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Underpricing of private equity backed and non-backed IPOs

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Abstract

The aim of this paper is to contribute to the discussion on the effects of private equity ownership in general and the initial public offering underpricing conundrum in particular. In this thesis I describe initial public offering patterns, specifically I examine short-run underpricing differences between private equity backed and non-backed initial public offerings by evaluating 67 transactions between 2010 and 2017 on the Nasdaq Stockholm, out of which 35 offerings were private equity backed. Initially, I explore the mere existence of short-run underpricing on Nasdaq Stockholm. Subsequently, I investigate whether there are any underpricing differences between private equity backed and non-backed offerings and try explaining these using current research. My findings suggest that private equity backed initial public offerings exhibit lower underpricing than non-backed initial public offerings. Furthermore, I employ a model based on asymmetric information theory and find that offering size is associated with lesser degrees of underpricing. My findings suggest that when controlling for issue size, year and industry effects, the influence of private equity backing on initial public offering underpricing is reduced. These findings are consistent with previous research on US data.

Keywords: initial public offerings, private equity, private equity backed IPOs, underpricing, asymmetric information.

Tutor: Mariya Ivanova

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1.0 Introduction

1.1 Purpose

This thesis' main purpose is to provide an idea of the underpricing patterns for Northern European private equity(PE)-backed IPOs during the period 2010-2017. I provide this idea by investigating if PE-backed initial public offerings(IPOs) exhibit lower underpricing than non-backed IPOs. If PE-backed IPOs are found to be less underpriced, a natural secondary aim will be to explain why this occurs. The underpricing of an IPO is the listing of a stock below its market value and underpricing is measured as the first day return for the stock, or in other words the percent difference between the offer price and the close price of the first day. I am not the first to research the topic of underpricing. Subsequently, I aim to contribute to this well researched area by focusing on PE-backed IPOs.

The steady onset of private equity as a prominent ingredient Swedish economy during the last 30 years, suggests the proportion of PE-backed IPOs will increase as long as the IPO market continues to serve as an exit venue for the portfolio holdings of PE firms. The special circumstances surrounding private equity firms in an IPO is likely to influence the degree of underpricing. My thesis draws its theoretical inspiration from Megginson & Weiss (1990), where they show that Venture Capital(VC)-backed IPOs have relatively lower first-day returns compared to non-backed firms, which they attribute to VC certification reducing information asymmetry between investors and the issuing firm. In seeming contravention to this Beatty & Ritter (1986) show that there is an equilibrium relation between the expected underpricing of an IPO and the ex ante uncertainty about its value. They propose issue size as a proxy for ex ante uncertainty. In this paper I will investigate whether the relationship between PE-backing and IPO underpricing. In conclusion, my study aims to answer the following two research questions:

- Do PE-backed IPOs exhibit lower underpricing than non-backed IPO?
- Are larger issue sizes associated with lesser degrees of underpricing?

1.2 Background

Thirty years after the onset of the leverage buyouts of the 1980s, the role of private equity remains a heavily discussed topic in the popular press. As private equity funds have grown as an asset class amongst banks and institutional investors, critics have argued whether private equity is an appropriate financing source to further company growth and economic development. The steady progress of private equity is nevertheless stimulating interest in evaluating private equity fund short and long-term performance. The performance of PE-backed firms is of concern for both the Venture Capital and the buyout segment of private equity. Venture capital typically finance younger and emerging firms, whereas buyout funds chiefly invest in mature firms with lower operational risk (Kaplan & Strömberg, 2009). Private equity firms frequently use the IPO market as an alternative venue to exit both VC-backed and PE-backed firms. In this thesis I will analyse how PE-backed IPOs perform during the first day compared to non-backed firms.

Understanding the underpricing conundrum (Ritter & Welch, 2002) for IPOs is crucial for market participants and regulators alike. My research relates to different branches of previous IPO research. In Ibbotsson's seminal work (1975) the first empirical evidence for underpricing of IPOs in the US market is offered. Ibbottsson provided a list of reasonable explanations to IPO underpricing and many have been explored empirically during the last 30 years. According to Ritter & Welch (2002), one way of classifying underpricing theories is on the basis of whether asymmetric or symmetric information is assumed. My research relates to the much-emphasized asymmetric information explanation for IPO underpricing.

From an asymmetric information perspective, it is not unlikely that the incidence of PE firms in an IPO will influence the degree of underpricing because PE firms are subject to higher informational disclosure and scrutiny (from media and from investors), which lowers the degree of informational asymmetry between investors and the issuing firm. Megginson & Weiss (1990) document in support of the asymmetric information hypothesis that VC firms are significantly less underpriced than non-backed IPOs because PE firms can certify the value of the firm to investors. On the other hand, Beatty & Ritter (1986) suggest that larger issue sizes are less underpriced. If you pair that with the findings of Levis, (2011) and Barry, Muscarella, Peavy, & Vetsuypens, (1990), that PE-backed IPOs, are larger in terms of issue

size, it follows that PE-backed IPOs should be associated with lesser degrees of underpricing because they tend to be larger not because they certify the value of the IPO to investors. It is in the light of Megginson & Weiss (1990) and Beatty & Ritter (1986) that I aim to investigate if there are significant differences in underpricing between PE-backed and non-backed IPOs, and whether this is to do with the certificationary effect of private equity or because PE-backed IPOs are larger.

1.3 Scope of investigation

The scope of this thesis is limited to Sweden. It is interesting to take a closer look at Sweden since this study can serve as an interesting comparison to what is otherwise a US dominant research topic. Sweden is also interesting because private equity makes up roughly 5.5% of GDP in said country (Næss-Schmidt, Heebøll, & Karlsson, 2017). With such a heavy footprint in the Swedish economy, it is interesting to see if international PE-patterns also occur in Sweden.

The exchange that an IPO is listed on is likely to affect the underpricing of a new issue, since there is a larger network of financial information creation and distribution and stronger media scrutiny surrounding larger exchanges. Following this reasoning and considering that all PE-backed IPOs Between 2010-2018 were listed on Nasdaq Stockholm, it was necessary to limit the scope of the research to IPOs on Nasdaq Stockholm.

With regards to the time scope of my thesis, the sample period is limited between January 2010 and Dec 2017. This period was chosen because it falls after the Swedish financial crisis and it is sufficiently large to give a small albeit adequate sample size, without including IPOs from other exchanges in Sweden.

1.4 Contribution

My study contributes to the existing literature in several ways. First, my study increases the understanding of the PE-backed and non-backed IPO underpricing differential in a Swedish

setting. Since few studies have been conducted on Nasdaq Stockholm, there has not been sufficient documentation of this phenomenon. More knowledge on IPO underpricing is beneficial for regulators and market participants alike. Second, I use an updated dataset containing data after the financial crisis. This allows me to provide more recent evidence on these issues and indicate whether previous research findings hold true. Finally, I find that the influence of PE-backing in an IPO is reduced when you control for issue size, year and industry fixed effects. This contributes to the discussion on the effects of private equity ownership.

2.0 Literature review

In this section I will discuss the most pertinent ideas surrounding the area of the PE-backed IPOs. In order to think more clearly about this area, it is necessary to review the prevailing literature in IPO underpricing in general and PE-backed IPO underpricing in particular.

