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Venture Capital Finance and Exit Opportunities

Determinants of an Initial Public Offering

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Venture Capital Finance and Exit Opportunities

Determinants of an Initial Public Offering *

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Abstract

This paper examines the determinants of a venture capital (VC)-backed initial public offering (IPO). Despite the importance of success for VC firms, only a handful of academic studies explored the factors driving performance. Besides that an overview of previous research documenting on these factors is presented, some determinants are empirically assessed using a sample of US venture capital investments covering the period 1984 – 2003. The empirical analysis indicates that experience of the VC firm itself does not have an impact on the likelihood of an IPO. Also, limited evidence is found in support of young VC firms' 'grandstanding'. Despite that, the ability of a fund's manager and the level of syndication are important drivers of success. Finally, although no significant difference is found in the probability of an IPO between independent and captive VC firms, it can be concluded that the likelihood that public VC organisations exit investments through an IPO is significantly lower compared to independent VCs.

JEL classification: D82; G24; G32

Keywords: Venture capital; Initial public offerings; Determinants; Relogit

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1 Introduction

Many individuals over time have shown a great interest in turning mere ideas into real businesses. Examples abound. However, having ideas is one thing, making them reality is another and is easier said than done. When one has the desire to start its own firm, a large barrier to actually do so is generally financial constraints. In order to create a viable, effective firm, often quite a sum of capital is required to start-up, let alone to finance the first few years of commercial operations. Not everyone is in the position to invest such an amount of money by himself, nor is it rational to put all your eggs in one basket. Consequently, people apply for external financing. This can come in many forms, for example, bank loans, family loans, and venture capital (VC).

Since start-up firms generally do not have a proven track record, nor are they able to credibly signal their creditworthiness, and only have a few tangible assets in place which can qualify for collateral, it is found to be very hard for the founders to obtain bank loans on fair conditions (Scholtens, 1999). Even in the event that a bank loan is granted, this would not suffice the needs of the new firm, as the bank is not willing to lend significant amounts of capital to a high risk project, without high levels of collateral or other guarantees. Add the uncertain character of these new companies (due to *e.g.* moral hazard problems and asymmetric information) and it becomes clear why banks are not keen on financing these projects. This is the point where VC firms become important. They are mainly regarded to fill the gap between supply and demand of capital in markets where transactions between parties are costly (*i.e.* difficult) (Jeng and Wells, 2000).

Besides that venture capitalists provide finance to start-ups, a distinguishing feature compared to other types of financing is the active contribution to the investment. For example, due to the VC's experience and expertise, the portfolio company is offered a helping hand in making deliberate strategic decisions and directions for investment opportunities (Gompers et al., 1998). Furthermore, the involvement of a VC firm comes along with access to the investor's network, which includes, among others, suppliers, consultants, and lawyers.

The financial resources the VC firm has at its disposal to invest are generally raised from insurance companies, pension funds, wealthy individuals, etcetera. These parties are willing to invest in exchange of a respectable return. A return is created by exiting the investment in a profitable way. Since the VC firm returns part of the profits to the suppliers of the capital, it is of great importance to the VC firm to carefully screen beforehand and nurture portfolio companies such that they will turn out successfully indeed.

Considering that the venture capital industry is relatively novel, quite a large body of literature already addressed major topics in this area. Quite frankly, however, it is remarkable that only few studies investigated what determinants drive VC's success, while

it is of vital importance to the firm's existence. Since a vast majority of the literature indicates an IPO as the highest achievable exit vehicle, the aim of this study is captured in the following research question.

Research Question. *What are the determinants of a venture capital-backed initial public offering?*

Before bluntly taking up the data set and start an empirical analysis, first, existing literature is explored in detail in order to determine what is already known about the drivers of venture capital success. Most prominent factors are found to be as follows. Market conditions, like the size of the stock market, the level of competition, and how the institutional environment is organised; Investment specific details, such as the number of funding rounds or the stage of development of the portfolio company, the duration of the investment, the level of syndication, and control rights obtained by the investor; VC firm characteristics, like its experience, age, ability, and type; finally, geographical factors, like the entrepreneurial environment the portfolio company resides in and the location of the VC firm are found to be of importance.

From the literature study, it becomes clear that some fields are rather under-examined or no clear conclusions regarding the different effects are present. Therefore, in an attempt to close the gap in the existing research, and as far as the data permits to do so, these factors are examined empirically. In particular, the influence of a VC's experience, its incentives to 'grandstand', the VC firm's ability, the level of syndication, and the type of VC firm is addressed.

From the empirics, it turns out that experience, measured at VC firm level, does not influence the likelihood of an IPO. The reason why it does not have a significant effect can have a few sources. The most likely cause is that the firm's experience is not decisive, but instead, the experience of the staff members is what counts. Secondly, it also depends on what type of company is invested in. If the entrepreneurs already have the skill to make the company a success, the experience of the VC firm does not matter. Inexperienced VCs may deliver successful investments by investing in proven entrepreneurs, and do not really need the skills which are needed to select and nurture new entrepreneurial companies. Some support is found for 'grandstanding', however, it is less impressive than the results of Gompers (1996). This means that young VC firms are concerned about their reputation and are prepared to take portfolio companies public at a younger age compared to older VC firms, in order to establish themselves as successful investors. The abilities of the VC firm itself do not seem to be of importance, but the ability of the fund's manager has a large influence on the probability of an IPO. This is likely the consequence of the manager being in charge of investment decisions instead of the VC firm. The effect of syndication is likely to be most influential. It fosters information sharing and reduces risk, which

positively attributes to the likelihood of an IPO. Finally, no significant differences are found between captive and independent VC firm types, which is somewhat unexpected. Future research might address this issue with a different set-up of the model. Public VC organisations are found to issue significantly less IPOs compared to independent VC firms.

Besides that this study attempts to provide more insight into the determinants of an IPO, it is also, to the author's knowledge, the first study to provide an overview of the most relevant factors influencing the likelihood of this exit strategy. Furthermore, this study provides a meaningful insight for entrepreneurs seeking external finance, as they can determine the benefits of being supported by a certain VC firm type or assess the influence of particular determinants of success in general. Of course, the presented overview is also valuable for VC firms, as it attributes to the understanding of what factors are important drivers of an IPO.

The remainder of this paper is organised as follows. First, Section 2 discusses key terms used in this study. In particular, background knowledge is provided for venture capitalists and how investments are carried out in the industry. Section 3 considers previous literature in the field of interest of this study. Firstly, a common determinant of VC's success is assessed. Thereafter, an overview of factors influencing success is provided. The hypotheses are then formulated on the basis of to what extent factors are under-examined or for which few empirical results are available yet. Issues regarding the data applied in the empirical analysis are considered in Section 4. Next, Section 5 motivates the methods employed to determine the validity of the hypotheses. Section 6 focuses on the empirical findings. Based on these results, the effects of the determinants are discussed in more detail. Finally, Section 7 concludes.

2 Theory

Before turning to the details of this study, firstly, brief interpretations of the key terms used in the text are provided. Besides that this section aims to contribute to a solid background knowledge of the particular topics, it is also a necessity to provide clarifying remarks for one issue. Since the term venture capital is defined differently across Europe and the United States (Jeng and Wells, 2000), a clear explanation is required. In this study, it will be referred to as one type of private equity activities, whilst the term comprises private equity investments in general across Europe. A definition for the US is presented here as the study sheds light on the US venture capital market only.

2.1 Venture Capitalists

Having a look at the name alone, venture capital seems to be just one of the many alternatives to finance a company. Nonetheless, when comparing the characteristics with, say, capital acquired through bank loans, there is in fact quite a genuine difference. A very simplistic example of how a bank loan is granted is as follows. The entrepreneur who is willing to apply for a loan to start his own company has to provide a detailed business plan. After having received the concept, the bank will carefully screen the applicant, estimate the feasibility and viability of the new firm, and assess the level of risk associated with the investment. In case the entrepreneur meets the criteria, a certain amount of capital is lend against a certain level of interest and usually some restrictive covenants are included in the loan contract.

Now, where does the difference stem from? Before mentioning any differences, first of all, it should be noted that venture capital and bank loans do have some similarity. Both a bank and a VC firm act as financial intermediaries; these financial institutions raise funds from investors¹ and lend these funds to borrowers. However, the differences originate from the investors' origin. Where an entrepreneur has to provide, among others, collateral to the bank to secure a loan deal, VC firms provide capital in return of shares in the portfolio company. Furthermore, a bank can only intervene in the event that the company fails to repay its debt payments. On the contrary, a VC firm partly owns the company and has a significant influence on the day to day operations (Fenn et al., 1995; Hellmann and Puri, 2002).

