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Private equity backed IPOs in the US during the financial crisis and its aftermath.

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ABSTRACT

Initial public offerings (IPOs) backed by private equity firms (PE) have been under even more scrutiny since the financial crisis in 2008. This study investigates the performance of PE backed IPOs issued between 2007 and 2015, using a manually selected control sample and three indices as benchmarks. The results show that the PE backed sample has less underpricing and better long-run performance in the 2011-2015 period than its non-backed counterparts from the control sample. This study also analyses whether there are significant differences between the cold and hot issue market during and post crisis. No significant differences in the performance of PE backed firms between the 2007-2011 and 2011-2015 periods appear in both the short-run and the long-run.

Keywords: IPOs, private equity backed firms, hot and cold issues, underpricing and long-term performance JEL Classification: G14 and G32

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1. Introduction

Ernst & Young (EY) have recently published a report stating that the global Initial public offering (IPO) market reached a 10-year high in 2017. The IPO market seems to have recovered from its all-time low in 2008 (Mateu, 2018). In addition, the private equity (PE) backed IPO market has resurged. The PE backed IPO market almost entirely vanished during the financial crisis because of the high amount of debt accompanied by private equity and its deals. A PE firm normally acquires its portfolio company with a high amount of debt and during the crisis institutional investors looked distrustful at the PE backed companies (Atkins, 2014).

This thesis will look at PE backed IPOs and it contributes to the current literature by its methodology and by testing combined hypotheses from prior literature about cold and hot issue periods and its anomalies in the contemporary IPO market in the US from 2007 until 2015.

This thesis will focus on the main anomalies that go hand in hand with IPOs: the underpricing at introduction day and the underperformance of IPOs in the long-run. Furthermore, it will shed light on the extensive portfolio time of PE backed IPOs and how this can influence, both theoretically and practically, and even reduce these anomalies compared to ordinary IPOs.

Next to this, the sample is divided between the 2007-2011 and 2011-2015 periods because of the higher IPO volume and higher underpricing in the total IPO market in the US from 2011 on. The aim of this study is to analyze whether the same tendencies are applicable for the PE backed IPO market between those periods.

The long-run performance of the control firms, control with venture capital backed firms and private equity backed firms is measured according to the two most prominent methods in literature; the Buyand-hold abnormal return method (BHAR) and cumulative abnormal return method (CAR). The methodology is new in a way that it manually selects a portfolio of non-backed counterparts very carefully on the basis of issue date, industry and offer size and firm size. This portfolio is set against the same benchmarks, the S&P500 equal/value and the S&P600, over a three-year period. This is a period in which the performance of each individual IPO is calculated against these indices from date of issuance up to three years later.

This thesis starts with a literature overview in Chapter 2. This is an overview of:

- how IPOs work and how they deliver possible explanations for its anomalies,
- how IPO volumes change during time and how investors benefit,
- the measures enhanced by private equity firms in order to increase performance and profitability of its portfolio company and
- how these topics are related and how they, when combined, have lead to different results in prior literature.

After this comes the data section in chapter 3. Chapters 4 and 5 will deliver the short-run methodology followed up by its results and chapters 6 and 7 will do the same for the long-run. In chapter 8 the main conclusions are summed up. After the bibliography there is an appendix with additional insights.

2. Literature on IPOs and private equity

This review consists of a thorough outline of the literature on the explanation of the process and anomalies of IPOs and the private equity process with its history. Also on how these subjects are combined and how combining even leads to different results in the short- and long-run performance of IPOs.

2.1 The IPO process and its anomalies

Initial public offerings (IPOs) is the process when a private company goes to the exchange and sells its stocks to the public for the first time. The process of going public consists of multiple steps. The procedure starts with approaching the investment bank (underwriter) or using already existing connections with some banks.

This first step often contains proposing a large pitch to the bank with fundamental arguments about why the firm (or portfolio company) should go public. The firm will select banks as book runners, the banks that will take the lead in the financing, and co-leaders with slightly less responsibility. The next step contains the kick off meeting with almost everybody involved (from lawyers to auditors) and the due diligence department. Due diligence is the process of getting to know about all the fundamentals in a company. Speaking with market experts, getting in touch with customers and financial and tax due diligence are part of this. The results of this is the S1-file that is composed of everything that is known about the firm but also, for example, its risk characteristics.

After this, managers have to attract the attention of potential investors and plan meetings with them. When the order book is closed with potential investors, the management team will meet the bankers to decide on the final price of the shares. This pricing is based on fundamentals, but of course mostly on demand for the shares. Managers have the tendency to place the price at the lower end, to signal a good performance at the first day of trading (underpricing).

Finally, the syndicate bank teams will allocate the shares and the IPO is a fact (Lee, n.d.).

This study will focus on the return patterns of IPOs and therefore it is useful to keep an eye on tendencies or anomalies that concur with IPOs in order to account for it at the methodology. IPOs have two major anomalies that will be discussed in the upcoming sections.

2.1.1 The anomaly of the short-term IPO returns

The first anomaly is about the short-term returns. At the first day of an IPO, the stock is sold on the market for an offer price or the introduction price. This price, however, tends to be much lower than the average closing price of the stock on the exchange. This phenomenon is also called underpricing. Ibbotson, Sindelar, & Ritter (1994) found an average of 15.3% of underpricing at the first trading day for the US in the period 1960-1992.

There are several reasons and extensions on arguments pointed out by the literature for this condition. To start with information asymmetry, potential investors have significantly less information about the firm than its current owners. What's more, the firm was private before the IPO and, so, it does not have the obligation to publish annual reports. Next to this, owners are likely to influence the reports resulting in slightly more optimistic reports than reality shows. Besides, most organizations are complex firms and a combination of elements/aspects such as leadership, culture and technology will add value to a specific industry.

The most common explanation is the one by Rock (1986): Institutional investors in general know which IPOs are the cheapest (underpriced by the underwriter) and will subscribe to these IPOs. Private investors, nonetheless, do not have the insight to observe the most profitable IPOs, so they will probably end up with the least profitable IPOs. They are nonetheless aware of their weakness. They will demand a premium on their IPO investments otherwise they will not invest at all. As a result, a sufficient premium is given to compensate for the unfavorable allocation of IPOs. This process eventually leads to adverse selection bias. The compensation for the uninformed investors is the discount at the introduction price. Beatty & Ritter (1986) argued a bit further and stated that: "if the uncertainty about the market value of an IPO increases, its level of underpricing will also increase."

Criticism on this theory comes from Allen & Faulhaber (1989). Ritter showed in his research in 1984 that the hot-issues, shares issued where demand exceeds supply with a factor of 20 or more, only occur in several periods and in specific industries. This implies that the underpricing phenomenon only arises in case there is a boom period and even only then in certain industries. The risk composition of IPOs for uninformed investors should change between periods in this case. The results of Ritter (1984) do not support this however.

Allen & Faulhaber (1989) rejected the hypothesis that underpricing exists because of the information asymmetry between informed and uninformed investors. They argued that the information asymmetry mainly exists between the issuer and the investor. They explain it by stating that the issuer wants to signal the firms' value by underpricing. A firm with a high market value can easily bear the loss made for the initial owners at the introduction day and by underpricing, they signal to investors to more favorably interpret the following dividend results. The owners of bad firms cannot signal by underpricing, because they will be exposed when investors interpret its subsequent dividend payments. Publicity strengthens this signaling; the media often publishes articles where they mention the largest IPO winners. Concluding, the firm is better informed about its prospects than anybody else is.

Guo, Lev, & Shi (2006) attempted to explain this information asymmetry problem by trying to find the cause of it. They argued that the level of research and development (R&D) activity determines the level of information asymmetry. R&D expenditures are the intangible assets that are scrutinized and analyzed more precisely compared to the other intangible assets. Because the accounting principles state that one has accurately has to show the R&D expenditures. Guo, Lev, & Shi (2006) could easily obtain and analyze data in order to obtain accurate results. Empirics about R&D activity elaborates on two phenomena: R&D contributes to information asymmetry and investors often undervalue R&D intensive firms. The former phenomenon arises because firm insiders as large block holders or managers gain insight in the upcoming R&D projects and its cash flows. So, in the end they gain from trading in the shares of their own company, whereas insiders at low R&D intensive companies gain significantly less. The authors show the importance of R&D expenditures by demonstrating that the long-term performance of IPOs is better when a firm is R&D intensive. This is because investors of those firms undervalue the value added by R&D.

To put the discussion about underpricing in even more disagreement, Baron (1982) introduced another insight into the information asymmetry explanation. He argued that the information asymmetry problem exists between the issuing firm and the underwriter. IPO underwriters are the financial specialists (investment banks e.g.) who determine the offer price in agreement with the issuer, buy the stocks from the issuer and sell them to investors via their own network. The theory of Baron states that investment bankers (underwriter) are more aware about the prevailing conditions in the capital markets than the issuer himself. As a result the issuer is likely to delegate the pricing to the investment bank. The issuer, however, is incapable to monitor the pricing of the investment bank really carefully.

In the end, this information asymmetry causes underpricing compared to a situation where optimal monitoring is possible (Baron, 1982). Muscarella and Vetsuypens (1989) did research in this matter. They selected a sample consisting of firms that participated in the distribution of their own securities. By doing this they tried to avoid the information asymmetry between issuer and underwriter. They found that lead managers also underpriced their securities during an IPO. They therefore rejected Baron's hypothesis.

Beatty & Ritter (1986) stated that a firm can also solve this problem by selecting the underwriter with the best reputation. The underwriters with the best reputations are unlikely to deceive investors with underpricing, because their reputational loss would exceed the gain made from the underpricing at the first trading day.

Another explanation of Booth & Chua (1996) is one without the information asymmetry problem. They assumed that the firms that go public have a target ratio in mind and try to disperse the ownership up to a certain level. To acquire a broad (target) ownership dispersion, the firm has to sell enough shares at the IPO. To do this, is a liquid secondary market (the market where the primary, mainly institutional investors sell the shares of the IPO firm) necessary. Next to the liquid secondary market is a lot of subscription to the shares needed, sometimes called as oversubscription. Both these conditions lead to higher information costs for the investors. To make the IPO still as affordable as without the higher information cost, a discount at the introduction price will be given to the investors.

