in the form of tables and figures. The analysis is based on the paper's underlying theory and the research questions of the paper. The reasoning is conducted based on previous research. Furthermore, the authors discuss reflections around the result.

Chapter 6 - Conclusion:

This section answers the purpose of the paper, based on the results of the research presented and analysed. Furthermore, suggestions for further research are presented.

2. Previous research, theory, and hypothesis

This section highlights previous research with essential results and insights within the framework as well as the foundation for the hypotheses- expressed at the end of the chapter. Further, it presents financial theories contributing to model theory relevant to the purpose of this paper.

2.1 The business of Private Equity

The European Private Equity and Venture Capital Association, EVCA, (2007) identify private equity as "the provision of capital by financial investors, over a medium or long-term, to non-quoted companies with high growth potential" (EVCA, 2007, p.6). Private equity is generally considered to describe the multiple group of related things, e.g., the broad industry and the firms' form, responsible for the financing provided in a wide variety of situations, ranging from capital offered to start-up companies, to leverage buyouts of large publicly listed companies (British Private Equity & Venture Capital Association, 2010). Private equity is associated with two different fundamental areas, (1) BO and (2) VC. However, it can additionally include more complex formations in the form of Growth Capital, Fund of Funds (FOF), Real Estate investment vehicles, Special Purpose Acquisition Companies (SPAC), and other less recognizable investment structures (Fraser-Sampson, 2007, SVCA). The differences between BO- and VC firms' lie in the type of investment, level of capital invested, amount of equity obtained through the investment, and when during a company's lifecycle they get involved. VC firms invest in companies in exchange for a minority stake of equity, < 50% ownership (Schöber, 2008). EVCA further defines VC as equity investments made for the launch, early development, i.e. start-ups or expansion of business with particular emphasis on entrepreneurial undertakings rather than for mature companies (EVCA, 2007, p.6). Additionally, a VC-backed IPO is defined as an IPO that has received VC-backing at any time before going public. The funding for such purposes could take place in a single transaction or several rounds. EVCA (2007), on the other hand, illustrates a buyout transaction as "a transaction in a more mature stage of a company's life cycle where a significant amount of the financing required is often provided by bankers and other lenders in the form of various types of debt" (p.6). Hence, the terminology of an IPO backed by a BO firm requires a clarification- to assume a definition, the obvious starting point is the characterization of a leveraged buyout (LBO). An LBO refers to a transaction when a BO firm acquires a significant, often controlling interest, in a company or a company division. Typically, a large amount of up taken financial

debt is used to finance a major part of the shares acquired (Loos, 2005). A BO-backed IPO is defined by a company making its first public offering after previously completing an LBO (Holthausen and Larcker, 1996).

2.2 Previous research on BO-, VC-, and Non-backed IPOs

Early studies on the US market, made by DeGeorge and Zeckhouser (1993) and Holthausen and Larcker (1996), confirm a difference in long-term returns depending on whether the IPO has a sponsor or not. DeGeorge and Zeckhauser (1993), using a sample of 62 BO-backed IPOs dating from 1983 and 1987, found the accounting performance of BO-backed companies to outperform its counterparts before going public, and then worsened after that. Elsewise, they did not find any evidence of weak stock performance following the BO-backed IPO. On the other hand, Holthausen and Larcker (1996) examined the accounting and market performance of 90 BO-backed IPOs dating from 1983 to 1988. The investigation found that accounting performance for the four years following the IPO, on average, was significantly better for BO-backed IPOs compared with its counterparts. The result displays no confirmation of abnormal common stock performance after a BO-backed IPO. However, the results varied depending on the period and metrics chosen. Additionally, Bergström et al. (2006), using a sample of 152 BO-backed and 1,370 non-backed IPOs, argue that BO-backed IPOs outperform its non-backed counterparts across a horizontal of three years within the London Stock Exchange (LSE) and Paris Stock Exchange. Later also confirmed by Cao and Lerner (2009), which positive returns perform to be economically and statistically meaningful. And more recently confirmed by Levis (2011), who achieved positive and significant cumulative abnormal three-years return. Furthermore, Levis' results display that BO-backed IPOs outperform VC- and non-backed IPOs, as well as the stock market in general. The average negative returns for the entire sample exist predominantly due to the worse performance of non-backed IPOs (Levis, 2011).

In the case of VC-backed IPOs, early studies made by Brav and Gompers (1997) who examined a sample of 934 VC-backed IPOs, issued on the US market, state that VC-backed IPOs outperform its non-backed IPO peers, using equal-weighted returns. Value weighting significantly reduced the performance differences and substantially reduced the underperformance for non-VC-backed IPOs. On the other hand, Hamao et al. (2000), using a sample of 355 Japanese IPOs dating from 1989 to 1994, found VC-backed IPOs to not perform better than its counterpart of IPOs, except for IPOs backed by foreign-owned or independent

VC firms. Outside the US, the evidence also seems to be somewhat mixed, Rindermann (2004) examined a sample of 303 VC- and non-VC-backed IPOs, between 1996 and 1999, collected from the following stock markets; British techMARK, the French Nouveau Marche and the German Neuer Markt. Thus, using an international dimension, Rindermann overall found that VC-backed IPOs do not usually exceed those without VC-backing. Instead, only a subgroup of the operating VC firms has positive effects on both the operating and market performance of the IPO. These conclusions differ from Jelik et al.'s (2005) who studied a unique data sample of 167 MBO exiting by IPOs in the UK, dating from 1964 to 1997. The result of their studies displays no evidence for either significant underperformance or for VC-backed IPOs to overperform its non-backed counterparts. However, the results remain robust after applying different methods to measure performance and controlling for sample selectivity bias. More recently, Krishnan et al. (2009) completed a paper of 1,503 VC-backed IPOs conducted from the US market, dating from 1993 to 2004. The result displays that VC firms' and long-term IPO performance has a significant positive relationship.

2.3 Theories covering BO- and VC-backed IPOs

Bergström et al. state that the performance of BO-backed IPOs pattern is lower under-pricing and less underperformance than its counterparts. Those issues are in general IPOs of larger companies with greater information ability and thereby associated with less uncertainty.
Furthermore, IPOs of larger companies are characterized with a more substantial portion of institutional investors, acting more professionally in the book building or auction, resulting in fewer adjustments in the aftermarket. Thus, better long-term performance (Bergström et al., 2006).

Megginson and Weiss (1991) applies the certification hypothesis in their study, and argue that investors are more polite if a VC firm certifies the quality of the company that goes public, and, thereby increases the investor confidence that the company seeking public funding is of sound quality, with higher performance than those non-backed. The certification is, therefore, said to lower the risk and information asymmetry, which indicates that the offering price for a VC-certified company should, therefore, reflect all relevant and prior information. The certification may lower the risk, the information asymmetry and hedge certification of quality in the company. Thus, VC-backed companies can introduce companies at a higher price, and those companies are thereby less affected by IPO under-pricing. The phenomenon could have an

impact on the long-term development, since the VC-backed IPOs are more likely already "fair valued", while non-backed IPOs would be more underprized at IPO, due to not certified through a VC firm (Megginson & Weiss, 1991).

On the other hand, Loughran et al. (1994) argue that a fundamental reason for long-term IPO underperformance is the valuation of the company at the time of the IPO. VC-backed companies are expected to be younger companies, with more complex business models, which might increase the information asymmetry, i.e. due to the complexity for the investor to understand the underlying business of the company. Loughran et al. further argue that larger and mature companies are less likely to be affected by under-pricing. Assuming that information asymmetry and uncertainty leave room for misjudgement, primarily for VC-backed and non-backed companies, caused through that the market has not previously valued them. One metric used to test for companies' under-pricing, at the time IPO, is the short-term performance, through the first-day return metric, which reflects the share price development during the first trading day (Ritter, 1998). Furthermore, Ritter argues that under-pricing tends to also result in long-term underperformance.

The following hypotheses has a foundation in the theories mentioned above and previous research on IPO performance:

H0 - There is no significant difference between BO-backed and VC-backed IPOs, compared to non-backed IPOs in terms of long-term returns

H1 - There is a significant difference between BO-backed and VC-backed IPOs, compared to non-backed IPOs in terms of long-term returns

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2.4 Capital structure

In short, BO investors try to benefit from the increase in firms' value. Jensen (1986) states that the principal value driver for the BO business model is operational efficiency, achieved by closer monitoring, management expertise, and high levels of debt. Although Myers (2001) argues that there is no standard theory describing the ultimate combination of debt and equity, instead, Myers proposes two approaches of capital structure to explain why companies choose to obtain debt. The Pecking Order Theory explains that a company will borrow, preferably than issue equity when the internal cash flow does not generate enough cash to fund capital expenditures. Hence, the amount of debt obtained will reflect the company's rising need for

external funds. The Trade-off theory defines how companies seek after debt levels that balance the tax advantages of further debt against the costs of potential financial distress and predicts moderate borrowing by tax-paying companies. However, Levis (2011) argues that a higher debt ratio has a positive impact on long-term returns. Levis states that an increased amount of debt creates a leverage effect but also an increased risk, which is further responded by higher returns. Although the positive and significant correlation between debt and long-term performance for non-backed IPOs, the proportion of IPOs with total debt ratios similar to its BO-backed equals is inadequate (Levis, 2011).

The coefficient and extensive empirical evidence regarding the correlation between leverage and stock returns is slightly different, Cao and Lerner (2009), using a sample of 496 BO-backed IPOs dating from 1980 to 2002, sees a positive coefficient. While several studies find a negative coefficient (Dimitrov & Jain, 2008; Korteweg, 2010), and others display a positive relationship (Hamada, 1972; Bhandari, 1988; Hou & Robinson, 2006). Muscarella and Vetsuypens (1990) argue that a higher debt ratio forces management to improve the company's operations and thus generate better long-term returns compared to counterparts with a smaller amount of external capital. Furthermore, Holthausen and Larcker (1996) argue that the concentrated ownership and high debt levels of the LBO company might motivate the company to operate more efficiently during the time they are private. Consequently, they argue that the decrease in debt levels and dispersion of ownership could result in a decline in the performance of these companies after IPOs (Holthausen & Larcker, 1996). Further research through Gomes and Schmid (2010) has confirmed that the relationship between leverage and stock returns can seem to be more complicated. However, the paper points out that the decisive factor for long-term returns primarily depends on how the company chooses to use the debt.

