

Underpricing in IPOs and the Effects of IPO Cyclicity and Owners' Investment Philosophy

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Abstract

We examine underpricing levels in initial public offerings (“IPOs”) using a sample consisting of 50 private equity-backed, 50 venture capital-backed and 113 non-sponsored IPOs. The sample is collected using offering data from firms listed on the UK Main Market, International Main Market and AIM on the London Stock Exchange, between the years of 2006-2015. We compute first day returns and compare the results between our three subgroups. Also, we measure the effect of IPO cyclicity and owners' investment philosophy by comparing first day returns across subgroups in different periods of IPO activity and distinguishing between two types of owner focus, respectively. Our findings show that private equity-backed IPOs experience the lowest level of underpricing, followed by venture capital-backed IPOs. In periods of high market activity, venture capital-backed IPOs experience significantly higher levels of underpricing. Financially focused private equity firms achieve a lower level of underpricing than their operationally focused counterparts; the opposite is found to be true for venture capital firms. Our results substantiate the hot issue market theories and the relative power of participants in IPO deals, in a European equity market setting.

Keywords: Initial Public Offering (IPO), Underpricing, European Equity Capital Markets, IPO Cyclicity, Investment Philosophy

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1 Introduction

Private equity and venture capital firms have long been a mainstay of equity capital markets in the United States. As is observable from the increasing number of investment companies with ever-larger funds, we have seen such investors firmly establishing a position also on the European equity capital markets (Levis, 2011). In the US in 2003, private equity-backed IPOs accounted for 43% of total IPO volume, while that number amounted to only 9% in Europe. In 2013, corresponding figures were 50% and 48%, respectively, thus representing a staggering increase of 39 percentage points in Europe over the 10 year period (PwC, 2013).

A private equity (“PE”) firm is an investment manager that invests in the private equity of operating companies that are not publicly traded on a stock exchange. The various investment strategies employed by PE firms vary widely, but may include leveraged buyouts (“LBOs”), venture capital (“VC”), growth capital, distressed investments and mezzanine capital (Mogilevsky and Murgulov, 2012; Private Company Knowledge Base, 2016). PE firms typically comprise small teams which emphasize the recruitment of professionals with backgrounds from mainly investment banks, but also, to a lesser extent, management consulting firms and strategy consulting firms in particular. VC firms, on the other hand, invest money to seed early-stage, emerging growth enterprises that are generally much younger, more high-growth and smaller than their PE counterparts (Private Company Knowledge Base, 2016). Hence, VC investments are also more risky; too risky for seeking funding on the standard capital markets or to obtain regular bank financing. VC firms are usually structured in a similar way as PE firms, but their professionals have different skillsets. Instead of having backgrounds in finance, many VC professionals either have a background in technology, working as a scientist or a researcher, or have an industry background, working at a large corporation or a start-up (Mogilevsky and Murgulov, 2012). Often, VC professionals possess a distinct expertise within one or a few specific areas, which allows them to understand and separate groundbreaking business ideas from the average start-up. While private equity firms also highly value business acumen, their investments in more mature companies reduce the need for investment professionals to have start-up, doctoral or industry experience, instead relying to a greater extent on operational advisors/industry experts.

Because PE and VC firms realize their returns when exiting their investments, the exit process is one of the most critical stages in the investment process (Sinha *et al.*, 2005). As the initial public offering (“IPO”) is one of the main exit methods for PE and VC firms (Levis, 2011), one would expect to see a significant share of the academic IPO literature to be focused on VC- and PE-

backed IPOs and particularly on the underpricing of offerings and differences in underpricing levels when comparing such IPOs. Furthermore, as PE investors have grown more and more important in the European equity markets, one would expect to see recent literature narrow in on this topic. However, this is not truly the case, and notably not in Europe.

Mogilevsky and Murgulov find that PE-backed IPOs in the US experience a significantly lower level of underpricing than VC-backed and non-PE/non-VC (“non-sponsored”) IPOs. Megginson and Weiss (1991) state that the underpricing of VC-backed IPOs is less than that of non-sponsored IPOs as the presence of venture capitalists in the issuing firm acts as a certification of the quality of the issue through the venture capital firm’s investment in financial and reputational capital. Gompers (1996), Lee and Wahal (2004) suggest that VC firms look forward to creating a reputation for the firm in the market that will benefit them in the future in terms of increased demand for future fundraising and thus higher management fees. In order to achieve this future profitability and take future portfolio companies public, VC firms are willing to incur the upfront loss from underpricing.

Previous literature has scoured through the topics presented above, and there have been studies examining differences in underpricing levels between PE-backed, VC-backed and non-sponsored IPOs. Studying previous works, we note the dominance of US markets as the subject of significantly more studies than their European counterparts. Consequently, we identify a gap in existing studies and proceed to anchor this paper in the conventional owner-underpricing analysis on the European market. Having laid the groundwork, we refine the analysis by focusing on venture capital and the relation between underpricing in initial public offerings and equity capital market activity. Furthermore, we extend the regression models of previous literature to analyze underpricing differences by categorizing PE and VC firms as either primarily financially focused or primarily operationally focused. This addition is vital for our paper to constitute an important contribution to the existing financial literature – because of a range of difficulties in obtaining reliable data, few studies have been done focusing on this area. Our aim is for this study to provide a new angle while acting as a point of reference for future studies which doubtlessly are needed to encompass the various, too often neglected, qualitative elements of key stakeholders and their effects on underpricing in IPOs.

In order to collect our sample, we look at all successful listings on the London Stock Exchange (“LSE”), including the Alternative Investment Market (“AIM”), the UK Main Market and the International Main Market between November 2006 and December 2015 (inclusive). We subsequently manually classify each listing as PE-backed, VC-backed or non-sponsored. Our findings show that PE-backed IPOs experience a significantly lower level of underpricing than both VC-backed and non-sponsored. Additionally, our results indicate that VC-backed IPOs are significantly less underpriced than non-sponsored IPOs, but experience a higher level of underpricing than PE-backed IPOs. Our first finding provides further support of the theory put forward in 1982 by David Baron in which Baron states that the informational advantage investment banks experience in relation to the IPO firm leads to the IPO discount of the issuer’s stock. However, our results contradict the signaling theory put forward by Grinblatt and Hwang (1989), Allen and Faulhaber (1989) and Welch (1989). According to the aforementioned authors, the issuer has an advantage in terms of information and uses the IPO discount as a tool to signal the quality of the issue to the market. If this was the case, and quality signaling was the driving pricing method in IPOs, we would expect to see an increasing level of underpricing as the information advantage of the issuing firm increases. In our sample, this is not true. Our second finding relating to a lower degree of underpricing for VC-backed IPOs in relation to non-sponsored IPOs provides further support for Megginson and Weiss’ (1991) certification theory as well as the grandstanding theory put forward by Gompers (1996) and further supported by Lee and Wahal (2004).

Regarding the effects of highly active equity markets on the underpricing of VC-backed IPOs, our findings provide further supportive evidence of the hot issue markets theory formulated by Rossetto (2008). The findings are suggestive of VC-backed firms experiencing higher underpricing in times of high market activity. Our fourth finding establishes a link between the focus of owners and the IPO underpricing levels when their holdings are listed on a stock exchange. In short, PE firms deemed to be primarily financially focused owners, rather than operationally focused, tend to experience lower underpricing levels. For VC firms, operationally focused owners deliver the lowest underpricing levels when they list their holdings.

2 Relevant Literature, Previous Research and Hypotheses

In an attempt to provide context, we proceed by outlining, comparing and contrasting previous studies and their theories on underpricing and IPO cyclicity. A broad range of literature is available and, therefore, it is critical to bring coherence. Thus, this section culminates in the presentation of our hypotheses and the relevance of this study in the setting of previous literature.

2.1 Relevant Literature and Previous Research

The phenomenon of underpricing in initial public offerings (IPOs) was first documented by Ibbotson (1975) and has later been the topic of a number of research articles. Both Ibbotson (1975) and Ritter (1984) failed to provide any definitive reason for IPO underpricing; since then, a wide range of theories have been developed in efforts to explain why the underpricing phenomenon exists.

2.1.1 Previous Research on IPO Underpricing

The theoretical explanations for IPO underpricing can be separated into six distinct categories. First, Baron and Holmström (1980), and Baron (1982), suggest that underpricing is an effect of the *information asymmetry* regarding market conditions that exists between the security issuer and the underwriter. Second, Allen and Faulhaber (1989) and Grinblatt and Hwang (1989) develop an explanation based on the *signaling theory*, suggesting that underpricing is a way of sending credible signals to investors assuring the high quality of the firm, since only high quality firms would be able to recoup the upfront cost of the underpricing signal from subsequent issues. Third, both Chemmanur (1993), and Booth and Chua (1996) propagate for an *information generation cost theory* which suggests that in order for firms to encourage a wider subscription (reiterated by Datar and Mao in their 2006 article) and because outside investors face costs to generate information about the firm, underpricing must exist. Fourth, there is the *institutional explanation* and the theory of *deliberate underpricing*, to which a number of articles can be said to belong. Tinic (1988), Hughes and Thakor (1992), Hensler (1995), Ruud (1993) and Taranto (2003) describe the trade-off between potential litigation costs pursuant to the Securities Act of 1933 and upfront costs comprised of IPO underpricing. Hunt-McCool *et al.* (1996) proved that firms deliberately underprice, an explanation to which was offered by Prabhala and Puri (1998), arguing that deliberate underpricing is conducted by the underwriter to reduce the ex-ante uncertainty associated with an IPO. Fifth, the *behavioral imperfection theory* developed by Loughran and Ritter (2002) and supported by Ljungqvist and Wilhelm (2003) argues that underpricing is partly an effect of overly enthusiastic investors causing the market value of the company to surpass the fundamental value in an offering. Sixth, a range of contributors including Brennan and Franks (2005), and Booth and Chua (1996) put forward the idea of underpricing as *a means of retaining control*, since underpricing attracts a dispersed group of new owners which will be less likely to forcefully pursue objectives that clash with those of the pre-IPO owners.

Arguably the most prominent theory, information asymmetry has been the focus of much research. Ljungqvist's survey conducted in 2004 did indeed conclude that a theory of information asymmetry

offers the best explanation for the underpricing phenomenon. The presence of PE and VC firms will affect the information asymmetry between parties in such IPOs, and is therefore of particular interest for this paper.

In an early study of the effect of information asymmetry in IPOs and the principal-agent conflict effect on underpricing, Muscarella and Vetsuypens (1989a) conclude that self-underwritten IPOs show similar levels of underpricing, as do non-sponsored IPOs. In that case, the principal is in fact the same party as the agent. Looking to the second prominent study within this area, Ljungqvist and Wilhelm (2003) find support for less underpricing in cases where the underwriter had a significant pre-IPO stake in the company. Furthermore, the authors found that the underpricing levels are proportionate to the pre-IPO stake held by the underwriter in the firm, meaning there is a proven incentive to minimize underpricing if the underwriter owns shares in the issuing firm.

An alternative way to reduce information asymmetry is proposed by Carter and Manaster (1990) and Michaely and Shaw (1994). Since an exact measurement of the firm's intrinsic value is unknown to investors, the hiring of a prestigious advisory firm offers a "certification" of the quality of the firm and reduces the uncertainty over the firm's true intrinsic value. Prestigious underwriters are thus unlikely to manage offerings by low quality firms in the cases where reputational capital is important (Ljungqvist, 2004). Intuitively, a certification by a prestigious advisor that cares about its reputation ought to decrease IPO underpricing. There is indeed empirical evidence of this (Beatty and Welch, 1996), but overall, studies have yielded mixed results that have varied over time. Beatty and Welch show that an inverse relationship between reputable advisors and underpricing is in fact in place since the 1980's. An explanation is hitherto offered by Loughran and Ritter (2004), who suggest that underpricing levels have increased because banks have become more mindful of retaining clients that bring in recurring revenue by offering them options to earn abnormally large returns on IPO issues in the short term. Mogilevsky and Murgulov (2012) argue this is in line with the evolving business of banks – more revenue than ever is now derived from services other than advisory.