Final clarification described in this paper is the one of Hensler (1995). This reasoning is totally different from the others; Hensler assumed that especially smaller firms are afraid that investors will sue them if the stock price falls below the introduction price at the IPO. These potential litigation costs will cause a decrease in wealth. Because of tort law and the securities act of 1933, investors are in a strong position; however, Hensler could not find any empirical evidence for his hypothesis.

2.1.2 The anomaly of the long-term IPO returns

The second anomaly is about the long-term returns. In the long-run IPOs seem to underperform compared to other listed companies (Loughran & Ritter, 1995). Ritter found that in the US, IPOs averaged 27% lower return in 3 years than comparable listed companies and that this return was even 51% lower in a 5-year period. Opposed to the case with underpricing at the first day, this has to do with irrational investors and their excessive optimism. Investors overvalue the information that becomes public after the announcement date and invest on the hype surrounding the stock. The years after will show that the stock is not as attractive as it seemed and will return to its equilibrium price. The release of more information about the fundamentals (of which growth potential is one of the most important ones) will lead to less overoptimistic investors and so a relatively lower price. The divergence of opinion between investors diminishes over time.

This is, however, not the only explanation for long-run underperformance. In their research and based on prior research; Brau, Couch, & Sutton (2012) discovered that one of the main motivation for going public is creating public shares in order to acquire other firms. They shed a light on the post IPO merger activity and how this could influence the IPO underperformance. This argument stems from research performed in the 1980's by Roll, his hubris hypothesis states that managers overestimate their ability to select and attract targets and so overpay for those targets. As a result, the company's unprofitable investments could lead to decreasing performance and subsequently to a declining share price. This phenomenon seems especially relevant for tech- and glamour (low B/m ratio) firms. Even though investors are aware of dangers coming along with overinvestment (e.g. empire building), they interpret an IPO as very positive and optimistically agree with most investments. Older research concluded and confirmed that newly IPO firms are more active in the takeover market than non-IPO firms.

Brau, Couch, & Sutton (2012) took it a step further and scrutinized whether the new IPO firms experienced worse results than their counterparts that are not active at the takeover market. They found that the IPOs that acquire firms in the first year after going public have a long-term stock performance (three years) of -15.6% compared to 5.9% of the firms that went public but did not engage in acquisitions the first year.

They conclude that: 'investors are slow to recognize the tendency to overinvest".

Next to this observation is the one of Brav & Gompers (1997). They looked at the characteristics of firms and how this could influence their long-run performance. They find that venture backed firms outperform non-venture backed firms. Added to this, they find that especially in the case of non-venture backed IPOs, the smallest issuers experience underpricing.

Another remarkable explanation, and moreover solution, is the one of Liao, Yu, & Jen-Huang (2011). They did not look at information asymmetry nor the industries and activities in which a firm participated. They looked at the corporate governance a firm employs. They hypothesized that the number of independent outside directors will influence the level of monitoring subsequently leading to less divergence of opinions between investors because the firm is more reliable in determining its price levels. They did research in Taiwan where legislations made in 2002 obliges an IPO to have at least two independent outside directors at their boards. They found that the number of outside independent directors is positively related to monitoring and, so, to a mitigation of underperformance on the longrun.

2.2 IPOs and its cyclicality

Even though this research only takes into account a time period of eight years, the financial and market environment changed a lot in those years. Therefore, should this research possibly deal with some cyclicality in the IPO market and give some explanations to this.

Loughran & Ritter (2004) tried to analyze the influence of the state of the IPO market on underpricing. They discovered that the first initial returns are higher when the IPO market is "hot". They define a hot issue market as markets that have an unusually high volume of new offerings. Later they even augmented this statement by stating that a hot market has extremely high initial underpricing, but additional scrutiny told that this is biased because of some industries with exceptionally high underpricing and not the issue market as a whole. In 1999, during the internet related "hot-issue market", they found an initial underpricing of 71.7% compared to an 8.9% underpricing during the "cold" market of 2002. To remark, nonetheless is that the internet firms in 1999 experienced such a high underpricing that they increased the average underpricing of the total IPO market significantly. The same rationale goes for the hot issue market of 1980; the high returns were attributable to firm offerings in the natural resource industry.

Applicable to this paper is chart 1 below; the lowest IPO volume was measured during the peak of the financial crisis in 2008 and 2009. This research will take into account the time period of 2007 until 2015. To check whether there any differences within this sample as well, the sample will be separated and checked for the differences between 2007-2011 and 2011-2015. The 2007-2011 period is one of the coldest IPO periods in history. Only 31 new IPOs were issued in the US in 2008 for example, compared to over 200 in 2014. The 2011-2015 is not exactly what to call a hot issue market, but it is at least a warmer period. Degrande (2016) wrote a report on the performance of IPOs with 2002-2012 as sample. In his analysis he stated that he demonstrated that the start of 21th century was cold, followed by the warmer years of 2004-2007 and ending with the cold period of the crisis. Applicable to this paper, one can assume that the period from 2012 could be considered as a warmer period again (See chart). This research will check for the differences in underpricing and long-run performance of the assumed colder and warmer periods especially for the (larger) private equity backed IPOs.



Chart 1. IPO volume in the US since 1980, number of offerings in bars and underpricing as the line

Source: Jay Ritter using financial data from Dealogic and Thomson Reuters.

Most literature in this matter focusses on market timing. It assumes that firms go public in accordance with the "windows of opportunity". This is a period when the goals of a firm are more likely to be achieved. This window belongs to the market timing theory.

Implying that firms' optimal capital structure is based on and fluctuates with market conditions.

The term 'market condition' is rather vague and can be interpreted in different ways. Some papers define favorable market conditions as investor sentiment. Servaes & Raghuram (2002) made a model based on positive feedback trading (traders who follow trends in certain industries). They assumed that the portion of feedback traders fluctuate over time. Their model showed some explanatory power in underpricing, long-run returns and activity of IPOs.

Other studies aim to explain the IPO cycles by using a different behavioral approach. They try to explain the cyclicality as a result of information externalities (spillover effects). This means that a firm, that has interests in an IPO, takes a look at other firms that have recently done an IPO. They are more likely to perform an IPO after a similar firm obtains profitable returns after an IPO. This is already the case at introduction of the IPO, where other firms show interest (Schöber, 2008).

The last explanation that is common in explaining the cycles of IPOs has to do with the information asymmetry problem between issuer and investor discussed earlier. Inside investors try to obtain as much information about the firm value before and during the IPO as possible. Firms have an incentive to go public when they are overvalued. The overvaluation means that the firm is worth more than the investors value the company. However, the investors are aware that the firm is likely to time the IPO during an overvalued period. They will demand a discount on the information asymmetry costs. Low information asymmetry comes down to valuation discounts. High IPO activity is likely to be during periods with lower information asymmetry costs.

Several researchers found evidence that the sensitivity to market conditions differ between PE backed and non-PE backed IPOs. Levis (2011) for example, showed that buyout backed IPOs have less underpricing than their VC and non-sponsored equivalents.

2.3 The history of PE in the US.

Private equity firms try to acquire entire firms or divisions and take these firms or divisions off the market in order to restructure them in such a way that the PE firm is able to sell them with profit. This process dates back to the post-world war two era. In 1946 the AR&D (American research and development corporation), the first company that engages in what we call nowadays "private equity investing", was founded. They gathered funds from multiple sources and invested this in the stocks of private equity. This was new in the way that firms were sold with the objective to make profit. Back then, firms were usually only transferred to family members from the next generation. The AR&D had the first major success on the market as well; in 1957 an investment of \$70,000 was exited eleven years later at \$35.5 million by means of an Initial public offering of the shares (IPO) (Bartlett, 2008).

Until the late 1970's the mechanisms of private equity, buying shares in private companies and trying to sell them for a higher price, were carried out by only a few instances. It was exclusive to wealthy families and a few of the large venture capital firms. These venture capital firms were mainly focused on small start-ups with high growth potential.

The period between 1980 and 1990 was called the first private equity boom period. By the late 1980's private equity firms had grown in prominence and became visible for the ordinary civilian; they were able to acquire the largest firms in the industry. With maybe the best example of RJR Nabisco, two private equity firms were battling on the acquisition of this firm in a \$25 million investment. The perception of the public on these private equity firms differs a lot from now. The general public regarded the private equity firms as "criminal" organizations that undertake excessively high risk by borrowing almost everything for their investment. This is, however, justified by statistics: the amount borrowed at an average leveraged buyout (LBO; see chapter 2.4 for a brief description) has now decreased to only 1/3 of the investment on the contrary of that back then; sometimes percentages up to 97% had to be borrowed.

At the start of the 1990s the market experienced a large number of bankruptcies of buyout funds. Therefore this period is mentioned as the first bust period. However, the PE market showed its persistence and grew faster during the late 1990s than any other asset class (Thomson Reuters).

Despite some other bust periods in 2001 and 2008 (the internet bubble and financial crisis respectively), the private equity market showed its strength and nowadays the largest private equity players are one of the largest companies on the exchange in general (Bishop, 2004).

2.4 PE and its buy and build strategy

The finance theory differentiates between four broader steps for the investment funds of PE firms:

- 1. Screening investment opportunities.
- 2. Investing the capital provided by partners.
- 3. Managing or restructuring the companies in the portfolio.
- 4. Harvesting in such a way that target firm value maximizes.

Ad 1. The process of PE starts with discovering the best potential investment opportunities. On average out of 100 firms of interest, PE firms more deeply investigate only 24 firms and only close in on six target firms to put in their portfolio. Most of the closed deals are self-generated by the PE firm. Others come from management and/or network connections. Gompers, Kaplan and Mukharlyamov (2016) held a survey with CEO and board members of large PE firms and they ranked the most important characteristics and variables for them in their search for the most interesting target firm. The most important factor is the business model and the competitive position in the industry. The management team, the ability for the PE firm to add extra value to the company and valuation are a bit less of importance but still fairly relevant. The industry of the target and the match with the fund is of least importance. The conclusion that the business model is the most important is extraordinary. It seems that business strategies of the target firms remain approximately the same (and so has to be in a decent state already at the time of purchase), where the management team is more likely to change during the process. The track record of the PE firm in the same industry seemed also of moderate importance, getting experience in how an industry works is relevant (Gompers, Kaplan and Mukharlyamov, 2016). They attribute the selection and picking of target firms to operational engineering.