The following hypotheses are based on the theories mentioned above and previous research on capital structure at IPO:

H0 - There is no significant difference in long-term returns with higher debt in the capital structure

H2 - There is a significant difference in long-term returns with higher debt in the capital structure

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2.5 Critical reflection of literature

The pervasive pattern from previous research is that sponsored IPOs tend to outperform non-backed ones, although not all performance differences can be statistically assured. However, previous research seems to be more focused on under- and overpricing of IPOs. Although BO firms have several different exit options, previous literature (e.g. Bergström et al., 2006; Schöber, 2008) has hypothesised how BO firms actively try to match periods of high valuation while selling their stocks to the public stock market. The results are however mixed, as Bergström et al. (2006) find that fewer BO-backed firms go public during high-volume years than non-backed firms whereas Schöber (2008) reveals that BO-backed IPOs are timing high volume IPO markets. Additionally, (Gompers, 1996; Lee & Wahal, 2004) presented the grandstanding theory, suggesting it is beneficial for VC firms to under-price offerings to make it easier to bring its future portfolio companies public, which make the VC firm more reputable and raise more funds, thus earning higher management fees in the future. The previous research presented in *2.2* measures various time periods and markets with different methods and metrics. As an example, Krishnan et al (2009) used return on assets, the market-to-book equity ratio, and listing survival to measure long-term performance. The purpose of this paper is to measure the stock performance, while these metrics measure the operational performance and efficiency of the company, which might cause difficulties comparing results. Furthermore, several previous studies have a time period dating back to the 1990's (DeGeorge & Zeckhouser, 1993; Holthausen & Larcker, 1996; Jain & Kini, 1995). None of them found clear evidence that BO-backed IPOs perform better long-term, while several of the more recent studies found that BO-backed IPOs perform significantly better long-term (Bergström et al., 2006; Levis, 2011). The results seem to differ between the time periods selected. Thus, the studies published more recently should be applied more thoroughly for a more accurate comparison. Jelik et al.'s (2005) research solely used MBO-backed IPOs (management buyouts) in their sample. The purpose of this paper is to investigate BO- and VC-backed IPOs. MBO-backed IPOs differ from BO-backed IPO since they have different natures and characteristics e.g. in terms of overall capital structure and might therefore differ in their long-term performance. They do not find a statistically significant difference between backed and non-backed IPOs.

3. Methodology

This section includes the various steps required to complete the paper and its reliability. The chapter also presents, motivates, and critically examines the data, which is one of the most comprehensive parts of this paper.

3.1 Scientific approach

This paper uses a quantitative methodology to test the above-stated hypotheses. It aims to follow the deductive logic presented by Bryman and Bell (2017). The hypotheses are deducted from the theories presented in Chapter 2 and further tested in Chapter 4. The paper aims to define the factors that influence the phenomenon, making this paper a descriptive study. Furthermore, it is crucial to account for causality. Causality is the certainty that the independent variable causes the variations in the dependent variable. To increase the causality of the results of the regressions, several control variables were added (Bryman & Bell, 2017).

Bryman and Bell (2017) argue that reliability is essential to convey the credibility of the presented results. For quantitative research, it is crucial to know the level of accuracy and stability of the measurements, if something else is measured rather than what is intended to be answered by the measurement it is considered non-reliable. To make the paper replicable, the authors have motivated the choices made and explain how the data is collected and processed. The primary source used for collecting data is the Bloomberg database. Bloomberg is well-established within financial data (Bloomberg, 2020). To increase reliability, a few observations are compared against other sources, e.g. Zephyr, MergerMarkets, and companies' annual report publications.

Validity refers to the paper's level of relevance (Bryman & Bell, 2017), i.e. how well the research measures its purpose. Firstly, it is of importance to determine how well the dependent variable (abnormal return (CAGR)) measures the long-term stock performance of the sample companies. The most commonly used method for long-term performance in previous research is the BHAR (Levis, 2011; Ritter, 1991). As mentioned in 3.3.1, the metrics used in this paper is similar, except for the number of observations per company. Since the sample of VC-backed IPOs is smaller during the period used, it might not accurately reflect the actual effect of being a VC-backed company completing an IPO.

3.2 Data selection

3.2.1 Time frame and stock markets

In order to collect adequate data during different economic environments, a period of eleven years was selected, from January 1, 2006 to December 31, 2016. The end year refers to 2016 since the paper analyses the three-year stock performance following the IPO. Investigating the effect of only one or two years, the authors believe, would not capture the actual performance, which is in line with previous research, e.g. Levis' (2011) and Ritter's (1991). The event period is calculated from the IPO dates' closing price to the closing price three years later. Since all observations in the sample have the same event period, the data compared and analysed is accurate. The geographical area is limited to the Nordic market, and the sample is collected from Nasdaq OMX Stockholm, First North Stockholm, Spotlight Stock Market (AktieTorget), Nordic Growth Market, OMX Helsinki, First North Finland, Nasdaq OMX Iceland, First North Iceland, Oslo Stock Exchange, Norwegian OTC, OMX Copenhagen, Dansk OTC, and First North Denmark.

3.2.2 Ownership structure

The first hypothesis is stated to investigate the ownership structure's effect on long-term stock performance. Since the strategy between VC- and BO-backed IPOs differ, and most likely will behave differently on the market, the authors chose to divide them into two different samples. To control the effect of BO and VC-backed IPOs, the authors select non-backed IPOs as the control group.

3.3 Data collection

The database used to collect data is mainly Bloomberg, complemented with data from Zephyr, MergerMarkets, annual reports, quarterly reports, S&P Global Market Intelligence, and Börsdata. In total, a sample of 111 non-backed, 62 BO-backed, and 20 VC-backed IPOs were collected from January 2006 to December 2016. If an IPO did not include all variables needed for regressions, through the databases above, it was excluded from the selection. The average market capitalization, at issue, for the non-backed sample is SEK 2.7bn, an average company age of 32 years, and an industry focus on the financial and consumer industry. Corresponding characteristics for the BO-backed sample are a market capitalization at issue average of SEK 10.1bn, with an average age of 33 years, and a focus on the consumer industry. Lastly, the characteristics for the VC-backed are an average market capitalization at issue of SEK 5.0bn,

an average age of 10 years, and an industry focus on the consumer and communications industry.

3.3.1 Dependent variable and benchmark

To measure the long-term abnormal stock performance, the authors chose to calculate the abnormal return CAGR. To obtain the abnormal return and compare it with the stock market environment, the authors used an industry group index. The group indices used are the MSCI's industry group indices from Bloomberg. All stock prices are collected from Bloomberg, and in a few cases, to increase the validity, the authors compared them with other databases.

The abnormal return CAGR is calculated with industry group indices as a benchmark. Thus, two observations are collected for all stocks, (1) the closing stock price of the first-day trading and (2) the stock price three years after that date. If the second observation occurred on the weekend, the previous Friday is the date used. Calculations are done to see the percentage change for the stock over the three years. Then, for each company, the industry group index was found. From the index one observation was collected from the date of the IPO, and secondly one observation three years later. Thus, the percentage increase or decrease during a period of three years could be calculated. Lastly, the calculation below was conducted for each company.

$$Abnormal\ return\ (CAGR) = \left[\left(\frac{p_1 - p_0}{p_0}\right) - \left(\frac{r_1 - r_0}{r_0}\right)\right]^{\frac{1}{3}}$$

p_0 is the closing stock price on the IPO date for company *i*
p_1 is the closing stock price three years later
r_0 is the industry group index for industry *j* that company *i* belongs to at the date of the IPO of company *i*
r_1 is the industry group index for industry *j* three years after the IPO date of company *i*

The above metric is used to test whether BO or VC-backed IPOs have better long-term performance, within three years. This metric is similar to BHAR- the difference is that it calculates two observations for a company and not the compounded monthly stock price.

3.3.2 Independent variables

Data for the ownership structure classification is retrieved through Bloomberg and complemented with data from Zephyr and MergerMarkets, where it was not clearly defined by Bloomberg. To test the second hypothesis regarding leverage, data for each company's debt-

to-equity ratio was collected from Bloomberg. To measure the capital structure, the debt-to-equity ratio was used from the last quarter before the IPO where possible, 100% means the same amount of debt as equity, and >100% indicates debt > equity. Where the last quarterly reports prior the IPO was not available, the most recent annual was used. Several control variables are used to control for factors influencing the long-term performance, except for the ownership- and capital structure. Those are market capitalization at offering, industry group, the company's age, year of the IPO, stock exchange country, R&D expense (used only as a cross-term with VC in the regression), the share of intangibles, and gross profit margin. These control variables are used to distinguish the different characteristics of VC-, BO-, and non-backed IPO companies, and understand if those characteristics have an impact on the different ownership structures' long-term performance. Market capitalization at issue is calculated as the number of stocks times the initial stock price (no of shares*share price). It is used to measure the size of the company since it might have an impact on the long-term performance as well as different IPO backings might dominate in larger or smaller companies. Bloomberg's industry categorization defines industry groups and consists of seven various industries: Financial, Basic Materials, Technology, Industrial, Energy, Consumer, and Communication. Different industry groups might dominate in different types of IPO backings and are therefore relevant to control. The country of the stock exchange and the year of the IPO were also retrieved from Bloomberg's database. The company age is calculated through the date of the IPO subtracted by the foundation date, rounded to the closest year. The foundation year is collected from S&P Global Market Intelligence as well as the companies' websites. BO-backed companies are expected to be more mature companies in terms of age, while VC-backed companies are expected to be younger start-ups, which is the reason for including this in the regression. Since the time frame includes different economic environments, the year of the IPO is expected to have an impact on long-term performance.

To calculate the share of intangible assets data for tangible assets and total assets were retrieved through Bloomberg, as well as from annual and quarterly reports. Since the authors aimed to account for the effect at the time of the IPO, the last quarterly report before the IPO date was used where available. R&D expenses are collected from the quarterly report before the IPO date as well. Both R&D expenses and share of intangibles are used to measure the effect of the information asymmetry problem. Advance companies, with a higher level of information asymmetry, tend to have higher R&D expenses as well as the share of intangibles (Loughran et al., 1994). Gross profit margins are collected from the company's quarterly report for the

most recent quarter before the IPO and is calculated through net sales subtracted by the cost of goods sold, divided by net sales. Profit margin can, therefore, take a negative value if COGS > net sales. Gross profit margin measures the company's maturity and profits, e.g. start-ups tend to have COGS > net sales (Byström, 2010).