2.1.2 Previous Research on Underpricing in Venture Capital-backed IPOs

Various studies have focused on the causes of IPO underpricing in venture-capital backed IPOs. As a result, there are six broadly defined theories offering different explanations. While the following explanations are different than those introduced above, there are many commonalities across the closely related genres of underpricing research. (Abraham and Joseph, 2015.)

First, the *certification theory* (discussed above) brought forward by Megginson and Weiss (1991) yielded empirical results supporting a lower level of underpricing for firms backed by venture capitalists, and has been influential in explaining the underpricing phenomenon. Second, Gompers (1996) and Lee and Wahal (2004) presented the *grandstanding theory*, which suggests it is beneficial for VC firms to underprice offerings in order to make it easier to bring its future portfolio companies public, make the VC firm more reputable and raise more funds, thus earning higher management fees in the future.

A third theory, the *conflict of interest theory*, was theorized by Gompers and Lerner (1999) and Hamao *et al.* (2000). Studies of VC-backed offerings in Japan showed that when the venture capital firm's parent company acted as underwriter – as was often the case in Hamao's sample, since VC firms in Japan are often part of larger financial institutions – a conflict of interest with regards to pricing of the issue arose. This resulted in investors demanding higher underpricing as a compensation for potentially losing out on future equity upside because of the underwriter's bias to set a high issue price. Fourth, the *trade-off theory* presented by Habib and Ljungqvist (2001) suggests that a firm aspiring to roam the public arena faces a trade-off between marketing costs and underpricing in the equity offering. Prestigious underwriters reduce underpricing, but cost more to mandate. Thus, if the IPO issue is large enough, it makes sense to employ a relatively pricy underwriter in an effort to reduce underpricing. Since VC firms regularly retain little post-IPO ownership (Abraham and Joseph, 2015), they are usually incentivized to choose a reputable underwriter rather than face a larger underpricing.

In 2008, Rossetto proposed the *hot issue markets theory*, which argues that the extent of the underpricing in a VC-backed IPO depends on the presence of “hot issue markets” or “IPO windows”. In hot issue times, many firms look for public funding simultaneously and also experience a higher level of underpricing, on average, than during what could be labeled “cold issue times” (Ibbotson and Jaffe, 1975; and Ritter, 1984). During such IPO windows, VC-backed IPOs show greater underpricing than non-sponsored IPOs; however, during other times, the initial day returns for VC-backed IPOs are significantly less than those of non-sponsored IPOs. Sixth, the *timing theory* was put forward by Lerner (1995). His study showed that VC firms are more capable of timing IPOs than regular firms, resulting in lower underpricing. Furthermore, Lerner acknowledged the fact that venture capitalists are more likely to list their firms during market peaks, preferring private financing in times of low equity market valuations.

2.1.3 Previous Research on IPO Cyclicity

Numerous studies have illustrated the cyclical nature of IPOs and how the market is flooded with companies waiting to go public in booming markets, enjoying high stock market valuations (Ibbotson, 1975; Ritter & Welch, 2002; Schöber, 2008). Similar studies have been done on the how underpricing differs in various stock market conditions (Ibbotson & Jaffe, 1975; Ritter, 1984; Loughran & Ritter, 2004; Levis, 2011). In their 2004 study, which focused on comparing the underpricing during the hot market period of 1999-2000 with the cold market period in the three subsequent years, Loughran and Ritter found substantial evidence that underpricing also tends to increase in booming market conditions. Loughran and Ritter found that the average first day return in the hot market period was 65%, compared to an average of 11.7% in the cold market period. Bergström *et al.* (2006) as well as Levis (2011) found that the underpricing in sponsored-backed IPOs was less volatile with the market conditions than those IPOs being backed by a venture capital firm or having a non-financial owner.

When it comes to the cyclicity of PE-backed IPOs specifically, previous literature does not offer unanimous results. Bergström *et al.* (2006) found that fewer PE-backed companies go public in booming market conditions, while Schöber (2008) found the opposite.

As IPO timing is decided by senior executives in the boardroom, the most widely popular theories for describing IPO cyclicity are market timing theories (Schöber, 2008). The *pseudo market timing theory*, based on the premise that more firms go public in booming markets, is arguably the most widespread line of thought. In this theory, managers' decision to raise equity financing is uncorrelated to their predictions of future returns. Rather, the pseudo market theory is based on empirical evidence showing that specific stock price levels ("trigger prices") are used by management to determine when it is appropriate to use equity financing (Schulz, 2003). In a study covering 15 countries, Loughran, Ritter & Rydkvist (1994) showed that the total number of IPOs increases in tandem with the level of the general stock market in all countries but one.

When it comes to the key determinants that prospective public companies face in their IPO journey, Ritter & Welch found in their 2002 survey of the IPO literature that market conditions is the singularly most critical factor. Pástor and Veronesi, who introduced the term "optimal IPO timing" in 2005, suggested in their study that CEOs tend to await favorable market conditions before pursuing an IPO.

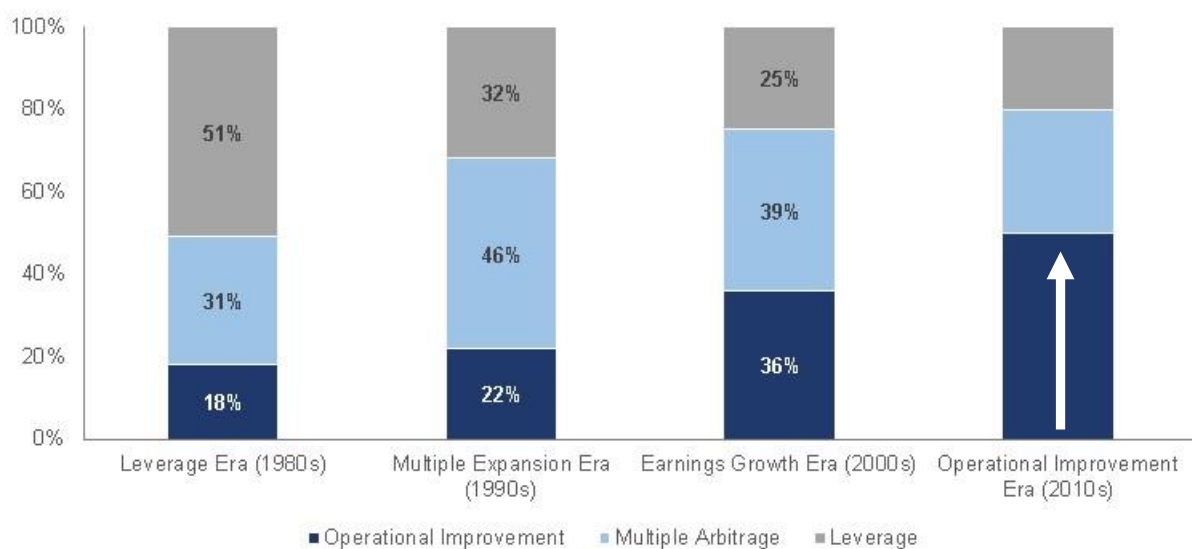
Similarly, PE firms take into account the IPO windows as they evaluate different exit strategies for their portfolio holdings. Naturally, a PE firm may divest a portfolio company ahead of its planned holding period through an IPO given an especially attractive valuation, but may also hold onto a company a bit longer than initially anticipated if the IPO window is closed (and no lucrative trade/secondary sale opportunity presents itself). In a study by Cao (2011), it was shown that PE firms generally reduce their holding periods in times with favorable IPO conditions.

On the whole, there is not yet a perfect explanation for variation in underpricing levels in VC-backed IPOs. The certification theory has hitherto proved the most popular, but fails to explain statistically significant cases of higher underpricing in VC-backed IPOs during specific conditions. Similarly, the other models do not offer fully compelling reasoning that holds true for all cases. Countering other research in the area, Chemmanur and Loutskina argued that perhaps a whole new model was needed, and developed an alternative approach for analyzing venture capital involvement in 2007. The authors argue for the need of another measurement to better capture the dynamics of VC-backed IPO underpricing; hence, they introduce a new way to measure returns – the offer price to intrinsic value ratio. Alas, their model has yet to gain a foothold.

2.1.4 Previous Research on Investment Philosophy

In the 1980s and 1990s, returns for private equity investors were heavily dependent on the private equity firm's financial engineering skills. However, as credit is neither as cheap nor as accessible as during the years leading up to the Great Recession, the entire industry is undergoing a radical change. Limited partners ("LPs") nowadays require their General Partners ("GPs") to add value in more sophisticated and sustainable ways beyond that of financial engineering techniques. The shift in private equity value creation is illustrated in Figure 1 below (Brigl, Herrera, Meerkatt, Liechtenstein, Prats, and Rose, 2008).

Figure 1 – Breakdown of Value Creation in Private Equity



According to Brigl, Herrera, Meerkatt, Liechtenstein, Prats and Rose (2008), 46% of gross IRR for private equity firms is generated through sales growth, 10% through EBIT margin improvements, 21% through EBIT multiple expansion, and 23% through net debt and corresponding leverage effects. In a private equity survey conducted in 2008, 77% of the respondents named “operational value improvement” as the single most crucial value creation driver for the coming five years. Also, 54% of the respondents believed that “operational value improvement” had become increasingly more important over the last five years.

As the private equity industry experiences a radical shift in how value is created for LPs, one would expect to see an increasingly larger share of private equity-related academia to be focused on which role an investment manager’s investment philosophy plays in the value creation process. Unfortunately, we do not identify any previous literature which explicitly focuses on how underpricing levels differ between operationally and financially focused private equity firms. However, in closely related fields, we identify relevant literature. In a paper from 2009, Hemptinne and Hoflack (2009) identify that an increasing number of private equity firms have put in-house operations teams or operating partners, rather than external advisors and industry experts, in place. Hemptinne and Hoflack (2009) also find that utilizing operating partners as “firefighters” may result in better-performing portfolio companies. However, the authors note that it does not necessarily create a sustainable operational value in the long-term. Seemingly, our perspective is novel.

2.2 Summary and Hypotheses

Much research has indeed been dedicated to finding explanations for underpricing in IPOs, and the scope has often been wide. A large majority of the work has been conducted using US data, which means that there are topics in Europe not covered by existing research. Furthermore, authors (including Mogilevsky and Murgulov) have not tested specifically for how underpricing differs between non-sponsored and VC-backed offerings. Some papers have argued that differences between the two categories are not major, others have dedicated focus to PE-backed companies and were thus not required to further test differences between the VC and non-sponsored categories, and still more have studied VC-backed firms in exclusion. We believe there is a clear distinction between underpricing levels not only when comparing non-sponsored IPOs with sponsored IPOs, but also when contrasting between sub segments of private financing – primarily, private equity and venture capital. While more niched sub segments may prove interesting to study, the predicament of proving eventual differences on a statistically significant level is likely to be hard to overcome. Based on the reasoning above, we gather there is an opportunity to make a relevant contribution to existing literature by focusing on non-covered areas of research. In this paper, we therefore initially seek to prove that PE-backed firms exhibit lower levels of underpricing than IPO firms that are backed by other owner types. Furthermore, we provide reasoning regarding differences in the size and age between our three categories and also further compare European underpricing levels in VC-backed IPOs with the two other categories, and seek to offer plausible explanations and reflective commentary on why or why not the results differ when comparing them to US studies. Moreover, this paper aims to shed some light on the effects of changes in market sentiment. We isolate the market climate effect and specifically study how the presence of hot issue markets affects underpricing levels across our three firm categories. Lastly, we address the differences in financial sponsors' value creation style in an attempt to uncover further reasons to differences in IPO underpricing. Specifically, we distinguish between operationally focused and financially focused VC and PE firms.