2.1 IPO magnitude underpricing

Ritter & Welch (2002) divide previous research within IPOs into: decisions to go public, pricing and allocation, and long-run performance. The focus of my research falls under the pricing and allocation ("short-run underpricing") portion of the IPO research area. Below I will discuss what the weight of evidence suggests concerning the magnitude of first day returns.

Stoll & Curley (1970), Logue (1973) and Ibbotson (1975) were the first to document a systematic increase from the offer price to the first day closing price. In academia, the term underpricing and first-day returns is used interchangeably. Ritter & Welch (2002) observe that approximately 70% of IPOs end the first day of trading at a closing price greater than the offer price, on a dataset of American IPOs that stretches from 1980-2001. More recent research corroborates this finding. Loughran & Ritter (2004) report 6391 IPOs in the US between 1983-2002 and reports average underpricing of 19%. Shi, Pukthuanthong, & Walker (2013) studies underpricing patterns in 34 countries and finds average underpricing of approximately 30 percent, with lower average underpricing patterns in the Northern Europe. The weight of evidence suggests average underpricing of most IPOs ranges from 15 to 20%. The underpricing phenomenon for operating companies is therefore seemingly consistent over time and geographies (Ritter & Welch, 2002).

Although IPO research regarding underpricing has been extensive, an academic consensus has not yet prevailed regarding why underpricing occurs. One thing researchers agree on is that it is unlikely that simple market misvaluation or asset-pricing risk premia explain

average first day return in the order of 15 to 20%. As Ritter & Welch (2002) describes it, since average returns are much lower, if first day investors demand such sizeable returns to compensate them for bearing systemic risk in the IPO, why do second-day investors not need this compensation (average returns are in the magnitude of roughly 0.05%), since fundamental and liquidity risk is unlikely to be resolved within one day? Thus, the solution to the underpricing puzzle has to lie in focusing on the setting of the offer price, where the normal interplay of supply and demand is suppressed by the underwriter (Ritter & Welch, 2002). In the next section I will discuss how researchers think about the reasons for underpricing and how this relates to my study.

2.2 IPO underpricing theories

Ritter & Welch (2002) classifies theories of underpricing on the basis of whether asymmetric information or symmetric information is assumed. The former can, in turn, be classified into theories in which IPO issuers are more informed than investors and into theories in which investors are more informed than the issuer (perhaps about demand). A related subset of IPO underpricing research concerns the underpricing of sponsor-backed IPOs. Sponsors in this instance relates to financial intermediaries such as PE and VC firms. Due to the special function that sponsors serve in the economy, the presence of Sponsor firms is likely to influence the underpricing of Sponsor-backed IPOs. The pioneering efforts in this research area where due to Megginson & Weiss (1990) and Barry et al. (1990). Megginson & Weiss (1990) compare VC-backed IPOs to non-backed IPOs matched by industry and offering size between January 1983 and September 1987. Their findings suggest that the first-day returns of VC backed IPOs are significantly lower than returns for non-IPOs. They argue that their results are consistent with the idea that venture capitalists certify the true value of the firm to outside investors and therefore reduce underpricing. This reduction in underpricing instead accrues to the owners of the firm at the IPO.

Barry et al. (1990) on the other hand focus on the monitoring role of venture capitalists in IPOs between 1978 and 1987 and find that the ownership, the length of board service, and the number of VCs invested in the firm before the IPO are negatively correlated to IPO

underpricing. Based on this correlation, they surmise that venture capitalists are ‘‘recognized by capital markets through lower underpricing for IPOs with better monitors’. Habib & Ljungqvist (2001) take a different approach. They put forth the wealth incentives of the old shareholders rather, which are dependent on the retained shares in the IPO rather than the incidence of PE-backing to explain the difference in underpricing between PE-backed and non-backed IPOs.

The breadth of evidence suggests that PE-backed IPOs are significantly less underpriced in relation to non-backed IPOs. Muscarella & Vetsuypens (1989), Fall & Mohan, (1991), Hogan, Olson, & Kish (2001), Ang & Brau (2002), Cao & Lerner (2006), Schöber (2008) and Ferretti & Meles (2011) observe a lesser degree of underpricing for PE-backed IPOs compared to non-backed IPOs or similar control transactions. The PE-backed IPOs in these papers exhibit underpricing in the order of 2 to 10 percent, except for Cao and Lerner (2006) who observe average underpricing for PE-backed IPOs of 15 percent. These investigations have been conducted outside of Sweden which makes it interesting to investigate if this pattern also occurs in Sweden.

2.3 IPO underpricing and uncertainty about the offering

While it is true that IPOs are underpriced on average, many new issues decline during the first day of trading. Consequently, even though on average initial public offerings are underpriced, an investor purchasing a stock cannot be certain about the value of the IPO before it starts trading publicly. Beatty & Ritter (1986) call this uncertainty ex ante uncertainty, and in the mentioned paper they show that there is a relationship between the uncertainty of the issues and the expected underpricing of the IPO. This means that the greater the uncertainty of a new offering the larger the first day return should be. Beatty & Ritter (1986) propose Issue size as a proxy for ex ante uncertainty and they expect larger issues to exhibit less uncertainty and therefore exhibit lesser degrees of underpricing. This theory is especially interesting considering PE firms float larger issues on average, since the IPO market often serves as a final exit route for the holdings of PE firms. Therefore, I have another explanation compared to the certificationary effect proposed by Megginson & Weiss, (1990) for why PE-backed IPOs exhibit lower underpricing. It is interesting to see if the

certificationary effect is more important than the issue size of the float, for the underpricing of an IPO. I will describe this setting more closely in the Hypotheses development.

2.4 Peak Year literature and industry dummies

Financial and non-financial reasons play a role in the decision of companies to go public. In most cases the reason to go public is the desire to raise equity capital and create a market in which shareholders can convert some of their wealth into cash at a future date, nonfinancial reasons such as increased publicity play only a minor role for most firms (Ritter & Welch, 2002). This still leaves the question of why the motivation to do an IPO is stronger in some times or times than in others. (Gompers & Lerner, 2001) report that there were fewer U.S. IPOs from 1935 to 1959 than 1969 alone for example. A related issue to the uneven volume distribution of IPOs across years, is that underpricing tends to also vary across years. Ibbotson and Jaffe (1975), suggest that underpricing has a positive correlation with high volume IPO years. They find that during so called "hot markets" IPOs tend to be more underpriced than other years. They reason that during "hot markets", a not insignificant portion of IPOs may be unattractive to well informed investors. Underpricing can thus be used to stimulate demand for the IPO.

A related phenomenon to the positive correlation between underpricing and "hot markets", is that specific industries exhibit less underpricing than others. Kaplan & Stromberg (2004) describe the due diligence and analyses conducted by venture capitalists prior to the provision of financing. These processes combined with the specific sector experience these firms accumulate makes the portfolio companies of financial sponsors cluster in certain industries. In Lee & Wahals' (2004) sample of 6,413 VC and Non-VC Backed IPOs between 1980 and 2000, they find that venture financing is disproportionately provided to firms in technology-intensive industries, particularly software and commercial biological research. The analytical processes involved in screening prospective portfolio companies, seemingly leads to investing in firms in certain industries, with properties that sponsors are looking for. This is relevant from an underpricing perspective since the underpricing magnitude in a specific industry might be reflected in the expected underpricing of the particular IPO.