3.3.3 Currency

SEK is the currency used for all metrics since the sample mainly consists of companies listed on the Nasdaq OMX Stockholm. Since most of the variables are ratios, the currency does not have an impact.

3.4 Data and selection criticism

Since a part of the chosen period was characterized by extensive economic regression (2008-2009), few data points could be found during this period. IPOs made during this period may behave differently than IPOs made in another economic environment and will, therefore, be controlled for.

The industry group indices taken from MSCI indicate the accumulated industry group performance (total return) in the European stock market and not specifically the Nordic stock market. There were no similar indices founded for the Nordic stock market. The option was between choosing a market index for the whole Nordic stock market or industry group indices for the European stock market as a whole. The authors found that the companies moved in a more similar way to their industries in comparison to its geographic stock markets, which is why the MSCI indices were chosen. The average market capitalization of the MSCI Industrials Europe Index for 2020 is 11.8bn USD, which is considerably higher than the sample average market capitalization of industrial companies which is SEK 4.36bn (MSCI, 2020). Even though the sample consists of observations made before 2020, there is probably a big difference in market capitalization average. The optimal solution to increase the validity would be to create a portfolio with a corresponding market capitalization with Nordic companies only, but due to limited access to databases and other prioritizations, this was not done.

In some cases, companies have not published a quarterly report years before IPO; and then the closest annual report had to be used instead to retrieve certain measurements. The yearly report numbers are expected to not be considerably different from the quarterly reports, due to only

year-end adjustments, which generally tend to have a minor effect on the numbers. Consequently, it should not influence the result.

The sample of VC-backed companies is relatively small and might not reflect an accurate picture of the VC-backed companies' performance. The reason for the small sample is the difficulties in finding information on whether companies received equity backing from private equity firms. The data consists mostly of IPOs on Nasdaq OMX Stockholm and only a few on Nasdaq OMX Iceland.

3.4.1 Survivorship bias

Survivorship bias is described by Carpenter and Lynch (1998) when the results are solely based on a sample that has survived during the entire event period. Data matching the criteria, but for reasons, such as, acquisitions or bankruptcy during the period, are excluded from the sample. To solve this bias problem, one could have truncated the abnormal returns for companies that were delisted or acquired. But, since all other data of variables could not be found for most of these companies, the authors chose not to. According to Carpenter and Lynch (1998), the effect it has on the results depends on whether it impacts the sample groups differently, e.g. if a VC-backed company is more prone to be acquired than a non-backed company. In this paper, survivorship bias exists in all of the examined groups, and it might be the case that VC- and BO-backed companies are more prone to be acquired or delisted, which might impact the results.

3.4.2 Handling of data

All data retrieved from various sources were exported to Microsoft Excel to be adjusted and further processed to be analysed in Eviews. Since the market capitalization and age are absolute numbers (i.e. not a ratio), the logarithms of these numbers were used (Fama, 1998). The year of IPO, IPO stock market, industry group of the company, and ownership structure at IPO cannot be measured quantitatively and are therefore translated into dummy-variables.

3.5 Statistical testing

Various statistical tests are used to investigate whether the results are statistically significant and if the hypotheses can be proven. To test the hypothesis the significance levels of 1%, 5%, and 10% were used. According to Westerlund (2005), the 5% significance level is the most

frequently used. The significance level measures the probability of rejecting a correct null hypothesis. Thus, a low significance level is desired to call it statistically significant.

3.5.1 T-test

T-testing is the most commonly used method for testing the average difference between the two different groups. Since hypothesis (1) requires testing for three different groups, several t-tests were conducted and tested in pairs. The t-test tests for the difference between the means of the two samples and to see if the mean difference is representative of the population the selection aims to reflect (Körner & Wahlgren, 2006). If the t-test indicates a p-value <5% the result is significant, and the mean difference is representative for the population. The sample consists of three groups, (1) VC-backed IPOs' long-term performance, (2) BO-backed IPOs' long-term performance, and (3) non-backed IPOs' long-term performance. For hypothesis (2), regarding the capital structure, a t-test was performed. The two samples consisted of (1) the long-term return of companies with a high debt-to-equity ratio, and (2) the long-term return companies with a low debt-to-equity ratio.

3.5.2 Ordinary Least Squares (OLS)

A regression explains the relationship between a dependent variable and one or several independent variables. OLS is used as the regression analysis method since the authors believe OLS is the most appropriate method to investigate the hypotheses. For the year of the IPO, 2009 is set as the reference. For the country of the stock exchange, Iceland is the reference. The industry group "Basic Materials" is the reference for the industry group dummies. Non-backed IPOs are set as the reference group regarding the ownership structure. The OLS regression tests the hypotheses: (1) if VC- and/or BO-backing has an impact on long-term IPO performance and (2) if the capital structure has an impact on long-term returns.

The regression is conducted as follows:

$$y_i = \alpha + \beta_1 x_{1i} + \beta_2 x_{2i} + \beta_3 x_{3i} + \beta_4 x_{4i} + \beta_5 x_{5i} + \beta_6 x_{6i} + \gamma_1 D_{1i} + \gamma_2 D_{2i} + \gamma_3 D_{3i} + \gamma_4 D_{4i} + \varepsilon_i$$

y_i denotes the independent variable abnormal return (CAGR) for company *i*
α denotes the intercept C
$\beta_1 x_{1i}$ denotes the independent variable debt-to-equity ratio (%) for company *i*
$\beta_2 x_{2i}$ denotes the control variable ln(age) of company *i*
$\beta_3 x_{3i}$ denotes the control variable gross profit margin (%) of company *i*
$\beta_4 x_{4i}$ denotes the control variable share of intangibles (%) for company *i*
$\beta_5 x_{5i}$ denotes the control variable ln(market capitalization) at offer for company *i*
$\beta_6 x_{6i}$ denotes the control variable first day trading (%) for company *i*

$\gamma_1 D_{1i}$denotes the dummy variables for ownership structure (VC, BO with NB as a reference)
$\gamma_2 D_{2i}$denotes the dummy variables for industry group (financials, consumer, energy, industrials, communication, and technology with basic materials as a reference)
$\gamma_3 D_{3i}$denotes the dummy variables for country of stock exchange (Sweden, Denmark, Norway, and Finland with Iceland as a reference)
$\gamma_4 D_{4i}$denotes the dummy variables for the year of the IPO (2006, 2007, 2008, 2010, 2011, 2012, 2013, 2014, 2015, and 2016 with 2009 as a reference)

Furthermore, the general requirements for OLS are listed below (Brooks, 2014).

1. E (ε) = 0. The average value of the errors should be zero.
2. Var (ε) = $\infty < \sigma^2$. The errors' variance is constant and does not increase or decrease with the dependent variable (i.e. heteroscedasticity should not exist).
3. Cov ($\varepsilon_t, \varepsilon_j$) = 0. The errors should not be correlated with each other.
4. Cov (ε, x) = 0. The errors should not be correlated with the independent variables.
5. $\varepsilon \sim$ N (0, σ^2). The errors should be normally distributed.
6. Multicollinearity in too high of a degree should not exist. This means that two or more independent variables should not be highly correlated with each other.

To see if there exists a linear relationship between the dependent and independent variable, a Ramsey RESET test was performed. A White's test is performed to test for assumption (2). The Durbin-Watson statistics is used to test for autocorrelation, assumption (3). A Jarque-Bera test was conducted, to test for assumption (5). A variance inflation factor test and a correlation matrix were conducted, to test for multicollinearity, assumption (6).

The table below summarizes the assumptions, tests, and values to hold.

Assumption	**Test**	**Significance level or equivalent**
Linearity	Ramsey's RESET	> 5%
Homoscedasticity	White	> 5%
No autocorrelation	Durbin-Watson	Close to 2
Normally distributed errors	Jarque-Bera	> 5%
No multicollinearity	Correlation matrix and VIF	< 0.8

4. Results

This section presents the paper's results from the data collected and the tests conducted. The t-tests are presented in an attempt to illustrate whether there are any statistical differences between the three IPO-groups and different capital structures. Regression analysis is conducted to determine whether the selected independent variables have an impact on long-term performance. Furthermore, the results of the OLS assumptions are presented.

4.1 Presentation of data

Table 1 - Descriptive statistics

Variable/Ownership	Buyout-backed (BO)	VC-backed (VC)	Non-backed (NB)	All
Debt-to-equity *(mean/median)*	202 / 93 (%)	44 / 63 (%)	101 / 55 (%)	144 / 59 (%)
Age *(mean/median)*	33 / 17 (years)	10 / 17 (years)	32 / 14 (years)	32 / 15 (years)
Gross Profit Margin *(mean/median)*	-687 / 1,86 (%)	-1030 / 1,36 (%)	-701 / 2,98 (%)	-695 / 1,95 (%)
Share of Intangibles *(mean/median)*	42 / 49 (%)	33 / 46 (%)	22 / 14 (%)	30 / 26 (%)
Market capitalization at offer *(mean/median)*	10114 / 2263 (MSEK)	5014 / 2074 (MSEK)	2731 / 687 (MSEK)	5868 / 1266 (MSEK)
First day trading *(mean/median)*	4,32 / 2,24 (%)	-0,69 / 1,47 (%)	5,24 / 0 (%)	4,85 / 1,04 (%)
Abnormal return (CAGR) *(mean/median)*	18,39 / 2,24 (%)	27,43 / 5,14 (%)	15,08 / 6,68 (%)	17,42 / 6,68 (%)

Table 1 presents the descriptive statistics (mean and median) of the independent variables and the dependent variable used in the regression. Since a few companies in the sample are making losses, their gross profit margins are highly negative numbers. Consequently, the mean of the gross profit margin is negative for all sample groups. As expected, BO-backed IPOs are, on average, older companies with larger market capitalization, and more debt in comparison to VC-backed. In 4.2.1, it is tested whether the mean difference in Abnormal Return (CAGR) is statistically significant.

4.2 T-test

4.2.1 Ownership structure

H0 - There is no significant difference between BO-backed and VC-backed IPOs, compared to non-backed IPOs in terms of long-term returns

Table 2 - VC-/non-backed t-test

Variable	Count	Mean	St. Dev.	St. Dev. of Means
Abnormal return – VC-backed	20	0.2743	1.1027	0.2466
Abnormal return – non-backed	111	0.1508	0.4202	0.0399

Method	df	Value	Probability
t-test	129	0.8857	0.3775

Table 2 presents the results from the t-test between VC- and non-backed abnormal returns. The results display that there is no significant difference in the mean between the two samples (see Appendix 1).