Ad 2. After a target is carefully determined, gathering funds from investors is main part of the job. Differences in types of PE financing and investing exist. The largest distinction is between the PE buyouts and venture capitalists. PE focuses more on major firms and even firms with high financial distress risk. By using leveraged buyouts (LBOs) they acquire large firms and by augmented monitoring they try to repair or extend the reputation of the portfolio firms. Venture capital (VC) focusses on small startups with fluctuating cash flows. The holding period is less fixed than is the case with PE. In addition is the higher percentage of debt used in a LBO compared to a venture capital investment, venture capital is usually solely funded on the basis of equity. Because of the large differences between the mentioned two, they should be carefully distinguished in doing research (Velde, 2014). In this paper, the focus is on private equity backed firms and so on leveraged buyouts.

This acquisition of targets mainly goes by the method of leveraged buyouts (LBO). LBOs are a way of financing a buyout by a private equity firm. Sufficient amounts of debt are obtained from several fund partners so that an acquisition can take place. These partners exist of both institutional investors and individual investors. They can both invest in private equity funds in pursuance of extraordinary profits. There are two types of investors in private equity funds: general partners and limited partners. In a general partnership the investor has some influence in the picking of target firms and can even add firms to the target portfolio. Besides they have influence in the strategy used by the private equity firm on how to boost the target firms. In a limited partnership (mainly institutional investors) the investor has little to no influence on the decision-making. The advantage of being a limited partner is that you can quit the funding more easily than as a general partner (Baldwin, 2018).





Ad 3. Kaplan and Strömberg (2009) discover three types of value-increasing actions influencing the broader steps mentioned above to some degree:

a. financial engineering, e.g. determining optimal capital levels in a buyout

- b. governance engineering, e.g. restructure the board of directors
- c. operational engineering, e.g. gain industry knowledge in order to enhance value.

Ad a. There are several criteria by which a private equity firm determines its optimal level of debt in such a leverage buyout (LBO). This is part of financial engineering. Gompers, Kaplan and Mukharlyamov (2019) asked how important the capital structure is of targets for the PE firms and whether this could even influence their decision to purchase or not. For 2/3 of the questioned was the trade-off theory of importance; the beneficial side of attracting debt versus the downside of financial distress costs when you attract too much debt in valuing the capital structure. However, even with a suboptimal capital structure most firms would engage in the targets. The authors were also interested in the metrics used by the PE firms. They found out that, contrary to finance theory, firms generally used the internal rate of return (IRR) instead of the DCF or APV method to determine the cash flows, purchase and exit values. After a target is carefully determined, strategies to boost the financial core values are part of the job. Nevertheless, before this comes the target setting and time horizon for a target firm: This is an average time span of 5 years with an IRR of 25%. This means that the average PE firm tries to triple the purchase value compared to the exit value in 5 years' time.

Ad b. The restructuring and/or managing of a newly acquired firm is one of the major steps in the buy and build process performed by private equity players. Larger PE firms will demand larger boards of their targets. The PE firms will roughly pick three new members for their target board, which usually consist of about eight directors. Next to this they will take one to two management seats with sometimes an extra seat for an outsider for both firms. In the research of Gompers, Kaplan and Mukhalaryamov on average 70% invest in the existing management team of the target. Even half of their questioned admitted that they end up recruiting their own senior management team to put on the target. Added to this, is the CEO change of target companies, almost one-third has to/or changes its CEO during the portfolio period. This is all part of governance engineering. To motivate and align interests, on average a target company allocates 17% of its shares to management and employees.

Ad c. In terms of financial metrics, the most important source of value increasing is increasing the revenue of a firm. Another, more remarkable, finding is that for only 1/3 of the companies reducing costs is identified as important. It appears that firms really ought to restructure companies in a way to not only make more profit but also in a way to rebrand it and gain a larger market share. Growth is more of importance than restructuring.

Ad 4. The exit strategies will be discussed in this upcoming section. These exit strategies normally focus on cashing out and harvesting the value in such a way that value from the target firm is maximized. The regular means to exit a target firm for a private equity firm are trade sales, secondary buyouts (to another PE firm) and IPOs. According to recent data, dividend recapitalization should not be considered as an exit strategy anymore. Write-offs are a divestment strategy as well; however, these are simply put unsuccessful investment projects. These exit strategies fluctuate a lot in their relative frequency through time; for example, data of exit strategies during the financial crisis showed that IPOs were barely used as a way to exit a company. Due to the different options for private equity firms to sell their company, it is most likely that they will do this via an IPO when the stock market is bullish. This has mainly to do with the market liquidity, when the bid ask spread widens it is more likely that sellers lose money in the case of an IPO. Other disadvantages of an IPO are the high transaction costs coming along (Baker, Filbeck, & Kiymaz, 2015). The main and most clear advantage of using an IPO as an exit strategy is because it is the most profitable way compared to the other strategies. Schmidt, Steffen and Szabo (2010) showed that the IRR of the funds sold by IPO was 111% opposed to 49 percent for secondary sales and, logically, 100 percent negative for write-offs. How shorter the cycle between the purchase and sale of a target firm, how higher the return. Therefore, in a bullish market this could lead to higher IPO returns and less information asymmetry in the first days (Baker, Filbeck, & Kiymaz, 2015). The goal of a leveraged buyout is to sell a purchase with profit. This comes down to trying to gather more equity than for which the target company was bought for at the time of exit. If this goal has been reached, the private equity firm can pay off its debt and still has some extra profit. This paper will not focus on the profit made between the time of purchase and sale of a target company. It will primarily focus on the post IPO returns to see whether the mechanics of the buy and build strategy have a long lasting effect on the target firms.

2.5 An example of the process of PE in practice

One of the largest PE funds in the US is Apollo. It is the second largest PE firm on the market with a revenue of \$2.61 billion in 2017. Because there are many target firms backed by Apollo in the data sample of this research, it makes sense to have a look at their implementation of the buy and build strategy. Apollo consists of many investment funds that invest in multiple sectors in the spectrum: from financial services to technology and from consumer services to chemicals. It does not work with day-to-day decision making; this takes place at their offices in NY and London. Differentiating in companies that are trading at low relative and low absolute value. The ability on which it prospers is to take companies out of the public eye or carve them out of a big corporate parent and put intense management focus and scrutiny on it. It tries to be a value added partner with engaged directors and very involved sounding boards for key decisions (Kleinman, 2017).

Apollo uses opportunistic buyouts and build-ups, corporate carve-outs and distressed investments strategies in order to generate returns at the private equity department. One of the best examples of the buyout and build strategy of Apollo is the one concerning Hostess brands. Hostess is a leading sweet goods company. This firm was already in a bankruptcy process when Apollo came around. This made the job only easier for Apollo; it did not have to incur the pre-existing liabilities nor the legacy contracts. Apollo was able to rebuild the corporate organization and structure around the most valuable assets. Furthermore it successfully reopened three upgraded bakery facilities and, by doing so, they already reached their target EBITDA after 2 years (Apollo, 2017).

2.6 Prior findings and results on private equity backed IPOs

The PE process as described before leads in many cases to profitable investments for private equity firms. Even though the target firms usually totally end up independent of their parent after an exit strategy is used, it is still likely that the new strategies adapted in the portfolio time will result in less information asymmetry at the first day of the offering and outperform non-backed firms on the longterm. The first day's exceptionally high return of IPOs could be diminished in the case of PE backed IPOs, just like the case of underperformance in the long-run.

Muscarella & Vetsuypens (1989) are one of the first to perform research in this topic. They observe 72 firms between 1983 and 1989, which went public, but, before underwent a full or divisional leveraged buyout (LBO). They call this process a reversed leveraged buyout in the literature (RLBO). They emphasize the fact that financial statements covering several years of private ownership are being disclosed in the IPO prospectus. This paper distinguishes itself from the other literature, back then, by studying the characteristics of RLBO in the light of the agency theory by looking at the changing government structure. They find several interesting things: managers and directors own a substantial fraction of the equity of the firm after the LBO (so still before going public) and that in the sample most executives stayed at their jobs even though their payment system changed. Firms try to align interests by implementing incentive plans. Analysis shows that most of the firms are more profitable after going public (again). This is mainly due to the abilities of the firm to reduce costs and not of better asset turnover or revenue improvement. The efficiency gains are unaffected by acquisition nor divestiture activity. Although the authors of this paper are not really interested in the stock returns on the announcement day nor at the long-run, it highlights the effect of going private and what measures firms use to (re)gain strength.

During the 90's the performance of IPOs backed by private equity became more prominent in the literature. Another example is the research conducted by Mian & Rosenfeld (1993); they conducted research of RLBOs and their long-run performance. Striking about this paper is the finding that a high incidence of takeover activity takes place at these firms. The papers finds that 39% of the firms used in the sample are taken over within three years after going public. Besides they find the outperformance of the RLBO firms compared to non-RLBO IPOs. They try to explain this observation by the statistic of the takeover firms. The shares of targets are likely to increase after a takeover. By analyzing the data they indeed conclude that this should be one of the main reasons; the firms that are taken over significantly

obtain higher stock returns than the firms that are not taken over.

Another main factor that influences the positive abnormal long-run performance is whether there is an active investor present in the firm's organization. When there is a LBO sponsor (active investor) present, the chances are more likely that the firm will be acquired after going public. The explanation given by the authors is as follows: primary investors ought to get an opportunity to liquidity stake via a third-party takeover.

Levis (2011) finds in his research that the underpricing is indeed lower in the case of PE backed IPOs and explains this by stating that PE backed firms are larger and more mature in terms of market capitalization, leverage and total assets. In the investor's view, this would subsequently lead to less risky investments. Next to that, investors could be more reserved in investing in PE backed firms, because of the high leverage ratios just before going public. Besides the more modest first day returns, he finds in his research that the firms are larger in both sales and assets and are more profitable. Besides, he finds that firms that are PE backed often operate in a service or consumer goods related industry. In the three years after an IPO, the private equity backed firms' displays better performance than the non-backed ones. Levis is one of the few papers written in this topic in the post-financial crisis period, so especially relevant for this paper. Less relevant is the use of the London stock exchange as sample.

Cao (2011) did research in RLBOs and especially looks at timing of the issuing process. He, for instance, finds that portfolio time of target companies is negatively related to the market conditions. So when the market is booming, the duration in which a company is held private decreases. Next to this, he finds that the parent company keeps a substantial share after the IPO process and keeps involved in corporate governance decisions.