The question why certain types of companies seek financing from VC firms has several answers. One of the key arguments is that venture capital tries to close the gap between supply and demand of capital in markets where transactions between these parties are costly (Jeng and Wells, 2000). Therefore, the role of venture capital is best described as

¹In the case of banks, funds are usually provided by savers.

a function of financial intermediation, as mentioned before. Even though the prevailing literature designates an important role for banks acting as financial intermediaries (Campbell, 1979; Myers and Majluf, 1984; Fama, 1985), a bank is actually not really suited to provide intermediary services to this particular group of customers. After a new company is established, only very few tangible assets are in place which can qualify for collateral. Furthermore, when taking another issue into account, namely that the newly established company cannot trust upon a proven track record of past performance, it becomes clear that the founders face difficulties proving their creditworthiness when applying for bank loans (Scholtens, 1999). In the case of the US, banks are not allowed to possess equity, which makes it even harder for new companies to acquire a loan (Jeng and Wells, 2000). Even in the event that a bank loan is granted, this would not suffice the needs of the new company, as a bank is not keen on lending significant amounts of capital to a high risk project, without corresponding levels of collateral. Besides that, the high levels of risk associated with such companies are more than compensated with extraordinary high levels of interest rates on loans provided by the bank. Not only will this result in severe liquidity problems when running daily operations but, even more importantly, it will restrict the company's growth opportunities (Gompers, 1995) and opportunities in general (Evans and Jovanovic, 1989). In contrast with banks, VC firms do not require any form of intermediate payments from their investments. Since they are entitled to a share of the company through their investment, they profit from increases in the company's value.

Despite the low levels of possible collateralisation, other factors can be named that influence the extent to which banks are prepared to provide loans. Moral hazard problems, asymmetric information, the information gathering process, and monitoring costs are likely to be the most influential causes for banks' restraint in this particular investment area. Due to the uncertain character of new companies, banks rather refrain from financing; this is the point where the venture capitalists come in.

Vcs usually tend to narrow their expertise to a few fields and carefully observe the latest developments in technologies and monitor the markets they operate in. By doing so, the firm remains up-to-date and is able to make informed decisions (Fenn et al., 1995). Start-up companies which are supported by venture capitalists are innovative (Hellmann and Puri, 2000), early stage, situated in high tech industries (Gompers, 1995; Black and Gilson, 1998; Gompers et al., 1998), prone to information asymmetries (Gompers, 1995), high potential (Sahlman, 1990; Bygrave and Timmons, 1992; Zacharakis and Meyer, 2000), and operate in an uncertain environment (Sahlman, 1990; Ruhnka and Young, 1991; Zider, 1998).

The search for promising companies is a very selective process and takes place with due diligence. After all, the venture capitalist is not investing its own money. Instead, it

originates from a fund, raised by all different types of investors, like insurance companies, pension funds, wealthy individuals, etcetera and aims to achieve a respectful return. The selection process can be described as follows. First, the VCs screen the entrepreneur and scrutinise the viability of the business plan (Garmaise, 2001). Then, if the company is regarded as a worthwhile undertaking, they offer help by setting up appropriate incentive schemes and accompanying compensation packages for the staff (Kaplan and Strömberg, 2003). However, the company does not merely receive financing, there is more to it. For example, after the initial investment is settled, the VC firm actively tries to bring in other venture capitalists (Gorman and Sahlman, 1989; Gompers and Lerner, 2001). On the one hand, this enables them to diversify away the risk; now they can invest in more projects instead of investing a bulk of their capital in a single project. Furthermore, in the event that multiple firms take part in the investment deal, it is less likely to end up in a bad engagement, since different parties valued the project. In addition, they actively contribute to the firm, often by taking a chair in the board (Gorman and Sahlman, 1989; Lerner, 1995; Gompers and Lerner, 2001), which beneficially attributes to the monitoring of their investment. By doing so, the company also benefits from the expertise and know-how they bring in. One could think of advice on strategic decisions and investment opportunities (Gompers et al., 1998). Besides that, involvement of such a financier entails access to a broad network of suppliers, consultants, and lawyers. Also, the staging of investments provides the investor a great deal of control over the project (Gompers, 1995) and, by keeping the target company on a leash, risk can be reduced. Also, control is strengthened by offering compensation in the form of equity, which aligns the interests of executives and stakeholders (Kaplan and Strömberg, 2001). Finally, VCs contribute to the professionalisation of the company (Hellmann and Puri, 2000, 2002; Keuschnigg, 2004) by attracting experienced executives and replacing staff when under performing. It can be concluded that this type of companies is in need of an ‘active investor’ (Jensen, 1993).

2.2 Stage Investment Process

In the end, all effort VC firms exert in selecting and guiding the right investment projects is intended to create a respectable return for their stakeholders. This return can be achieved by a number of exit vehicles, for example, by a merger, a trade sale, a leveraged buyout, or an initial public offering (IPO) (*e.g.* Amit et al., 1998; Cumming and MacIntosh, 2003).

Preceding the final goal of the investment, a profitable exit, about 3-7 years have past (Armour and Cumming, 2006). However, taking into account the recent economic downturn, it is not inconceivable that, currently, a period of 5-10 years will elapse before exit. During this period, investment takes place in stages. On the one hand, this allows the

investor to monitor the progress of the firm and creates a possibility to withdraw from the project when it turns out unsatisfactory, or intervene where necessary. On the other hand, at the early stages of the company, much of the assets are intangible, which gives rise to high agency costs. In later stages, assets are more tangible and the investor can recover more of its investment in case of liquidation. Accordingly, funding duration increases in later rounds (Gompers, 1995).

Funding takes place in stages, whereby the number of and intensity of future funding rounds depend upon the achievement of predetermined milestones, also referred to as 'key benchmarks' (Ruhnka and Young, 1987). Besides that this allows for objective developmental measures, it also provides the investor the opportunity to withdraw from the project when the company is unable to achieve the benchmarks. Consensus among VC firms was found, dividing the developmental process of the companies in five sequential stages, which can be captured as follows (Ruhnka and Young, 1987)².

1. Seed capital. The first round of financing is focused on the development of the concept and to prove that the business concept works, *e.g.* by making prototypes at a competitive cost.
2. Start-up stage. Early stage companies need resources to develop the products and set out a marketing strategy in order to capture a market which makes an economically feasible production possible.
3. The third stage often entails bringing the product on the market, increasing production levels, and installing a full management team.
4. In the fourth stage, the firm receives funding in order to ramp up the production even further and to remain ahead of the competition. It includes more or less an expansion of the third round and a continuation of the processes. This is regarded as a critical stage, as quite a few companies, which were once destined to be profitable, turned to so-called 'living dead' investments³.
5. The fifth round of funding is usually regarded as the final stage of investments. Investments are mainly focused on increasing, or at least maintaining, market share

²Part of the literature body discusses six or eight stages of funding (Pratt, 1983; Plummer, 1987), however, the results presented by Ruhnka and Young (1987) point out the use of only five stages. This conclusion was drawn from a study which analysed whether and how venture capital firms differentiated the different stages in the company's development process. 73 CEOs or managing partners of different US based VC firms were asked for their perceptions. When comparing the stages determined by Pratt (1983) and Plummer (1987), who discerned between six and eight different stages, respectively, with the five stages of Ruhnka and Young (1987), the stages are quite similar and the latter stages show a high level of overlaps.

³See Ruhnka and Young (1991) for a more elaborate explanation on 'living dead' investments.

and creating a prosperous environment for cashing-out the investment through one of the earlier addressed exit vehicles.

Typically, the venture capitalists stipulate that their investment includes certain rights, in order to secure their investment position. Among others, preferred-equity ownership and disproportional voting power is prevailing. Additionally, agreements are made regarding anti-dilution clauses. In the event that future funding rounds are based on a lower per-share value, this will turn out to be detrimental for the preceding investor(s).

3 Literature Review and Hypotheses

Considering the relative novelty of the VC industry — although first venture capital activity took place shortly before the second World War, the industry really started to boom during the 1960's and 1970's with the emergence of Silicon Valley — quite a large body of the finance, entrepreneurship, and economics literature touched upon this topic already. For example, much is known about the structure and governance of VC firms (among others Sahlman, 1990), VC fund raising activities (*e.g.* see Gompers et al., 1998; Gompers and Lerner, 2004), monitoring and control of investments (*e.g.* Gompers, 1995; Hellmann, 1998; Kaplan and Strömberg, 2001), timing of the exit strategy (for example Gompers, 1996), and factors influencing the extent of underpricing at the time of an IPO (*e.g.* Barry et al., 1990; Megginson and Weiss, 1991; Lee and Wahal, 2004). However, after a thorough inspection of the existing research, it can be concluded that, unexpectedly, not to say remarkable, only little is known about what drives venture capitalists' success.