Looking at PE-backed companies, especially in relation to non-sponsored and VC-backed companies, it is a fair assumption to make that the private equity firm is more informed than the typical owner of the issuing firm. This depends on a number of factors. First, private equity firms are to a greater extent more involved in the managerial aspects of running a firm than their venture capital counterparts. Second, the degree of financial expertise that private equity firms possess is significantly greater than that of typical owners and in most cases also trump that of VC firms. The

primary reason for this is that private equity firms repetitively invest in companies, amass experience and expertise through the management of the companies over a substantial time period, usually 3-7 years, and then divest each of their investments (Rossetto, 2008). An important method of exit is the listing of the portfolio company on a stock exchange, which, over time, works to facilitate tighter connections with underwriters. Also, private equity firms with many professionals who have experience from leading investment banks naturally have closer affiliation with banks than VC firms with primarily entrepreneurs and industry experts in their teams. Therefore, in the setting of initial public offerings, private equity firms are in an especially beneficial position information-wise.

We proceed to formulate a hypothesis relating to the degree of underpricing in IPOs of private equity-backed companies. As it is hard to argue that private equity-backed issuers are not going to be more informed than “ordinary” issuers and venture capital-backed issuers (Wright and Robbie, 1998), we advance a case in which the informational advantage of the issuing private equity firm is, compared to other issuers, strengthened. Academics that argue that underpricing is an outcome of high quality issuers signaling their quality to the markets would anticipate that the more informed the issuer is, the more it will use underpricing as a method to signal the high quality of the issue. Hence, we would expect to see higher levels of underpricing in IPO firms backed by private equity investors (Allen and Faulhaber, 1989). The other breed of academics argue that the investment bank’s informational advantage and incentives leads to underpricing would anticipate a lower level of underpricing in private equity-backed IPOs as the informational advantage is reduced or even eliminated, and incentives more aligned between the investment bank and the issuer (Baron, 1982). Hence, the approach taken in regards to the asymmetry problem dictates the likely effect on the actual underpricing. As we shift the informational advantage from the lead underwriter (the investment bank) to the client, which is in line with the latter approach to information asymmetry, we arrive in the following hypothesis:

Hypothesis (1): The level of underpricing in private equity backed IPOs is significantly lower than that of venture capital-backed and non-sponsored IPOs.

There are, however, a number of other factors that influence the level of information asymmetry in an IPO. Larger firms commonly experience a greater degree of public scrutiny, analyst coverage and media coverage than smaller firms, which could be subject to the “neglected firm effect” resulting in a relatively lower level of information asymmetry for larger firms in relation to smaller firms. Hence, the size of the firm may serve as a representation for the ex-ante uncertainty of an

IPO (Beatty and Ritter, 1986). As private equity firms tend to acquire more mature and established companies, we anticipate that PE-backed companies are larger (measured by total assets) at the time of the IPO than VC-backed and non-sponsored firms. Also, we expect VC-backed firms to be, on average, smaller than the other subgroups. Could this be verified, it would be in line with previous research.

Applying similar reasoning regarding firm age, we would naturally expect more information to be publicly available for older firms than for younger firms. Previous IPO literature has indeed indicated that a company's age plays an important role in reducing the level of information asymmetry and hence also the degree of underpricing (Ritter, 1984; Muscarella and Vetsuypens, 1989; Megginson and Weiss, 1991). We believe this to be true also with our dataset.

Previous literature offers a number of perspectives on why VC-backed firms should showcase higher, or lower, underpricing levels. While this has changed over time and more recent studies show that VC-backed IPOs are underpriced to a greater extent than that of other types of firms (Lee and Wahal, 2004; Abraham and Joseph, 2015), it is not clear whether this holds true within the European capital markets, or if the certification theory (Megginson and Weiss, 1991) and timing theory (Lerner, 1995) instead prevails. It is clear, however, that venture capital firms in general have less financial expertise than their private equity counterparts, but a minority of venture capital professionals share similar backgrounds as private equity professionals. In our sample, the average percentage of top management with financial backgrounds is 65.7% for our PE sample, while that number amounts to 44.2% for our VC sample. That statistic is certainly lower, on average, for non-sponsored firms, and thus merits higher underpricing levels for non-sponsored IPOs. The highly important aspect of investment professionals' experience and backgrounds lets us arrive at our second hypothesis:

Hypothesis (2): Venture capital-backed IPOs exhibit a lower level of underpricing than that of non-sponsored IPOs, but a significantly higher level of underpricing than that of PE-backed IPOs.

In their summary of previous research within the VC-backed IPO underpricing area, Abraham and Joseph (2015) speak of venture capitalists' preference for exiting via an IPO. In the US, this led to a higher level of underpricing in VC-backed IPOs. Rossetto (2008), Ibbotson and Jaffe (1975) and Ritter (1984) all showcased similar evidence, but found this phenomenon to be especially true in periods of high IPO activity. As European capital markets have grown more and more similar to

their American counterparts in terms of venture capital activity, we hypothesize this phenomenon to prevail in Europe as well, allowing us to formulate our third hypothesis:

Hypothesis (3): In “hot issue markets”, venture capital-backed companies conducting an IPO tend to experience a higher level of underpricing than both private equity-backed and non-sponsored firms.

We believe that dividing investment firms (PE/VC) into two groups based on their overarching focus and investment philosophy could contribute to explaining differences in underpricing. Specifically, we distinguish between operationally focused and financially focused investment firms, regardless of their preferred investment stage. As financially focused firms can be assumed to have a deeper financial expertise than their operationally focused counterparts, we believe that these firms will be able to reduce the information advantage that investment banks in general have over their IPO clients. If true, portfolio companies with a financially focused sponsor owner exiting via an IPO should experience a lower level of underpricing compared with their operationally focused counterparts. Hence, our fourth, and perhaps most important, hypothesis is:

Hypothesis (4): Sponsor-backed companies with a financially focused owner exiting via an IPO will experience a lower level of underpricing than their operationally focused counterparts.

3 Model of IPO Underpricing

In this section we begin with introducing the original model used in previous literature to measure the level of underpricing in an equity offering. We subsequently introduce our additions to the original model and provide an explanation for our extended underpricing model. Finally, we look at the relative effects of our control variables on the adjusted initial returns.

3.1 The Original Model

We employ an extended version of the original model to better account for discrepancies in offering and firm characteristics. In the original model, the first day stock returns for subscribing investors are used as a proxy for IPO underpricing, yielding the following equation:

$$UP_i = \frac{P_{i,1} - P_{i,0}}{P_{i,0}}, \quad (1)$$

where $P_{i,1}$ is the closing price on the first day of trading in the aftermarket and $P_{i,0}$ is the offer price collected manually from IPO prospectuses and admission documents.

3.2 Additions to the Original Model

In order to properly account for the effects of venture capital or private equity backing in a public listing, we deem it necessary to control for a range of variables¹, yielding an extended OLS regression equation estimated as:

$$UP_1 = \alpha_0 + \alpha_1 PE + \alpha_2 VC + \alpha_3 LN_AGE + \alpha_4 LN_ASSETS + \alpha_5 LN_PROCEEDS + \alpha_6 MKT_SHARE + \alpha_7 ROA + \alpha_8 RETAINED + \alpha_9 AIM + \alpha_{10} MAIN_MARKET + \alpha_{11} OWNER_FOCUS + e_i^b \quad (2)$$

3.3 Relative Effect of Control Variables

In line with Mogilevsky and Murgulov (2012), we construct an additional regression model to account for the combined relative effects of the control variables on the adjusted initial returns, which are calculated as in Habib and Ljungqvist (2001). The initial returns equation is thus adjusted to reflect the true loss of wealth to the issuer by accounting for the post-IPO dilution of ownership, yielding the following equation:

$$UP_{ADJ1} = (1 - \%RETAINED) * \frac{P_{i,1} - P_{i,0}}{P_{i,0}} \quad (3)$$

where UP_{ADJ1} is defined as the adjusted initial return.

Habib and Ljungqvist argue that using the adjusted initial return metric more accurately captures the effects from what is actually “left on the table” by the issuer in the IPO, and thus, the retained ownership stake is of the utmost importance in this approximation. The OLS regression for adjusted initial returns becomes the following:

$$UP_{ADJ1} = \alpha_0 + \alpha_1 PE + \alpha_2 VC + \alpha_3 LN_AGE + \alpha_4 LN_ASSETS + \alpha_5 LN_PROCEEDS + \alpha_6 MKT_SHARE + \alpha_7 ROA + \alpha_8 AIM + \alpha_9 MAIN_MARKET + \alpha_{10} OWNER_FOCUS + e_i^b \quad (4)$$

4 Data

Our sample of IPOs on the LSE is collected from LSE’s website. In order to capture periods of both high and low IPO market activity, and hence also avoid any bias towards either period, we

¹ Please see section 5 – Variable Description for more information

include floatations between 2006 and 2015. From this dataset, we manually classify listings as PE-backed, VC-backed or non-sponsored. If a company has been listed previously and subsequently delisted before relisting (as in the case of secondary buyouts), we exclude this observation from our dataset. The reason is that more information will be available for this company in relation to companies going public for the first time, given the filing requirements of a public company, which will reduce the information asymmetry between the issuer and the market and might skew the dataset. Companies are only classified as PE-backed or VC-backed if the company was backed at the time of the listing. We have also excluded all types of REITs, equity investment instruments, investment companies, investment entities, non-equity investment instruments, all types of investment trusts and other types of special purpose acquisition vehicles (SPACs) for comparability reasons. All listings that are not classified as IPOs by the LSE (i.e. seasoned equity offerings, re-listings on other stock exchanges etc.) are also excluded from our sample.

The initial listing return data is collected from Yahoo! Finance, which covers the vast majority of publicly traded stocks on all of the world's stock exchanges. The daily Yahoo! Finance data covers daily opening and closing prices as well as individual tickers. The data also contains daily closing prices, adjusted for stock splits and dividend payments where any dividend payment is assumed to be re-invested on the ex-distribution date.

We collect basic information about each IPO firm, such as year of incorporation, from each company's webpage. From the IPO prospectus/admission document, we collect data regarding the company's pre-IPO size (measured as total assets), pre-IPO profitability (defined as last fiscal year's pre-IPO Earnings before Interest and Taxes (EBIT) over the company's average total asset base during the last fiscal year prior to the IPO, i.e. ROA calculated with an average asset base), pre-IPO shareholders' post-IPO ownership, total proceeds (measured using the sum of both primary and secondary issues) as well as which underwriter(s) managed the offering.

In order to classify a PE or VC firm as *financially* or *operationally focused* we use senior management's previous assignments and jobs as a proxy for the corporate culture and primary value creation strategy. If a majority of the senior management comes from a finance oriented background, we label that PE or VC firm as financially focused, and vice versa. We obtain this data from the company's team biographies available at each company's webpage, and complement this information with press releases and articles about firm executives. Since it is not possible to gather such detailed

information about top management going back in time, we use the current constellation of professionals as a proxy also when looking at IPOs that occurred back to 2006. This is reasonable since one could credibly assume that an investment firm's focus has not radically changed going back just a few years. Supportive of this line of thought is the fact that firms' funds often have a lifespan of 10 years, or more, which matches our sample. This is important because a firm's value creation strategy is specified in the contract between LPs and GPs at the time of capital commitment, and this contract does not warrant the execution of strategies outside of the set boundaries.