3.0 Hypothesis development

In this section I will present my hypotheses and empirical predictions based on theory and previous research. After those have been presented I will discuss the hypotheses for my controlling factors. I will start by presenting the theoretical foundation underpinning my main hypotheses.

Asymmetric information theory conjectures that underpricing in an IPO results from informational asymmetries between the issuing firm, the underwriter (usually an investment bank), and investors purchasing shares in the IPO. Because the parties have different information about let's say the projects of the firm, corporate insiders have an incentive to hide or postpone the revelation of adverse information because doing so will enable them to offload securities at a higher price. Rational investors understand the incentives of corporate insiders and will only offer a low average price for the securities offered unless they can be credibly assured that the offering price already reflects all relevant information. This in turn, can create a market failure of the type described by Akerlof (1970) unless the informational asymmetries can be meaningfully lessened. Megginson and Weiss (1990) suggest that this information asymmetry can be reduced by VC firms if three tests are met:

- First, the certifying agent must have reputational capital at stake which would be lost by certifying an over-valued new issue as fairly priced.

- Second, the value of the certifying firm's reputational capital must be greater than the largest possible one-time wealth transfer which could be gained by certifying falsely.

- Third, the services of the certifying agent must be costly for the issuing firm to obtain and the cost structure must be such that a separating equilibrium is achieved between high and low information quality firm.

Megginson and Weiss (1990) mean that venture capitalists can certify the quality of the offering to investors, thus reducing the information asymmetry between the issuer and the

investor. This in turn increases the willingness of the investor to purchase the offering at a higher price, thus increasing the gain to the owners of the issuing firm and reduces the underpricing of the stock.

I propose that similarly to VC firms, PE firms are also able to pass the aforementioned tests put forth by Megginson and Weiss for the following reasons:

- Firstly, because PE firms regularly bring companies public. This in turn indicates that PE firms risk losing access to the IPO market on favourable term if they certify an over-valued issue as fairly priced.

- Secondly because the returns for financial sponsors are directly related to the reputational capital of the firm, since it allows the certifying firm to retain access to the IPO market. It stands to reason that the gains of reputational capital will surpass any one-time wealth transfer.

- Thirdly, PE firms just like VC firms certainly seem to meet this test since the financial capital, managerial and technical expertise, enhanced access to other financial specialists they provide as well as certification when the firm ultimately goes public-is both very costly and very difficult to obtain (Megginson & Weiss, 1990).

This ought to indicate that PE firms could similarly to VC firms provide a certification of the value of the issuing firm and therefore reduce the information asymmetry between the issuer and the investor, and as a result increase the willingness of the investor to pay for the stock. This in turn decreases the underpricing of the stock and this is the theoretical foundation for the certification effect that I aim to explore in this paper. This reasoning leads me to my first hypotheses.

H_1 : *PE-backed IPOs exhibit a lesser degree underpricing compared to non-backed IPOs.*

Following Megginson & Weiss (1990), I expect a PE-backed IPOs to exhibit a lesser degree of underpricing. This in turn indicates that I expect a negative sign for the coefficient in my

regression model. I also expect the presence of a PE firm in an IPO to be negatively correlated with underpricing.

In my second hypothesis I will investigate if there is evidence that larger IPOs exhibit lesser degrees of underpricing. Beatty & Ritter (1986) show that there is a positive correlation between the expected underpricing of an IPO and the ex ante uncertainty about it true value. That is, the more uncertain an investor is about the value of the firm, the more underpricing is needed to entice her to buy into the IPO. In their paper they suggest using issue size as a proxy for ex ante uncertainty. Therefore, I suggest the following hypothesis.

H_2 *: Issue size has a negative correlation with underpricing.*

Following previous research, I expect a negative correlation between issue size and underpricing. Therefore, I expect the sign for the coefficient to be negative. This means that larger issue sizes should exhibit lower degrees of underpricing.

3.1 Control variables

In this section I will discuss my hypotheses for the controlling factors in my model. Previous literature suggests that underpricing varies across years. According to Ibbotson & Jaffe (1975) underpricing has a positive correlation with high volume IPO years. The theoretical foundation behind this relationship is that less informed investors require IPOs to exhibit a higher degree of underpricing during times of considerable IPO activity. This would indicate that the level of IPO activity during a year should be positively correlated with the underpricing of IPOs, which leads me to my third hypothesis:

H_3 : *The level of IPO activity during a year has a positive correlation with underpricing.*

Since I expect years with many IPOs to exhibit higher degrees of underpricing, I expect the coefficient to be positive.

For my fourth and final hypothesis I want to investigate if industries, in which many IPOs occur exhibit higher underpricing. This hypothesis is especially interesting since the portfolio holdings of PE firms tend to cluster in certain industries. Previous research indicates that underpricing is higher in industries where many IPOs occur. This leads me to my last hypothesis.

H_4 : *Industries with many IPOs have a positive correlation with underpricing.*

Since I expect industries with many IPOs to exhibit higher degrees of underpricing, I expect the coefficient to be positive.

4.0 Methodology

In order to understand the effects how PE-backing and Issue size, as well as industry and year effects, affect underpricing of an IPO, I will use a regressions analysis. Below I present the model I intended to use to test my hypotheses.

4.1 Dependent Variable

I measure my dependant variable, UP as the difference between the offer price, obtained from the IPO prospectus and the first day close price, obtained from Yahoo finance.

$$UP_i = \frac{P_{i,\mathrm{c}} - P_{i,\mathrm{o}}}{P_{i,\mathrm{o}}}$$

Where $p_{i,\mathrm{o}}$ is the offer price and $p_{i,\mathrm{c}}$ is the closing price at he end of the first day of trading. UP_i equals the underpricing of the IPO.

I then separate PE-backed IPOs from non-backed IPOs when calculating underpricing for various portfolios. I first measure under-pricing for these two respective groups of IPOs on an

aggregate level, before calculating portfolios on industry segments as well as years. I then calculate equally weighted underpricing for all portfolios, by assigning the same weight to each return regardless of the relative market capitalization of each stock. The formula is defined as below:

$$UP_p^{EW} = \frac{1}{n_p}\sum_{i=1}^{n_p} up_i$$

Where UP_p^{EW} is the equally weighted underpricing for portfolio p.

Furthermore, I calculate value weighted returns, by assigning weights to stocks in proportion to their market capitalization in the portfolio. Value weighting returns allows for perceiving differences in underpricing between large and small firms.

The value weighted abnormal portfolio return formula is defined as

$$UP_p^{VW} = \sum_{i=1}^{n_p} up_i * \frac{Mkt\ Cap_i}{\sum_i^N Mkt\ Cap_i}$$

Where UP_p^{VW} is the value *w*eighted level of underpricing for N IPOs.

4.2 Main Independent variables

PE-backed

PE-backed is a dummy variable which takes the value 1 if the IPO was backed by a PE firm and zero otherwise. I hypothesize that there should be a negative relationship between this variable and underpricing.

Ln(IssueSize)

Beatty and Ritter (1986) argue that there is a positive relationship between the "ex ante" uncertainty about the value of a firm and the expected underpricing in an IPO. This means that smaller issue sizes should be associated with higher underpricing. I use the natural logarithm to reduce the influence of extreme observations. I have hypothesized a negative relationship between issue size and underpricing.