Thomas Schöber is one of the last prominent researchers who tried to capture the effect of PE backed IPOs with the US as sample. His timeframe is 1990-2006, ending just before the start of the financial crisis, but incorporating the bust period of the internet bubble around 2001. Schöber uses control firms that are not PE backed and looks at the (robust) differences. He concludes that the underpricing at the first trading day is less for PE backed firms again endorsing the hypothesis of Jensen, that there is less information asymmetry for the large PE backed firms. He attributes this to the fact that the PE backed firms are supported and monitored by their parent very narrowly, which result in only a negligible discount to the fair value.

In the long-run, the performance of buyout backed IPOs is ambiguous compared to their control firms. They, however, outperform their counterparts the first year of trading (Schöber, 2008).

One of the most recent studies in this matter was conducted by Raghupathy and Thillairajan (2015), focusing on Indian private equity firms. Especially relevant for this paper is the methodology used. They matched VC (venture capital) backed companies to non-VC backed companies and found that the VC backed companies had a better performance on several parameters. However, they could not ascribe this to the buy and build strategy operated at the portfolio company (Raghupathy & Thillairajan, 2015). Even though this study used VC backed instead of PE/buyout backed IPOs, it is still useful in its contemporary framework.

3. Data

The Data will be retrieved from the Thomson one database. Thomson one has a lot of information about IPOs and its accompanying characteristics. The screening and analysis section of Thomson one will be used in the matter of equity. At this section the most important descriptions will be given. For example, the company-location and issue type commands will be used. Most important is the command whether an IPO is private equity backed or not. This can be enhanced by setting the private equity backed IPO issue flag to Y. Next to this, a custom date range starting 1/1/2007 until 1/1/2011 for the first period and ranging from 1/1/2011 up to 1/1/2015 will be used. The underlying reason for this time frame is because this paper tries to find the long-term (3 year performance) of these stocks. In this way up data up to 2015 will provide the most recent data.

For statistical relevancy, this paper also includes a VC backed sample combined with the control firms in order to give an insight of the influence and performance of the VC firms. However due to several reasons (main one's are issue and sample size), the main comparisons and analysis will be made on the control firms vs the PE backed firms. After acquiring the SEDOL or otherwise the ISIN numbers from Thomson one, one can use DataStream to obtain the monthly, weekly and daily stock returns of the specific firm in order to calculate return differences. Some firms, however, had to be removed from the sample. This was for several reasons: missing and unfindable SEDOL codes, IPOs that were accomplished after or before the mentioned time frame or not accomplished at all (Harrah's Entertainment Inc. e.g.) after manually checking and, also, because some of the companies were only partly backed by private equity firms.

The table below gives a first look at how the data is distributed and how the initial returns look like. What is remarkable is that the median and mean differ a lot and that the samples suffer from a high standard deviation, besides the minimum and maximum look extremely high.

Variable	Observations	Mean	Std. Dev.	Min	Max	Median
Initial return	226	24.244%	1.14	-49.733%	1206.50%	5.10%
PE						
Initial return	180	35.931%	1.60	-72.73%	1160%	4.84%
CO						
Initial return	241	33.405%	1.41	-72.73%	1160%	5.95%
VC+CO						

Table 1. Initial statistics of the sub samples.

4. The methodology used in order to analyze the short-run returns

This section will elaborate on the different methodologies used in order to make conclusions about the differences in underpricing between PE backed and non-backed firms and the differences between periods.

4.1 Selecting control firms

To perform an analysis about underpricing, this paper uses a large IPO pool. This pool consists of IPOs offered during the same sample period and PE backed IPOs are logically excluded from this pool because otherwise the danger arises of selecting a PE backed IPO as a control firm. Next to this, is the exclusion of venture capital backed IPOs. This is because of several reasons: venture targets experience a pretty similar portfolio approach as the PE targets. It is therefore likely that due to the enhanced monitoring, corporate governance structure and costs rearrangement, the targets end up comparable to the PE backed firms. Furthermore, the venture backed firms are small growth firms opposed to the PE backed firms in this research. The PE backed firms are large matured firms. Therefore, it is likely that due to size criteria, that these firms would not be selected as control firm anyways.

However, for means of comparison and statistical significance, the methodology, uses as stated before, a separate analysis on a sample that includes venture backed firms added with control firms. This, because prior research concluded that the effect of underpricing diminishes even more in the case of the inclusion of venture capital backed IPOs (Schöber, 2008).

This paragraph will elaborate on the procedure enhanced in order to obtain the control firms. To start with, a large sample of non-PE and non-venture capital backed IPOs from the years 2006-2016 (recall that the period used in this research is 2007-2015) is created.

The goal of this matching procedure is to match a PE backed IPO (case firm) to up to three control firms. However, as explained below, sometimes there are not enough control candidates. Moreover, in some cases multiple case companies are matched to the same control firm. By doing this, the chance of obtaining excessively high returns (outliers) is diminished.

The matching procedure contains several criteria explained in the upcoming section.

The first and leading criteria is that the issue date between the case firm and the control firm cannot differ more than 12 months. Different economic circumstances and legislations on the exchange could bias the results.

The second constraint is that the firms should belong to the same macro industry. These macro industries categorize the firms in 12 different sub samples. These sub samples range from macro industries as financials containing a lot of firms to, for example, communications with only a few firms.

The next constraints are firm- and offer size. These factors could heavily bias the results because, as prior research shows, an inverse relationship exists between the level of underpricing and firm- and offer size. Boudriga, Slama, & Boulila (2009) did research in the factors influencing the underpricing. They stated that how larger the offer size is, the larger the firm is and that this eliminates some risk. The underwriter is besides, more likely to be an experienced investment bank with a good reputation. Therefore, it is likely that the level of underpricing is lower for large firms with a large offering at the exchange. They also declared that large firms are better diversified and have better access to resources and capital.

Concluding, this methodology should account for firm- and offer size differences between the matched companies, otherwise the effect of being backed by a private equity firm would be overestimated in the case of underpricing (because the lower underpricing would also result from the size differences). This research uses the following method in finding a usable control firm; a range of 20% to 500% the firm and offer size of the case firm is used as an acceptable range for the control firm.

When there are multiple firms left that satisfy the conditions so far, this research uses a last constraint. This last constraint is the price-to-earnings ratio (P/E ratio). A relatively new theory in the underpricing spectrum is the one of the price to earnings ratio. It provides the stock's market value compared to the company's earnings. A high P/E ratio means a stock's price is high relative to its earnings. The theories state that a higher P/E ratio leads to a higher underpricing level. Yang (2012) finds that indeed the P/E ratio has a significant influence on the level of underpricing. Research on the variables influencing the value of an IPO from Kim & Ritter (1999) concludes that P/E ratio using forecasted earnings leads to accurate valuations, definitely compared to others multiples.

In case there are many similar potential control firms left, the most comparable P/E ratio of a potential control firm with a case company will determine which one is chosen. However, only approximately half of the database contains information about the P/E ratio. That's why this last constraint is used only several times in certain macro industries with a lot of potential controls.

4.2 Underpricing

The existing literature is inconclusive in how to determine the underpricing. Lowry, Officer, & Schwert (2010) for example argued that the one-month return after offering should be used. Because this would consider the true stock value. Lakic (2011) therefore used this method when determining the underpricing in his research.

Nevertheless, when looking at underpricing most literature uses the first day closing market price at the exchange compared to the initial offer price at the first trading day. Leading to the following formula:

$$R_{i} = \frac{P_{t+1,i} - P_{t,i}}{P_{t,i}}$$
(1)

Where R_i is the first day return at the issue day of firm *i*, $P_{t+1,l}$ is the first day closing price and $P_{t,i}$ the offer price

After manually checking the data samples with some histograms, it was immediately clear that some firms had extreme initial returns (these appeared in every sample). The maximum underpricing appearing in the control sample was as high as 1100%! Even after doing some manual research at stock information sites, no conclusions could be made whether this underpricing was legit or not. The means were significantly higher than the medians, symbolizing the non-normal distribution. To confirm our concern, a Shapiro-Wilk test was conducted to exhibit the skewed distribution. The research of Anker & Stark-Johansen (2015) suffered from the same problem. They came up with a solution to this problem; they trimmed the 2% highest and lowest outliers. This research however, employs a slightly different approach. Even though the extreme outliers are doubtful, one should still be careful with removing these outliers. Another possible solution to deal with these outliers is the method of winsorizing. Winsorizing is the statistical interference of replacing the outliers. The outliers will not be removed with this method, but instead they are replaced by the most extreme value (smallest or largest) that is not counted as an outlier. Dubiousness arises about which of the two methods to apply. However researcher Bryan McCarthy stated: "Winsorization is probably more appropriate when sample sizes are small and when you need to protect statistical power." Next to this is a dissertation from the Tulane University that presented extensive computer simulations of normal and skewed distributions, with varying sample sizes, thereby engaging in both trimming and winsorizing.

His recommendation was to winsorize rather than trim, if one suspects a skewed distribution and wants to make the statistical test less conservative (Reifman & Keyton, 2010).

There are several interval levels that can be employed with Winsorization. One of the most common is the (1%, 99%) interval. This interval infers a method whereby the smallest and largest percent values of the sample are being replaced. However, operating at this interval level does not lead to any significant improvements concerning the standard deviations and the distribution of the both the samples (controls+PE backed) in this research. Therefore a (2% 98%) is picked, and leading to lower variances and a more reliable distribution.

4.3 T-tests on different sub-samples

The main research focusses on the comparison between the firms that underwent the support of a private equity firm and the firms that did not. This will be performed for both the short-term and long-term. With the short-term, this paper looks at the first day announcement returns leading to the following hypothesis:

1a: PE backed IPOs experience less first day underpricing than their non-backed counterparts in the post crisis period of 2007-2015.

As section 2.2 elaborated, the timing and period in which an IPO occurs could influence the results. Loughran & Ritter (2004) found that in a "hot" IPO market the initial underpricing significantly exceeds the initial return of a "cold" IPO market. Applicable to this paper, the following hypothesis:

1b: The underpricing of the PE backed IPOs in the period 2011-2015 significantly exceeds the underpricing of the PE backed IPOs during 2007-2011.

In this section the methodology for differences between groups is explained.

The literature distinguishes several statistical T-tests and non-parametric methods in order to compare different samples. Non-parametric methods are primarily used with small sample sizes and with a skewed distribution. The main disadvantage of using a non-parametric test (for instance the Wilcoxon signed rank test, where the ranks of values are summed up) is that they lack statistical power (Ball & Whitney, 2002).