Table 3 - BO-/non-backed t-test

Variable	Count	Mean	St. Dev.	St. Dev. of Means
Abnormal return – BO-backed	62	0.1839	0.4099	0.0521
Abnormal return – non-backed	111	0.1508	0.4202	0.0399

Method	df	Value	Probability
t-test	171	0.5023	0.6161

The results presented in Table 3 displays that there is no significant difference in the mean between BO- and non-backed abnormal returns (see Appendix 2).

4.2.2 Capital structure

H0 - There is no significant difference in long-term returns with increased debt in the capital structure

Table 4 - Debt-to-Equity t-test

Variable	Count	Mean	Std. Dev.	Std. Err. of Mean
Abnormal return - High D/E-ratio (>150%)	49	0.1309	0.3236	0.0462
Abnormal return - Low D/E-ratio (<75%)	104	0.2154	0.2154	0.0651

Method	df	Value	Probability
t-test	151	-0.8442	0.3999

A t-test was conducted to test for the difference in abnormal return for different capital structures. Two groups were constructed, (1) companies with a debt-to-equity ratio > 150% and (2) companies with a debt-to-equity ratio < 75%. The mean of the two groups' abnormal

return was compared. The results in Table 4 display that there are no significant differences in the mean of the two groups (see Appendix 3).

4.3 OLS Regression

H0 - There is no significant difference between BO-backed and VC-backed IPOs, compared to non-backed IPOs in terms of long-term returns

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H0 - There is no significant difference in long-term returns with increased debt in the capital structure

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Table 5 - Regressions

Variables	Regression 1	**Regression 2**	Regression 3
α	1.2192	**1.4016**	1.4803
Std. error	(0.5381)	**(0.5443)**	(0.5527)
p-value	[0.0248]**	**[0.0109]****	[0.0082]***
β_1 (Debt-to-Equity)	-0.0034	**-0.0580**	-0.0601
Std. error	(0.0124)	**(0.0338)**	(0.0343)
p-value	[0.7826]	**[0.0880]***	[0.0820]*
β_2 (lnAge)	0.0057	**0.0169**	0.0091
Std. error	(0.0330)	**(0.0320)**	(0.0328)
p-value	[0.8633]	**[0.5981]**	[0.7807]
β_3 (Profit Margin)	0.0007	**0.0007**	0.0007
Std. error	(0.0008)	**(0.0008)**	(0.0008)
p-value	[0.3939]	**[0.3875]**	[0.3680]
β_4 (Share of Intangibles)	0.0743	**0.1446**	0.1475
Std. error	(0.1690)	**(0.1673)**	(0.1797)
p-value	[0.6610]	**[0.3887]**	[0.4130]
β_5 (lnMarket Cap. at Offer)	-0.0131	**-0.0012**	-0.0077
Std. error	(0.0260)	**(0.0283)**	(0.0289)
p-value	[0.6152]	**[0.9664]**	[0.7900]
β_6 (First Day Trading)	0.5593	**0.3608**	0.3196
Std. error	(0.2155)	**(0.2292)**	(0.2473)
p-value	[0.0061]***	**[0.1174]**	[0.1981]
γ_1 (Financials)	0.0477	**0.1102**	0.1125
Std. error	(0.2344)	**(0.2310)**	(0.2320)
p-value	[0.8390]	**[0.6339]**	[0.6285]
γ_2 (Energy)	-0.0557	**-0.0932**	-0.1143
Std. error	(0.2777)	**(0.2696)**	(0.2732)
p-value	[0.8413]	**[0.7301]**	[0.6764]
γ_3 (Consumer)	0.1135	**0.0894**	0.0763
Std. error	(0.2165)	**(0.2096)**	(0.2112)
p-value	[0.6009]	**[0.6703]**	[0.7181]
γ_4 (Communication)	0.2888	**0.2689**	0.2760
Std. error	(0.2607)	**(0.2515)**	(0.2532)
p-value	[0.2696]	**[0.2867]**	[0.2774]
γ_5 (Technology)	0.1997	**0.1440**	0.1596
Std. error	(0.2544)	**(0.2488)**	(0.2526)
p-value	[0.4337]	**[0.5637]**	[0.5284]
γ_6 (Industrials)	0.0157	**-0.0064**	-0.0037
Std. error	(0.2369)	**(0.2291)**	(0.2300)
p-value	[0.9474]	**[0.9778]**	[0.9872]
γ_7 (Sweden)	-0.2393	**-0.4252**	-0.4401
Std. error	(0.3975)	**(0.3894)**	(0.3911)
p-value	[0.5480]	**[0.2765]**	[0.2622]
γ_8 (Finland)	-0.1332	**-0.3187**	-0.3224
Std. error	(0.4100)	**(0.4020)**	(0.4041)
p-value	[0.7457]	**[0.4290]**	[0.4262]
γ_9 (Denmark)	-0.3256	**-0.4788**	-0.5244
Std. error	(0.4209)	**(0.4113)**	(0.4150)
p-value	[0.4403]	**[0.2461]**	[0.2084]
γ_{10} (Norway)	0.0994	**-0.3162**	-0.3295
Std. error	(0.4010)	**(0.3948)**	(0.3968)
p-value	[0.8046]	**[0.4243]**	[0.4075]
γ_{11} (VC-backed)	0.1573	**-0.0087**	-0.2780
Std. error	(0.1364)	**(0.1444)**	(0.3161)
p-value	[0.2503]	**[0.9520]**	[0.3805]
γ_{12} (Buyout-backed)	0.0560	**0.6693**	0.6122
Std. error	(0.0979)	**(0.3884)**	(0.3923)
p-value	[0.5687]	**[0.0868]***	[0.1207]
γ_{13} (IPO 2006)	-0.9901	**-1.0384**	-1.0125
Std. error	(0.3072)	**(0.3127)**	(0.3181)
p-value	[0.0015]***	**[0.0011]***	[0.0018]***
γ_{14} (IPO 2007)	-0.8487	**-0.8860**	-0.8819
Std. error	(0.3180)	**(0.3299)**	(0.3362)
p-value	[0.0084]***	**[0.0080]***	[0.0096]***
γ_{15} (IPO 2008)	-0.2448	**-0.3730**	-0.3719
Std. error	(0.3454)	**(0.3565)**	(0.3622)
p-value	[0.4795]	**[0.2970]**	[0.3061]
γ_{16} (IPO 2010)	-1.0480	**-1.1177**	-1.1104
Std. error	(0.3130)	**(0.3274)**	(0.3336)
p-value	[0.0010]***	**[0.0008]***	[0.0011]***
γ_{17} (IPO 2011	-1.0609	**-1.1475**	-1.1429
Std. error	(0.3080)	**(0.3184)**	(0.3241)
p-value	[0.0007]***	**[0.0004]***	[0.0006]***
γ_{18} (IPO 2012)	-1.0957	**-1.0802**	-1.0861
Std. error	(0.3586)	**(0.3639)**	(0.3698)
p-value	[0.0026]***	**[0.0035]***	[0.0038]***
γ_{19} (IPO 2013)	-0.8615	**-0.8820**	-0.8646
Std. error	(0.3212)	**(0.3271)**	(0.3323)
p-value	[0.0081]***	**[0.0078]***	[0.0102]**
γ_{20} (IPO 2014)	-0.9186	**-0.9082**	-0.8980
Std. error	(0.2894)	**(0.2999)**	(0.3065)
p-value	[0.0018]***	**[0.0029]***	[0.0039]***
γ_{21} (IPO 2015)	-0.9170	**-0.9537**	-0.9517
Std. error	(0.2856)	**(0.3028)**	(0.3090)
p-value	[0.0016]***	**[0.0020]***	[0.0025]***
γ_{22} (IPO 2016)	-1.0532	**-1.0827**	-1.0824
Std. error	(0.2801)	**(0.2942)**	(0.2992)
p-value	[0.0002]***	**[0.0003]***	[0.0004]***
γ_{12}*β_1 (BO*Debt-to-equity)		**0.0791**	0.0810
Std. error		**(0.0373)**	(0.0379)
p-value		**[0.0352]****	[0.0341]**
γ_{11}(VC)*R&D expense		**0.0034**	0.0029
Std. error		**(0.0016)**	(0.0017)
p-value		**[0.0410]****	[0.0915]*
γ_{12}*β_5 (BO*lnMcap)		**-0.1109**	-0.1019
Std. error		**(0.0560)**	(0.0567)
p-value		**[0.0496]****	[0.0740]*
γ_{12}*β_6 (BO*First Day Trading)		**1.3189**	1.3682
Std. error		**(0.5175)**	(0.5281)
p-value		**[0.0118]****	[0.0105]**
γ_{11}*β_4 (VC*Share of Intangibles)			-0.0328
Std. error			(0.4666)
p-value			[0.9441]
γ_{11}*β_6 (VC*First Day Trading)			0.0430
Std. error			(0.7969)
p-value			[0.9570]
γ_{11}*β_2 (VC*lnAge)			0.1560
Std. error			(0.1251)
p-value			[0.2144]

Table 5: Three different regressions presented with its respective constant, independent, and dummy- variables. For each variable, its value, standard error, and probability is displayed. Regression 2 is the regression later analysed. All regressions have Abnormal return (CAGR) as its dependent variable. See Appendix 4-6 for R^2 etc.

* Significance at 10%
** Significance at 5%
*** Significance at 1%

The regressions performed are presented in Table 5. The first regression (Regression 1) gave no statistically significant results, except for the year-dummies. A few assumptions were made and discussed regarding the nature of BO and VC-backed companies in Chapter 2. In Regression 3, some of these assumptions were tested with interaction terms. It was tested whether BO-backed companies' capital structures have an impact on the long-term returns (in comparison to non-backed IPOs' capital structures) by adding the interaction term BO*Debt-to-Equity. It was also tested whether VC-backed companies' R&D expenses, share of intangibles, and age had an impact on the long-term performance (compared to non-backed) by adding the interaction term presented in Regression 3.