Our final dataset, which combines the LSE data, Yahoo! Finance data, basic company information from each company's website and the data gathered from the prospectus/admission document, includes a total of 213 IPOs during the time period stretching from November 2006 to December 2015. Of the 213 total observations, 50 are classified as PE-backed, 50 as VC-backed and 113 as non-sponsored. Our final dataset represents approximately 4% of our initial dataset from LSE containing 5,292 issues.

4.1 Data Criticism

Although we consider our sample to be both sufficiently comprehensive and exhaustive in order for us to test our hypotheses in a proper way, we are aware of the potential lacunas in our dataset. This section features a discussion where we outline the main points of potential criticism.

First, one might consider our sample set to be inconclusive. Since our initial dataset consisted of 5,292 issues and our final dataset contains 213 issues, our sample size is definitely one point of criticism. Mainly, this relates to the process of data collection. Notable is that, out of our initial 5,292 issues, 2,126 issues were classified by the London Stock Exchange as "Not IPO", meaning they were either re-admissions, re-listings from other stock exchanges or seasoned equity offerings (SEOs). Of the remaining 3,166 observations, 786 IPO firms are different types of investment trusts (Real Estate Investment Trusts, Venture Capital Investment Trusts etc.), Investment Companies, Investment Entities, non-equity investment instruments and equity investment instruments that went public in order to raise money for their future operations. Hence, they could not be considered operational at the point of time of the IPO and have thus been excluded. Furthermore, we excluded all other stock exchanges (e.g. the Specialist Fund Market (SFM) and the Professional Securities Market (PSM)) on the London Stock Exchange except the AIM, UK Main Market and the International Main Market, lowering our total number of observations by a further 50 observations. Of the remaining sample of 2,330 IPOs, we excluded all IPOs where we were not able to

obtain the necessary information about the company and/or the offering. We rely only on first-hand information.

Second, there is a diminutive risk that some PE-backed IPOs have been erroneously classified as VC-backed, and vice versa. When collecting our data and classifying our observations as PE-backed, VC-backed or non-sponsored, we excluded every observation where we experienced the slightest uncertainty with regards to the ownership structure pre-IPO. We mitigated this potential issue by only classifying IPOs from the first-hand information found in the prospectuses, admission documents or the PE/VC firms' website, as we deemed these to be the most credible sources. Some may also argue that the distinction between venture capital and private equity is vague. However, we only include PE-backed IPOs in which the PE firm held a controlling stake pre-IPO and as VC firms very seldom hold controlling stakes, this potential concern is mitigated.

Another point of criticism regarding our data is whether our final sample set is representative of the entire population. This concern arises primarily from the fact that our final sample constitutes roughly 4% of our initial population. Hence, it might be the case that our entire sample is skewed in either direction. However, as our results are statistically significant at conventional alpha levels and are in line with previous research, we acknowledge support for stating that our sample is in fact not skewed.

4.2 Variable Description

In this section we define the key variables used in our empirical tests and provide a brief initial hypothesis of each variable's effect on our regression model.

Private Equity – “PE”

PE is a dichotomous variable where unity means that the IPO was backed by a private equity firm and zero means it was not. Previous research by Mogilevsky and Murgulov (2012) suggest that PE-backing should decrease the level of underpricing, at least in the US market where their research was conducted. We believe that a negative relationship should exist between this variable and underpricing also in Europe.

Venture Capital – “VC”

VC is a dichotomous variable where unity means that the IPO was backed by a venture capital firm and zero means it was not. Previous research by Megginson and Weiss (1991) suggests that VC-

backing should decrease the level of underpricing, while a more recent study by Lee and Wahal (2004) suggests the contrary. We hypothesize that a negative relationship between this variable and underpricing should exist, but should be less pronounced than the expected negative relationship displayed by the PE variable.

The Age of the Issuing Firm – “LN_AGE”

This variable is the natural logarithm of 1 + the age of the issuing firm (in years) and is used to control for the level of information asymmetry in the offering. For older, more established firms, we expect more information to be available which should reduce the level of information asymmetry and subsequently the underpricing in the issue. This hypothesis was confirmed in a study by Muscarella and Vetsuypens (1989) in which the authors showed that the older the firm, the lower the initial listing return. This variable has also been used for control purposes in a number of studies, including Ritter (1984), Megginson and Weiss (1991), and Mogilevsky and Murgulov (2012). We hypothesize that PE-backed firms on average are older and more established than their VC-backed and non-sponsored counterparties. Furthermore, VC-backed firms should be smaller than the two other sub groups.

The Size of the Issuing Firm – “LN_ASSETS”

This variable is the natural logarithm of the GBP value of pre-IPO total assets for the IPO firm. Beatty and Ritter (1986) find that the level of underpricing decreases with a decreased level of information asymmetry. We expect more information to be publicly available the larger the firm is and hence we use the firm’s size, measured by total assets, as a proxy for ex-ante uncertainty.

The Size of the Offering – “LN_PROCEEDS”

This variable is the natural logarithm of the GBP value of the total proceeds raised from the offering (including both primary and secondary offerings). Beatty and Ritter (1986) argue that the smaller the offering is, the more speculative it is and thus initial returns should be higher. Hence, we hypothesize the coefficient of *LN_PROCEEDS* to be negative.

The Issuing Firm’s Profitability – “ROA”

Return on assets (*ROA*) is used as a measure of firm performance and profitability pre-IPO. While other metrics could be used, a measure of profitability attributable to both debt and equity investors has been so widely used by previous studies that it could be said to have become the standard within IPO underpricing research. We define the variable as Earnings before Interest and Taxes

(EBIT) over total assets, calculated using the average asset base. For firms with high profitability, we expect reduced information asymmetry as we expect greater confidence in high-performing firms. Hence, we believe that better performing firms will have lower levels of underpricing which results in a negative coefficient for this variable.

Underwriter Reputation – “MKT_SHARE”

MKT_SHARE is the lead underwriter’s market share in the year of the IPO and serves as a proxy for the underwriter’s reputation. As our data only contains European samples, we use the underwriters’ market share in the EMEA region in the year of the IPO. If the issue was led by a syndicate of multiple joint global coordinators (JCGs), we use the weighted average market share. Previous research from Carter and Manaster (1990) as well as Booth and Smith (1986) document that reputable underwriters provide a certification of the issue quality and that higher quality underwriters reduce the level of underpricing. Hence, we hypothesize that there should be a negative coefficient between this variable and the initial listing returns.

Insider Retention – “RETAINED”

This variable measures the percentage of total shares held in the firm post-IPO by the firm’s pre-IPO shareholders. We expect to see a negative relationship between the number of shares offered in the issue and the level of underpricing (i.e. the more shares that are offered, the lower the level of underpricing). We expect this to be the case as the firm’s pre-IPO owners stand to lose more from underpricing (as they are selling their shares at a discount) and thus should put in more effort as they sell more in order to reduce the level of underpricing as a means of maximizing their own return on investment (Habib and Ljungqvist, 2001).

Stock Exchange Differences – “AIM”

AIM is a dichotomous variable where unity represents a listing on the AIM. We expect smaller, younger, technology-related firms and hence higher risk firms to list on the AIM. Given these firm characteristics, we expect a higher level of information asymmetry for these IPOs and a positive coefficient in relation to underpricing. Since firms that are sponsored by venture capitalists are generally smaller than other firms, a relatively large number of VC-backed firms in our sample have listed on the AIM.

Stock Exchange Differences – “MAIN_MARKET”

MAIN_MARKET is a dichotomous variable where unity represents a listing on the International Main Market or the UK Main Market. We expect larger, older and more established firms to list on the Main Market stock exchanges, and hence we predict a lower level of information asymmetry and subsequently lower first day returns for these IPO firms. The variable is used to control for different levels of underpricing across different stock exchanges.

Focus of the Principal Owner – “OWNER_FOCUS”

The variable is included in order to account for the different levels of financial expertise when considering investment professionals' backgrounds. It is a dichotomous variable and unity represents that the firm is deemed to be financially focused, and operationally focused if the contrary is true. We hypothesize that IPO companies with a financially focused PE/VC owner should experience a lower level of underpricing than IPO companies with an operationally focused PE/VC owner.

5 Methodology

This section is dedicated to describing the framework used in this study's empirical tests.

5.1 First-day Returns

While the measurement of initial returns has varied across prior studies, this paper employs a straight forward calculation. Previously, returns calculations have varied across i) post-IPO time measurement periods, ii) aftermarket stock price quotes and iii) whether or not authors have adjusted the initial return for market movements.

First, we use the first day closing price instead of any other time period as the impact of any new information reaching the market would impact returns in ways that would be difficult to control for. This conforms to recent trends in finance literature; earlier studies more often used longer time periods for returns calculations (Schöber, 2008).

Second, there is the question of which aftermarket stock price quote to use. In order to provide a relevant contribution to existing literature, and to generate comparable results, it is paramount that our measurement method is aligned with that of other studies. Instead of using the closing bid price (Ritter, 1984; Beatty & Ritter, 1986), we resort to the first day closing price, which resonates with studies made by Lowry & Schwert (2002), Loughran & Ritter (2004), and Otchere et al. (2013).

Third, we have chosen not to adjust initial returns for market movements, which according to Beatty and Ritter (1986) is reasonable since the market movements are very small compared to average initial returns. This methodology is supported by Schöber (2008). The calculation of initial, first-day, returns thus becomes the following:

$$R_i = \frac{P_{i,1} - P_{i,0}}{P_{i,0}} \quad (5)$$

For the testing of differences in underpricing levels between our three sub-samples (see hypotheses 1-4), we create four subgroups (g) consisting of i) all IPO samples, ii) PE-backed IPOs, iii) VC-backed IPOs and iv) non-sponsored IPOs. Moreover, we use three different time periods (a); the first stretches across our entire sample from 2006-2015, the second counts samples belonging to periods of hot issue markets (high IPO market activity), and the third accounts for samples belonging to periods of low or medium IPO market activity. For our last test, whether IPO firms backed by a financially focused sponsor experience lower levels of underpricing than those backed by an operationally focused sponsor, we divide our sample into six subgroups consisting of: i) all IPOs backed by a financially focused sponsor, ii) all IPOs backed by an operationally focused sponsor (non-sponsored IPOs assumed to be operationally focused), iii) PE-backed IPOs backed by a financially focused sponsor, iv) PE-backed IPOs backed by an operationally focused sponsor, v) VC-backed IPOs backed by a financially focused sponsor, and vi) VC-backed IPOs backed by an operationally focused sponsor. Using an equal weighting, we calculate the average first day returns for each group as follows:

$$R_{g,a}^{ew} = \frac{1}{n_{g,a}} \sum_{i=1}^{n_{g,a}} R_i \quad (6)$$

where $n_{g,a}$ is the number of initial public offerings in each sample group during a given period of market activity and $R_{g,a}^{ew}$ is the equal weighted first-day return for group g in time period a .