Therefore, in an attempt to find an answer to this under-exposed matter, the aim of this research is to ascertain determinants of success of VC firms and to close the gap in the existent literature. The most prominent factors can be categorised in the following groups. Geographical location, control rights, market conditions, venture capitalist's characteristics, entrepreneurial company's characteristics, and fund related factors. However, before addressing to these factors, it should be clear what is actually understood by the term 'success' in this study.

3.1 Determining the Performance Measure

It was already described in Section 2.2 that venture capitalists' returns are created via an exit vehicle. Several exit strategies are encountered in the literature, but does any of those stand out? It was found that after a VC firm exited its investment position in a certain portfolio investment, capital providers were able to judge the VC's performance relative to the returns on other investments (Gompers, 1996). Accordingly, it should be possible to compare the performance of the different exit options and determine the most profitable type. A small selection of the available present literature observed the following strategies.

1. *Initial Public Offering (IPO)*. The company is sold on the market through a stock market listing (*e.g.* Gompers, 1995; Amit et al., 1998; Black and Gilson, 1998; Bascha and Walz, 2001; Schwienbacher, 2008; Cumming and MacIntosh, 2003; Hege et al., 2003; Schwienbacher, 2005; Cumming et al., 2006; Cumming, 2008).

2. *Mergers & Acquisitions/Trade Sale*. In this case, the company is usually acquired by a strategic investor, typically a large firm with an interest in the company's products/services. This entails that the large firm acquires full ownership, which means that both the venture capitalist as well as the founding entrepreneurs sell their stake in the company (among others Gompers, 1995; Amit et al., 1998; Black and Gilson, 1998; Bascha and Walz, 2001; Schwienbacher, 2008; Cumming and MacIntosh, 2003; Hege et al., 2003; Schwienbacher, 2005; Cumming et al., 2006; Cumming, 2008).
3. *Leveraged Buy-out (LBO)*. For example, the founders repurchase the stake currently owned by the venture capital firm. Other possibilities, among others, are management buy-outs (MBO) and management buy-ins (MBI) (*e.g.* Amit et al., 1998; Black and Gilson, 1998; Bascha and Walz, 2001; Cumming and MacIntosh, 2003; Cumming et al., 2006; Cumming, 2008).
4. *Secondary Sale*. The share owned by the VC fund is sold to a third party, for example, another VC firm. In this situation, the entrepreneurs retain their share of interest (*e.g.* Amit et al., 1998; Bascha and Walz, 2001; Cumming and MacIntosh, 2003; Schwienbacher, 2005; Cumming et al., 2006).
5. *Liquidation/Write-off*. In case that the company does not develop according to plan, the venture capitalists exit their investment with no or a very small return (for example Gompers, 1995; Amit et al., 1998; Bascha and Walz, 2001; Cumming and MacIntosh, 2003; Schwienbacher, 2005; Cumming et al., 2006; Cumming, 2008).

Comparing the different views on and looking at what performance measures are employed to analyse success of VC firms, an IPO is regarded as the most profitable exit strategy (among others Petty et al., 1994; Fenn et al., 1995; Gompers, 1995; Amit et al., 1998; Black and Gilson, 1998; Gompers et al., 1998; Gompers and Lerner, 2001; Schwienbacher, 2008; Cumming and MacIntosh, 2003; Hege et al., 2003). This observation is also supported by empirical evidence, which presented a clear lead over the other exit vehicles. IPOs showed a return of approximately 60% per year, mergers & acquisitions about 15% per year, while a loss of 80% was incurred over the investment period in the case of liquidations (Venture Economics, 1988). Schwienbacher (2005) came to a similar conclusion. Trade sales are perceived as a common exit vehicle, comprising both promising investments as well as somewhat less profitable companies. However, IPOs seem to be reserved to the "most promising ventures" only. Other research is in support of the notion that only the best firms are taken public by a listing on a stock exchange and yield the highest returns (Fleming, 2004). Informational asymmetries also play a crucial role in

the decision whether to take a company public. Cumming et al. (2006) argued that only those companies are disposed through an IPO which are of the highest quality. Reputation is an important factor here, as it can signal important information to potential investors at the time of an IPO (Barry et al., 1990). For example, VC firms who are experienced and known to have an expertise in monitoring investments are likely to raise significantly larger amounts of capital in an IPO compared to obscure venture capital firms. Furthermore, venture capitalists use successful IPOs in marketing campaigns to attract funds (Gompers et al., 1998).

Summarising the above, one can conclude that an IPO is a good representation of a venture capital firm's success. Therefore, the research problem is formulated as follows;

Research Question. *What are the determinants of a venture capital-backed initial public offering?*

3.2 Previous Literature on the Determinants of an IPO

Several studies (e.g. Schwienbacher, 2008; Das et al., 2003; Giot and Schwienbacher, 2007; Cumming, 2008) already provided some insight into the determining factors of an IPO. Nonetheless, part is rather under examined or mixed results are found. This section provides an overview of factors that are found to be of an influence on an IPO and are not investigated empirically.

3.2.1 Market Conditions

Former research particularly pointed out the influence of market conditions on the exit decision (e.g. see Ritter and Welch, 2002; Giot and Schwienbacher, 2007). This section will focus on the impact of the stock market, the institutional environment, and competition.

Stock Market In a cross-country study conducted in 1998, Black and Gilson came to the conclusion that countries with larger, well developed stock markets were related with more IPOs. One reason named for this relation is that, when there is easier access to an exit strategy, this is more likely to occur. This would also hold for the higher number of observed IPOs; with a larger equity market, it requires less of an effort to exit the investment via a stock listing. Jeng and Wells (2000) and Armour and Cumming (2006) also emphasised the importance of the stock market. Contrarily, according to a cross-country study among Asian-Pacific countries (Cumming et al., 2006), the size of the stock market did not significantly influence the number of IPOs.

Tangent to the topic concerning the size of the equity market is the market capitalisation. Empirical evidence indicates that the number of IPOs is positively related to the market capitalisation (Cumming, 2008).

Besides the size of the stock market, the general condition of the IPO market is found to be of an influence as well. Ritter (1984) presented evidence for massive swings in the IPO market during the 1980's. In line with these results, Ruhnka and Young (1991) and Cumming and MacIntosh (2003) concluded that the decision to use an IPO as exit vehicle depends on the cyclical stage the stock market is in. Furthermore, Giot and Schwienbacher (2007) concluded that the time to an IPO is significantly reduced when the IPO market is very active. In addition, they noticed that, when market conditions were favourable for an IPO to occur, it seems as if exits at those points in time are sped up. This is possibly caused by venture capitalists who were eager to take advantage of higher capitalisation possibilities. This is in line with earlier studies regarding stock market liquidity, which can provide an easier exit.

Exit via the stock market is also considered to be more preferable in the situation of high stock valuations in the industry. In that case, the venture capitalists are able to reap considerably higher profits compared to another exit vehicle. For example, a study focusing on the biotech industry proved that more IPOs took place when the value of already stock listed biotech companies was high (Stuart and Sorenson, 2003). Lerner (1994b) provided similar results for this industry.

Related to the relative equity value is the market perception of the company's value. Empirical research confirmed a strong, positive relation between the value of the VC-backed company and the likelihood of going public (Gompers, 1995; Darby and Zucker, 2002; Cumming and MacIntosh, 2003; Das et al., 2003; Cochrane, 2005). This seems consistent with a conclusion drawn earlier. An initial public offering yields (in the far majority of investments) the highest returns.

In addition to high equity valuations, it is quite plausible that investors are interested in a good return on their investments. Having said that, it is likely to observe an increase in the number of IPOs in the event that stock returns are high, due to a higher willingness to invest among the different investors. Comments by Cumming et al. (2006) pointed in a similar direction; the return on the stock market might influence the likelihood of an IPO. This is confirmed by the findings of Cumming (2008). Although not directly, but with a time-lag of three months prior to the IPO date, an increase in stock returns significantly increases the number of companies proceeding into an IPO. Armour and Cumming (2006) also showed an increase in exits in response of high stock returns.