To test if BO- and VC-backed IPOs are less underprized and its impact on long-term returns the interaction terms VC*First Day Trading and BO*First Day Trading were added. Regression 3 gave several significant results at a 10% and 5% level, e.g. the debt-to-equity level is expected to decrease the long-term return in general (at a 10% significance level), but is expected to increase the long-term returns for BO-backed IPOs compared to non-backed IPOs. The final regression (Regression 2) used only the significant interaction terms from Regression 3 which made the results, in general, more significant. Larger, in terms of market capitalization, BO-backed IPOs tend to have a negative impact on the long-term returns compared to non-backed IPOs. Increased amount of debt in comparison to equity has a positive effect on the long-term returns for BO-backed IPOs. An increased amount of R&D expenses has a positive impact for VC-backed IPOs compared to non-backed IPOs, but only with a $\beta = 0.0034$. IPOs with a higher first-day return have a positive long-term return impact for BO-backed companies compared to non-backed. In Regression 2, BO-backed IPOs are performing better long term in comparison to non-backed IPOs.

4.4 OLS Assumptions

4.4.1 Homoscedacity

A White's test was performed to test for heteroscedasticity. As shown in Appendix 7, the significance level is >5%, the threshold, and therefore the null hypothesis of heteroscedasticity can be rejected. Consequently, there is some evidence that the error is homoscedastic.

4.4.2 Autocorrelation

The Durbin-Watson statistics was used to test for autocorrelation, i.e. to test if the errors are correlated with each other. According to Brooks (2014), two indicated there is little evidence of autocorrelation, a number close to zero indicated positive autocorrelation, and a number close to four indicated negative autocorrelation. As seen in Appendix 4, the Durbin-Watson statistic is 1.91 which is close to two. Therefore, there is little evidence that the errors are autocorrelated.

4.4.2 Multicollinearity

A variance inflation factor (VIF) test and a correlation matrix were conducted to test for multicollinearity. According to Brooks (2014), some correlation between the independent variables will exist, but issues will arise if the variables are too correlated. The correlation matrix in Appendix 9 displays that the correlation between different variables are all close to 0, which is confirmed by the VIF test where all centred VIF are close to 1 and there is no spike (see Appendix 8).

4.4.3 Non-linearity

A Ramsey RESET test was performed to test whether a linear model should be applied. The test was performed on Regression 1 by adding the squared residual to the regression (Brooks, 2014). The test result shows (see Appendix 10) that the F-statistics has <5% significance, which is the threshold, and therefore rejects the null hypothesis of linearity. Consequently, the model used is misspecified and there exists non-linear relationships in the independent variables. Also, confirmed by the interaction terms' significance in Regression 2 and 3. Thus, significant interaction terms were added in Regression 2.

4.4.4 Normally distributed residuals

A Jarque-Bera test was conducted to test if the residuals are normally distributed. The result shows that the p-value was 0.0000, and thus the null hypothesis of non-normality could not be rejected (see Appendix 11). However, the Gauss-Markov theorem states that as long as the errors' mean is 0, the errors' variance is constant, and the errors are uncorrelated. The OLS estimator is still the best linear unbiased estimator (Wooldrigde, 2013). Brooks (2014) further argues that the parameter estimates will still be consistent if the errors' mean is zero and its variance is constant. The result, see Appendix 11, displays that the residual (which is a proxy for the error terms) mean is zero, and in previous sections it has been proven that the residual variance is constant (see *4.4.1*) and that the residuals are uncorrelated (see *4.4.2*), and therefore OLS is still chosen as the method for analysing the data. Furthermore, due to the sample size and its graphic appearance, the errors can be assumed to be approximately normally distributed, according to the central limit theorem (Brooks, 2014).

4.5 Hypotheses outcome

H1 - There is a significant difference between BO-backed and VC-backed IPOs, compared to non-backed IPOs in terms of long-term returns

BO-backed IPOs perform better long-term compared to non-backed IPOs. There is no significant difference between VC-backed and non-backed IPOs in respect of long-term performance. However, R&D expenses have a minor positive impact on long-term returns for VC-backed IPOs.

H2 - There is a significant difference in long-term returns with increased debt in the capital structure

Higher debt in comparison to equity has a negative impact on long-term returns (at a 10% significance level). For BO-backed companies, increased debt in the capital structure has a positive impact on the long-term returns.

5. Analysis and discussion

This section analyses the empirical results of previous chapters presented in the form of tables and figures. The analysis is based on the paper's underlying theory and the research questions of the paper. The reasoning is conducted based on previous research. Furthermore, the authors discuss reflections around the result.

Previous research comparing BO-/VC-backed versus non-backed IPOs long-term performance has presented a variety of results. The results presented in Chapter 4 displays that BO-backed IPOs, in long-term, outperform its non-backed peer IPOs (at a 10% significance level), as the authors' expected. It is in line with previous research presented by Levis' (2011), who found BO-backed to outperformed VC-backed IPOs, as well as the market in general. Also, in line with Bergström et al. (2006) and Cao and Lerner (2009), that presented results proving BO-backed IPOs to outperform other IPOs in the European and the US market, respectively. This paper's results regarding BO-backed IPOs long-term performance compared to non-backed IPOs contradicts the conclusion presented by Jelik et al. (2005). They did not see a statistically significant difference between sponsored and non-sponsored IPOs. Hence, the sample consisted of MBO-backed IPOs and might, therefore, generate different results. DeGeorge and Zeckhauser (1993) and Holthausen and Larcker (1996) did not find a significant difference in terms of BO-backing and long-term returns. Although, their sample consisted of BO-backed IPOs going back to the 1980s' and might, hence, come to other conclusions.

The results presented in Chapter 4 additionally examined whether VC-backed IPOs perform better long-term than non-backed IPOs. The results confirmed no statistical significance. Hamao et al. (2000) did a similar study on the Japanese market. They found that the positive returns of VC-backed IPOs were generally not statistically significant from zero, which corresponds to the results of this paper. Rindermann (2004) investigated the French, German, and the UK market, and found overall similar results. A few previous papers' have presented results of the opposite, that VC-backed IPOs perform better long-term (Krishnan et al., 2009 and Brav & Gompers, 1997). However, all these studies are made on the US market and use different performance metrics to receive the results. The authors expected, based on the previously presented theories, VC-backed IPOs to perform worse long-term compared to non-backed IPOs. The certification hypothesis states that VC-backed IPOs should be less under-priced due to the decreased level of information asymmetry, according to Megginson and Weiss

(1991). The authors believed that this would harm long-term returns, which is also supported by Ritter (1998).

The authors found evidence confirming BO-backed IPOs to have a higher debt-to-equity ratio, in comparison to both VC-backed and non-backed IPOs, which was expected (see Appendix 12). Levis (2011) clarifies that a higher debt ratio has a positive effect on long-term stock returns. Cao and Lerner (2009) found similar results. The authors found, on the contrary, the debt-to-equity ratio had a negative impact (at a 10% significance level) on long-term returns. However, this result corresponds to Dimitrov's and Jain's (2008) and Korteweg's (2010) studies. The authors expected that the debt-to-equity ratio would have a positive impact on the long-term returns due to the leverage effect, where the higher returns would correspond with higher risk.

This paper confirms (at a 5% significance level) that an increased debt-to-equity level has a positive impact on the long-term returns for BO-backed IPOs compared to non-backed IPOs. This might be due to the higher management expertise and closer monitoring, according to Jensen (1986). Levis (2011) also argued that the number of non-backed IPOs with total debt to assets ratios comparable to their BO-backed counterparts is relatively small, which might imply that non-backed companies are not taking advantage of the leverage effect. Furthermore, Muscarella and Vertsuypens (1990) argue that a higher debt ratio forces management to improve the company's operations and thus demonstrates better long-term returns. Non-backed companies have lower debt levels compared to its BO-backed counterpart, which might imply that non-backed companies do not feel as forced to focus on operational improvement. Contrarily, Holthausen and Larcker (1996) argue that while the higher debt levels might motivate the company's managers to operate more efficiently during the time they are private, this might have the opposite effect once they IPO due to the decrease in debt levels. These findings by Holthausen and Larcker (1996) might be an explanation to the results showing a negative relationship between debt-to-equity and long-term returns. Gomes and Schmid (2010) state that the decisive factor for long-term returns depends on how debt is used. The authors speculated that BO firms have greater expertise and experience on how to leverage debt compared to non-sponsored companies. Thus, BO firms might better use the increased debt level to increase long-term returns.

According to the certification hypothesis, the authors expected that VC-backed companies would be less under-priced compared to its non-backed counterparts. As mentioned earlier, the authors assumed that this would harm long-term returns. Loughran et al. (1994) mentioned that first-day return is a good proxy for measuring the effect of under-pricing. The results displayed that the average VC-backed IPOs have a lower first-day return than non-backed IPOs, which might imply less under-pricing. However, the regression results found no significant evidence that the decreased level of under-pricing harmed long-term returns for VC-backed companies. For BO-backed IPOs, the first-day return had a positive impact on the long-term results compared to non-backed IPOs, implying that under-pricing increases the long-term returns for BO-backed IPOs. Bergström (2006) stated that BO-backed IPOs generally are less under-priced and therefore underperform in the aftermarket. Conversely, BO-backed IPOs that are more under-priced should perform better long-term, confirmed by the results.

This paper found that R&D expenses had a positive effect on long-term returns for VC-backed companies compared to non-backed companies, although, without crucial impact. The certification hypothesis also implies that VC-backed companies have more complex business models which is why the "certification" is needed, for investors to believe that the company is more profitable and consequently increasing the long-term returns. Therefore, the certification hypothesis should hold for more complex VC-backed IPOs. Since high R&D expenses usually means a more complex business, the authors tested if it has a positive impact on long-term performance for VC-backed companies.

5.1 Model impact

Previous research uses different metrics for long-term returns. Brav and Gompers (1997) investigated long-term returns for VC-backed IPOs, using equal-weighted returns. In their paper, value weighting reduced the performance differences, and therefore resulted in VC-backed IPOs outperformed its non-backed counterpart. Levis (2011) used the cumulative abnormal three-year return as a metric for long-term returns and found that BO-backed IPOs achieve positive and significant returns, similarly to the results of this paper, even though with the use of other metrics.

In this paper a time frame of three years is used, which is in line with previous studies within this field. It can be argued that studying a longer time frame to determine long-term

performance might capture the actual impact better. The impact of the capital structure might have confirmed different results if a longer time period was used. Furthermore, the years following the financial crisis of 2008 and 2009 has been a time of economic growth. The companies completing IPOs during these years have never seen a recession, which their long-term performance might have benefitted from.