Adding to the widespread measure of first day returns on an equal-weighted basis, we proceed to also plot the value-weighted first day returns. This allows the reader to establish a perception of how varying sizes in our IPO samples affect average returns across the subgroups. Weights are assigned to each offering based on the first day opening market capitalization as a percentage of

the total opening market capitalization for the matching subgroup. The value-weighted averages for group g in time period a , $R_{g,a}^{vw}$, are calculated as follows:

$$R_{g,a}^{vw} = \sum_{i=1}^{n_{g,a}} \left(\frac{P_{i,1}}{P_{i,0}} - 1 \right) * \frac{w_i^{g,a}}{n_{g,a}} \quad (7)$$

$$w_i^{g,a} = \frac{mc_{i,0}}{\sum_{i=1}^{n_{g,a}} mc_{i,0}} \quad (8)$$

Where $w_i^{g,a}$ is the weighting for observation i in group g in time period a , and $mc_{i,0}$ is company i 's market capitalization at market opening on day 0.

5.2 Market Period Definition

According to Jaffe (1975) and Ritter (1984), “hot issue markets” are characterized by an increased level of underpricing and a clustering of firms going public in the same time period. Rossetto (2008) documented that the level of underpricing in VC-backed IPOs depends on whether the issue market could be characterized as “hot” or not. In hot issue markets, VC-backed IPOs experience a higher level of underpricing than non-sponsored firms, but on the contrary, the level of underpricing in VC-backed firms in Rossetto’s study was significantly lower than non-sponsored firms without the presence of a hot issue market.

We apply the approach suggested by Schöber (2008) and proceed to classify the IPO activity in any given year, using the total sample of 213 IPOs on the London Stock Exchange, as high (low) if the total number of IPOs in that year in Europe is above the 75th percentile value (below the 25th percentile value) of the ten years included in our sample (2006-2015). Listings in other years were classified as medium IPO activity. Applying this methodology, we define the IPO activity in years 2009, 2011 and 2012 as low; 2008, 2010, 2013 and 2015 as medium; and 2006, 2007 and 2014 as high.

5.3 Test Statistics

A number of tests are employed in order to statistically verify our results, and in extension, our hypotheses. Variables are tested in unpaired, unmatched t-tests and by running a linear regression model in order to establish the coefficients, p-values and contributions of each variable in our underpricing regression models.

The descriptive statistics reward the reader with an introduction to our dataset, IPO statistics and an insight into the most IPO-intense industries. The first day returns section firmly establishes the phenomenon of underpricing in IPOs across the three subgroups: PE-backed firms, VC-backed firms and non-sponsored firms. We pair each subgroup with each distinct period of IPO activity (high period and medium/low period) and also provide average first day returns on a value-weighted basis. As for more detailed information on the complete set of our variables, table 6 provides an overview that gives us several indications of potential differences in firm characteristics between the three groups.

In order to corroborate the results indicated in table 6, we proceed to employ a two-sided t-test to test whether the differences in average first day returns between the subgroups are significantly different from zero. We match each subgroup with each of the other subgroups, creating three pairs. All variables in the main regression model are tested, apart from the *MAIN_MARKET* variable which is excluded in order to avoid any collinearity with the *AIM* variable. These test sequences allow us to establish a substantiated claim with regards to the fact that average underpricing levels for our subgroups are, as it seems, significantly different from each other.

Further, in table 8, we show the Pearson bivariate correlation coefficients between all variables. This is done in order to clearly display the relationships between our regression variables, and capacitates us to draw early conclusions about which variables may display collinearity. It also provides indications that facilitate an augmented discussion regarding the relationship between certain firm details and corresponding offering characteristics.

The analysis conducted above may be seen as the prologue to what is naturally the most important part of this study: our regressions. We essentially run six separate regressions, three regressions for each of the two different dependent variables. First, a linear ordinary least squares (OLS) regression is completed. All explanatory variables are included, except for *MAIN_MARKET* (reasoning provided above), and the dependent variable is first set to the initial return using the original equation, $R_i = \frac{P_{i,1} - P_{i,0}}{P_{i,0}}$. Second, we eliminate outliers in each of our variables as a means of robustness. While it decreases our sample size, it reduces the tendency of our dataset to become skewed towards one way or the other, and significantly increases the model's explanatory value. Third, the robust model is corrected by omitting the *LN_ASSETS* variable, which displays high collinearity with the *LN_PROCEEDS* variable.

We run a similar OLS regression with the same explanatory variables a second time, but now use the adjusted initial return metric, $R_i = \frac{P_{i,1} - P_{i,0}}{P_{i,0}} * (1 - RETAINED)$, as a proxy for underpricing. The adjustment for retained ownership helps us better understand the wealth loss to the issuer, so we re-do the above analysis with this, more nuanced, dependent variable. Similar to the second regression described in the paragraph above, we run the linear regression with eliminated outliers, still using the adjusted initial return metric as a proxy for IPO underpricing. The regression model is run a third time with the *LN_ASSETS* variable omitted to avoid collinearity.

Results from the regression models enable us to bring forward evidence that can verify our first and second hypothesis, as well as drawing other interesting conclusions. This means we can establish an informed view on underpricing in PE-backed and VC-backed IPOs relative to each other as well as non-sponsored IPOs.

Hypothesis 3, which aims to unravel the connection between highly active IPO markets and an increased underpricing in venture capital-backed IPOs, is investigated by running t-tests that test the differences in average first day returns between high and medium/low periods of IPO activity for each subgroup.

The fourth and final hypothesis seeks to establish a proven connection between the focus of PE/VC firms' investment philosophy and underpricing levels. We run t-tests to see whether there is a significant difference in means for the PE and VC subgroups depending on owner focus. Investment philosophy is divided into two categories: operationally focused and financially focused owners. Results indicate whether there is a statistically significant difference in means between operationally and financially focused owners for PE and VC firms in our sample, however not for the total sample.

6 Results and Analysis

6.1 Descriptive Statistics

Table 1 – Annual Distribution of IPOs by Number of IPOs and Average Total Assets

Year	Total				Average Total Assets (GBPm)			
	Total	PE	VC	NS	Total	PE	VC	NS
2006	2	2	0	0	57	57	NA	NA
2007	2	2	0	0	249	249	NA	NA
2008	2	0	0	2	1,010	NA	NA	1,010
2009	2	0	2	0	1	NA	1	NA
2010	10	0	5	5	100	NA	11	189
2011	6	0	3	3	9,176	NA	7	18,346
2012	12	0	8	4	1,173	NA	8	3,502
2013	46	6	6	34	407	1,755	5	241
2014	83	21	18	44	310	1,011	19	94
2015	48	19	8	21	1,178	1,009	4	1,779
Total	213	50	50	113	816	1,013	11	1,077

The total IPO sample of 213 IPOs constitutes 50 private equity-backed (PE), 50 venture capital-backed (VC) and 113 non-sponsored IPOs listings on the London Stock Exchange between 2006 and 2015. Average total assets is calculated using the average asset base for the last fiscal year prior to the IPO.

Non-sponsored companies (GBP 1,077m) pursuing an IPO are, on average, larger than their PE (GBP 1,013m) and VC (GBP 11m) counterparts, measured in terms of total assets prior to the IPO. The disproportionately high value of average total assets in 2011 for the subgroup NS is attributable to the IPO of Glencore, one of the world's largest commodity trading and mining companies, which had an average total asset base of GBP 51,112m at the time of the IPO.

Table 2 – Percent of IPOs by Activity Period and Subgroup

IPO Activity	IPO Sample Distribution (%)				Average Total Assets (GBPm)			
	Total	PE	VC	NS	Total	PE	VC	NS
High	41	50	36	39	302	874	19	94
Medium/low	59	50	64	69	1,170	1,188	6	1,704
Total	100	100	100	100	816	1,031	11	1,077

Companies are further divided into subgroups by IPO activity and the distribution of IPOs in percent. IPO activity periods are calculated as follows: the top quartile of the 10 years (defined as >75th percentile) is categorized as “high”, the bottom quartile (defined as <25th percentile) is categorized as “low”) and the two midmost quartiles are defined as “medium”. The high (medium/low) activity period includes the following years: 2006, 2007 and 2014 (2008-2013, 2015).

As illustrated in table 2 above, a PE-backed IPO is more likely to occur in a high activity IPO period than its NS and VC-backed counterparts. This is in line with what Schöber (2008) documented on the US market, but contradicts what Bergström *et al.* (2006) found to be true on the Paris Stock Exchange and London Stock Exchange, implying that PE-backed IPOs have become relatively more common on the London Stock Exchange since Bergström *et al.* performed their study. In high IPO activity periods, IPO firms are generally smaller, using average total assets prior to the IPO as a proxy for firm size, than firms conducting IPOs in the medium/low periods. This is true also for PE-backed and NS IPOs, however to a greater extent for the latter. For the NS IPOs, this is largely attributable to the Glencore IPO in 2011 (a year characterized with medium/low activity). On the contrary, VC-backed firms are significantly larger in high IPO market activity periods (GBP 19m) than in medium/low activity periods (GBP 6m).

Table 3 – Number of IPOs per Stock Exchange and Subgroup

Stock Exchange	Number of IPOs			
	Total	PE	VC	NS
AIM	134	8	48	78
International Main Market	6	1	1	4
UK Main Market	73	41	1	31
Total	213	50	50	113

The table above illustrates the distribution of IPOs across different stock exchanges and subgroups in our sample.

The table above illustrates the sample distribution per stock exchange and subgroup. As illustrated, the AIM stock exchange has experienced the highest number of flotations (134) followed by the

UK Main Market (73) and the International Main Market (6). For VC-backed listings, the AIM accounts for a grand total of 96% of all listings. For non-sponsored listings, the AIM also accounts for the vast majority of total listings (69%). However, for PE-backed IPOs, the UK Main Market has been the most popular exchange, accounting for 82% of all listings. As larger companies generally list on the Main Market stock exchange rather than on smaller exchanges such as the AIM, this finding is in line with our expectations that PE firms in general are larger than their VC and NS counterparts.

Table 4 – Most Common Sector by Stock Exchange and Subgroup

Stock Exchange	Number of IPOs			
	Total	PE	VC	NS
AIM	Software & IT Services	Travel & Leisure	Software & IT Services	Software & IT Services
International Main Market	NA	General Retailers	Media	NA
UK Main Market	Commercial Services	Travel & Leisure	General Retailers	Oil & Gas
Total	Software & IT Services	Travel & Leisure	Software & IT Services	Software & IT Services

The table above illustrates the most common sector by stock exchange and subgroup. Industry classifications are derived from the London Stock Exchange.

For PE-backed IPOs, the most common sector across all stock exchanges is Travel & Leisure. Looking at the most common sector for PE-backed IPOs, we find that the list is crowded by sectors within the consumer/retail space, which does not come as a surprise as this industry has long been one of the most PE-crowded (PwC, 2013). For VC-backed IPOs, which are concentrated on the AIM exchange, the most common sector is Software & IT Services. As venture capital firms historically have employed a technology-oriented focus, this finding is in line with our expectations.

6.2 First Day Returns

Table 5 – First day returns for each Subgroup and IPO Activity Period

	Total	PE	VC	NS
Average (%, equal-weighted)	10.95***	3.91***	9.40***	14.76***
Average (%, value-weighted)	6.52***	11.63***	18.53**	13.11***
High period average (%, equal-weighted)	10.37***	1.96	13.98***	13.68***
Medium/low period average (%, equal-weighted)	11.45***	6.31***	6.86***	15.45***
Total Observations	213	50	50	113

Value-weights are calculated using market capitalization at the time of the IPO (using open prices). The high period includes 2006, 2007 and 2014, with the remaining years in our sample being classified as medium/low. The alpha levels refer to two-sided t-tests in which it is tested whether the means are different from zero, where alpha levels of 10 percent (*), 5 percent (**) and 1 percent (***) are illustrated. When calculating the value-weighted average returns for PE and VC-backed IPOs, we have excluded extreme outliers, resulting in a sample size of 47 PE-backed IPOs and 45 VC-backed IPOs.