Institutional Environment Often, a market's attractiveness to invest depends on the institutional settings. For example, if investors enjoy protection rights, they are more likely to invest. A cross-country study conducted in 2006 showed that countries with a strong institutional environment, *e.g.* encompassing legal certainty and protection of

investors, are better able to create favourable conditions to take a firm public (Cumming et al., 2006). For example, with proper regulations in place, the extent to which companies are under priced as a consequence of asymmetric information is reduced, which results in lower costs to undertake an IPO. Empirical results showed a significant positive relation between a strong institutional setting and the likelihood of an IPO. Nonetheless, since this study concentrates on one country only, issues regarding legal rights and protection of investors are not taken into consideration.

When deciding about the exit decision, a VC firm also needs to take the transaction costs associated with the deal into account. For example, looking at the comparative transaction costs incurred by the different types of exit, it might favour one strategy over the other. On the other hand, potential investors also look at the post-exit transaction costs associated with operating the company. Therefore, when the investors reduce the amount they are willing to pay for the company by these expected post-sale costs, the venture capitalist might be tempted to alter its choice of exit (Cumming and MacIntosh, 2003).

Competition In the ideal situation, a company is not affected in its day to day operations by competing entities. For all that, this is not realistic. For example, it might be argued that, with more intense competition, profitability is modest and might even become under pressure. In that situation, it is not inconceivable that an IPO is less likely to occur, as investors are shun by the company's future prospects. Stuart and Sorenson (2003) found that, if the number of competitors in close proximity to the company increases, the probability of an IPO is lower. It was also hypothesised by Ruhnka and Young (1991) that an IPO depends on the anticipated future competition.

Most of the arguments mentioned above are in line with theories developed in corporate finance. According to the corporate finance literature, the valuation of a company depends to a large extent on the industry's dynamics. For example, the number of competitors, entry/exit barriers, prospects of growth and profitability of the industry, and other trends of the market. Therefore, it does not seem inconceivable that market conditions could play a major role in the exit process of the investment and the decision to enter the IPO market.

3.2.2 Characteristics of the Entrepreneurial Company

A number of general characteristics of the company have an influence on the probability of an exit through an IPO. For example, it is found that the size of the company's assets play a role in whether the company meets the requirements to be listed on a stock exchange. Furthermore, the industry the company operates in, the growth potential and capital needs of the company are of importance (Cumming, 2008). Cumming et al. (2006) presented

evidence for a higher likelihood of an IPO when the market/book ratio is higher (consistent with Gompers and Lerner, 2004). With a higher market/book ratio, the company's growth potential is higher, which is reflected in a higher likelihood of an IPO.

Additionally, the number of patents assigned to a company are associated with a significant increase in the number of IPOs (Stuart and Sorenson, 2003). This is related to a study by Schwienbacher (2008) and Hege et al. (2006), who found that an IPO is reserved to only the most promising companies. The former study also explored the impact of innovation. The research points out that the level of innovation is positively related to the number of IPOs. These results are compatible with Darby and Zucker (2002). One explanation is that by innovating, the company differentiates from the incumbent parties which can lead to higher returns.

Finally, the development stage the company is currently in has an impact on the probability of an IPO (Das et al., 2003). Companies in later stages of development are more likely to result in an IPO and this probability increases from the early stage to the later financing stages. Although some industries have a higher likelihood of proceeding to an IPO (*e.g.* biotech, high tech, medical sector (Das et al., 2003)), the general pattern holds across almost all industries.

3.2.3 Characteristics of the Investment

Funding Rounds Financing in stages allows both the opportunity to exit unprofitable investments in an early stage as well as it provides a monitoring device. According to Schwienbacher (2005), stage financing has a significant, positive influence on the probability of an IPO. Gompers (1995) argued that this is attributable to the quality of the company. Firms that are more successful receive more rounds of funding, while not that successful firms are usually divested in an early stage. Gompers (1995) came to the conclusion that IPOs were financed in more rounds compared to other exit vehicles, like an acquisition or liquidation. Similar results are presented by Giot and Schwienbacher (2007). It is found that if a company passes a higher number of milestones, this significantly increases the probability of an IPO. In this situation, more uncertainty regarding the future prospects of the company is resolved, increasing the likelihood of an IPO. This positive relationship was confirmed by Hochberg et al. (2007) and empirical evidence is found by Hege et al. (2003); Stuart and Sorenson (2003). Additionally, the former study detected that more frequent staging can lead to less agency costs and a better performance in the end. The research concluded that if the time between subsequent funding rounds decreases, the probability of an IPO is increased.

Furthermore, the total investment is larger for an IPO (Gompers, 1995; Stuart and Sorenson, 2003). In line with this research, Das et al. (2003) found that if the amount of

capital invested in a round increases, the probability of an IPO is increased as well.

Duration of the Investment Cumming and MacIntosh (2003) hypothesised that, when the time the VC firm is involved in the investment increases, the more likely to end the investment through a high return exit. For example, in time, information asymmetries between insiders and outsiders are reduced. Furthermore, the more time a VC firm spends on its investment, the more likely that it is of high quality. Nonetheless, this hypothesis was not supported by their results. The probability of an IPO is negatively related with the duration of the investment. However, it should be noted that the evidence is weak. Some support was provided by Giot and Schwienbacher (2007). It is found that, when time flows, the probability of an IPO increases. However, at some point in time, a plateau is reached after which investments have fewer and fewer possibilities to exit via an IPO. This might explain the findings of Cumming and MacIntosh (2003). Possibly, potential IPOs are selected relatively early.

3.2.4 Control Rights

In exchange for providing capital to risky investment projects, VC firms often seek control rights, which allows them to safeguard their investment and to monitor the development of the company. However, this does not mean that the firm receives exclusive rights only. Generally, rights are contractually assigned among the founding entrepreneurs and the VC firm.

First of all, by investing in a company, the VC firm acquires a certain share of the company's shares. According to Barry et al. (1990), VC firms hold large equity stake in companies which they take public. It is hypothesised that, when the number of shares owned in the company increases, the venture capitalist has a higher incentive to monitor. This is likely to increase the probability of success. However, there are different types of shares. For example, common shares or convertible shares. The former is associated with weak venture capitalist's control rights (Cumming, 2008). Research pointed out that ownership of common shares by the investor increases the probability of an IPO by 12% (Cumming, 2008). On the other hand, convertible shares did not seem to influence the likelihood of an IPO (Hege et al., 2003).

Furthermore, the VC firm includes a number of covenants in the investment contract. Among others, it may include the right to replace the founding entrepreneurs, drag-along rights, and reporting requirements. Mixed evidence is found for the influence of the right to replace the founding management and the likelihood of an IPO. Hege et al. (2003) did not find a relation, but Schwienbacher (2005) did report a significant, positive impact. Drag-along rights, defined as the entrepreneur's obligation to sell its shares when the VC

firm does, are negatively related with the number of IPOs, but have a positive relation with the number of acquisitions (Cumming, 2008). Reporting requirements are found to negatively affect the likelihood of an IPO (Schwienbacher, 2005). For example, reporting requirements can include presence on the board of directors by the VC firm. In that case, the entrepreneur might have less of an incentive to exert high effort, which might retard the progress of the firm. As a way of illustration, Cumming (2008) presented a 30% increase in the probability of a merger when the VC firm has board control and the right to replace the CEO.

Finally, Cumming (2008) found that promising companies are usually associated with strong entrepreneurial control. For such companies, it is not likely that a conflict regarding the exit decision will arise, as both the entrepreneur and the VC firm prefer an IPO. The entrepreneur, because he will benefit from remaining in charge of the company, and the VC firm because an IPO is likely to yield the highest return. Schwienbacher (2008) proved that, if the entrepreneur's private benefits are increased, an IPO is more likely. In the event that the company is less promising in the early stages, or if it is likely that a conflict about the exit decision will arise, then the venture capitalist will seek, and receive more control rights, which the entrepreneur is willing to give up in exchange for finance. It is confirmed by the data that there is a negative relation between venture capitalist's control rights and the probability of an IPO. In addition, an increase in control rights lead to a preference to exit the investment via a merger.