The results showing that BO-backed IPOs perform better long-term than non-backed IPOs and that the debt level has a negative impact on long-term returns, are both results based on a 10% significance level. This implies a 10% probability of rejecting a correct null hypothesis (that BO-backed IPOs do not outperform non-backed IPOs and that the capital structure does not have an impact on long-term returns). A significance level of 5% is the most commonly used one (as mentioned in 3.5) in previous research. If 5% significance would have been the threshold, BO-backed IPOs would not significantly outperform non-backed IPOs, and this paper's result would have been in line with Jelik et al.'s (2005). Similarly, the debt-to-equity ratio would not have a significant impact on long-term returns if a 5% significance level were used.

5.2 Benchmark impact

Based on the assumption of stock performance, this paper includes different benchmarks to test the genuine picture of long-term stocks' performance. However, the choice of market index, as benchmark, to account for the stock market and obtain the abnormal return, has an impact on the result. Group MSCIs sector indices are used as a comparison in the paper. For each IPO, a specific European index is used, which reflects an index for the whole of Europe. Therefore, this paper´s result could generate another result if the index were exchanged with a Nordic index. Additionally, (Fama, 1998; Dutta & Jog, 2009) state that an important part of measuring post-IPO performance is benchmarking long-term stock returns as the choice of benchmark influences the results of the tests. Respectively used benchmark indices also include the IPO to compare with, which has an impact on the actual result. The indices include all IPOs (VC, BO and non-backed) in all comparisons.

It can be argued that the result could have been different if an own index was created, matching the risk profile of the data, in terms of example market capitalization, debt-to-equity ratio, company age, indicating a better match to the sample used. On the other hand, Barber and Lyon

(1997) as well as Brav et. al. (2003) argue that adjusting the indices by excluding the IPOs in the sample has little impact on the actual results. Even if it could potentially lead to making the abnormal returns retrieved to be biased. Instead the authors could have used the reference portfolio approach, such as a market portfolio (index), as a benchmark. This could have led to less misspecified test statistics, impacting the results with three observed biases: new listing bias, rebalancing bias, and skewness bias (Barber & Lyon, 1997). The difference in results between papers' may be a methodological issue as the outcome depends strongly on the used method and benchmark of the paper. Same underlying data can therefore yield different results.

One can argue that choosing the Nordic stock market could have a specific impact on the results. The European sovereign debt crisis, which began in 2008 and peaked between 2010 and 2012, had a bigger impact on the crisis than the Nordic countries, therefore the results could have been different if the authors used an index, especially for the Nordic countries. The authors do not think that this would have a specific impact on the three different IPO groups and thus all groups operate in the Nordic market.

5.3 Data selection impact

The fact remains that the data is relatively small and differs in size between the three IPO-groups. The sample consists of 111 non-backed, 62 BO-backed IPOs and 20 VC-backed IPOs. If the paper had the same amount of BO and VC-backed as the amount of non-backed IPOs, the result could be influenced.

The result in this paper may differ from other papers, due to the choice of geographical stock market. Previous research has been done on bigger markets, with another economic environment, and therefore the IPOs may behave differently. Previous research, for example the US market, could be affected by other incidents. The Nordic stock market, compared to the US and UK stock market, includes, in general, smaller companies. Although, the small company effect, demonstrated by, i.e. Reinganum (1981), indicates that small companies generally generate a higher risk-adjusted return than large companies, which means that this paper inevitably takes this change of direction.

6. Conclusion

This section answers the purpose of the paper, based on the results of the research presented and analysed. Furthermore, suggestions for further research are presented.

6.1 Conclusion

The purpose of this paper was to examine whether there exist differences in terms of long-term stock price performance between BO and VC, compared to non-backed IPOs. Furthermore, the purpose was to examine the capital structure´s influence on long-term stock performance. The result confirmed a statistical significance for the long-term performance of BO-backed IPOs. The relationship between the three-year abnormal return and BO-backing is thereby confirmed. However, the results confirmed no statistical significance for the long-term performance of VC-backed IPOs. Therefore, it could not be confirmed whether there exists a relationship between three-year abnormal returns and VC-backing. Regarding the difference in capital structures, a higher level of debt in comparison to equity has a positive effect on the long-term performance for BO-backed IPOs compared to non-backed IPOs. Generally, an increased level of debt-to-equity has a negative effect on the long-term performance.

6.2 Suggestions for future study

This paper does not include fundamental characteristics of the sponsorship- such as the sponsor's ownership stake and the level of engagement of the sponsor. The ownership stake surely has an impact and could in future studies be distinguished as a variable. Which could give a higher level of explanation (increased R^2) to the regression and give a deeper analysis of BO-backed firms' impact on the returns. Similarly, the level of engagement of the sponsor might be of interest, whether the sponsor has passive or active ownership. Furthermore, the same study could be conducted with the same method but with different metrics. As an example, ROA (return on assets) or ROE (return on equity) could be used to measure profitability instead of the gross profit margin. The metrics CAR or BHAR could have been used instead of the abnormal return (CAGR).

7. References

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8. Appendix

Appendix 1 - t-test VC-backed/non-backed

Test for Equality of Means Between Series
Date: 05/19/20 Time: 13:17
Sample: 1 193
Included observations: 193

Method	df	Value	Probability
t-test	129	0.885654	0.3775
Satterthwaite-Welch t-test*	20.00508	0.494562	0.6263
Anova F-test	(1, 129)	0.784383	0.3775
Welch F-test*	(1, 20.0051)	0.244592	0.6263

*Test allows for unequal cell variances

Analysis of Variance

Source of Variation	df	Sum of Sq.	Mean Sq.
Between	1	0.258603	0.258603
Within	129	42.53000	0.329690
Total	130	42.78860	0.329143

Category Statistics

Variable	Count	Mean	Std. Dev.	Std. Err. of Mean
AR_CAGR...	20	0.274293	1.102708	0.246573
AR_CAGR...	111	0.150762	0.420245	0.039888
All	131	0.169622	0.573710	0.050125

Appendix 2 - t-test BO-backed/non-backed

Test for Equality of Means Between Series
Date: 05/19/20 Time: 13:15
Sample: 1 193
Included observations: 193

Method	df	Value	Probability
t-test	171	0.502283	0.6161
Satterthwaite-Welch t-test*	128.9867	0.505849	0.6138
Anova F-test	(1, 171)	0.252288	0.6161
Welch F-test*	(1, 128.987)	0.255883	0.6138

*Test allows for unequal cell variances

Analysis of Variance

Source of Variation	df	Sum of Sq.	Mean Sq.
Between	1	0.043785	0.043785
Within	171	29.67754	0.173553
Total	172	29.72132	0.172798

Category Statistics

Variable	Count	Mean	Std. Dev.	Std. Err. of Mean
AR_CAGR...	62	0.183938	0.409936	0.052062
AR_CAGR...	111	0.150762	0.420245	0.039888
All	173	0.162652	0.415690	0.031604

Appendix 3 - t-test Debt-to-equity ratio

Test for Equality of Means Between Series
Date: 05/19/20 Time: 13:29
Sample: 1 193
Included observations: 193

Method	df	Value	Probability
t-test	142	0.883181	0.3786
Satterthwaite-Welch t-test*	141.6164	1.264634	0.2081
Anova F-test	(1, 142)	0.780008	0.3786
Welch F-test*	(1, 141.616)	1.599298	0.2081

*Test allows for unequal cell variances

Analysis of Variance

Source of Variation	df	Sum of Sq.	Mean Sq.
Between	1	0.261663	0.261663
Within	142	47.63564	0.335462
Total	143	47.89731	0.334946

Category Statistics

Variable	Count	Mean	Std. Dev.	Std. Err. of Mean
LOW	104	0.215411	0.664015	0.065112
MEDIUM	40	0.120240	0.238654	0.037734
All	144	0.188975	0.578745	0.048229

Test for Equality of Means Between Series
Date: 05/19/20 Time: 13:28
Sample: 1 193
Included observations: 193

Method	df	Value	Probability
t-test	116	0.395315	0.6933
Satterthwaite-Welch t-test*	103.9048	0.532387	0.5956
Anova F-test	(1, 116)	0.156274	0.6933
Welch F-test*	(1, 103.905)	0.283436	0.5956

*Test allows for unequal cell variances

Analysis of Variance

Source of Variation	df	Sum of Sq.	Mean Sq.
Between	1	0.061890	0.061890
Within	116	45.93979	0.396033
Total	117	46.00168	0.393177

Category Statistics

Variable	Count	Mean	Std. Dev.	Std. Err. of Mean
LOWEST	87	0.222884	0.701449	0.075203
HIGHEST	31	0.170847	0.347618	0.062434
All	118	0.209213	0.627038	0.057724

Test for Equality of Means Between Series
Date: 05/19/20 Time: 13:20
Sample: 1 193
Included observations: 193

Method	df	Value	Probability
t-test	151	-0.844244	0.3999
Satterthwaite-Welch t-test*	150.7918	-1.058754	0.2914
Anova F-test	(1, 151)	0.712747	0.3999
Welch F-test*	(1, 150.792)	1.120961	0.2914

*Test allows for unequal cell variances

Analysis of Variance

Source of Variation	df	Sum of Sq.	Mean Sq.
Between	1	0.238094	0.238094
Within	151	50.44172	0.334051
Total	152	50.67981	0.333420

Category Statistics

Variable	Count	Mean	Std. Dev.	Std. Err. of Mean
HIGH	49	0.130863	0.323630	0.046233
LOW	104	0.215411	0.664015	0.065112
All	153	0.188334	0.577425	0.046682

Appendix 4 - Regression 1

Dependent Variable: AR_CAGR
Method: Least Squares
Date: 05/19/20 Time: 12:41
Sample: 1 193
Included observations: 190