4.3 Control variables

Peak underpricing years

Ibbotson & Jaffe (1975) documented the effect of "hot" IPO issue markets, where IPO underpricing is concentrated in periods with high IPO activity. To control for changing market conditions during the sample period I include offer year dummy variables in my regression model.

Since the sample is very skewed to the end of the measurement period this is true for:

2014, 2015, 2016 and 2017.

For example, the dummy variable 2015 takes the value 1 if the IPO occurred in 2015, 0 otherwise. This is common practice when regressing for sponsor influence. See Lee & Wahal (2004) for example.

Industry fixed effects

Because previous research suggests industries with many IPOs, have a positive correlation with underpricing, I control for the high number of IPOs in the manufacturing, real estate and pers/bus/rep svc by including control variables for these industries. These dummy variables take the value 1 when the IPO occurs in the specific industry, 0 otherwise.

4.4 Regression model

Now that I have defined my independent variable, dependant variable and control variables I have in fact specified my regression model. I will test my empirical predictions using the simple regression model presented in the equation below:

$$UP = \propto + \beta_1 PE - backed + \beta_2 Manufacturing + \beta_3 \text{Pers/bus/Rep svc}$$
$$+ \beta_4 \text{Real estate} + \beta_5 2014 + \beta_6 2015 + \beta_7 2016 + \beta_8 2017 + \beta_9 Ln(Issuesize) + \varepsilon$$

This model is my starting point, but it is subject to change if I find strong reason to suspect multicollinearity present in the model.

5.0 Empirical data

In this section I will begin by outlining my method for selecting the sample used in my empirical tests. I will then discuss my data collection and my choice of time period. I will end this section by giving a short overview of Nasdaq Stockholm and display some descriptive statistics of the selected sample as well as show coefficient correlations for the variables in my regression model.

5.1 Sample Selection

I have selected one sample of Swedish IPOs for one purpose, testing my empirical predictions. I chose to limit my sample to IPOs that were listed on Nasdaq Stockholm sometime in the period 2010-2017, because I wanted to have a recent dataset in order to compare my eventual findings with older research. The preliminary sample was selected after

adjusting the sample I obtained from SDC Platinum. The data quality issues associated with SDC Platinum are well known (Ljungqvist, 2018). They include among others: misreporting of shares outstanding, misreporting of shares issued in IPOs, misreporting of first day returns and mislabelling VC, PE and non-backed IPOs. I discuss below how this affected my data gathering process and the steps I took to rectify this.

The preliminary sample was obtained by selecting all new equity issues over the period 2010-2017, this left me with 181 companies, which made up the foundation of my sample. In the next step I removed IPOs that failed to fulfil any of the following requirements (see Table 1 for a detailed summary of the data selection process).

First, I removed new issues that were not original IPOs and listings that did not raise capital, because secondary offerings and list changes fall outside of the scope of this paper. The list a company IPOs on is likely to affect the underpricing of the issue, because the lists are ordered after size and receives different media and analyst coverage. Therefore, I removed all IPOs that were not listed on Nasdaq OMX. This reduced my sample by 92 firms.

In the second step, I wanted to ensure that my sample was correctly labelled with regards to PE and non-backed. To do this I obtained the prospectuses of all listings and relabelled mislabelled IPOs accordingly and removed VC-backed IPOs. This is because the mislabelling would have affected the outcome of the empirical tests and VC ownership is outside the scope of this thesis.

Lastly, I removed unsuccessful IPOs because they don't allow for calculation of underpricing. The final sample consisted of 67 PE and non-backed IPOs from 2010-2017.

Table 1 shows the details of the sample selection.

Criteria*	Adjustments	#IPOs
Original dataset within delimination*		181
Original IPO on Nasdaq Stockholm	92	89
PE-backed and non-backed	9	80
Successfull IPO	5	75
(Removed duplicates)	8	67
Total	**114**	**67**

***Critera**

*PE-backed and non-backed IPO of an operating company on Nasdaq Stockholm
*Original IPOs that raises funds.

*Period 2010-2017

5.2 Data collection and time period

Because of the well documented data quality issues in SDC Platinum I deemed it necessary to compile data on first day returns and issue size. I collected data on issue size and first day returns for the period 2010-2017 using IPO prospectuses and Yahoo Finance. IPO prospectuses were used to obtain offer prices and issue sizes while Yahoo finance was used to obtain data on first day close prices. I have chosen the time period 2010-2017 for two reasons. First, one of the contributions of this this paper is to make a study of IPO underpricing in Sweden using recent data. This time period fulfils this purpose. Second, prospectuses are easier to obtain for more recent IPOs because they are generally still available on the investor relations page, on their companies' respective webpages. This simplified the compiling of first day returns and issue sizes. Bearing these two facts in mind, I selected the time period 2010-2017.

5.3 Sample Characteristics

The Nasdaq Stockholm is the largest stock exchange in Sweden. It had 604 listed companies at the end of March and a total market capitalization of approximately 12000 Billion SEK. The stock exchange is home to some of the largest companies in the Nordics and is highly international with roughly half of the ownership coming from outside of Sweden. The exchange has four market segments: Large cap, mid cap, small cap and first north. The first three hosts stocks in declining order of market capitalization whilst first North hosts newer companies, typically of lower market capitalizations.

Table 2 displays the number of investigated IPOs on Nasdaq Stockholm between 2010-2017. As previously noted the total number of IPOs in my sample is 67 out of which 32 are PE-backed and 35 are non-backed. It is my contention that my sample is reflective of the overall market, especially with regard to PE-backed IPOs. I note that the IPO volumes exhibit a non-uniform pattern across the years in the sample. Table 3 demonstrates the low activity on the IPO market in the beginning of the measurement period, following the financial crisis which hit its peak in October 2008. The IPO market remains quite stable for 3 years after which it soars in activity between 2014-2017. I note that PE-backed IPOs follow the activity of the wider IPO market relatively well. The overall pattern is that non-backed IPOs make up the majority of IPOs in nearly all years except 2015. I note that PE-backed IPOs make up more than two thirds of IPOs in 2015 in my sample. If the sample is indicative of the overall population, the overall picture suggests that demand for equity financing seems to cluster around certain high-volume years, similar to what Ritter & Welch (2002) discuss.

Table 2 exhibits the volume distribution of PE-backed and non-backed IPOs across years over the measurement period.

Year	2010	2011	2012	2013	2014	2015	2016	2017	Total
PE-backed	1	1			4	12	7	7	**32**
Non-PE-backed	1	2		1	9	6	7	9	**35**
Total	**2**	**3**	**0**	**1**	**13**	**18**	**14**	**16**	**67**

Table 3 exhibits the volume distribution of PE-backed and non-backed IPOs across years over the measurement period.