3.2.5 Geographical Location

Entrepreneurial Network It seems that the success of a company is partly determined by its location. For example, Shepherd and Zacharakis (2001) found that, when the entrepreneurial ecosystem and tradition is more developed, companies are taken onto the stock market earlier. Some factors that influence the faster development of the company in such a system are knowledge spillovers, specialised labour, and an appropriate infrastructure. Giot and Schwienbacher (2007) came to a similar conclusion. Locating in a well-developed entrepreneurial environment provides access to all types of services required to start-up from scratch successfully. Silicon Valley is an outstanding example of such an environment. Such a network leads to a better performance of the company (Hochberg et al., 2007). This effect is increased when many entrepreneurial companies with similar objectives cluster and operate in the same region, as this will reduce the informational costs for investors. Accordingly, Giot and Schwienbacher (2007) hypothesised that companies operating in such a cluster are more likely to end up in an IPO. Stuart and Sorenson (2003) concluded this for the biotechnology industry as well. Locating in the close neighbourhood of biotech innovators is positively related to the number of IPOs. It

is explained that through local networks, new knowledge and developments can spread quickly, which enhances performance. Furthermore, with many specialised colleagues nearby, technological problems can be quickly resolved. In addition, advances of other firms spread quickly too, which might motivate the company to perform better. Finally, such a network allows to compile a staff from a pool of high quality personnel, which is also beneficial for the performance of the company.

Location of the VC Firm Hege et al. (2006) hypothesised that an increase in the proximity between the VC firm and the portfolio company might increase the probability of success. For example, locating closely to the investment, the investors are able to monitor more effectively, providing advice becomes easier, etcetera. On the one hand, support is found by Giot and Schwienbacher (2007). However, although the research concluded that proximity of the VC firm reduced the number of liquidations, it only affected the number of trade sales positively. The probability of an IPO was unaffected. This provides some support for an argument posed in the former section. Greater control of the VC firm is positively related with the number of acquisitions. Furthermore, Stuart and Sorenson (2003) found that the number of VC firms in close proximity of the portfolio company is negatively related to the probability of an IPO. This can be attributed to the opportunity for key-personnel to leave the company and start an own company with VC backing. Giot and Schwienbacher (2007) addressed a similar hypothesis and concluded that the proximity to the investment — in this case located in the same state — does not influence the probability of an IPO. Additionally, although Gompers et al. (1998) found that investments tend to be focused on four states only, *i.e.* California, Massachusetts, New York, and Texas, the region where the VC firm is located does not influence the probability of an IPO (Giot and Schwienbacher, 2007). It might be argued that the location of the head office might reflect the need to be located nearby potential sources of capital and not necessarily close to the companies invested in (Gompers et al., 1998). Fenn et al. (1995) discussed a geographical reason for syndication; it allows local monitoring of the investments.

3.3 Hypotheses

In order to contribute to the existing literature in a meaningful manner, only those topics are investigated in more depth for which only little is known yet, as far as the data permits to do so.

3.3.1 Venture Capitalist's Characteristics

Reputation and Experience Generally, not much is known about venture-financed companies due to asymmetric information. In that case, potential investors rely on the quality of the actors affiliated with the start-up company as it could signal the quality of this new company (Megginson and Weiss, 1991). Therefore, as a VC firm, it is important to establish a reputation as a quality investor. Benefits of enjoying a good reputation are twofolds. On the one hand, it helps attracting funds to invest, and on the other, it allows more favourable exit opportunities. For example, if the firm is notorious of bringing high quality companies to the market only, then it is more likely that it will succeed in issuing a subsequent IPO.

A study by Amit et al. (1998) confirms this notion. It is found that the reputation of the VC firm plays an important role at the IPO stage. If potential investors are uninformed, the likelihood that this will significantly affect the value of the company is high. Therefore, the venture capitalist has an interest in investing in its reputation of offering high quality IPOs. Fleming (2004) confirmed that venture capitalists tend to take the best performing companies public. In line with that are the results of Bascha and Walz (2001). They came to the conclusion that lower valued companies are preferred to be offered in a trade sale rather than in an IPO. In the same direction, Cumming and MacIntosh (2003) concluded that the quality of the venture capitalist and the number of IPOs are positively related. In addition, it is likely that VC firms will operate on the stock market in the future again. Accordingly, they have an incentive to care about their reputation and take this into account when deciding whether, when, and for what price they take the company public (Barry, 1994).

The reputation of the underwriter (usually an investment bank) influences the number of IPOs as well, as it provides a signal about the quality too. Reputation is also affected by the extent to which a company is under- or overpriced. The latter case negatively affects the number of IPOs (Barry, 1994).

Reputation is not something which comes automatically. Usually, it comes with the years and is related to experience and perceived expertise in the industry. Barry et al. (1990) hypothesised that, the longer a firm invests in a particular industry, the more experienced it becomes and therefore, the likelihood of an IPO is higher. This is supported by the research of Hege et al. (2003). In more mature VC markets, more IPOs were issued. However, Cumming et al. (2006) did not find a significant relationship between years of experience and number of IPOs. Similarly, Giot and Schwienbacher (2007) hypothesised that experienced VC firms are more likely to add value to the company and therefore, experience is likely to increase the likelihood of an IPO. Nevertheless, this was not supported by the results; age did not have a significant influence on the probability of an IPO.

This might prove that skills associated with success are difficult to take possession of. So, it is not just a matter of putting in many years of work to achieve success (*e.g.* see Kannianen and Keuschnigg, 2004).

For the biotech industry, it is found that seasoned VC firms tend to be particularly good at timing the IPO close to market peaks, *i.e.* experienced firms are better at timing the IPO. However, compared to other industries, biotechnology companies do not require large upfront investment and reside in the R&D stage for about a decade. This might be the explanation why venture capitalists in this industry are able to try to time the IPO. Other industries might be in need of more intermediate capital and different forms of active monitoring. These factors might pose a more important influence on the IPO decision compared to market conditions (Lerner, 1994*b*).

It seems rather counter intuitive that neither age of the VC firm, nor experience acquired has an impact on the number of IPOs. Experience is likely to come with the years, but, as already commented upon, it is difficult to acquire the ‘right’ skills by putting in many years. However, in the existing literature, experience was measured by age of the VC industry (Hege et al., 2003) and years of experience (Cumming et al., 2006; Giot and Schwienbacher, 2007), while it is just argued that this is not a good proxy for experience. Therefore, the following is hypothesised.

Hypothesis 1a. *Experience, measured by the number of funding rounds the VC firm was involved in, has a positive influence on the probability of an IPO.*

Even though age does not seem to influence the number of IPOs, it is worthwhile to test this. Namely, a study by Gompers (1996) introduced the topic of ‘grandstanding’. He found that young VC firms take companies public earlier in order to establish a reputation, which comforts them in attracting capital for subsequent funds. Lee and Wahal (2004) also found a positive relation between the VC firm’s age and the age of the portfolio company at the IPO date.

Hypothesis 1b. *Younger VC firms have an incentive to ‘grandstand’ and are more likely to take a company public earlier.*

Capital Raised It is likely that VC firms with higher abilities are able to raise larger amounts of capital and that firms with more capital under management are associated with an increased number of IPOs (Barry et al., 1990). In line with this, Cumming et al. (2006) found that the abilities of the fund manager are important drivers of an IPO. It is found that larger funds have an increased likelihood of achieving an IPO. This is expected, because mainly the high skilled venture capitalists are able to raise large amounts of capital and high ability entrepreneurs tend to seek financing from this type of funds

(Hsu, 2004). When looking at the fund size under a manager's supervision, there is a significant, positive effect on the probability of an IPO, reflecting that managers with the responsibility over more capital are more able. Hochberg et al. (2007) confirm that there is a positive relation between fund size and the likelihood of an IPO. The effect of ability on the likelihood of an IPO can be captured in the following hypothesis.

Hypothesis 2. *Capital under management/Fund size is positively related with the number of IPOs.*

The literature also pointed out the importance of specialisation in a certain industry. For example, Cumming et al. (2006) argued that funds, specialised in a certain sector, are more likely to achieve an IPO, but the probability of a write-off is increased as well. This reflects that specialisation enhances ability and increases the probability of a successful exit, but also that the fund is exposed to more risk. Hege et al. (2003) found supporting evidence, indicating that venture capitalists focused on early-stage investments were less likely to take a company public. One reason is that not much is known about the prospects of the company and technological risk needs to be resolved.

Furthermore, the life time of a VC fund's limited partnership is finite. When approaching the end of this partnership, an IPO is more likely (Sahlman, 1990). Cumming and MacIntosh (2003) came to a similar conclusion and posed that, when nearing the end of the agreement, hurried decisions regarding the exit strategy can be taken.