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.219195	0.538108	2.265709	0.0248
LAGE	0.005694	0.033014	0.172474	0.8633
DEBT_TO_EQUITY	-0.003422	0.012384	-0.276346	0.7826
PROFIT_MARGIN	0.000726	0.000849	0.854774	0.3939
LMCAP	-0.013090	0.025989	-0.503661	0.6152
SHARE_OF_INTANGIBLES	0.074260	0.169011	0.439379	0.6610
FIRST_DAY_TRADING	0.599308	0.215540	2.780491	0.0061
COUNTRY_DK	-0.325571	0.420880	-0.773547	0.4403
COUNTRY_SE	-0.239331	0.397495	-0.602100	0.5480
COUNTRY_NO	-0.099384	0.401034	-0.247818	0.8046
COUNTRY_FI	-0.133191	0.410045	-0.324819	0.7457
INDUSTRY_COM	0.288779	0.260690	1.107752	0.2696
INDUSTRY_CONS	0.113494	0.216542	0.524119	0.6009
INDUSTRY_ENER	-0.055695	0.277657	-0.200591	0.8413
INDUSTRY_FIN	0.047709	0.234389	0.203545	0.8390
INDUSTRY_IND	0.015653	0.236869	0.066081	0.9474
INDUSTRY_TECH	0.199699	0.254436	0.784871	0.4337
Y06	-0.990055	0.307197	-3.222865	0.0015
Y07	-0.848722	0.318022	-2.668750	0.0084
Y08	-0.244801	0.345417	-0.708713	0.4795
Y10	-1.047975	0.313003	-3.348127	0.0010
Y11	-1.060942	0.307988	-3.444749	0.0007
Y12	-1.095710	0.358646	-3.055133	0.0026
Y13	-0.861507	0.321240	-2.681821	0.0081
Y14	-0.918642	0.289379	-3.174527	0.0018
Y15	-0.916962	0.285605	-3.210599	0.0016
Y16	-1.053165	0.280062	-3.760474	0.0002
VC	0.157337	0.136373	1.153724	0.2503
BUYOUT	0.055938	0.097938	0.571159	0.5687

R-squared	0.224521	Mean dependent var	0.175796
Adjusted R-squared	0.089656	S.D. dependent var	0.529390
S.E. of regression	0.505102	Akaike info criterion	1.611529
Sum squared resid	41.07554	Schwarz criterion	2.107127
Log likelihood	-124.0953	Hannan-Quinn criter.	1.812289
F-statistic	1.664777	Durbin-Watson stat	1.910184

Appendix 5 - Regression 2

Dependent Variable: AR_CAGR
Method: Least Squares
Date: 05/19/20 Time: 13:42
Sample: 1 193
Included observations: 190

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.401592	0.544284	2.575111	0.0109
LNAGE	0.016881	0.031956	0.528253	0.5981
DEBT_TO_EQUITY	-0.057968	0.033768	-1.716641	0.0880
PROFIT_MARGIN	0.000711	0.000820	0.866524	0.3875
LNMCAP	-0.001196	0.028327	-0.042233	0.9664
SHARE_OF_INTANGIBLES	0.144617	0.167320	0.864310	0.3887
FIRST_DAY_TRADING	0.360825	0.229201	1.574273	0.1174
COUNTRY_DK	-0.478835	0.411299	-1.164201	0.2461
COUNTRY_SE	-0.425208	0.389417	-1.091909	0.2765
COUNTRY_NO	-0.316240	0.394798	-0.801017	0.4243
COUNTRY_FI	-0.318715	0.401967	-0.792890	0.4290
INDUSTRY_COM	0.268881	0.251498	1.069117	0.2867
INDUSTRY_CONS	0.089413	0.209599	0.426591	0.6703
INDUSTRY_ENER	-0.093196	0.269627	-0.345650	0.7301
INDUSTRY_FIN	0.110249	0.231026	0.477213	0.6339
INDUSTRY_IND	-0.006393	0.229067	-0.027907	0.9778
INDUSTRY_TECH	0.143986	0.248830	0.578653	0.5637
Y06	-1.038395	0.312667	-3.321087	0.0011
Y07	-0.886013	0.329894	-2.685753	0.0080
Y08	-0.372999	0.356456	-1.046411	0.2970
Y10	-1.117673	0.327441	-3.413354	0.0008
Y11	-1.147529	0.318400	-3.604046	0.0004
Y12	-1.080171	0.363885	-2.968437	0.0035
Y13	-0.881990	0.327104	-2.696360	0.0078
Y14	-0.908238	0.299918	-3.028293	0.0029
Y15	-0.953654	0.302822	-3.149226	0.0020
Y16	-1.082688	0.294205	-3.680053	0.0003
VC	-0.008715	0.144428	-0.060338	0.9520
BUYOUT	0.669287	0.388431	1.723054	0.0868
BUYOUT*DEBT_TO_EQUITY	0.079082	0.037306	2.119819	0.0356
VC*R_D_EXPENSE	0.003392	0.001646	2.060460	0.0410
BUYOUT*LNMCAP	-0.110891	0.056039	-1.978822	0.0496
BUYOUT*FIRST_DAY_TRADING	1.318905	0.517541	2.548409	0.0118

R-squared	0.298993	Mean dependent var	0.175796
Adjusted R-squared	0.156112	S.D. dependent var	0.529390
S.E. of regression	0.486316	Akaike info criterion	1.552672
Sum squared resid	37.13095	Schwarz criterion	2.116629
Log likelihood	-114.5039	Hannan-Quinn criter.	1.781123
F-statistic	2.092607	Durbin-Watson stat	2.081512
Prob(F-statistic)	0.001552		

Appendix 6 - Regression 3

Dependent Variable: AR_CAGR
Method: Least Squares
Date: 05/19/20 Time: 12:45
Sample: 1 193
Included observations: 190

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.480333	0.552696	2.678386	0.0082
LAGE	0.009148	0.032794	0.278948	0.7807
DEBT_TO_EQUITY	-0.060088	0.034324	-1.750626	0.0820
PROFIT_MARGIN	0.000747	0.000828	0.902792	0.3680
LMCAP	-0.007708	0.028896	-0.266729	0.7900
SHARE_OF_INTANGIBLES	0.147479	0.179655	0.820904	0.4130
FIRST_DAY_TRADING	0.319619	0.247271	1.292588	0.1981
COUNTRY_DK	-0.524364	0.415043	-1.263397	0.2084
COUNTRY_SE	-0.440138	0.391094	-1.125402	0.2622
COUNTRY_NO	-0.329548	0.396758	-0.830602	0.4075
COUNTRY_FI	-0.322400	0.404093	-0.797837	0.4262
INDUSTRY_COM	0.276013	0.253227	1.089983	0.2774
INDUSTRY_CONS	0.076294	0.211194	0.361248	0.7184
INDUSTRY_ENER	-0.114282	0.273242	-0.418245	0.6764
INDUSTRY_FIN	0.112472	0.232021	0.484748	0.6285
INDUSTRY_IND	-0.003696	0.230039	-0.016069	0.9872
INDUSTRY_TECH	0.159590	0.252570	0.631864	0.5284
Y06	-1.012495	0.318097	-3.182977	0.0018
Y07	-0.881865	0.336171	-2.623265	0.0096
Y08	-0.371890	0.362198	-1.026758	0.3061
Y10	-1.110369	0.333635	-3.328093	0.0011
Y11	-1.142864	0.324099	-3.526278	0.0006
Y12	-1.086129	0.369786	-2.937180	0.0038
Y13	-0.864620	0.332250	-2.602317	0.0102
Y14	-0.897971	0.306541	-2.929366	0.0039
Y15	-0.951703	0.308969	-3.080260	0.0025
Y16	-1.082363	0.299159	-3.618016	0.0004
VC	-0.278038	0.316137	-0.879485	0.3805
BUYOUT	0.612157	0.392254	1.560611	0.1207
BUYOUT*DEBT_TO_EQUITY	0.080993	0.037891	2.137516	0.0341
VC*SHARE_OF_INTANGIBLES	-0.032752	0.466610	-0.070192	0.9441
VC*R_D_EXPENSE	0.002924	0.001722	1.698150	0.0915
VC*LAGE	0.156007	0.125138	1.246680	0.2144
BUYOUT*LMCAP	-0.101914	0.056662	-1.798644	0.0740
BUYOUT*FIRST_DAY_TRADING	1.368171	0.528141	2.590539	0.0105
VC*FIRST_DAY_TRADING	0.042993	0.796943	0.053947	0.9570

R-squared	0.307090	Mean dependent var	0.175796
Adjusted R-squared	0.149611	S.D. dependent var	0.529390
S.E. of regression	0.488185	Akaike info criterion	1.572633
Sum squared resid	36.70204	Schwarz criterion	2.187858
Log likelihood	-113.4001	Hannan-Quinn criter.	1.821852
F-statistic	1.950034	Durbin-Watson stat	2.072757
Prob(F-statistic)	0.003073		

Appendix 7 - White's test

Heteroskedasticity Test: White
Null hypothesis: Homoskedasticity

F-statistic	1.430648	Prob. F(41,148)	0.0637
Obs*R-squared	53.92884	Prob. Chi-Square(41)	0.0850
Scaled explained SS	709.2538	Prob. Chi-Square(41)	0.0000

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 05/19/20 Time: 13:56
Sample: 1 193
Included observations: 190
Collinear test regressors dropped from specification