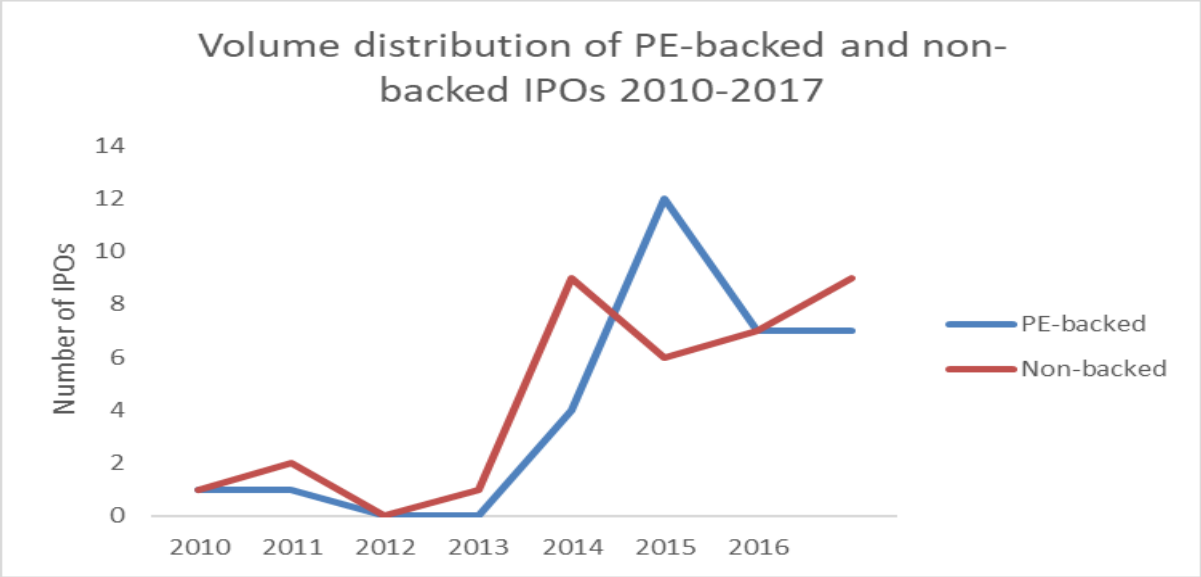

Table 4 show the year of new issues and its corresponding median and average issue size. In the table I, I can see that the years associated with the highest volume also exhibit the largest total issue size. In my sample PE-backed IPOs raises far more capital in the IPO market than non-backed IPOs despite the proportion of PE-backed IPOs being smaller. Issue sizes varies across years. I note that for all years, PE-backed IPOs have higher medians and averages for issue size. Although not reported here PE-backed IPOs make up 12 out of the 15 largest IPOs in terms of Issue size. Focusing briefly on issue size over market capitalization, I note the approximate loss of control that occurs when a firm is listed. I note that for all years, PE-backed IPOs have a higher issue size over market capitalization (and thus a lower retained share). This higher offering share for PE-backed IPOs can be understood from the perspective that the owners use the IPO market to exit the lion share of their investment. The fact that

issue size over market capitalization is not 100 percent indicates that PE firms are not able to exit their whole investment at once.

I also note that issue size over market capitalization is relatively stable for both groups over the measurement period. This quotient is larger for PE-backed IPOs not only because of the wealth incentives of the owners but also because PE-backed IPOs are larger in terms of market capitalization. That is, if non-backed IPOs would issue the same amount as PE-backed IPOs their share would be lower since market capitalization, the denominator, is larger for PE-backed IPOs. Table 5 displays the average, total and median market capitalization over the period.

Table 4 shows the mean, median and total issue size in MSEK as well as issue size relative to market capitalization of PE-backed and non-backed IPOs respectively over the period 2010-2017. The last column exhibits the total sum over the period. Issue size is defined as the total amount of capital raised over the period, or shares offered times the offer price, depending on the information given in the IPO prospectus.

Issue Size Msek	2010	2011	2012	2013	2014	2015	2016	2017	Total
PE-backed									
Mean	623	580			2792	2754	2142	1685	2256
Median	623	580			1830	2591	950	1113	2035
Total	623	580			11169	33045	14992	11792	72201
Issue size/Market Cap	55%	57%			55%	53%	39%	47%	49%
Non-Backed									
Mean	550	305		650	1099	1986	720	622	892
Median	550	479		650	815	1100	759	560	645
Total	550	609		650	9889	11917	5040	5600	34255
Issue size/Market Cap	31%	23%		26%	39%	37%	33%	32%	34%
Year	2010	2011	2012	2013	2014	2015	2016	2017	Total

Table 5 exhibits the mean, median and total market capitalization in MSEK for PE-backed and non-backed IPOs, respectively, across the measurement period. The market capitalization refers to the number of shares outstanding times the offering price at the time of the IPO.

Market Cap Msek	2010	2011	2012	2013	2014	2015	2016	2017	Total
PE-backed									
Mean	1125	1017			5656	5820	6097	3739	5108
Median	1125	1017			4700	4873	3295	2947	3720
Total	1125	1017			22623	69845	42681	26175	163466
Non-PE-Backed									
Mean	1750	1229		2500	2608	5139	2415	2029	2748
Median	1750	1229		2500	1629	3342	2477	1474	1750
Total	1750	2459		2500	23476	30833	16903	18259	96180
Year	2010	2011	2012	2013	2014	2015	2016	2017	Total

Table 6 and 7 shows the distribution of IPOs across industries in my sample. Here I note that there is some overlap in industries between PE-backed and non-backed IPOs as manufacturing firms firm make up the largest portion of IPOs for both PE and non- backed IPOs. The second largest fraction of IPOs where real estate companies for non-backed IPOs, reflecting the strong housing market in Stockholm. The rest of the PE-backed IPOs were similarly distributed across other industries.

Table 6 exhibits the volume distribution of PE-backed IPOs on the Nasdaq Stockholm across year and industry for the measurement period 2010-2017.

PE-backed IPOS

Industry	2010	2011	2012	2013	2014	2015	2016	2017	Total
Commercial Bank						1	1		2
Construction						2		1	3
Healthcare						2	1		3
Leisure								1	1
Manufacturing					1	3	2	3	9
Other Services							2	1	3
Pers/Bus/Rep Svc		1				1		1	3
Radio/TV/Telecom					1				1
Restaurant/hotel					1	1			2
Retail	1								1
Transportation						1			1
Wholesale						2	1		3
Total	1	1			4	12	7	7	32

Table 7 exhibits the volume distribution of non-backed IPOs on the Nasdaq Stockholm across year and industry for the measurement period 2010-2017.

Non-backed IPOs

Industry	2010	2011	2012	2013	2014	2015	2016	2017	Total
Co-generation	1								1
Commercial Bank							1		1
Construction							1	1	2
Healthcare								1	1
Investment Bank						2			2
Manufacturing		1			3	1	3	4	12
Other Finance							1		1
Pers/Bus/Rep Svc		1				1	1	2	5
Radio/TV/Telecom						1			1
Real Estate				1	5	1			7
Wholesale					1			1	2
Total	1	2		1	9	6	7	9	35

5.4 Correlation coefficients between variables in the regression model

Table 8 displays the Pearson statistic between the appropriate variables in my regression model.