3.3.2 Syndication

Venture Capitalist's Network A VC firm's network is likely to depend upon its reputation. For example, a well established, reputable firm probably enjoys better network facilities compared to a recently started firm. Hochberg et al. (2007) showed that a new fund enjoys a significantly higher performance (measured by an exit via an IPO or trade sale) when the VC firm was better networked at the establishment of the fund. Furthermore, the size of the venture capitalist's network, the likelihood that it is invited to join a syndicate, and the extent to which the VC firm has access to the best networked venture capitalists are found to have a significant influence on performance. It is pointed out that a network is not directly connected with experience. When controlling for networks, the effect on performance of experience was diminished or even disappeared.

Quite often, VC firms invest as a syndicate. According to Barry et al. (1990), IPO companies are financed by three VC firms, on average. In this study it is hypothesised that, if the number of venture capitalists increases, more knowledge will be available and the lead VC firm is induced to monitor intensively (since, as the lead investor initiated the deal, its reputation is at stake), which is likely to result in an IPO. However, the research by Hege et al. (2003) did not find significant support for this hypothesis. In

contrast, Giot and Schwienbacher (2007) did present empirical evidence supporting the hypothesis. Syndication is found to significantly reduce the time to exit the investment through an IPO, which supports the notion that syndication adds value to the investment. For example, due to complementarities of the different investors, or it might be argued that underwriters of higher quality are attracted to seal the IPO deal. Lerner (1994a) also shows that a syndicate allows to assess the information provided by the portfolio company in a better way. In addition, joining a syndication leads to a reduction in risk and provides access to resources, such as information (Bygrave, 1987, 1988). By involving other parties in the investment, information can be shared, leading to a better selection and management of the investment (Lockett and Wright, 2001). Following the above, the next hypothesis is composed.

Hypothesis 3. *A larger syndicate, which allows for complementary skills, positively influences the likelihood of an IPO.*

3.3.3 Type of VC Firm

Although it has not been addressed in the literature that often, the type of VC firm can impact the number of IPOs as well. In this study, the impact of three types of VCs is investigated; Independent, captive, and public organisation VCs (Gregoriou et al., 2007).

The objectives of the three firm types might differ somewhat. A primary goal of independent firms is often a good return on investment, or financial objectives (Gregoriou et al., 2007). In addition, it is also argued that independent firms take reputational issues into account when exiting an investment. Therefore, some VCs might opt for an IPO instead of another, more rational exit strategy as it is believed that successful IPOs greatly benefit the firm's reputation (Schwienbacher, 2008).

Captive VCs usually have different, strategic objectives compared to independent firms. For example, Cumming et al. (2006) found that captive VC firms, which are affiliated with banks or larger corporations, are less likely to achieve an IPO, compared to independent VC firms. This might be attributed to conflicting objectives, autonomy, pay-for-performance, etcetera. In a relatively more recent study, Cumming (2008) came to a similar conclusion. Captive VC firms are more associated with acquisitions compared to IPOs. One reason named for this relation is a strategic character of the investments. For example, an industry giant might invest in a bunch of small companies, in the hope of achieving increased returns from synergies with their core business (Hellmann, 2002). Therefore, if it turns out that the investment adds value to the firm, it is more conceivable to acquire the portfolio company as a subsidiary compared to the likeliness of exiting via an IPO. In addition, Riyanto and Schwienbacher (2006) argued that corporate venture capital enables the firm to respond quickly to new investment opportunities. It also al-

lows the headquarter to take less concern of secondary issues, such as outsourcing R&D activities. They concluded that, if the costs of doing so are low, a corporate venture capitalist prefers an acquisition as exit vehicle, since the profits gained by merging — due to complementarity of the products — outweigh the proceeds of selling the investment as a stand alone company. Furthermore, bank or insurance firm affiliated VCs tend to invest in a later stage of the portfolio company, usually shortly before an exit opportunity (Tykvová, 2006). It is also argued that affiliated investors are less active than independent venture capital firms (Hege et al., 2003).

The main goal of public VC organisations is to stimulate the venture capital market by supplying finance. They thereby attempt to reduce the equity gap in the market, especially in particular venture capital-absent regions (Harrison and Mason, 2000). Financial gains is not the main objective, but more emphasis is placed on the development of certain regions and environmental issues. Combining the above results in the final hypothesis.

Hypothesis 4. *Independent venture capital firms have a higher probability to exit via an IPO compared to captive or public VCs.*

The next section elaborates on the data employed to test the hypotheses empirically.

4 Data

This section is intended to provide an overview of the type of data employed in this study. In addition, it gives some insight into the decisions why certain observations are removed from further analysis and why/how the data is adjusted.

4.1 Construction of the Data

The data is retrieved from the Thomson VentureXpert database and covers the period January 1st, 1969, until April 28th, 2010⁴. The VentureXpert data is provided by Thomson Financial and includes detailed information of venture capital and private equity in Asia, Europe and the United States. Its contents are updated on a continuous basis and the data is widely used by other empirical studies (see Block et al., 2010, p.6).

The hypotheses are tested by the use of a data set comprising of the venture capital market in the United States. The scope of the analysis only extends to this country, because no measures regarding country-specific differences have to be taken. In addition, the US venture capital market can be considered as developed, while other markets, such as the Asian and European market are rather novel.

The data is constructed as follows. Information is present regarding different US-based portfolio companies at their respective investment dates. Among others, it contains particular characteristics of the company, like its founded date, the industry it is operating in, the company's IPO date (if applicable), and its current public status. Furthermore, it reveals information regarding the different investment deals. For example, the type of investor, fund size, round number, and the amount of capital managed by the investor are included. Some variables, like the round number and the number of investors at the investment date are displayed multiple times for the same portfolio company. This is caused by the fact that sometimes more than one investor invests at a particular investment round and the same round number is assigned for all those investments.

4.2 Variables

4.2.1 Dependent Variables

As discussed in Section 3.1, the aim of this study is to determine which factors have an influence on an IPO. In order to do so, a special variant of a Logit model is employed⁵, which requires the input of a binary dependent variable. Since the effect of certain factors

⁴The data was obtained at April 29th, 2010.

⁵For the ease of argumentation, the model itself, or the choice for the particular model is not explained here. This is the topic of Section 2.

on an IPO is tested here, the dependent variable will be a dummy for IPOs, named *IPO*. More specifically, for each of the observations, it was ascertained whether an IPO date was present for the portfolio company. If so, this indicated that the investment was exited through an IPO and is coded one. In the event that there is no data available for the particular variable, it is assigned value zero.

In order to assess the validity of hypothesis 1*b*, another dependent variable is used; the age of the portfolio company at the IPO date, *CompAge_IPO*.

4.2.2 Explanatory Variables

Consider the independent variables. Several factors are expected to affect IPOs, which was already emphasised in Section 3.3. In particular, the following variables are included to test for their effects. The number of funding rounds the VC was involved in prior to the investment is used as a proxy for experience, which is required to test Hypothesis 1*a*. Unfortunately, this measure is not completely accurate. Some VCs invest in multiple companies at one date. Because no additional information is available about which investment preceded the next on a similar date, it is not possible to assess the respective experience. Therefore, all investments at the same day are assigned a similar number of experience⁶. Additionally, it was hypothesised that *Experience*, defined as above, would be a better proxy compared to the one which is generally tested (*e.g.* Hege et al., 2003)⁷, the age of the VC firm (*Age*). Therefore, in order to see whether this holds, Hypothesis 1*a* is also tested for *Age*.

Hypothesis 1*b* aims to determine whether young VC firms tend to ‘grandstand’. To do so, a dummy variable named *Young_VC* is created. In a similar fashion as Gompers (1996), the data is divided into two groups. The first includes those firms which are younger than six years, the second group represents those VC firms which are older. The dummy variable takes value 1 if the particular VC firm is younger than six years, 0 if not.

Effects of capital under management by the VC firm and the fund size managed are tested in Hypothesis 2, in order to determine the effect of ability. The former is represented by the variable *FirmCap*, while the latter is estimated by *Fund_Size*.

The number of investors taking part in an investment — the topic of Hypothesis 3 — is measured by the variable *Syndication*. In the event that multiple parties invest in the same portfolio company, in the same funding round, the value of *Syndication* is similar

⁶For example, consider the situation where the first investment takes place on January 1st, 1990, the second and third on January 8th, and the fourth on January 10th, 1990. Then, experience is assigned as 0, 1, 1 and 3, for investment 1, 2, 3, and 4, respectively.

⁷Although the number of years investing in a certain industry is used as a proxy for experience by other authors as well (*e.g.* Giot and Schwienbacher, 2007), this is not really testable with the data set at hand. Therefore, only the effect of *Age* is tested.

for all investors.