After choosing the T-Test as the most usable test for the mean comparison between the samples, one has to ask which specific features to employ. The most important assumption of the normal student Ttest is the one of equal variances between groups. A Levene's test is used in order to obtain more information about the variances between the PE-backed and control groups. This test shows, nonetheless, that all sub samples had highly significant different variances between the groups. This leads to the conclusion that the Welch's T-test should be the most appropriate test for the sample, it assumes unequal variances and unpaired observations. Ruxton (2006) confirmed the use of the Welch's Test by stating that the test is always preferred compared to the students T-test or Mann-Whitney U test when comparing two unrelated samples.

4.4 Robustness checks by univariate testing

In order to obtain more information and another insight in the relevant factors that influence the (winsorized) initial returns, this research also performs a regression with the winsorized initial returns as dependent variable. This regression will follow the method of Aas & Seljeseth (2018), who partly derived their method from Schöber (2008) but with some differences, more applicable to this research as well. This regression uses some additional variables that could possibly have some influence on the initial returns. These variables are, for example, the ones picked to determine the control variables from the non-PE or venture backed sample. These variables are: the *offersize* of the IPO (Proceeds including oversold shares in the market), the *firmsize* (total assets before the offering of the IPO) and *pe* (price to earnings ratio before offering).

Next to this is the use of the total dataset, so the dataset contains data from the period 2007-2015 and contains both the PE backed data and the control firms.

The regression includes several dummy variables; one that divides the sample between the periods 2007-2011 and 2011-2015 called **Dhot2**. If the value is 1, the accompanying firm belongs to the period 2011-2015 (which is assumed as the hot issue period), it takes on the value 0 if the IPO took place in the period 2007-2011.

After summarizing the initial return per macro industry, the industries with the largest and smallest initial returns with at least a frequency of 5% of the total sample are chosen to make dummy variables; *Dmacro7* for the industrials category with the lowest underpricing and *Dmacro8* as the materials category with the highest initial underpricing.

To see if hypothesis 1a holds in a different setting, a dummy for PE versus non-PE backed is created, called *dPE2*. This will lead to the following regression model:

$$R_{i} = a + B_{1}dHot2 + B_{2}dMacroindustrials + B_{3}dMacromaterials + B_{4}firmsize + B_{5}offersize + B_{6}dPE + \varepsilon_{i}$$
(2)

After performing the OLS regression, a white test and some manual checks (by graphs) will be performed in order to determine whether heteroscedasticity assumptions are needed. If this is the case then a regression assuming constant robust variances will be enhanced. Next to this, the Ramsey test to discover omitted variable bias in the model will be used.

5. Analysis of the short-run results

This section is divided in several chapters. To start with the short-term returns, then the differences between the sub-samples and to finish with an OLS- regression.

5.1 Results underpricing

As stated before in section 4.2, measures were taken because of the uncertainty around the initial underpricing results: Therefore the initial returns were winsorized at a 2% 98% interval. In table 2 are the means, observations and winsorized means visible with their standard errors in parenthesis. Retrievable is the diminished standard error for every sub sample in the database. Especially the PEbacked sample has a far better standard error, leading to a more normal distribution (also see histogram in appendix). Table 2 shows that every sub sample has initial underpricing. All the subsamples have significant underpricing even at the 1% confidence level. As expected according to literature and expectations, the PE backed firms have the lowest initial underpricing at 13.49% and the control firms, without VC backing, the highest with 32.97%. The venture capital backed sample suffers from a underpricing of 23.29% and outperform the control group. This is also in agreement with the findings of most prominent literature (see next page). PE backed firms are larger than the VC backed firms and are therefore monitored more extensively, besides they are more experienced in general and the better informed parties. However, the VC backed firms have had a portfolio time as well and the VC parent is more likely to offer their portfolio company at a reliable market price than non-backed firms. Apart from the levels of underpricing is remarkable that the VC backed data sample is by far the smallest sample with only 57 firms. This is because most available VC backed firms were too small in terms of offer- or firm size, and because of this, could not be selected as a comparable firm in this research.

Remember from section 2.2 that sometimes the market suffers from high underpricing because some industries experience exceptionally high underpricing. In table 3 is the distribution of the underpricing observable between industries in this sample (with a minimum of 10 observations). Especially the materials industry seems to influence the underpricing results upwards, for the control sample it averages even up to 188%. In total, most firms belong to the finance industry.

Туре	observations	Mean underpricing	Winsorized mean
		(standard error in	underpricing
		parenthesis)	(St. Error in parenthesis)
PE backed	226	24.244% (0.076)***	13.489% (0.020)***
VC backed	57	27.346% (0.076)***	23.288% (0.044)***
Control firms	180	35.931% (0.120)***	32.974% (0.100)***
Control+VC	237	33.405% (0.091)***	31.273% (0.079)***
*P<10% **P<5%	***P<1%		

Table 2. Characteristics total sample 2007-2015

Table 3. Industry specification of the winsorized results

Industry	Underpricing PE sample	Observations PE	Underpricing CO sample	Observations CO
Consumer products	12.74%	13	5.61%	11
Energy and power	5.90%	30	9.82%	31
Financials	18.73%	28	14.26%	44
Healthcare	2.74%	15		
High technology	10.36%	33	11.47%	18
Industrials	3.79%	26	16.52%	14
Materials	17.8%	22	188%	18
Retail	29.51%	30		
Real estate			-0.01%	16

The literature is inconclusive about the level of underpricing of PE and buyout backed firms; Muscarella & Vetsuypens (1989) retrieve a percentage of 2.04% underpricing for the buyout backed sample, whereas Cao and Lerner (2006) find a more comparable number to this research (after winsorizing) of 12.88%. Cao and Lerner (2006), Levis (2011) and Schöber (2008) discovered comparable findings to this research when analyzing the results between the subsamples; all three papers found out that PE backed firms significantly outperform their non-backed counterparts. In agreement with this paper, Levis (2011) noticed that VC backed firms have lower underpricing than non-backed firms but higher than the PE backed firms.

5.2 T-tests comparing the sub-samples

Table 2 shows that all the different types of firms have significant underpricing, nonetheless relevant for the hypothesis testing is if the types have significant different levels of underpricing compared to one another. The unwinsorized means haven't got any significant differences after performing the Welch's T-test assuming unequal variances, but after applying winsorization the PE backed sample suddenly has a lower mean underpricing and way lower standard deviation leading to a significant difference between the PE backed- and control sample at a 10% confidence level. After combining the VC firms with the control firms, and comparing them with the PE backed firms, an even more significant difference arises at the 5% confidence level even though the VC backed sample has a lower underpricing than the control sample (because the sample size increases and the standard error decreases).

Because of the skewed distribution and the large outliers without winsorizing the initial returns, this papers confirms hypothesis 1a because of the results of the winsorized comparison of means.

	comparison of means	Winsorized comparison of means
	(T-Stat)	(T-Stat)
PE backed vs control firms	-0.83	-1.83*
PE backed vs control+VC firms	0.77	-2.17**

Table 4. Differences in means of the total sample 2007-2015

*P<10% **P<5% ***P<1%

5.3 Analysis of the underpricing results between 2007-2011 and 2011-2015

This section will try to give an answer whether the findings of Loughran & Ritter (2004) about cyclicality are applicable to this research in a later period as well. They discovered that IPOs are even more underpriced during a hot issue market than during a cold issue market (1999 was the hot market related to the internet bubble and 2002 as the cold market). The literature is ambiguous about the definition of a hot issue market, but as stated in section 2.2 and retrievable from chart 1, it seems that the 2007-2011 is definitely a colder issue market than the 2011-2015 period.

From table 5 is visible that both the non-backed combined with the VC on one side and PE group on the other side, have increasing number of issues during the latter period.

On the contrary is visible from table 5, the lower winsorized mean compared to the mean of the 2007-2011 period, which is assumed to be the cold market.

The results of the T-test show that no convincing conclusions can be made about the differences in underpricing between the periods, but the hypothesis 1b should still be rejected, since there is no evidence that the later period has higher underpricing and from visible observation it seems that the earlier period even has higher underpricing.

Besides Cao (2011) assumed that the portfolio time is shorter during hot periods; from our sample the opposite is true. What is assumed to be the colder market has a shorter time to exit. Debate whether the 2011-2015 sample is really a hot period is justified, although about 50% more issues took place in the latter period in the US.

	Winsorized	Winsorized	Winsorized	Time	Time to	Observations	Observations
	mean 2007-	mean 2011-	Comparison	to exit	exit	2007-2011	2011-2015
	2011	2015	of means	in	in years		
			(T-Stat)	years	2011-		
				2007-	2015		
				2011			
PE backed	23.741%	14.412%	-0.85	4.95	5.6	92	134
Control	32.794%	22.032%	-0.70	-	-	83	154
firms(+VC)							
*P<10%	**P<5%	***P<1%					

Table 5. Differences between the periods 2007-2011 and 2011-2015

5.4 Regression results on underpricing

In table 6 is the output of the regression model build in section 4.4. From this regression is the effect of PE backing observable, next to the effect of being issued in the different period. By doing this regression one can test both hypothesis at the same time.

The results show that there are only two significant variables; the constant and the dummy containing the firms in the industry with the highest initial underpricing. If a firm comes from the materials industry, it has a significant higher coefficient than if it the firm stems from another industry.

Nonetheless, the low F-squared in the regression model gives away the fact that this model has few statistical significance; the H0 corresponding with the F-squared is that all of the model coefficients are equal to zero. With the low F statistic this H0 cannot be rejected.

Next to this is the low R-squared that reveals that the coefficients have little explanatory power.

Unfortunately no conclusions can be made from the model.

For statistical reasons some tests were performed.

A white test is performed to check for heteroscedasticity. The results show that there is homoscedasticity (see appendix). Also a Ramsey test is performed in order to see if there is omitted variable bias between the coefficients, however at a 5% significance level we cannot reject the h0 that the model has **no** omitted variable bias.

The last statistical check was to discover multicollinearity. Perfect multicollinearity could cause low tstatistics and insignificant results (so this seems relevant for our results). Because of that, a correlation matrix between the independent variables was constructed. A correlation of 0.8 higher between different variables is viewed as too high, however none of the independent variables reached this level of correlation (see appendix).