	UP	ln(Issue size)	PE	2017	2016	2015	2014	Real estate	Manufacturing	Pers/bus/Rep svc
LN(Issue Size)	-0.140618	1								
PE	-0.283778	0.34892896	1							
2017	-0.092001	-0.2032995	0.0783	1						
2016	0.0410177	-0.2032995	0.13407	-0.2874	1					
2015	-0.165353	0.35437413	0.13407	-0.2874	-0.3056	1				
2014	0.1826204	-0.0738729	-0.1708	-0.2874	-0.3056	-0.3056	1			
Real estate	-0.061231	-0.0156809	-0.3292	-0.1989	-0.2115	-0.0609	0.39088	1		
Manufacturing	-0.099392	-0.1764658	0.01739	-0.0444	0.02708	-0.079	0.13313	-0.2748292	1	
Pers/bus/Rep svc	0.3043713	-0.0837359	-0.0713	0.1127	-0.0609	0.08971	-0.2115	-0.1463415	-0.274829179	1

I present the Pearson correlations between the variables in my model in Table 8. I expect my dependant and independent variables to be correlated, thus contributing to the model's explanatory power. I note that both issue size and PE-backing exhibit negative correlation with underpricing. I also note that PE-backing and issue size is positively correlated (In 5.3 I showed that PE-backed IPOs raise far more capital). Both these findings are according to my

expectations. In 5.3 I saw that certain industries made most of their listing during a particular year. This means that I expect some of my dependant variables to be highly correlated. I discuss multicollinearity in further detail in 6.5.

Overall, the results are in line with my expectations. All my independent variables are correlated to my dependent variable. I note that years 2017 and 2016 has very low correlation to underpricing. This indicates that these variables are likely to contribute less to the explanatory power in my regressions. This is in contravention to Ibbotson & Jaffe (1975). Remember that high issue years should according to previous research be positively correlated with underpricing. Because 2016 and 2017 are correlated with industry variables and exhibit low correlation with underpricing and I therefore decide to exclude them from my model. Similarly, I decide to exclude real estate because most of the IPOs in this sector occurred in 2014. This means that including both would likely lead strong correlation between those variables. I also decide to exclude 2015 since this was a year associated with very large issues and hence the correlation between issue size and 2015 is very large. My final model is therefore the following:

$$UP = \propto +\beta_1 PE - backed + \beta_2 Manufacturing + \beta_3 \text{Pers/bus/Rep svc} + \beta_4 2014 + \beta_5 Ln(Issuesize) + \varepsilon$$

6.0 Results

In the section below, I present the results of undepricing for PE-backed IPOs and non-backed IPOs. This section is divided into two parts. In the first section I present my preliminary results and in the second section I show you my results from the t-tests and regression analysis.

6.1 Underpricing results

Table 9 demonstrates PE-backed and non-backed IPOs on average exhibit 3 and 8% underpricing respectively, consistent with my prediction that PE-backed IPOs are associated with lower degrees of underpricing. The table also displays that there are large variations in underpricing across years. PE-backed IPOs a lesser degree of underpricing during almost all years. I note that years of larger IPO volumes are associated with higher underpricing. I also note that the relatively high underpricing is to a large degree the result of the high underpricing during high volume IPO years. In IPO research, the positive correlation between underpricing and high IPO volumes is referred to as “hot markets”, see Ritter (1984). My sample share this characteristic to some degree with previous research.

Table 9 displays the yearly equally weighted underpricing of PE-backed and non-backed IPOs during the measurement period 2010-2017. Underpricing is defined as the first day return for the stock, the percent change between the offer and close price of the first day.

Year	PE-backed	#IPOs	Non-backed	#IPOs
2010	-4%	1	2%	1
2011	-3%	1	22%	2
2012				
2013			1%	1
2014	4%	4	13%	10
2015	-1%	11	8%	6
2016	6%	6	9%	7
2017	8%	7	2%	9
Average	3%		8%	
#IPOs	32		35	

Table 10 below shows average underpricing across the industries in the sample. The broad picture suggests that PE-backed IPOs exhibit less underpricing in most industries. I note that certain industries exhibit particularly high degrees of underpricing. The industries with the highest degree of average underpricing is Wholesale, Pers/Bus/Rep svc. and other services. Other services refer to educational and elderly care services companies. The industry specification was obtained from SDC Platinum.

Table 10 exhibits the equally weighted underpricing of non-backed and PE-backed IPOs, across industries, at the Nasdaq Stockholm exchange between 2010-2017.

Pe-backed IPO			Non-backed IPOs		
Industry	Underpricing	#IPOs	Industry	Underpricing	#IPOs
Commercial Bank	-3%	2	Co-generation	2%	1
Construction	5%	3	Commercial Bank	10%	1
Healthcare	4%	3	Construction	-4%	2
Leisure	1%	1	Healthcare	-1%	1
Manufacturing	1%	9	Investment Bank	0%	2
Other Services	11%	3	Manufacturing	4%	12
Pers/Bus/Rep Svc	2%	3	Other Finance	15%	1
Radio/TV/Telecom	-6%	1	Pers/Bus/Rep Svc	22%	5
Restaurant/hotel	6%	2	Radio/TV/Telecom	7%	1
Retail	-4%	1	Real Estate	4%	7
Transportation	-6%	1	Wholesale	21%	2
Wholesale	3%	3	Total	8%	35
Total	3%	32			

I also want to discuss the results from the value weighted calculation of underpricing. Table 11 shows that depending on the weighting method you obtain different levels of underpricing. When using the equally weighted method, the underpricing for both PE-backed and non-backed IPOs is lower, by quite a considerable margin. This is because the equally value weighted method does not account for the differences in size between issues and market capitalizations. There is no consensus regarding which method to use. The lower value for value weighted underpricing suggest that large issue sizes are associated with lower underpricing. This finding might lend support to the ex ante uncertainty hypothesis, i.e larger issue sizes exhibit lesser degrees of underpricing because they are associated with higher degrees of scrutiny from analysts and the media. This is also a reason that could explain why PE-backed IPOs exhibit lower underpricing, i.e because they tend to be bigger in terms of offering size. I go into this in more detail in 6.2.

Table 11 exhibits the different underpricing results obtained depending on the weihgting method. Underpricing is defined as the percent change between the offer and close price during the first day.

Method	PE-backed	Non-backed
Equally weighted	3%	8%
Value weighted	2%	6%

My initial results suggest there are variations in underpricing across industries and year, with PE- backed IPOs in general exhibiting less underpricng. Now that I have discussed my preliminary underpricing results I will interpret the results from my statistical test and cross - sectional analysis.

6.2 Statistical results and analysis of research variables

Table 12 shows a summary of the hypotheses, the appropriate test used and the outcome of the test.

Null Hypotheses	Statistical test	Outcome
H1: PE-backed IPOs exhibit more or the same degree of underpricing compared to non-backed IPOs	one-sided t-test and linear regression	Accepted
H2: Issue size has no or positive correlation with underpricing in an IPO	one-sided t-test and linear regression	Rejected
H3: The level of IPO activity during a year has no or negative correlation with the degree underpricing in an IPO	Linear regression	Rejected
H4: High underpricing industries have no or negative correlation with IPO underpricing	Linear regression	Accepted

Hypothesis 1. My first hypothesis tested for higher underpricing for PE-backed IPOs, compared to non-backed firms. First, I tested this hypothesis univariately, using a student's t-test. I chose a one-sided test because previous research suggested that PE-backed IPOs exhibit lesser degrees of underpricing. The outcome of the t-test suggested that my hypothesis

was correct, and that PE-backed IPOs exhibit lesser degrees of underpricing. See table 13 for t-test results.

After having secured that this relationship was true on a univariate basis, I tested the second hypothesis using linear regression. The results from the linear regression deny the first hypothesis. This result rejects that the presence of a PE-backer in an issuing firm act to reduce the degree of underpricing and this increase in market value accrues to the owners of the issuing firm (Megginson & Weiss, 1990). This result suggests that more than simply PE-backing is correlated with the lesser degree of underpricing for PE-backed IPOs. See table 14 for cross-sectional results.