Hypothesis 4 investigates the effects of the different VC firm types on an IPO. In order to do so, first, the 15 firm types discerned in the data set are divided into three groups, according to Gregoriou et al. (2007). The groups are *Independent_VC*, *Captive_VC*, and *Public_VC*. The first includes those firms which are private independent VCs and invest predominantly through limited partnerships. The second embodies firms which mainly receive their funds from a parent company, like a financial institution or a large corporation. Finally, *Public_VC* comprises of those firms which receive funds from the government and are controlled by governmental institutions. Please refer to Table 1 for the exact groupings. For each of the groups, a dummy variable is created, which is assigned value 1 if the firm's type belongs to the particular group, zero if not.

4.2.3 Control Variables

Region, *Industry*, and *Year* are dummies which are included as control variables. In addition, since the round number (among others Schwienbacher, 2005) and the size of the investment (e.g. Gompers, 1995) are also found to be of an influence, these are included as well to control for their effects. Dummies for the region and industry are created based on the MoneyTree™ Reports provided by PricewaterhouseCoopers in collaboration with the National Venture Capital Association (PricewaterhouseCoopers, 2010). For each of the 18 MoneyTree regions and 17 industries, a dummy is created. Year dummies are based on the year the investment takes place, to control for overall economic effects or time patterns. For example, if an investment took place on June 14, 1995, the year dummy representing 1995 would be assigned a 1, while the other years are assigned a zero.

The number of rounds is taken into account by the variable *Round_Number*. *Investment* corresponds to the estimated amount of equity invested at a particular investment round. This value comprises of the total investment, which means that, in the situation where several VCs participate in a funding round, the same value is displayed for all these investors. Table 1 provides an overview of the variables employed in the empirical analysis.

Table 1: Definition of the Variables

Variable Name	Definition
Dependent Variables	
IPO	Dummy variable. Only a small part of the investments resulted in an IPO. In the case that an IPO date is present, the dummy takes value 1. If not, it is assigned 0.
CompAge_IPO	The age of the portfolio company at the IPO date, in days. Also referred to as time-to-IPO.
Independent Variables	
<i>◇ Proxies for Experience</i>	
Age	Age of the investor at the time of investment, in days.
Experience	Experience at the investment date, measured by the number of investment rounds the investor was previously involved in.
Young_VC	Dummy variable. Value 1 is assigned if the investor is younger than six years, 0 if older. One year is calculated as 365 days.
<i>◇ Investment Deal</i>	
FirmCap	Capital under management by the investing firm.
Fund.Size	Fund size from which the investment is originated.
Syndication	Number of firms investing in the portfolio company at the investment date.
<i>◇ Investor Type</i>	
Independent_VC	Dummy variable. Equal to 1 if the investor is an 'Angel Group', 'Individuals', 'Investment Management Firm', 'Private Equity Firm', 'Private Equity Advisor or Fund of Funds', 'Service Provider', 0 otherwise.
Captive_VC	Dummy variable. Equal to 1 if the investor is 'Bank Affiliated', 'Corporate Private Equity VC', 'Endowment, Foundation, or Pension Fund', 'Insurance Firm Affiliate', or 'Other', 0 otherwise.

Continued on Next Page...

Table 1 – Continued

Variable Name	Definition
Public_VC	Dummy variable. Equal to 1 if the investor is a ‘Government Affiliated Program’, ‘Incubator/Development Program’, ‘Small Business Investment Company’(SBIC), or a ‘University Program’, 0 otherwise.
◇ <i>Control Variables</i>	
Investment	Estimated amount of equity invested at the particular investment round.
Industry	Industry dummies. Based on the MoneyTree industries provided by the MoneyTree™ Reports (PricewaterhouseCoopers, 2010). A value of 1 is assigned if the industry the portfolio company operates in is equal to the particular MoneyTree industry the dummy controls for, 0 otherwise.
Region	Region dummies. Based on MoneyTree regions. Similar to the MoneyTree industries, except that the dummies are here defined for the regions.
Round Number	Round number of a particular investment.
Year	Year dummies. A value of 1 is assigned if the year of the investment is equal to the particular year the dummy controls for, 0 otherwise.

4.3 Modifications

Some adjustments to the data set are needed before it can be used in the empirical analysis.

4.3.1 Adjustments

The analysis covers the period 1984 – 2003. Some elaboration on this selection follows in Section 4.3.3. After a brief inspection of the data set, it is found that several portfolio companies received an investment, while it was taken public before 1984. Therefore, these observations are left out of consideration. Furthermore, for quite a few observations, the investment originates from an ‘Undisclosed Firm’ or from ‘Individuals’. Because some of the variables are created on a per firm basis, like *Experience*, those observations

where the investing firm's name was 'Undisclosed Firm' or 'Individuals' are also removed as this could result in biased effects of the variables. In addition, the age of the investing firm and the age of the portfolio company at IPO date is negative by occasion. These observations are dropped too.

4.3.2 Missing Data

Unfortunately, the available data set is not complete. Some variables contain missing values for part of the observations.⁸ In the event that there are many missing values, complete case analysis could result in biased results. *I.e.* on the one hand, the sample size might be reduced a lot and on the other, it might result in biased parameter estimates (UCLA, 2010a). The statistical package used for the empirical analysis, Stata 10.1, employs list-wise deletion by default. This entails that, if the program encounters a missing value for any of the variables of a particular observation, the observation is removed from the analysis. By doing so, much valuable information can be lost. In order to tone down this effect, there are a couple of solutions.

One approach is to replace all missing values by the mean of the particular variable. However, this becomes problematic if the number of missing values is large and if the observations are not strictly random (Acock, 2005). For example, for the former part, if 30% of the data is missing, and the mean is substituted in for those cases, then 30% of the data will have a variance of zero. This would greatly underestimate the correlation with other variables. Furthermore, the distribution will show too many observations around the mean. When the observations are not strictly random, replacing a missing value simply by the mean could be a poor guess. In addition, Little and Rubin (2002) noted that replacing missing values by the mean could produce estimates which are even more biased than complete case analysis.

A slightly more sophisticated approach is to divide the data into subgroups and then replace missing values by the mean. This would result in a better estimate and also preserves more of the variance compared to the former method. Nonetheless, a bias would still remain present.

Finally, it is also possible to employ multiple imputation techniques. This basically comes down to the following. Missing values are drawn from a random sample, which is based on its distribution. The distribution of these imputed values is based on the observed data. This implies that there is some variation in the generated values (UCLA, 2010b). However, after having imputed five data sets, it can be concluded that this option does

⁸Having made an inquiry to Thomson Reuters, missing values are the result of the following. The VentureXpert database is compiled of public filings and quarterly industry surveys. Not all firms disclose their investment details and nor are all managers responding to the surveys willing to disclose full information, for example, due to the private character of some information. Therefore, it is purely due to non-disclosure.

not suit the type of data very well. For example, the variables *FirmCap*, *Fund_Size*, and *Investment* can take negative values in the imputed data sets, which is not possible in reality. Furthermore, the mean of these variables is somewhat higher than the original set. Since these three variables are quite often jointly missing, it might be the case that the data is not missing at random, which makes it even more precarious to replace missing values by imputed values. Therefore, complete case analysis is considered as the lesser of two evils and is adopted in this study.

An overview of how the sample is constructed after taking the adjustments and missing values into account can be found in Table 2. A more detailed description of why certain years are excluded is provided in the next section.