The sample experiences positive first day returns across all subgroups over our period of study (2006-2015), which is in line with most previous studies, regardless of how the first day return is calculated. This finding provides evidence that all subgroups experience underpricing, regardless of the IPO activity period. These findings are also statistically significant at reasonable alpha levels (disregarding the high period PE average t-test). Using the equal-weighted first day return of our entire sample, we find that the average first day return is substantially lower than the 15-18% interval that Jenkinson & Ljungqvist (2001) find to be true in the vast majority of industrialized countries. For this discrepancy, we see two possible explanations. The first one ties into the theories of asymmetric information and the second to changing market dynamics over time. First, within the group of countries which could be categorized as “industrialized”, there are large differences with regards to how well functioning capital markets each country has. UK, which is considered to be Europe’s financial hub, will most likely have one of the best functioning capital markets within the group of countries which are categorized as industrialized (and should hence have a lower average first day return as the asymmetric information gap is tightened). Second, since Jenkinson & Ljungqvist performed this study in 2001, one could assume that financial markets generally have undergone a positive development over time as regulation, reporting standards, transparency and governance have all improved. Hence, one could assume that the average underpricing should be less today than 15 years ago. Supportive of this argument are two more recent studies performed

by Schöber (2008) and Cao and Lerner (2009), whom presented average equal-weighted underpricing levels of 9.91% and 12.88%, respectively.

The first day equal-weighted return for the PE sample of 3.91% could be compared to the findings of previous studies done on the European markets in which both first day returns are calculated using a similar approach as the one we apply, and PE-backed IPOs have been categorized based on similar reasoning as ours. Bergström *et al.* (2006), Levis (2011) and Sevonius and Hertervig (2014) all performed studies examining first day returns for PE-backed IPOs in Europe. The studies found initial first day returns of 9.3%, 9.1% and 6.0%, respectively. One possible explanation for the differences could be the different time periods studied; Bergström *et al.*'s sample is from 1992-2005, Levis' from 1994-2004 and Sevonius and Hertervig's from 1997-2010. As our results are most in line with Sevonius and Hertervig's, it is interesting to note that our sample shares the largest overlap, which however is still rather small, in terms of time period with these authors' study. Bergström *et al.* and Levis use samples from earlier time periods, which could provide a possible explanation to our different findings.

Bergström *et al.* (2006) also employ a value-weighted approach when calculating first day returns for their two subgroups in their sample, namely PE-backed IPOs on the Paris and London Stock Exchange. Their value-weighted first day returns on the two subgroups amount to 7.24% and 7.32%, respectively, which is rather low in comparison to our value-weighted first day return for PE-backed IPOs of 11.63%. As our PE-backed observations on average are larger than the VC-backed and non-sponsored IPOs, PE-backed IPOs with a high level of underpricing are rewarded a relatively higher weight than their counterparts, providing a possible explanation to our higher first day returns on a value-weighted basis.

Table 6 – Firm and Offering Characteristics per Subgroup

Variable	Statistics	PE	VC	NS
Initial Return (percent)	Mean	3.91	9.40	14.76
	Median	5.53	9.75	10.00
	Std. Dev.	6.19	10.25	16.70
	Minimum	(11.32)	(16.00)	(8.00)
	Maximum	18.52	35.71	117.10
Adjusted Initial Return (percent)	Mean	1.78	4.18	5.61
	Median	2.08	2.80	3.06
	Std. Dev.	3.63	5.07	8.25
	Minimum	(10.84)	(5.00)	(4.04)
	Maximum	10.63	18.21	53.67
Age (years)	Mean	31.8	12.6	20.4
	Median	23.3	7.8	10.0
	Std. Dev.	34.3	24.4	49.9
	Minimum	1.4	0.0	0.0
	Maximum	166.6	174.4	497.3
IPO Proceeds (£, millions)	Mean	354.5	35.3	167.1
	Median	223.1	11.1	25.2
	Std. Dev.	412.6	70.2	622.5
	Minimum	17.5	0.7	0.5
	Maximum	2,160.0	360.1	6,193.5
Pre-IPO Assets (£, millions)	Mean	1,031.0	11.0	1,076.7
	Median	411.1	5.1	13.5
	Std. Dev.	1,457.8	17.8	5,995.4
	Minimum	38.1	0.0	0.0
	Maximum	6,038.6	94.1	51,111.6
Underwriter Market Share (percent)	Mean	4.21	1.36	2.26
	Median	4.93	1.19	1.19
	Std. Dev.	2.67	1.27	2.66
	Minimum	0.15	0.10	0.00
	Maximum	8.91	7.79	11.90
ROA (percent)	Mean	9.63	7.46	13.11
	Median	8.26	2.75	9.42
	Std. Dev.	11.38	28.72	27.19
	Minimum	(43.35)	(42.45)	(48.02)
	Maximum	32.61	73.45	97.22
Retained Ownership (percent)	Mean	50.44	60.69	64.74
	Median	55.15	64.30	68.52
	Std. Dev.	20.27	21.72	21.81
	Minimum	0.00	0.00	0.00
	Maximum	81.20	92.40	97.74
Offer Price (£)	Mean	2.24	1.06	1.61
	Median	2.00	0.91	1.15
	Std. Dev.	1.45	0.69	2.02
	Minimum	1.00	0.08	0.01
	Maximum	11.50	2.67	13.25
Firm Focus (percent, variable only applicable for investment companies)	Mean	65.71	44.25	Not Applicable
	Median	64.58	50.00	
	Std. Dev.	23.95	34.37	
	Minimum	0.00	0.00	
	Maximum	100.00	100.00	
Total Observations		50	50	113

Table 6 provides a comprehensive overview of firm and offering characteristics in our sample. From these statistics we note that PE-backed IPO firms in our sample are, as per median values above, 15 years older than VC-backed IPO firms and 13 years older than non-sponsored IPO firms. Firms backed by private equity players on average also raise significantly larger proceeds (£223m versus £11m and £25m for VC-backed and non-sponsored, respectively) and have much

larger asset bases pre-IPO compared to the other categories. Perhaps most interestingly, mean underpricing figures are significantly different between the three subgroups, which is in line with expectations. As per the original underpricing model and median values, PE-backed firms show the lowest level of IPO underpricing at an average of 5.53%, compared to 9.75% for VC-backed firms and 10.00% for non-sponsored firms. The adjusted initial return yields similar results, however at a much lower underpricing level, and is thus supportive of both hypothesis (1) and (2).

Table 7 – Difference in Mean Tests of Firm and Offering Characteristics for PE-backed, VC-backed and Non-sponsored IPOs

Variable	T-statistic		
	(PE, NS)	(PE, VC)	(NS, VC)
Initial Return (percent)	-5.664*** (0.000)	-3.030*** (0.003)	-2.523** (0.013)
Adj. Initial Return (percent)	-3.245*** (0.001)	-1.956* (0.053)	-1.398 (0.164)
Age (years)	1.693* (0.093)	3.239*** (0.001)	-1.348 (0.180)
IPO Proceeds (£ millions)	2.267** (0.025)	5.393*** (0.000)	-2.219** (0.028)
Pre-IPO Assets (£ millions)	-0.241 (0.810)	4.545*** (0.000)	-1.950* (0.054)
Underwriter Market Share (percent)	4.304*** (0.000)	6.808*** (0.000)	-2.919*** (0.004)
ROA (percent)	1.081 (0.282)	1.196 (0.237)	0.648 (0.518)
Retained Ownership (percent)	-4.056*** (0.000)	-2.441** (0.017)	-1.095 (0.276)
Offer Price (£)	2.255** (0.026)	5.206*** (0.000)	-2.585** (0.011)
Owner Focus (% financial)	19.400*** (0.000)	3.623*** (0.000)	9.103*** (0.000)

Table 7 illustrates t-statistics and p-values (in parenthesis) for the difference in means between the subgroups (PE, VC and NS IPOs). *, ** and *** resembles results significant at an alpha level of 0.10, 0.05 and 0.01, respectively.

Our findings presented in the table above indicate that there is a statistically significant difference in the level of underpricing between the three subgroups. This is especially true when looking at the first day return calculated in accordance with equation 1. On average, the first day return for PE-backed IPOs (3.91%) is significantly lower than that of VC-backed IPOs (9.40%), which in turn is significantly lower than that of non-sponsored IPOs (14.76%). Hence, we find further support for our first and second hypothesis.

The results presented in the table above suggest that the differences in both proceeds raised in the IPO and total pre-IPO assets are statistically significant between the three subgroups. PE-backed companies going public raise considerably more, on average, than their counterparts (median proceeds of £223.1m versus £11.2m and £25.2m for VC-backed and non-sponsored firms, respectively). In contrast to the findings of Megginson and Weiss (1991), the lowest average amount

raised is found in VC-backed IPOs (median proceeds of £11.1m). A similar pattern could be seen with regards to total pre-IPO assets. Private equity-backed IPOs have, by far, the largest median asset base (£411.1m), while venture capital-backed IPOs have a median asset base of £5.1m and non-sponsored IPOs £13.5m. These results are in line with our expectations and previous studies, e.g. Mogilevsky and Murgulov (2012). The logical reasoning for this finding is rather intuitive. Private equity players, generally speaking, tend to invest in companies which are both mature and operate in relatively stable markets. Subsequently, the portfolio companies may be exited through IPOs. These IPOs and the PE-backed companies are larger than their counterparts.

The average age of the IPO firms in each subgroup may also offer a partial explanation for the considerably smaller size of VC-backed companies. As we expect firms that have been operating for a long time period to be larger in terms of total assets, we would expect these firms to raise larger amounts in their IPOs. Our findings indicate that there is a statistically significant difference between PE-backed firms and non-sponsored firms in terms of age. This may explain the differences in offering size between the two subgroups. Hence, the results are in line with our expectations that there would be a significant difference in company age between PE-backed and non-sponsored firms. Furthermore, VC-backed IPO firms are significantly younger than both of their counterparts. Muscarella and Vetsuypens (1989a) found that a negative relationship existed between the age of the firm and the first day returns. As the average underpricing is larger for NS firms than VC-backed firms, our sample does not support this prediction.

Habib and Ljungqvist (2001) highlight the importance of examining the ownership percentage that pre-IPO shareholders retain in the company post-IPO. The authors argue that the larger stake sold in the IPO by the pre-IPO holders, the more concerned these owners will be about how much money is left on the table in the offering (i.e. the level of underpricing). Table 6 illustrates that, on average, non-sponsored firms retain the largest stake in the company post-IPO. This finding is in line with our predictions, as non-sponsored firms do not have a principal owner whose primary aim is to utilize the IPO as a divestment opportunity. Following Habib and Ljungqvist's reasoning, we would expect to see a relatively lower level of underpricing in non-sponsored IPOs in comparison to PE-backed and VC-backed IPOs, which however is not the case in our sample. Furthermore, there is a statistically significant difference in the average percentage of retained ownership between PE-backed and non-sponsored IPOs, PE-backed and VC-backed IPOs, and between non-sponsored and VC-backed IPOs in our sample.