Hypothesis 2. My second hypothesis tested for issue size having a negative correlation to underpricing. Similar to above, I tested this hypothesis univariately at first, using a student's t-test. I choose a one-sided test because previous research suggested that issue size had a negative correlation with underpricing. The t-test was used to see if the average Issue size was significantly larger for PE-backed firms, because the larger issue sizes for PE-backed IPOs could hypothetically explain the lesser degree of underpricing for PE-backed IPOs.

The outcome of the test suggested that PE-backed IPOs have an average issue size that is larger than non-backed IPOs. After having secured this relationship univariately, I tested hypothesis 2 using linear regression. The results from the linear regression confirm my initial hypothesis. The coefficient proved highly significant, indicating that issue size plays a significant role in the underpricing of IPOs. This result might support that ex ante uncertainty about the offering is positively correlated with underpricing. This might in turn indicate that larger IPOs are associated with more scrutiny from media and investors which reduces the information asymmetry between the issuer and the investor and increased the willingness of the investor to pay a higher offer price for the IPO.

Table 13 shows the t-test conducted for underpricing and issue size. The tests indicate that PE-backed IPOs exhibit lower average underpricing and larger average issue size.

Underpricing	*PE-backed*	*Non-backed*	*Issue size*	*PE-backed*	*Non-backed*
Obs	30	35	Obs	30	35
Degrees of freedom	48		Degrees of freedom	50	
t-stat	-1.697052285		t-stat	3.472679908	
P(T<=t) one-sided	0.048081466		P(T<=t) one-sided	0.00053626	
t-critical value one-sided	1.677224196		t-critical value one-sided	1.675905025	
P(T<=t) two-sided	0.096162931		P(T<=t) two-sided	0.001072521	
t-critical value two sided	2.010634758		t-critical value two sided	2.008559112	

Hypothesis 3. My third hypothesis tested for years of high issuing activity having a positive correlation with IPO underpricing. I tested this hypothesis using linear regression. The result from the regression confirm my initial hypothesis for year 2014. This means that IPOs during this year is associated with larger degrees of underpricing. The tendency of IPOs to show higher degrees of underpricing in high volume years, is consistent with the hot issue theory of Ibbotson (1975). The time period can likely be characterized by positive investor sentiment, causing many investors to buy into the IPO on the first day of trading. When a lot of new firms are listed, certain IPO candidates may be considered unattractive to well informed investors. In this regard, underpricing might be used by the underwriter to stimulate demand for the new issue.

Hypothesis 4. My final hypothesis tested for specific industries having a positive correlation with underpricing. This hypothesis was also tested using linear regression. The result from my regression show that IPOs in manufacturing are associated with lesser degrees of underpricing and IPOs in Pers/bus/Rep svc are associated with higher degrees of underpricing. I note however that only manufacturing is significant. This means that I accept the null hypothesis. The negative coefficient for manufacturing is not strange considering the low average underpricing across the measurement period in the manufacturing industry. The negative coefficient indicates that IPOs in that segment are correlated with lower underpricing.

Table 14 reports the cross-sectional regression results with underpricing as the dependant variable and PE-backing, issue size as independent variables and year and industry as controlling variables.

Regression statistics	
Multiple R	0.430
R square	0.185
Adjusted R Squared	0.118
Standard Error	0.130
Observations	67

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	5	0.23556239	0.047112	2.799354	0.024309997
Residual	61	1.037736841	0.017012		
Total	66	1.273299231			

	Coefficents	*Stardard error*	*t stat*	*P-value*	*VIF*	*Tolerance*
Konstant	0.176627117	0.050952805	3.466485	0.000972		
LN(issue size)	-0.020192166	0.008097917	-2.4935	0.015377	7.97	0.13
PE_backed	-0.032148058	0.034212371	-0.93966	0.351097	8.68	0.12
Manufacturing	-0.102456866	0.060472033	-1.69429	0.093456	9.79	0.1
Pers/bus/Rep svc	0.069329553	0.050968707	1.360238	0.150146	8.12	0.12
2014	0.086266173	0.045723741	1.886682	0.043965	9.72	0.1

6.3 Concluding Analysis

The results of the t-tests and the cross-sectional analysis seem to indicate that PE firms, because of the size of their offering, may be associated with more publicity from media and analysts, thus reducing the ex ante uncertainty about the value of the IPO, which reduced the expected underpricing for the IPO (Beatty & Ritter, 1986). The strategy of private equity firms to float larger issues, time the IPO and select more suitable industries that are associated with a lesser degree of underpricing, seem to contribute significantly to the lesser degree of underpicing for PE-backed IPOs compared to non-backed IPOs.

Since issue size, year and industry fixed effects show significance, whereas PE-backing is not significant, the regression results seem to suggest that the fundamentals of the IPO, i.e. issue size, industry and year of the IPO, contribute more to PE-backed IPOs exhibiting lesser degrees of underpricing, rather than the certificationary role of the PE firm, as suggested by Megginson and Weiss (1990).

6.4 Explanatory power

First, I note that my model is significant at a 5 % percent level. This is indicated by the F-value in table 14. My model explains roughly 12 percent of the variance in underpricing. The explanatory power is lower in model compared to previous research. There are two main reasons for the low observed explanatory power adjusted (R-squared=0.12). The first reason is to do with the sophistication of my model. My model predicts underpricing as a function of issue size and the presence of a private equity backer in the IPO, controlled for fixed year and industry effects. It stands to reason that there are many other factors that to could explain the degree of underpricing. For example, in my model I don't consider the role of the underwriter, only the backer and the issuing firm. Including IPO proceeds, see for example Beatty & Ritter (1986), (the reason being that smaller IPOs are more speculative and therefore require larger underpricing), would likely increase the explanatory power of the model. There is however a trade-off here between the complexity of the model and the availability of data. I favoured a simpler model, but it is important to be mindful of missing explanatory variables and its impact on the explanatory power.

I also believe that using sic codes rather than the SDC Platinum industry descriptions would most likely increase the explanatory power of the model. I fear that the industry descriptions do not capture the business characteristics of each firm in my data set correctly. I also know that Winsorizing or removing outliers might increase the explanatory power of the model.

Below I will discuss some issues relating to the explanatory power of the model, namely multicollinearity and heteroskedasticity.

6.5 Multicollinearity

Multicollinearity exists when independent variables in a multiple regression model exhibit a high degree of correlation. This causes problems when interpreting results from the regression as the explained variance can be randomly distributed between intercorrelated variables (Farrar & Glauber, 1967). I investigate multicollinearity by calculating VIF factors. I display the VIF factor for each of the independent variable in table 14. The table show that there is quite considerable multicollinearity in the model, however none of the VIFs reach above the cut-off point of 10. This can be interpreted as there are multiple coefficients in the model which captures the same phenomenon. I discussed this at length in 5.3. This won't affect the model's predictive capabilities, but it makes it harder to interpret the regression coefficients. I note however that the coefficients in my model, behave according to expectations.