Independent variables	Winsorized initial return (2% 98%)	
Constant	0.138 (0.070)**	
DHOT	0.021 (0.066)	
Dmacroindustrials	-0.038 (0.091)	
Dmacromaterials	.256 (0.097)***	
DPE	0.011 (0.057)	
Firmsize	0.00 (0.00)	
Offersize	-0.00 (0.00)	
Price/earnings ratio	0.00 (0.00)	
F-statistic	1.19	
R-squared	0.032	
P<10% **P<5% ***P<1%		

Tuble 0. OLD regression on initial anacipricing

6. The methodology used in order to analyze the long-run returns

This section will explain how prior literature used different methodologies in order to make conclusions about the performance in the long-run.

6.1 Introduction to prominent approaches in the literature

There are several methods to be distinguished in the literature. The current relevant literature is still inconclusive about which method delivers the most statistical and practically relevant results. One of the aspects where differences arise is the method enhanced in order to measure and calculate the returns; the buy-and-hold abnormal returns (BHAR), cumulative abnormal returns (CAR) and median returns.

Both BHAR and CAR are the most common techniques used in the literature. There exists an ongoing discussion on which method to use. They both have their (dis)advantages. The key advantage of BHAR is that it really replicates an investor's experience of holding that same particular stock.

The main advantage of CAR compared to BHAR is as Fama (1998) stated: CARs provide a less biased method to calculate long-horizon returns because they eliminate the compounding effect of a single year's poor performance. BHARs deliver more extreme results due to compounding. That is why they often violate the assumptions of ordinary T-tests. Schöber (2008) uses both methods but is stating that, because of previous literature, the discussion mainly concentrates on BHARs as they are a more realistic description of reality.

The BHAR and CAR are both mostly calculated in what scientists call the event time. New methodology arises in which the returns are calculated in the calendar time. One of the methods that only makes use of calendar time is the one of Jensen's alpha. This technique gathers a portfolio of stocks for which the event occurred and define the abnormal return earned by this portfolio over the risk free rate. This abnormal return is a return that cannot be ascribed by expected return models, like CAPM or the three-factor model.

However, the main disadvantage of this model is the low statistical power in detecting abnormal performance in the long-run. This happens because the method averages out the outliers of the extreme hot and cold weeks in the sample (Mitchell & Stafford, 2000).

Another insight prominent in the literature is the equal and value weighted returns method. Equal weighted returns are logically where every firm has an equal stake in the mutual return calculation of an entire portfolio. Value weighted returns, on the contrary, are portfolio returns where firms with a higher firm value rank higher and have a larger impact on the entire portfolio than firms with a smaller firm value. By doing this, a researcher can test whether the size factor has a significant role in influencing the returns of an entire portfolio. The size factor in general says that firms with a larger firm value have a less volatile return distribution, in either up- or downside direction. Applied to this research, one would expect to see less underperformance in the three year time span for the value weighted portfolios.

Another important aspect of this research is determining the benchmarks. Since market effects are more prominent over the long-run, we could not simply use the PE backed firms and compare them directly with the control firms.

Because the firms selected in the control sample could be issued up to one year before or later than the PE backed counterpart, a lot of market differences can arise between the two on the long-run causing market biases. However, indirectly this paper will still compare them by putting them both against three major benchmarks over a three year timeframe and check how they both perform against those same benchmarks.

The following three indices are chosen:

- The S&P 600, that consists of firms with a market value of 300 million up to two billion US dollar.
- The S&P 500 equal, with the 500 largest firms by market capitalization given an equal stake in the average share price development.
- The S&P 500 value, which gives the even larger firms in the sample an even higher stake in portfolio development of the index.

The stock price at the day after the issue date for the individual stocks of the PE and control sample is matched with the stock price of the three indices at the same date and accordingly matched the full period of three years. By doing this, the market or time related biases are deleted.

6.2 Long-run methodology in this paper

To calculate the cumulative abnormal return (CAR) this research simply follows the methodology of Holthausen & Larcker (1996).

The first trading day will be excluded for every firm since as stated before the price can suffer from underpricing the first day leading to a share value that is not in line with the fair value of the firm. Besides at the first trading day not all investors are allocated the shares accordingly as on average in later periods (remember, mainly institutional investors invest at introduction).

Another important remark is about firms that delist between their introduction and three years later. The method implies that when firms in the sample are delisted in the time period of three years post IPO we will exclude their returns from the sample and all the returns will be set to zero when calculating the CAR.

The calculation of both BAHR and CAR uses weekly data. Since monthly data retrieved from DataStream uses stock price data that occur also during weekends, it cannot be guaranteed that this monthly data summarizes stock prices of the week before or after. It is also possible that this data stems from the Friday before the weekend but because of statistical safety this paper uses weekly data instead. Weekly benchmark adjusted returns are calculated as the weekly raw returns on a stock minus the corresponding (5-day) weekly benchmark return. This is expressed as follows:

$$ar_{it} = r_{it} - r_{mt} \tag{3}$$

The ar_{it} being the benchmark adjusted return.

With the average adjusted return for the total portfolio of N stocks for month t, being:

$$AR = \frac{1}{N} \sum_{i=1}^{N} ar_{it} \tag{4}$$

These average adjusted benchmark returns are summed up accordingly to obtain the CAR (Ritter, 1991):

$$CAR_{q,s} = \sum_{t=q}^{s} AR_t \tag{5}$$

Where q is the event month and s the final month to be calculated.

Reminisce from the previous findings and literature that the PE backed firms in most papers outperform their counterparts that went through an IPO on the long-run. This paper ought to check for similar results, leading to the following hypothesis:

2a. The CAR and BHAR of the PE backed firms outperforms the control groups' CAR and BHAR in a three year time period for both the 2007-2011 and 2011-2015 sample.

The methodology of the buy and hold abnormal return is fairly similar to the one of the Cumulative abnormal return. If a firm delists before the end of the three-year period, the return of the IPO and the corresponding benchmark returns, only includes the period from the day after issuance until the week before delisting. The three year buy and hold abnormal return "holding experience" is defined as follows:

$$BHAR_{1,T}^{i} = \prod_{t=1}^{T} (1 + R_{t}^{i}) - \prod_{t=1}^{T} (1 + R_{t}^{i,B})$$
(6)

 R_t^i is the ordinary return in month t of stock i. $R_t^{i,B}$ is the simple return of the corresponding benchmark with the returns on the same date as the specific stock. Both these returns are compounded for the three year period.

Reminisce the research performed by Loughran & Ritter (2004). They discovered that firms that were introduced to the market suffered from higher initial underpricing than firms that were issued in a cold market. This paper analyses the underpricing results when a firm is issued in a cold or hot market, and moreover tries to find out if there is a significant difference in the long-term performance as well. Several papers with different IPO samples found out that the level of underpricing influences the long-run performance; a higher initial underpricing leads to a worse performance in the long-run (Levis, 1993) (Chi & Padgett, 2005). These findings along with the assumption that the underpricing differs between the "hot" and "cold" issue market, one could presume that the long-run performance of the hot issue market 2011-2015 will have a worse performance than the cold issue market 2007-2011 for the samples in this paper. However, in section 5.3 we discovered that the underpricing was lower in the proposed "hot" period. Therefore we analyze what is more important; the higher level of initial underpricing in 2007-2011 or the increasing IPO volume in the US market but also in our database in 2011-2015.

2b. The PE backed firms of the 2007-2011 have significantly different performance from the PE backed firms of the 2011-2015 on the long-run.

In order to calculate the value weighted returns, the total assets before the offering are obtained from ThomsonOne. When data is not available for a specific firm, the median total assets value of the other firms from the same sample (pe or control) are selected. To obtain the value weights across the entire sample; the total assets per firm at month 1 are summed up. Each firm has its stake equal to its value divided by the total value of the portfolio. The value weighted means of all the returns are determined and delivers significantly different results than the equal weighting scheme.

6.2.1 Statistical hypothesis testing

The statistical methodology differs a bit from the one at the underpricing section. Because of the large number of observations of returns in the samples, it was not possible to perform a numerical distribution test like the shapiro-wilk test mentioned before. After checking several histograms and plots, however, the distribution seems normal (see appendix). For safety reasons will this section use the non-numerical Wilcoxon signed-rank test, for which a normal distribution is not necessary. This test counts the negative and positive numbers from zero in order to make a conclusion about the significance of the results.

Still, for the significance test of the results of the PE backed versus the control group, the Welch's t-test assuming unequal groups and variances, is operated. This due to the fact that the Wilcoxon signed-rank test requires paired samples. The sample sizes of the PE backed and the control group differ making it impossible to engage in this test.

The Welch's t-test is unusable for the test between the PE and the control group, since the value weighted returns are generated as means from the equal weighted returns. Only individual tests are possible on this sample (see following sections and corresponding tables).

7. Analysis of the long-term returns

This section will discuss the performance of the control firms and the private equity backed firms according to different statistical methods in the long-run and compares it with prior literature.

7.1 The Buy and Hold abnormal returns (BHAR)

Table 7 shows the compounded returns for the 2007-2011 sample both equal and value weighted. As is visible from the returns, every subsample significantly underperforms compared to the indices of the S&P600 and the S&P500 equal. The three year performance of the control firms are -12.98% and -10.08% against these indices and also the PE backed sample underperforms with -10.27% and -5.78%. Remarkable is the fact that the first year performance of all the samples seem positive against the indices, however from the second year on the indices seem to outperform the samples. The returns compared to the S&P500value, on the contrary, seem positive but are all not significantly different from zero (the null hypothesis). Only the value weighted returns of the PE backed firms have a significant positive value compared to the benchmark. The larger firms in the sample seem to have a slightly better performance, as supported by literature.

The combined VC and control backed sample seem to perform better than the control backed sample on its own. One could argue that the venture capital backed firms perform slightly better than their nonbacked counterpart. The firms that are backed by a private equity parent don't seem to show any improvement in returns compared to both the control sample as the combined sample of VC and control firms. Strengthening this argument is panel D where the results of the Welch's t-test between the PE backed firms and the control firms are stated. None of the results, even at year 1 (week 52) or year 2 (week 104), are significant.

Noteworthy is the fact that the S&P600 index is performing the best against all the samples, even though one would say that the firms with similar sample size would have similar results as the firms in the samples even strengthened by the fact that this index is also value weighted like the benchmark best performed against (S&P value). An explanation probably comes from the volatility topic, where more risk is rewarded with higher returns if an investor invests in an index like the S&P600.