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.657995	1.378936	1.202373	0.2311
LNAGE^2	0.009357	0.039636	0.236064	0.8137
LNAGE*DEBT_TO_EQUITY	-0.013651	0.053521	-0.255065	0.7990
LNAGE*PROFIT_MARGIN	-0.013862	0.015173	-0.913601	0.3624
LNAGE*LNMCAP	0.015274	0.044708	0.341645	0.7331
LNAGE*SHARE_OF_INTANGIBLES	-0.620014	0.489319	-1.267096	0.2071
LNAGE*FIRST_DAY_TRADING	-0.241915	1.118412	-0.216302	0.8290
LNAGE*VC	1.549663	0.519160	2.984942	0.0033
LNAGE*BUYOUT	0.221644	0.295635	0.749722	0.4546
LNAGE	-0.076940	0.321188	-0.239549	0.8110
DEBT_TO_EQUITY^2	-0.001989	0.008138	-0.244446	0.8072
DEBT_TO_EQUITY*PROFIT_MARGIN	0.113813	0.115212	0.987856	0.3248
DEBT_TO_EQUITY*LNMCAP	0.018818	0.051787	0.363365	0.7169
DEBT_TO_EQUITY*SHARE_OF_INTANGI...	-0.159209	0.271344	-0.586744	0.5583
DEBT_TO_EQUITY*FIRST_DAY_TRADING	0.216024	0.766225	0.281933	0.7784
DEBT_TO_EQUITY*VC	0.655789	0.598056	1.096535	0.2746
DEBT_TO_EQUITY*BUYOUT	0.071775	0.132306	0.542494	0.5883
DEBT_TO_EQUITY	-0.097519	0.308844	-0.315754	0.7526
PROFIT_MARGIN^2	-5.12E-05	5.16E-05	-0.992665	0.3225
PROFIT_MARGIN*LNMCAP	-0.007687	0.008171	-0.940753	0.3484
PROFIT_MARGIN*SHARE_OF_INTANGIB...	0.085120	0.063888	1.332341	0.1848
PROFIT_MARGIN*FIRST_DAY_TRADING	-0.051120	0.057862	-0.883483	0.3784
PROFIT_MARGIN*VC	0.085306	0.034836	2.448770	0.0155
PROFIT_MARGIN*BUYOUT	0.020274	0.027358	0.741067	0.4598
PROFIT_MARGIN	0.009382	0.060551	0.154943	0.8771
LNMCAP^2	0.017798	0.032280	0.551373	0.5822
LNMCAP*BUYOUT	-0.148722	0.209616	-0.709494	0.4791
LNMCAP	-0.384637	0.396990	-0.968883	0.3342
SHARE_OF_INTANGIBLES^2	1.567800	1.915668	0.818409	0.4144
SHARE_OF_INTANGIBLES*FIRST_DAY_...	-3.150261	3.338181	-0.943706	0.3469
SHARE_OF_INTANGIBLES*VC	-7.747973	1.837108	-4.217484	0.0000
SHARE_OF_INTANGIBLES*BUYOUT	-0.509087	1.091362	-0.466470	0.6416
SHARE_OF_INTANGIBLES	-1.020688	2.357588	-0.432937	0.6657
FIRST_DAY_TRADING^2	0.594213	1.366459	0.434856	0.6643
FIRST_DAY_TRADING*VC	4.359586	2.873554	1.517141	0.1314
FIRST_DAY_TRADING*BUYOUT	1.029493	2.284064	0.450729	0.6528
FIRST_DAY_TRADING	1.411788	3.124443	0.451853	0.6520
VC^2	9.093332	2.139034	4.251139	0.0000
BUYOUT^2	0.371220	1.304147	0.284646	0.7763

R-squared	0.283836	Mean dependent var	0.265365
Adjusted R-squared	0.085439	S.D. dependent var	1.432420
S.E. of regression	1.369862	Akaike info criterion	3.659590
Sum squared resid	277.7251	Schwarz criterion	4.377353
Log likelihood	-305.6610	Hannan-Quinn criter.	3.950345
F-statistic	1.430648	Durbin-Watson stat	1.988339
Prob(F-statistic)	0.063690		

Appendix 8 - VIF

Variance Inflation Factors
Date: 05/19/20 Time: 14:11
Sample: 1 193
Included observations: 190

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
C	0.025456	17.36298	NA
LNAGE	0.001009	6.300978	1.331880
DEBT_TO_EQUITY	0.000152	1.416087	1.195252
PROFIT_MARGIN	7.52E-07	1.057153	1.031581
LNMCAP	0.000601	20.90909	1.518788
SHARE_OF_INTANGI...	0.024495	2.799892	1.207098
FIRST_DAY_TRADING	0.043963	1.110460	1.038502
VC	0.017865	1.282635	1.147621
BUYOUT	0.009231	2.054608	1.384157

Appendix 9 - Correlation matrix

Correlation							
	AR_CAGR	LNAGE	DEBT_TO_E...	PROFIT_MA...	LNMCAP	SHARE_OF...	FIRST_DAY...
AR_CA...	1.000000	0.014076	-0.011868	0.064105	-0.042053	0.062502	0.165755
LNAGE	0.014076	1.000000	0.176700	0.123299	0.441913	0.104170	0.094187
DEBT_...	-0.011868	0.176700	1.000000	0.067751	0.366748	0.101500	-0.016819
PROFI...	0.064105	0.123299	0.067751	1.000000	0.150559	0.007076	-0.025177
LNMCAP	-0.042053	0.441913	0.366748	0.150559	1.000000	0.014447	0.091486
SHARE...	0.062502	0.104170	0.101500	0.007076	0.014447	1.000000	0.085600
FIRST_...	0.165755	0.094187	-0.016819	-0.025177	0.091486	0.085600	1.000000

Appendix 10 - Ramsey RESET test

Ramsey RESET Test
Equation: UNTITLED
Omitted Variables: Squares of fitted values
Specification: AR_CAGR C LNAGE DEBT_TO_EQUITY PROFIT_MARGIN LNMCAP SHARE_OF_INTANGIBLES FIRST_DAY_TRADING COUNTRY_DK COUNTRY_SE COUNTRY_NO COUNTRY_FI INDUSTRY_COM INDUSTRY_CONS INDUSTRY_ENER INDUSTRY_FIN INDUSTRY_IND INDUSTRY_TECH Y06 Y07 Y08 Y10 Y11 Y12 Y13 Y14 Y15 Y16 VC BUYOUT

	Value	df	Probability
t-statistic	5.909646	160	0.0000
F-statistic	34.92392	(1, 160)	0.0000
Likelihood ratio	37.51275	1	0.0000

F-test summary:

	Sum of Sq.	df	Mean Squares
Test SSR	7.359379	1	7.359379
Restricted SSR	41.07554	161	0.255128
Unrestricted SSR	33.71616	160	0.210726

LR test summary:

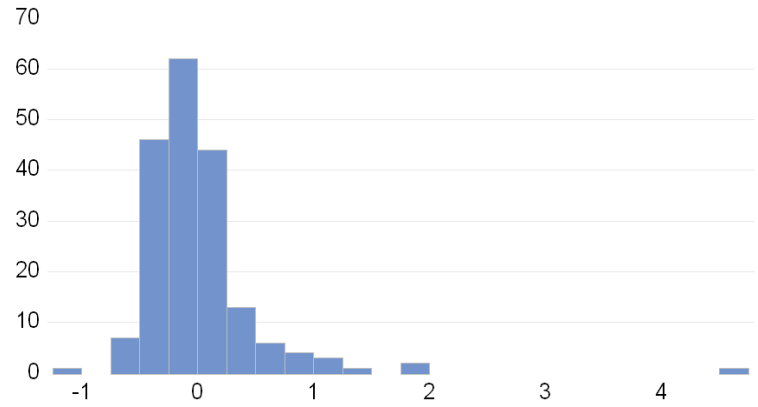
	Value
Restricted LogL	-124.0953
Unrestricted LogL	-105.3389

Unrestricted Test Equation:
Dependent Variable: AR_CAGR
Method: Least Squares
Date: 05/26/20 Time: 14:37
Sample: 1 193
Included observations: 190

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-2.095865	0.744204	-2.816252	0.0055
LNAGE	0.008542	0.030008	0.284650	0.7763
DEBT_TO_EQUITY	-0.004832	0.011257	-0.429248	0.6683
PROFIT_MARGIN	0.000401	0.000774	0.518537	0.6048
LNMCAP	0.021447	0.024332	0.881436	0.3794
SHARE_OF_INTANGIBLES	0.192683	0.154903	1.243894	0.2154
FIRST_DAY_TRADING	-0.483254	0.268196	-1.801868	0.0734
COUNTRY_DK	-0.137093	0.383834	-0.357167	0.7214
COUNTRY_SE	-0.020653	0.363143	-0.056874	0.9547
COUNTRY_NO	-0.141293	0.364539	-0.387594	0.6988
COUNTRY_FI	-0.032216	0.373051	-0.086358	0.9313
INDUSTRY_COM	-0.141653	0.247864	-0.571494	0.5685
INDUSTRY_CONS	-0.049389	0.198719	-0.248535	0.8040
INDUSTRY_ENER	-0.067050	0.252349	-0.265706	0.7908
INDUSTRY_FIN	-0.008751	0.213233	-0.041039	0.9673
INDUSTRY_IND	-0.009193	0.215313	-0.042696	0.9660
INDUSTRY_TECH	-0.062325	0.235450	-0.264708	0.7916
Y06	2.010776	0.579476	3.469992	0.0007
Y07	2.045180	0.568625	3.596714	0.0004
Y08	0.899904	0.368874	2.439597	0.0158
Y10	1.949891	0.581599	3.352639	0.0010
Y11	1.975421	0.585095	3.376239	0.0009
Y12	2.093815	0.630502	3.320868	0.0011
Y13	2.062987	0.574569	3.590495	0.0004
Y14	2.085962	0.572417	3.644132	0.0004
Y15	2.066417	0.567652	3.640286	0.0004
Y16	1.973278	0.571883	3.450492	0.0007
VC	-0.038297	0.128285	-0.298533	0.7657
BUYOUT	-0.083277	0.092073	-0.904466	0.3671
FITTED^2	2.729232	0.461827	5.909646	0.0000

R-squared	0.363462	Mean dependent var	0.175796
Adjusted R-squared	0.248089	S.D. dependent var	0.529390
S.E. of regression	0.459049	Akaike info criterion	1.424620
Sum squared resid	33.71616	Schwarz criterion	1.937308
Log likelihood	-105.3389	Hannan-Quinn criter.	1.632302
F-statistic	3.150329	Durbin-Watson stat	1.816391
Prob(F-statistic)	0.000002		

Appendix 11 - Jarque-Bera test



Series: Residuals
Sample 1 193
Observations 190

Mean	-5.84e-18
Median	-0.083974
Maximum	4.514310
Minimum	-1.043799
Std. Dev.	0.518829
Skewness	4.231439
Kurtosis	33.30475
Jarque-Bera	7837.485
Probability	0.000000

Appendix 12 - ANOVA debt-to-equity

Test for Equality of Means Between Series
Date: 05/19/20 Time: 14:14
Sample: 1 193
Included observations: 193

Method	df	Value	Probability
Anova F-test	(2, 190)	5.106043	0.0069
Welch F-test*	(2, 71.3875)	5.614845	0.0054

*Test allows for unequal cell variances

Analysis of Variance

Source of Variation	df	Sum of Sq.	Mean Sq.
Between	2	1119367.	559683.3
Within	190	20826270	109611.9
Total	192	21945636	114300.2

Category Statistics

Variable	Count	Mean	Std. Dev.	Std. Err. of Mean
NB_DEBT	111	100.7811	163.1627	15.48672
VC_DEBT	20	44.18350	86.85241	19.42079
BUYOUT_...	62	251.2287	539.4976	68.51627
All	193	143.2464	338.0831	24.33575