Table 8 – Variable Correlation Matrix – Pearson Bivariate Correlation

Variable	Initial Return	Adj. Ini- tial Return	PE	VC	LN_AGE	LN_ ASSETS	LN_PRO CEEDS	MKT_ SHARE	ROA	RETAIN- ED	OWNER _FOCUS
Initial Return	1.00										
Adj. Initial Return	0.81	1.00									
PE	(0.27)	(0.18)	1.00								
VC	(0.06)	(0.02)	(0.31)	1.00							
LN_AGE	(0.11)	(0.04)	0.31	(0.18)	1.00						
LN_ASSETS	(0.24)	(0.18)	0.50	(0.33)	0.39	1.00					
LN_PROCEEDS	(0.20)	(0.04)	0.52	(0.29)	0.38	0.72	1.00				
MKT_SHARE	(0.12)	(0.12)	0.36	(0.24)	0.26	0.54	0.64	1.00			
ROA	(0.19)	(0.06)	0.05	0.02	0.05	0.23	0.10	0.06	1.00		
RETAINED	(0.03)	(0.39)	(0.25)	0.01	(0.11)	(0.03)	(0.29)	0.02	(0.06)	1.00	
OWNER_FOCUS	(0.20)	(0.14)	0.66	0.08	0.15	0.31	0.27	0.13	0.03	(0.19)	1.00

In table 8, we have tabulated the Pearson bivariate correlations between dependent as well as explanatory variables. A negative correlation between the explanatory variables and the dependent variables (initial return and adjusted initial return) means that the larger the explanatory variable, the smaller the initial return (lower level of underpricing), and vice versa. Correlation coefficients between the PE variable and initial returns as well as adjusted initial returns match expectations – negative correlations of -0.27 and -0.18 respectively suggest that PE-backed firms experience lower IPO underpricing. Conversely, non-sponsored firms have a positive correlation with the two dependent variables of 0.28 and 0.18 respectively, suggesting that non-sponsored firms experience higher IPO underpricing. From the table above, we also gather that the larger a firm is, the likelier it is to raise a large amount of proceeds in an IPO (positive correlation of 0.72). Also, larger firms tend to employ underwriters with a large market share (often equivalent to more prestigious and thus more expensive advisors). This seems logical because more prestigious underwriters do not advise on offerings that are below a certain size. The positive correlation of 0.10 between total IPO proceeds and return on assets reveals that relatively more profitable companies manage to raise larger proceeds in an offering. However, firms with larger assets are even likelier to raise large proceeds, which can be seen through the correlation coefficient of 0.23 between *ROA* and *LN_ASSETS*.

Examining the variable *OWNER_FOCUS*, it is evident by a positive correlation of 0.27 with the proceeds variable that companies which are owned by investment firms (PE/VC firms) that are primarily financially oriented tend to be able to raise larger proceeds. A mild positive correlation between owner focus and underwriter market share furthermore suggests that underwriters with a large market share are more likely to advise owners with financial ties. This result indicates that the importance of the owner's connections with financial advisors, at least when examining financially

focused investment firms, is not to be easily dismissed. Intriguingly, a near-zero correlation between financially oriented investment firms and their return on assets signifies that while they employ the best underwriters and raise more proceeds, their companies are not more profitable than others. In line with expectations, it also seems like financially oriented owners are keener to cash out than are their more operationally focused brethren – on average, they keep a smaller stake in the company post-IPO (correlation of -0.19).

Table 9 – Main Regression Results: Initial Returns and Adjusted Initial Returns Examined with Three Different Underpricing Models

Panel A	Standard UP Model	Adjusted UP Model	Adj. UP Model (2)
Intercept	0.212 (3.29)***	0.018 (0.30)	0.058 (0.91)
PE	-0.099 (-2.66)***	-0.068 (-2.63)***	-0.090 (-3.15)***
VC	-0.070 (-2.73)***	-0.007 (0.34)	-0.004 (-0.20)**
LN_AGE	0.000 (0.03)	-0.010 (-1.05)	-0.018 (-1.74)*
RETAINED	-0.092 (-1.88)*	-0.036 (-0.94)	-0.064 (-1.55)
LN_ASSETS	-0.003 (-0.76)	-0.010 (-2.02)**	<i>Omitted</i>
LN_PROCEEDS	-0.008 (-0.90)	0.033 (3.97)***	0.025 (3.02)***
MKT_SHARE	0.584 (1.13)	0.045 (0.13)	0.240 (0.62)
ROA	-0.000 (-2.28)**	0.046 (1.35)	0.051 (1.35)
AIM	0.019 (0.58)	0.078 (3.18)***	0.075 (2.76)***
OWNER_FOCUS	0.014 (0.44)	0.001 (0.05)	0.005 (0.21)
Model F	3.83***	5.54***	5.65***
Adjusted R²	0.118	0.255	0.223
N	213	134	147
Panel B			
Intercept	-0.001 (-0.05)	-0.063 (-2.12)**	-0.063 (-2.26)**
PE	-0.029 (-1.54)	-0.025 (-1.47)	-0.029 (-1.74)*
VC	-0.025 (-1.91)*	-0.009 (-0.65)	-0.006 (-0.45)
LN_AGE	0.002 (0.37)	-0.000 (-1.27)	-0.011 (-1.88)*
LN_ASSETS	-0.005 (-2.54)	-0.007 (-2.35)**	<i>Omitted</i>
LN_PROCEEDS	0.014 (3.25)***	0.032 (6.42)***	0.027 (6.11)***
MKT_SHARE	-0.087 (-0.34)	-0.184 (-0.78)	-0.195 (-0.87)

Table 9 (cont.) – Main Regression Results: Initial Returns and Adjusted Initial Returns Examined with Three Different Underpricing Models

ROA	-0.000 (-0.14)	0.021 (0.90)	0.024 (1.06)
AIM	0.035 (2.15)**	0.075 (4.89)***	0.076 (5.05)***
OWNER_FOCUS	0.004 (0.23)	0.003 (0.20)	0.002 (0.10)
Model F	2.85***	6.51***	7.15***
Adjusted R²	0.073	0.272	0.252
N	213	134	147

Cell values represent unstandardized regression coefficients for individual variables. The corresponding t-statistics are shown within parenthesis. In Panel A, the dependent variable is the first day return, measured as the return in percent between the offer price and the first trading day's closing price. In Panel B, the dependent variable is the adjusted first day return, measured as the first day return multiplied with $(1 - \% \text{RETAINED})$, where *RETAINED* is the percentage owned in the company post-IPO by pre-IPO shareholders. *PE* is a dichotomous variable where the value 1 represents that the IPO firm was PE-backed, and zero if it was not. *VC* is a dichotomous variable where the value 1 represents that the IPO firm was VC-backed, and zero if it was not. *LN_AGE* is the natural logarithm of 1 + the firm's age in years at the point of time of the IPO. Where the date of company incorporation is not explicitly provided, the company is assumed to have been founded midyear. *LN_ASSETS* is the natural logarithm of the total pre-IPO assets, measured in GBPm. *LN_PROCEEDS* is the natural logarithm of the total IPO proceeds, measured in GBPm. *MKT_SHARE* is the lead underwriter's market share in the year of the IPO, measured in percent. *ROA* is the pre-IPO return on assets, calculated using Earnings before Interest and Taxes over the pre-IPO average asset base. *RETAINED* is the percent owned in the company post-IPO by pre-IPO shareholders. *AIM* is a dichotomous variable where the value 1 represents companies listed on the AIM exchange. *, ** and *** resembles results significant at an alpha level of 0.10, 0.05 and 0.01, respectively. *OWNER_FOCUS* is a dichotomous variable where the value 1 represents that the owner (in the case of the firm being PE or VC-backed) is primarily financially focused.

The results of our main regressions are presented in table 9 above. In the first column we present our findings using the standard underpricing model, defined in equation 4. In the second column, we present the results from the adjusted underpricing model in which we have excluded outliers. In the rightmost column, we present our results using the adjusted underpricing model where we have excluded the variable *LN_ASSETS* in order to avoid any collinearity with *LN_PROCEEDS*. In all three models we excluded *MAIN_MARKET* to avoid any collinearity with *AIM*. Furthermore, in Panel A and B have we present our findings using the initial return and adjusted initial return, respectively, as the dependent variable.

The second column in Panel A uses the standard underpricing model and has a relatively unimpressive explanatory power of 11.8% (adjusted R²). However, we note that the *PE* variable has a negative correlation coefficient of -0.099 at a 1% significance level. This is hard evidence that PE-

backed firms conducting an IPO, on average, experience lower underpricing levels than other firms. Regarding VC-backed firms, we see that our VC variable has a negative correlation coefficient of -0.070 at a 1% significance level. The correlation coefficient for our VC variable is however less pronounced than that for our PE variable, providing support for our second hypothesis.

Panel A also illustrates the results as we run the two other underpricing models. First, we note that the adjusted underpricing model has significantly higher explanatory power, which jumps from 11.8% to 25.5%, as we increase robustness by eliminating outliers (see column three). While we cannot draw any conclusions regarding VC-backed firms from the adjusted underpricing model, our PE variable still has a negative correlation coefficient of -0.068 at a 1% significance level. This holds true also when the standard underpricing model is further adjusted (see column four) – the PE variable has a negative coefficient of -0.090 at the same significance level. Consequently, Panel A provides further evidence in line with our first hypothesis.

When running the third underpricing model, the VC variable is once again significant – this time at the 5% level – and has a coefficient of approximately zero. The two adjusted underpricing models thus provide some evidence, however less than in the PE case, in line with our second hypothesis.

Previous literature (Habib and Ljungqvist, 2001, among others) has often come to the conclusion that a larger ownership stake retained by the pre-IPO owners should reduce underpricing in initial public offerings. Our results indicate the opposite. At the 10% level, a larger retained ownership stake appears to reduce the level of underpricing in our sample.

While the standard underpricing model provides no conclusive evidence of any effect on the underpricing level depending on the size of proceeds, our adjusted models do. At a 1% significance level and coefficients of 0.025 and 0.033 respectively, results indicate that the larger the proceeds raised in the IPO, the higher the level of underpricing. Applying the result to the traditional supply and demand curve, our result should stand tall. However, there are other perspectives. Larger firms tend to raise larger amounts of proceeds in their IPOs, as evident by the correlation of 0.72 between *LN_ASSETS* and *LN_PROCEEDS* in Table 8. This means that an IPO raising large proceeds is likely to have been conducted by a large firm. For large firms, we expect more public information to be available, as larger firms have a relatively larger direct effect on people's lives than smaller firms, in turn warranting increased media and analyst coverage. This should let larger firms price

their IPOs closer to the true value as the asymmetric information gap is narrowed. Applying this reasoning, our result is counter-intuitive. It also contradicts the conclusions of Beatty and Ritter (1984). The pair provides reasoning consistent with the theory of smaller offerings being more speculative than larger ones, which is their key argument in explaining why the proceeds variable should have a negative coefficient.

In addition to Panel A, results are shown of a regression with the same explanatory variables but with “adjusted initial return” as the dependent variable instead of “initial return” (see equations 3 and 5, respectively). We argue, in line with several previous studies (including Habib and Ljungqvist, 2001, and Mogilevsky and Murgulov, 2012), that the adjusted initial return variable better captures the loss of wealth to pre-IPO shareholders as it displays underpricing levels weighted with the percentage of stock ownership sold. Results prove to be less significant for most variables, and the explanatory power of the standard underpricing model decreases from 11.8% to a weak 7.3%. However, the adjusted model reacts more positively to our robustness measures, producing explanatory levels of 27.2% and 25.2% compared to 25.5% and 22.3% when using the initial return metric. We see that the coefficient of our PE variable is still negative, in line with expectations, however less so than when using the initial return metric. Also, the proceeds variable is still significant at the 1% level and produces mild, positive correlations of 0.014 – 0.032.