Table 7. The buy and hold abnormal returns for the 2007-2011 period

The Bhar is calculated by using the weekly adjusted returns compared to the specific index. These adjusted returns are compounded accordingly. If a firm delists before the three year deadline, the returns are incorporated in the analysis until the week before delisting. The value weighted returns are calculated using the total assets just before offering. Each firm has a stake in the average returns equal to its size compared to the total firm size in the sample.

	Equal weighted	BHAR 2007-	2011		
Week	Week Panel A. Control firms				
	S&P600	S&P500equal	S&P500value		
52	11.16%	11.84%	14.37%		
104	-4.64%**	-2.22%*	3.8%		
156	-12.98%**	-10.08%**	2.68%		
	Panel B. Control	firms + Venture b	acked		
52	7.91%	9.59%	12.56%		
104	-4.41%**	-1.89%*	5.03%		
156	-11.31%**	-8.23%**	5.91%		
Panel C. PE backed firms					
52	1.15%	3.39%	8.16%		
104	-7.28%**	-4.62%*	4.29%		
156	-10.27%**	-5.78%*	8.18%		
Panel D. PE vs. Control firms(T-statistic)					
52	0.62	0.56	-0.41		
104	0.33	-0.31	0.06		
156	0.19	0.3	0.38		

Va	Value weighted BHAR 200					
Week	Panel A. Control firms					
	S&P600	S&P500equal	S&P500value			
52	-5.69%	-5.47	-2.99			
104	-12.42%**	-9.25**	-4.53			
156	-19.99%**	-17.62**	-5.03			
Р	Panel B. Control firms + Venture backed					
52	3.47%	3.28%	6.4%			
104	-9.8%**	-7.86%*	-1.82%			
156	-10.63%**	-8.53%**	3.88%			
	Panel C. PE backed firms					
52	-3.01%	-0.60%	4.01%			
104	-4.94%*	-1.29%	6.01%			
156	6%	5.14%	17.46%**			

*P<10% **P<5% ***P<1%

The second period of 2011-2015 shows totally different results in a sense that the differences between the samples are larger now. The control groups still suffer from a large underperformance compared to the benchmarks, now even compared to the S&P500 value. The PE backed firms still have significantly negative three-year results of -7.18% and -5.61% on the long-run versus the S&P600 and the S&P500equal, however, these are definitely higher than the three year performance of the control firm at -25.94% and -22.24%. The PE firms show again positive three year performance against the S&P500 equal, these are however not significant. From Panel D. can be observed that the PE backed firm significantly outperforms the other samples at each period in time and for all three indices, thereby confirming our hypothesis 2a for at least this time period (2011-2015) and with this calculation method (BHAR). The value weighted samples again give higher statistics than the equal weighted sample.

	Equal weighted BHAR 2011-2015					
Week	Panel A. Control firms					
	S&P 600	S&P500 equal	S&P500 value			
52	-3.44%*	-3.52%*	-0.08			
104	-12.43%***	-11.27%***	-6.48%**			
156	-25.94%***	-22.24%***	-14.48%***			
Panel B. Control firms + Venture backed						
52	1.96%	1.89%	4.48%			
104	-8.03%***	-6.68%***	-1.97%***			
156	-24.13%***	-20.49%***	-13.03%***			
Panel C. PE backed firms						
52	10.35%	9.71%	12.50			
104	5.99%	5.52%	11			
156	-7.18%*	-5.61%*	2.48			
Panel D. PE vs. Control firms(T-statistic)						
52	2.26***	2.16**	2.18**			
104	2.41***	2.21**	2.27**			
156	2.08***	1.83*	1.86*			
*P<10%	**P<5%	***P<1%				

Table 8. The buy and hold abnormal returns for the 2011-2015 period

Valu	Value weighted BHAR 202					
Week	Panel A. Control firms					
	S&P 600	S&P500	S&P500			
		equal	value			
52	0.58	-0.16	1.96			
104	-2.50**	-0.58	3.89*			
156	-19.51***	-16.1%***	-8.73***			
Pane	Panel B. Control firms + Venture backed					
52	-2.78*	-3.63*	-1.52*			
104	-3.60***	-1.92**	2.66***			
156	-18.42***	-15.56***	-7.97**			
	Panel C. PE backed firms					
52	0.98	-0.11	2.87			
104	5.55	4.41	9.78			
156	-3.79	-1.91%	6.17%*			

7.2 The cumulative abnormal returns (CAR)

Table 9 shows the returns summed up for the 2007-2011 spectrum. On the equal weighted side, the returns look at first sight mainly positive. The control firms have a positive three year performance of -2.67%, 0.5% and 15.01% against the S&P600, S&P500 equal and S&P500 value respectively. Only the positive value of 15.01% is significant. The PE backed firms have notable positive values against the S&P500 value three year long. Against the other two indices the results are not significantly positive on the contrary. The value weighted CAR seem are to ambiguous to make conclusions about. On the one hand, there are significantly negative numbers at year 1 opposed to the equal weighted results and on the other hand are the even higher significant positive digits for the three year positive returns against the S&P500 value index. Just like the case of the BHAR 2007-2011, are no significant differences between the PE and control samples (Panel D) and therefore should hypothesis 2a be **rejected** for the 2007-2011 period.

Eq	ual weighted CA	R 2007-3	2011		Valu	e weighted CAR	2007	-2011
Week	Panel A. Control firms			Wee	k	Panel A. Control firms		
	S&P 600	S&P500	S&P500			S&P 600	S&P500	S&P500
		equal	value				equal	value
52	-3.98%	-1.32%	0.97%	5	2	-13.91*	-11.99*	-10.51*
104	-2.5%	0.81%	8.72%*	10)4	-13.92*	-9.21*	-3.03
156	-2.67%	0.5%	15.01%**	1	56	5.11	7.89	22.22**
Pan	el B. Control firm	ns + Venture k	backed		Pane	B. Control firms	s + Venture b	acked
52	-4.16%	-1.38%	1.51%	5	2	-4.41	-3.32	-0.77
104	-5.09%	-1.69%	7.13%	10	04	-4.33	-0.99	5.69
156	-6.88%	-3.60%	11.51%*	1	56	-2.24	0.07	13.57*
	Panel C. PE k	backed firms				Panel C. PE ba	acked firms	
52	1.20%	4.35%	8.90%**	5	2	-1.94	1.00%	5.61**
104	2.68%	6.35%	16.85%***	10	04	0.67%	5.19	14.01***
156	3.13%	7.64%	22.72%***	1	56	9.33	14.81	27.67***
Pan	el D. PE vs. Cont	rol firms(T-sta	atistic)					
52	0.57	0.63	0.88					
104	0.45	0.49	0.7					

Table 9. The cumulative abnormal returns for the 2007-2011 period

The cumulative returns are calculated by summing up the weekly adjusted returns.

P<10% **P<5% ***P<1%

0.38

0.47

0.49

156

The latter period of 2011-2015 shows the first significant positive digit for the equal weighted samples against the benchmark S&P500equal at year 2. Again, the PE backed firms seem to outperform the control firm, but now only for the first two years. Overall, the hypothesis 2a **is confirmed** for the period 2011-2015. The third year does not give significant T-statistics. The differences in returns between the value and equal weighted samples are the largest for this sample; The value weighted firms have higher returns.

Equal weighted CAR 2011-2015						
Week	Week Panel A. Control firms					
	S&P 600	S&P500	S&P500			
		equal	value			
52	-4.75	-4.41	-2.00			
104	-14.42**	-12.76*	-8.59			
156	-20.94***	-17.09**	-11.01			
P	anel B. Control firms +	Venture b	backed			
52	1.34	1.67	4.00			
104	-5.48	-3.70	0.30			
156	-12.70*	-8.83	-2.98			
	Panel C. PE bac	ked firms				
52	6.70	6.65	8.89**			
104	6.85	6.91*	11.52***			
156	-7.01	-4.80	1.51*			
P	Panel D. PE vs. Control firms(T-statistic)					
52	2.29**	2.15**	2.17**			
104	2.85***	2.63***	2.69***			
156 1.47 1.30 1.32						
P<10%	**P<5% ***P<1%					

Table 10. The cumulative abnorma	I returns for the 2011-2015 period
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Valu	e weighted CAR	2011	-2015
Week	Panel A.	Control firms	
	S&P 600	S&P500	S&P500
		equal	value
52	-2.82	-3.18	-1.20
104	-3.01*	-0.81	3.03
156	156 -13.36***		-3.92
Pane	l B. Control firm	s + Venture b	acked
52	-5.56*	-5.99*	-4.04
104	-2.29	-0.28	3.59
156	156 -11.22*		-0.21
	Panel C. PE b	acked firms	
52	1.70	0.92	3.71*
104	6.28	5.75*	10.36***
156 1.46		3.83	10.22**

7.3 Performance of the PE backed samples between time periods

Table 10 and 11 show the performance of the private equity backed firms from 2007-2011 against the PE backed firms from 2011-2015. As motivated in section 6.2 before the second hypothesis, this part will conclude whether the cold market of 2007-2011 will have significantly better long term performance than the hot market of 2011-2015. This hypothesis arose because of the relation between higher underpricing and worse long-run performance. The results from section 5.3 showed that the 2007-2011 sample have higher underpricing so that it is possible that the performance could be worse too. In table 11 and 12 are the results for this topic; only the two year performance for the BHAR is significantly different and only against the S&P600. Visible from the prior tables is that the performance of the PE backed sample is better in the sample of 2011-2015 than the 2007-2011 against the S&P600, even to an amount of around 12%. The results from section 5.3 showed that the 2007-2011 sample has higher underpricing, normally causing the long-run performance to decline. Fairly similar results appear using the CAR method; in that way that the differences are not significant.

Visible from table 12; only the three year performance against the S&P500value of the 2011-2015 period is significantly worse than the earlier period. In general, applying both methods, no really large differences arise between the timeframes. Possible explanations are that the PE backed sample in the US did not really have an uprising after 2012 like the total US IPO market (reminisce chart 1). Even though the number of offerings of PE backed IPOs increased with approximately 40%.