6.6 Heteroscedasticity

A regression model is subject to Heteroscedasticity the variables in a regression model have different variances. This violates an assumption in ordinary least squares (OLS) regressions. While this does not affect the coefficient, it can lead to incorrect decisions about their significance due to the biased estimates of standard errors (Cohen, Cohen, West, & Aiken, 2002). Since heteroscedasticity might be a problem in my regression I conduct a Breusch Pagan test. I test this by squaring the residuals that was generated when I regressed my model. Then I run the regression again with residuals squared as the dependant variable and all my explanatory variables as my independent variables.

The results from this test are presented in graph 15 and table 16. I find that the significance level in the test for heteroscedasticity is 0.47 in my model. Hence, I do not reject the null hypothesis and conclude that the coefficients in my regression model are not materially biased by wrongly specified error terms. I do however note that there is a considerable

amount of heteroskedasticity in my model, but not enough to warrant concern about the conclusions for the significance of the coefficients.

Graph 15 displays the heteroskedasticity of my model. With my fitted regression line as the x-axis and the squared residuals as the y axis.

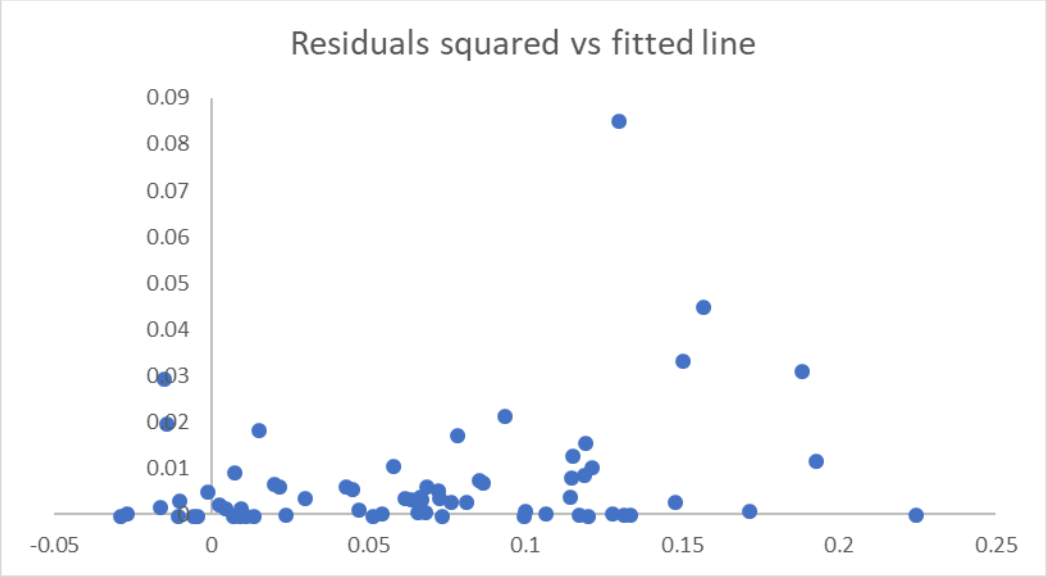

Table 16 displays the results from the heteroskedasticity test. The f-value indicates that while the model is subject to heteroskedasticity, it is not enough to warrant concern about the conclusions I make in the paper.

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	5	0.001186	0.000237	0.915484	0.477121268
Residual	61	0.0158	0.000259		
Total	66	0.016986			

6.7 Research method discussion

In this section I will discuss the validity, reliability and comparability of my study.

6.8 Validity, reliability and comparability

Regarding the validity of my study, I have sought to make well thought out decisions regarding all aspects of delimitation, data selection, models and tests. I chose to limit the study to Swedish operating companies listed on Nasdaq Stockholm to ensure that all companies operated under relatively similar conditions in terms of rules and regulations and received comparable analyst and media coverage. This was done in order to meaningfully isolate factors that might influence underpricing. Furthermore, I have also examined multicollinearity and heteroscedasticity, and found indications that while these are present they are not large enough to materially affect my results. However, because of the fair degree of correlation between issue size and PE-backing it is hard to disentangle these effects with my research design. I stress that it is important to be mindful of this in the analysis of this paper.

A problem that impacts the validity of my study is that my proxy for ex ante uncertainty (issue size) does not directly reflect uncertainty about the value of the offering. This means that it includes a certain amount of noise. In hindsight I would be wiser to have used for example number of news articles, dedicated analyst or another proxy for media coverage.

Regarding the reliability of my study. I believe that my results are replicable. I know that the findings in sponsor-backed IPO underpricing is subject to the quality of the data set and different research methodologies. It is my contention that the decisions I have made with regards to data collection and methodology are reasonable. The consistency with my model and previous findings seems strong, as I come to similar conclusions as previous research. This holds true regardless if I use the value weighted method[1] or equally weighted method, as using the natural logarithm for underpricing. The model exhibits a certain robustness in this regard. The comparability of my study is reduced because detection of underpricing is highly dependent on the choice of measurement period (Ritter & Welch, 2002). This means that it is difficult to draw wider conclusions about underpricing correlations. If I would have included data from a larger time period I would likely have different conclusions about the magnitude

[1] Not included in this paper.

of underpricing, even some of my other conclusions might be harder to make. I think however that I make a modest contribution to this area, especially if you consider my discussion here.

7.0 Suggestions for future research

In my study I have focused on the relationship between issue size, PE-backing and IPO underpricing in Sweden. In this process I have made several delimitations and identified a number of areas that could be of interest but have been outside the scope of my paper. I will now present these findings as suggestions for future research. Staying on the uncertainty hypotheses, I have used issue size (Beatty & Ritter, 1986) as a proxy for ex ante uncertainty. It would be interesting to use a more direct measure for uncertainty, such as dedicated analysts or level of news coverage for example and see what happens to the relationship between ex ante uncertainty and underpricing. I fear that issue size contains a fair degree of noise, which contaminates the analysis. I also encourage future research to include other markets, since institutional factors vary considerable across geographies. Furthermore, I think it would be fruitful to compare venture capital, private equity and non-backed IPOs since this might lead to a further understanding of ownership implications on underpricing.

I would however advise future research to include conflict of interest models. Frankly, I fear studying IPO underpricing and disregarding the wealth incentives of private equity and conflicts of interest between underwriters, private equity and investors, does not aid the understanding of this topic. I think the interaction and different incentives between private equity owners, underwriters and investors is a fertile ground for a more informed understanding of IPO underpricing. But that is an empirical question that only future research can prove.

8.0 Conclusion

In this study I have investigated underpricing for PE and non-backed IPOs. After I detected a lesser degree of average underpricing for PE-backed IPOs, I employed a regression model based on asymmetric information theory to investigate this underpricing differential. I have found evidence that the lesser degree of underpricing for PE-backed IPOs can be explained by issue size, controlling for fixed year and industry effects. My results suggest that issue size, fixed year and industry effects is more influential than PE-backing in explaining this result.

Previous studies on PE-backed IPOs have mainly been conducted in the US. My study contributes to the understanding of this phenomenon in Sweden. My results are similar to the findings in previous research, indicating that similar factors influence IPO underpricing in Sweden as in the U.S.

I believe that my study is a modest step towards the increased understanding of IPO underpricing in its different settings. However, I recognize that more research is needed to document underpricing in a variety of settings. I have identified some areas for future research including how other proxies for ex ante uncertainty might improve the analysis, including VC-backed IPOs in the analysis and devoting more time to study the conflict of interests between private equity, underwriter and investors.

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