Table 10 – T-tests of Differences in Average First Day Returns between High and Medium/Low period for each Subgroup

	Total		PE		VC		NS	
IPO Activity Period	High	L/M	High	L/M	High	L/M	High	L/M
Standard Underpricing Model	10.37%	11.45%	1.96%	6.31%	13.98%	6.86%	13.68%	15.45%
Diff	1.08%		4.36%		7.12%		1.77%	
T-statistic	-0.555		-2.210**		2.387**		-0.567	
P-value	0.579		0.032		0.024		0.572	
Adjusted Underpricing Model	4.19%	4.63%	0.90%	3.36%	6.44%	2.85%	5.14%	5.92%
Diff	0.44%		2.46%		3.59%		0.78%	
T-statistic	-0.458		-1.693*		2.244**		-0.512	
P-value	0.647		0.098		0.034		0.610	
Total Observations	87	126	25	25	18	32	44	69

Table 10 illustrates t-statistics and p-values for the difference in means between the subgroups (High vs. Medium/low IPO activity periods) for each subgroup (PE-backed, VC-backed and non-sponsored IPOs). *, ** and *** resembles results significant at an alpha level of 0.10, 0.05 and 0.01, respectively.

The table above illustrates how the averages in first day returns are affected by the IPO activity period at the time of listing. On average for the total sample, underpricing levels tend to be lower in high IPO activity periods, however, these findings are not statistically significant at any conventional level. For PE-backed firms going public, we find statistically significant evidence that underpricing levels are lower in high IPO activity periods. On the contrary, our results indicate that VC-backed firms experience higher underpricing levels in high IPO activity periods, providing support for our third hypothesis that VC-backed IPOs experience higher levels of underpricing in high IPO activity periods. Hence, our findings for the VC-backed IPOs are in line with the *hot issue market theory* put forward by Rossetto (2008) as well as with the findings of Ibbotson and Jaffe (1975) as well as Ritter (1984).

Table 11 – Comparing the First Day Returns for Financially vs. Operationally Focused Owner Firms

	Total		PE		VC	
Financial / Operational Focus	F	O	F	O	F	O
Standard Underpricing Model	10.37%	11.45%	1.96%	6.31%	13.98%	6.86%
Diff	1.08%		4.36%		-7.12%	
T-statistic	-0.555		-2.210**		-2.387**	
P-value	0.579		0.032		0.024	
Adjusted Underpricing Model	4.19%	4.63%	0.90%	3.36%	6.44%	2.85%
Diff	0.44%		2.46%		-3.59%	
T-statistic	-0.458		-1.693*		-2.244**	
P-value	0.647		0.098		0.034	
Total Observations	55	158	39	11	16	34

Table 11 illustrates t-statistics and p-values for the difference in means between the subgroups (financially focused vs. operationally focused owner firms) for each applicable subgroup (PE-backed and VC-backed IPOs). *, ** and *** resembles results significant at an alpha level of 0.10, 0.05 and 0.01, respectively.

The table above illustrates how the average first day returns differ depending on whether the principal owner (in the case of PE-backed and VC-backed firms) is financially or operationally focused. For non-sponsored IPOs, we have assumed the companies to be operationally focused. In the

aggregate, our tests provide no statistically significant evidence of different underpricing levels depending on owner focus. However, for PE-backed IPOs we find evidence that owners who are financially focused contribute to a lower level of underpricing at conventional significant levels. Interestingly, we find the contrary to be true for VC-backed IPOs. Hence, we find some support for hypothesis (4) that financially focused firms experience lower levels of underpricing, however this is only true for our PE sample. On a second note, we find that the majority of the PE firms are financially focused and the contrary to be true for VC-backed firms, as was previously hypothesized.

7 Conclusion

The existing financial literature on the topic of IPO underpricing is extensive and many prominent authors among the likes of Jay Ritter, from the University of Florida, and Tim Loughran, from the University of Notre Dame, have developed well-founded theories on why public offerings are underpriced. Unfortunately for perfectionists, an all-explaining theory has not yet been uncovered. It is likely that market gyrations, local variations in capital market structures and abstruse relationships between investment banks and owners bog down such attempts. Mindful of this struggle, it is our belief that the academia needs to conduct research on a more local level. It is not appropriate to conduct all studies on the US capital markets and assume an extrapolation of the results there may be correctly extended to other regions in the world. Also, we suggest the incorporation of more qualitative metrics. Studying the value creation philosophies of owners in a European market setting is something we believe firmly strengthens the breadth of possible explanations for the underpricing phenomenon. Certainly, interesting conclusions may also be drawn from the more traditional hypotheses laid forward by previous authors but applied in a European setting.

In line with the findings of Mogilevsky and Murgulov (2012), we find significant evidence that PE-backed IPOs on average experience a substantially lower level of underpricing than concurrently listed VC-backed and non-sponsored IPOs. These results are statistically significant at an alpha level of 1% for all three of our regression models. We also find that larger firms tend to employ more prestigious underwriters, i.e. underwriters with a relatively large market share. Since the PE-backed IPOs in our sample are the largest firms measured by total assets pre-IPO, we find further support for the trade-off theory developed by Habib and Ljungqvist (2001).

Moreover, our results support the theory that Baron put forward in 1982, namely that the informational advantage investment banks in general have over their IPO clients is strongly mitigated

or even eliminated in the case of private equity clients. We find the same to be true for venture capital clients, but to a less extent. However, as predicted, our findings do not support the signaling theory which argues for a higher level of underpricing in private equity-backed IPOs (Allen and Faulhaber, 1989; Grinblatt and Hwang, 1989). The grandstanding theory is also rejected since the PE-backed IPO sample indeed experiences lower levels of underpricing compared to non-sponsored IPOs. This proved valid also for VC-backed IPOs.

Our findings relating to hypothesis (1) extend the current research on the relative power of different parties in an IPO. If we assume that investment banks can alter the level of underpricing, depending on i) how lucrative the selling client (the firm going public, and its owners) is in relation to the buying client (institutional investors subscribing for shares in the IPO), and ii) how knowledgeable the selling client is, we can interpret our results in a more nuanced fashion. Assuming the aforementioned is true, we make an implicit assumption that investment banks will choose to please the most lucrative client by altering the underpricing level to this client's benefit. Hence, if the institutional clients subscribing for shares in the IPO are more lucrative in the context of future investment banking business opportunities than the private equity firm that divests a holding through an IPO, the investment bank will choose an underpricing level that benefits the institutional clients relatively more than the private equity firm. As this theory requires extensive statistical testing and empirical data-gathering, we are not able to draw any ultimate conclusion, but it is definitely one very interesting area for future IPO underpricing literature and research.

In Table 7, we find that venture capital-backed IPOs experience relatively higher underpricing than private equity-backed IPOs (at 1% significance level) and relatively lower underpricing than non-sponsored IPOs (at 5% significance level), using the standard underpricing model. Switching the dependent variable to the adjusted initial return metric, we find that PE-backed IPOs are still significantly less underpriced than are VC-backed (at the 10% level). We also conclude that VC-backed IPOs tend to experience lower underpricing levels than non-sponsored IPOs even when using the adjusted metric – however, this cannot be statistically verified at any conventional alpha level.

Our findings with regards to hypothesis (2) are consistent with our expectations and thus, we can verify our hypothesis in full with the standard initial return metric and in part when using the adjusted initial return metric. This conclusion is in line with the findings relating to the certification theory brought forward by Megginson and Weiss (1991).

We reason that the results show support for the trade-off theory (Habib and Ljungqvist, 2001). Since VC-backed IPOs are proven to be much smaller than their PE counterparts, it does not make economic sense for VC firms to mandate the most expensive underwriters. Because it does make sense for private equity firms, this difference could prove a valid explanation to why VC-backed IPOs experience a higher underpricing level than do PE-backed IPOs.

In line with the hot issue market theory put forward by Rossetto (2008), we find statistically significant evidence that VC-backed IPOs experience substantially higher levels of underpricing in high IPO activity periods. Our results are significant at an alpha level of 5% when looking at both the standard initial return metric and our adjusted initial return, further providing support that this theory is applicable in the European markets as well. We do note a certain skewedness in our data in relation to testing the hot issue market theory, which should be observed. It conforms to our selected years in the sample dataset and the relative intensity of IPO activity that year – in our sample, we have more VC-backed and non-sponsored companies going public in times of low or medium active IPO markets. However that may be, our results are in line with expectations. One possible explanation is that venture capitalists are eager to list their portfolio companies, since this is perhaps the best way of improving reputational capital, and they are simply given more chances in high activity periods. Further, better reputational capital increases the likelihood of larger future fund raisings, and thus higher future management fees for the VC firm, which may prove a legitimate reason as to why VC firms would accept higher upfront costs in the form of IPO underpricing.

Furthermore, our results indicate that the level of underpricing decreases further for PE-backed IPOs in hot issue markets, compared to low/medium periods. As markets are booming, and investor appetite for IPOs increases, one would assume that higher risk companies that might not be able to go public during lower activity periods will take the chance in high activity periods to utilize the momentum in the market. Hence, a possible explanation for why private equity-backed IPOs experience a lower degree of underpricing in high issue markets could be that as the market is flooded with higher risk companies going public (such as VC-backed firms), risk averse investors will pay a higher price, i.e. a lower level of underpricing, for lower-risk offerings, such as private equity-backed firms going public. Obviously, one would need to perform multiple empirical tests to verify this explanatory statement. Nevertheless, we believe it is an interesting area of future research.

Regarding hypothesis (4), the vast majority of PE firms in our sample are financially focused (39 vs 11), while the majority of VC firms are operationally focused (34 vs 16). We do not find statistically significant evidence that financially focused firms achieve a lower level of underpricing than their operationally focused counterparts. However, for our sample of financially focused PE firms taking portfolio companies public, we find statistically significant evidence, at an alpha level of 5% for the initial return metric and 10% for the adjusted initial return metric, that these IPOs achieve a lower level of underpricing than their operationally focused counterparts. Interestingly, we find the opposite to be true for VC-backed IPOs at a 5% alpha level. While these apparent differences may simply be the result of fewer number of observations within the less-dominant category for PE and VC firms respectively, we reveal some interesting takeaways that we argue should encourage future research within the area. First, our results entice thoughts of what might be the proper value creation style – is there a uniform, best-in-class investment philosophy that works across-the-board? According to this study, the answer is no. Owners that focus on creating value through financial adjustments appear to prevail within private equity. Venture capitalists with the same focus leave a lot more money on the table, experiencing much higher underpricing levels than their operationally focused peers. Considering the far-reaching differences between venture capital and private equity, one might argue that our results are not surprising. VC firms need to be able to take bets on operational business models which have not yet experienced a breakthrough in customer adoption rates, so there is a greater need for understanding the technology, its implications and who might make use of it. For PE firms, targets have had their breakthrough and are often well-functioning corporations with leading market positions. These companies may benefit more from adjusting their debt levels, replacing managers or acting as a platform for consolidation strategies rather than having experienced investment professionals who sincerely and profoundly grasp their business model. Certainly, these ideas validate further research and we are enthusiastic about the prospect of understanding differences in owner focus on a deeper level.

This paper provides a contribution to the relatively sparse existing literature in the setting of IPO underpricing on European capital markets. We present empirical evidence backed up by existing theories that confirms much of the research done on US capital markets. Furthermore, this study provides additional reasoning behind the underpricing phenomenon, how it differs between different owner types and which effects IPO cyclicalities have on underpricing. Finally, we have made some initial research regarding owner focus type and how this might affect underpricing in initial public offerings. There is much more to be done within this relatively unexplored area of financial

literature, but it is our hope that our study will shed some light on the fundamentals of the effects of investment philosophy on underpricing in IPOs.

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