Week	Equal weighted BHAR	2011-2015 -vs 2007-2	2011 (T-statistic)
Performance against:	S&P600	S&P500 equal	S&P500 value
52	1.22	0.83	0.57
104	1.87*	1.46	1.02
156	0.27	0.02	-0.49

Table 11. Comparison of the BHAR performance of the assumed 'hot' period with the 'cold' period

*P<10% **P<5% ***P<1%

Table 12. Comparison of the CAR performance of the assumed 'hot' period with the 'cold' period

Week	Equal weight	ed CAR 2011-2015 -vs 2007-20	011 (T-statistic)
Performance against:	S&P600	S&P500 equal	S&P500 value
52	0.97	0.35	-0.00
104	0.53	0.07	-0.67
156	-0.94	-1.16	-1.95*

*P<10% **P<5% ***P<1%

7.4 The long-run results compared to prior literature

There exists a lot of prior research in this topic. Some papers show similar results, others show slightly different results. Levis (2011) only used the BHAR method in his research, but also scrutinized value weighted returns with a similar approach, as this thesis. He found a three year performance of the control firms of -20.2% against an all US share index, similar to the results in table 7 and 8. His PE backed outperformance, however, was significantly larger; the PE backed firms in his sample showed a significant outperformance not only against the control firms but even against the general indices.

The same applies for the value weighted returns, his value weighted sample performs better as well and even better than the general stock market.

Gompers and Lerner (2003) used both the BHAR and CAR in their analysis. They did not analyze the difference between non-backed and backed firms; they only looked at the long-run IPO performance. They used the CRSP value weighted index and a book-to-market portfolio based index that consists of firms from the NYSE.

Their three year BHAR results range from -6.3% up to even -19.9%. Their results, following a fairly similar CAR as in this research, delivers significantly higher returns. Results hereby range from -4.5% up to 8%. These results are relevant for this paper because it looks at both CAR and BHAR and gives an explanation for the higher returns of the CAR results. They explain this by stating that: "This difference arises because of the large skewness in the individual IPO firm returns". Applicable to this research is approximately the same explanation; some firms suffer from excessively low negative returns and due to compounding bias the results to skewness to the left.

Schöber (2008) analyzed his buyout backed sample compared to three different indices; the S&P 500, NYSE composite and the IPOX composite. His buyout backed sample delivered three year holding returns that were only negative compared to the IPOX composite index. Although, he discovered that the three year median BHAR's all have a negative BHAR of -20% to even -30%.

	Control firms-BHAR equal	Control firms-CAR equal	Control firms-BHAR value	Control firms-CAR value
2007-	Significant	One index is being	Even lower performance	Slightly better performance
2011	underperformance against	outperformed	than BHAR equal	than equal weighted
	2/3 indices			comparables
2011-	Significant	Significant	Significant	A bit less but still significant
2015	underperformance against	underperformance against	underperformance against	underperformance
	all indices	2/3 indices	all indices	compared to equalweighted
	PE backed- BHAR equal	PE backed- CAR equal	PE backed- BHAR value	PE backedCAR value
2007-	PE backed- BHAR equal Underperformance and not	PE backed- CAR equal One index is being	PE backed- BHAR value Outperformance compared	PE backedCAR value Very similar results to equal
2007- 2011	PE backed- BHAR equal Underperformance and not significantly different from	PE backed- CAR equal One index is being outperformed, no difference	PE backed- BHAR value Outperformance compared to S&P 500value	PE backedCAR value Very similar results to equal weighted counterparts
2007- 2011	PE backed- BHAR equal Underperformance and not significantly different from the Control firms	PE backed- CAR equal One index is being outperformed, no difference compared to controls	PE backed- BHAR value Outperformance compared to S&P 500value	PE backedCAR value Very similar results to equal weighted counterparts
2007- 2011 2011-	PE backed- BHAR equal Underperformance and not significantly different from the Control firms Significantly better	PE backed- CAR equal One index is being outperformed, no difference compared to controls Significant outperformance	PE backed- BHAR value Outperformance compared to S&P 500value Outperformance against	PE backedCAR value Very similar results to equal weighted counterparts Better performance even up
2007- 2011 2011- 2015	PE backed- BHAR equal Underperformance and not significantly different from the Control firms Significantly better performance than the	PE backed- CAR equal One index is being outperformed, no difference compared to controls Significant outperformance of controls up to the 2 nd	PE backed- BHAR value Outperformance compared to S&P 500value Outperformance against one index.	PE backedCAR value Very similar results to equal weighted counterparts Better performance even up to the 3 rd year compared to

8. Conclusions and recommendations for further research

The main aim of this thesis was to provide a thorough analysis of the performance of private equity backed IPOs compared to its counterparts during and after the 2008 financial crisis. More specifically, to look at both the first day performance after introduction as well as the long-run performance of up to three years of private equity backed companies compared to selected and matched non-backed counterparts. Information of IPO volume and prior literature revealed that from 2011 onwards there was a warmer IPO market in the US and therefore it was decided to analyze the differences across the private equity backed sample. The sample was divided into two parts: The assumed cold market of 2007-2011 against the warmer market of 2011-2015.

The underpricing results for the entire sample of 2007-2015 led to the conclusion that all the samples experienced significant underpricing and that, after winsorization, the private equity backed IPOs have significantly lower underpricing than their control and control + venture capital backed counterparts. This is in agreement with the majority of the literature; most literature mentioned the relevance of Jensen's information asymmetry hypothesis. The larger and more mature PE backed firms are being monitored very narrowly by their parent and because of that they have an introduction share price that corresponds with the fair value of a firm. The analysis of the differences between the periods, however did not lead to any significant results. The underpricing seems higher for the 2007-2011 group, which is remarkable as this was during the assumed to be cold market period.

To analyze the long-run performance, two different methods were applied. The returns were calculated by applying the BHAR and CAR method and the samples were divided into the two periods from the start. According to the BHAR method, both the control and the PE samples significantly underperformed compared to the S&P600 and the S&P500 equal in the 2007-2011 period and also underperform compared to the S&P500 value for the 2011-2015 period. It is remarkable that during the 2007-2011 sample, the PE backed firms could not outperform their control and VC counterparts, opposed to the significant outperformance observed in the 2011-2015 period. Finally, an analysis on the value weighted return, based on market values before the offering was performed. This delivered slightly increased performance in general.

The CAR results showed notably higher returns than the BHAR in both periods. The only significant numbers during 2007-2011 were against the S&P500 value whereby both the PE and the control sample outperformed this benchmark. The 2011-2015 period showed some significant negative numbers again, but was generally close to the indices as well.

It was only during the 2011-2015 period that PE backed firms seem able to outperform their VC and control counterparts. The value weighted CAR seem to only influence the results unambiguous compared to the equal weighted equivalent.

Regarding both the short-run and long-run performance, the process undergone by the private equity backed company during portfolio time seems to increase the results compared to ordinary IPOs.

No significant differences arose at the testing of the performance of the PE backed sample in 2011-2015 versus the performance in 2007-2011, because very few significant results appeared. Some significantly different results only appeared at the two-year performance against the S&P600 for the BHAR method and the three-year performance against the S&P500 value.

One of the shortcomings of this thesis is the data selection process, although a great deal of time and effort was spent in order to prepare the dataset, it was still hard to distinguish private equity backed IPOs that really went through the private equity process of monitoring, changing and even redeveloping help from the private equity firm, from firms that were simply sold (by PE firms) in order to make profit. Besides, it was impossible to distinguish reverse leveraged buyout (that have been public before) from private equity backed IPOs that have never entered the exchange before. Further research with more time, financial resources and connections could differentiate more precise on this matter.

Further recommendations for future research could be in controlling for higher leverage risk for the private equity backed firms, since they are most likely to be financed with a notable amount of debt. Jensen's alpha method seems a good candidate for this, although some improvements are necessary. The significant loss of statistical power is one of the insights that have to improve.

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Appendix



Histogram and summarization of the PE initial returns 2007-2015

Histogram and summarization of the PE initial returns winsorized (2% 98%)



Histogram and summarization of the CO initial returns 2007-2015



Histogram and summarization of the CO initial returns winsorized (2% 98%)





Histogram and summarization of the CO+VC initial returns 2007-2015

Histogram and summarization of the CO+VC initial returns winsorized (2% 98%)



OLS regression	stata output	(section 5.4)
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Source	SS	df	MS	Numb	er of obs	=	260
Model Residual	1.70660558 51.6185235	7 252	.243800798 .204835411	Prob	> F uared	=	0.3087
Total	53.325129	259	.205888529	- Adj Root	R-squared MSE	=	0.0051
initialret~w	Coef.	Std. Err.	t	P> t	[95% Coi	nf.	Interval]
dHOT2 dMACRO7 dMACRO8 dPE2 firmsize_PE offersize_PE pe_PE cons	.02146 0378252 .256469 .010769 4.04e-07 0000412 .0000105 .1381447	.0657985 .091928 .0973308 .0574851 3.66e-06 .0000699 .0002398 .0703222	0.33 -0.41 2.64 0.19 0.11 -0.59 0.04 1.96	0.745 0.681 0.009 0.852 0.912 0.556 0.965 0.051	108123 218870 .064783 102443 -6.80e-0 000178 000461 0003493	5 2 5 4 6 9 7 5	.151045 .1432198 .4481545 .1239814 7.61e-06 .0000964 .0004827 .2766389

White test for homogeneity

	-		
Source	chi2	df	p
Heteroskedasticity Skewness Kurtosis	37.69 21.63 4.64	30 7 1	0.1578 0.0029 0.0313
Total	63.96	38	0.0053

Ramsey test for omitted variable bias

Ramsey RESET test using powers of the fitted values of initialreturnPE_w Ho: model has no omitted variables

F(3,	249)	=	2.49
Prob) > F	=	0.0611

Correlation matrix	between the in	dependent variables
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	dHOT2	dMACR07	dMACR08	dPE2	firmsi~E	offers~E	pe_PE
dHOT2	1.0000						
dMACR07	-0.0031	1.0000					
dMACR08	-0.0862	-0.1133	1.0000				
dPE2	-0.0419	0.1243	-0.0350	1.0000			
firmsize PE	0.0710	-0.0440	-0.0596	-0.0146	1.0000		
offersize PE	0.1034	-0.0243	-0.0848	0.0409	0.6079	1.0000	
pe_PE	-0.0219	-0.0204	0.1318	-0.0637	-0.0090	-0.0075	1.0000

Distribution of the bhar PE 2011-2015



Distribution of the bhar PE 2007-2011



Distribution of the car PE 2011-2015 over the S&P600



Distribution of the car PE 2007-2011 over the S&P600