Table 2: Sample Construction

Reason for adjustment	Adjustments (-)	Observations
Starting sample		281,835
Observations beyond year 2003	83,417	
Negative VC firm age	6,233	
IPO year before 1969	16	
Firm name “Undisclosed Firm”	21,529	
Firm name “Individuals”	5,850	
Investment date before year 1984	15,185	
IPO year before 1984	577	
Negative CompAge_IPO	32	
Final sample		148,996
FirmCap, Fund_Size, Investment and Region (non-disclosure)	48,200	
Relogit regression sample size		100,796

4.3.3 Sample Size

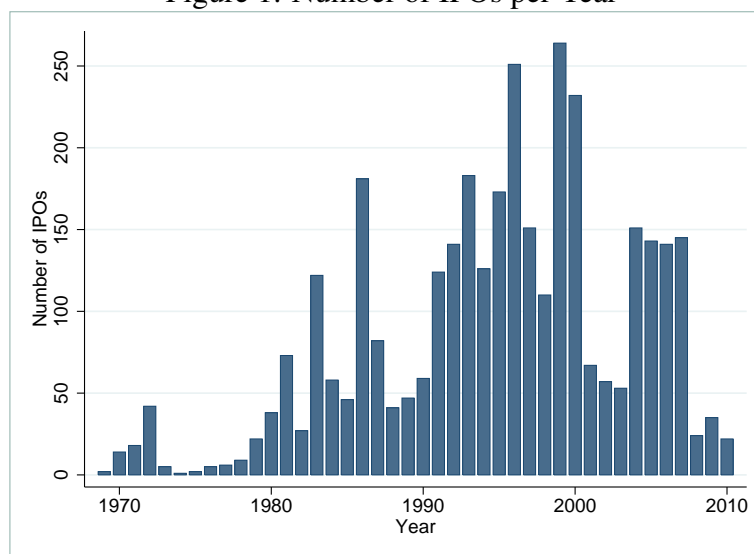
This section discusses how the sample size is selected. The empirical analysis will be based on the period ranging from the start of 1984 until the end of 2003, comprising of 100,796 observations. The underlying logic is as follows. Since the data set did not directly contain a variable indicating a VC’s experience, this needed to be computed by the use of another variable. In particular, the investment date is used. Experience is calculated as the number of investments the investor was involved in before. Accordingly, at the first investment date the investor appears in the data set, it has zero experience. This is not realistic of course, as a particular firm could have initiated more investments before 1969, the start date of the data set. In addition, all investors start at zero experience, which

is especially causing a bias for the first few years of the sample; firms are almost equally experienced. Therefore, in order to allow for a difference in experience, a period of 15 years is used to capture experience from all investing parties. Then, at the start of 1984, approximately 50% of the VCs are experienced (>50 rounds of experience), and 50% are novice to the industry or somewhat experienced.

It was already mentioned in Section 1.2 that the average time to proceed to an IPO is approximately 3-7 years (Armour and Cumming, 2006). However, due to the recent economic downturn, this period might be adjusted upwards. Evidence is found for a decrease in the number of funding rounds, as well as the amount invested in funding rounds (Block et al., 2010). As a consequence, the portfolio companies might receive too few funds in order to develop and grow as before. Therefore, lacking money, companies are likely to take more time to proceed to an IPO (or any other profitable exit vehicle). In addition, market conditions might also hamper the exit through an IPO, as outside investors are reluctant to invest in stocks of new, generally unknown companies.

From Figure 1 it becomes clear that the number of IPOs changes dramatically from one year to the other, which is in line with the findings of Ritter (1984). Furthermore, it can be seen that for the period 2008-2010 the number of IPOs is reduced a lot compared to former years. For example, with a business cycle of 3-7 years a company might have proceeded to an IPO in this period. However, since it is likely that the time of the business cycle is extended, the investment is not ready to exit yet. Therefore, it is assumed that the business cycle takes 5-10 years to complete, with an average of about $7\frac{1}{2}$ years⁹. Accordingly, the sample range ends at the end of 2003.

Figure 1: Number of IPOs per Year



⁹The results are robust if the business cycle is extended to 10 years. The conclusions remain unchanged.

4.4 Descriptives

A first glance at the summary statistics in Table 3 provides some understanding of the data already. As can be seen, around 15% of the observations (*i.e.* investments) resulted in an IPO. Other values worth highlighting are the maximum values for all other variables. It turns out that these are far distinct from the particular variable's mean. However, having a closer look at those observations, it can be concluded that these values belong to topnotch, high-frequency investors and are not to be considered as outliers.

Table 3: Descriptive Statistics

Statistic	Variables						
	IPO	CompAge	Experience	FirmCap	Fund.Size	Syndication	Young
Mean	0.15	3,237.6	186.0	2,986.1	189.2	5.02	0.33
Median	0	2,508	77	640	67.5	4	0
Standard dev.	0.36	3,095.3	283.2	6,934.1	427.7	4.20	0.47
Minimum	0	0	0	0.1	0.1	1	0
Maximum	1	38,081	2,189	91521	10,275	33	1
Observations	148,996	22,043	148,996	133,630	115,508	148,996	148,427

Notes: Summary statistics for the control variables are omitted for space and clarity reasons. FirmCap and Fund.Size are measured in millions of USD. Syndication is rated as the number of firms participating in a funding round, and Experience is presented in number of rounds. CompAge stands for the time-to-IPO, in days, and Young is an abbreviation of Young-VC.

The next section elaborates on the details of the methodology to test the hypotheses.

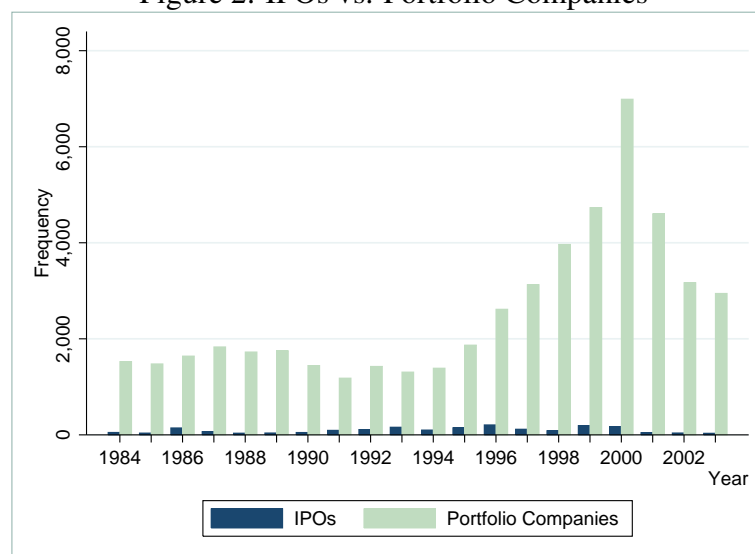
5 Methodology

In order to have a good understanding of which model is applied in the empirical analysis and why this particular model fits the type of data well, this section provides some background intuition. Subsequently, information regarding correlations and collinearity of the variables is presented.

5.1 The Model

A regular logit model could be employed to test the effects of the different variables on IPOs, since the dependent variable is binary. However, before directly taking the appropriateness of this method for granted, it needs to be determined whether it really suits the data. When consulting Figure 2, it becomes clear that the number of IPOs compared to the total number of portfolio companies in a certain year is very low. Therefore, a logit model does not seem to be a good method after all.

Figure 2: IPOs vs. Portfolio Companies



Note: The number of IPOs issued and the number of portfolio companies invested in in a particular year are displayed.

As noted by King and Zeng (1999), in the case that there are a dozen, or even thousands more of non-events (zeros) than events (ones), standard models like logistic regression might greatly underestimate the probability of such an event to occur. This is exactly what is observed in the data here. From a 12% peak of the companies exiting through an IPO in 1993, to as low as only 1% in 2001, it can be concluded that the events are rare. In an attempt to overcome the problem they were facing, King and Zeng developed methods which correct for these *rare events*. These are captured in a statistical model, which is known as *Rare Events Logistic Regression* (Relogit) (Tomz et al., 2003). The difference

between an ordinary logit model and a Relogit model stems from corrections regarding a rare events bias and standard error inconsistencies. In effect, compared to logit coefficients, the estimated logit coefficients generated by Relogit are roughly unbiased and lower-variance estimates.

Following the above, a Relogit analysis is employed to estimate the relationship between the independent variables and the measure of whether an investment was exited through an IPO or not.

It is expected that several factors have an influence on an IPO. This is both found in the existant literature and hypothesised. Therefore, when testing for each hypothesis, all explanatory variables are included in the model. That is, both the variable(s) from the hypothesis as well as variables from other hypotheses and control variables are included in the analysis. This way, all possible influential factors are included when estimating the effect of a given variable.

Year dummies are included to control for overall economic effects, or time patterns. This is also adopted in Hochberg et al. (2007). In line with Giot and Schwienbacher (2007), industry dummies and the size of the investment per round is included to control for specific characteristics belonging to a particular project. Giot and Schwienbacher also incorporated a dummy to control for the development stage of the portfolio company, but unfortunately, this information is not present in the current data set. Instead, the round number is included to control for development (previous research (*e.g.* Gompers, 1995; Hege et al., 2003) already indicated the important influence of the round number on an IPO. To some extent, it is also a measure of the development of the company). Finally, the model contains dummy variables for the region the portfolio company is operating in, because this is also found to have an influence on IPOs (Shepherd and Zacharakis, 2001)¹⁰.

To start with, all hypotheses are estimated based on IPO as dependent variable. Because success (*i.e.* IPO) is measured on portfolio company level, the models are clustered around a company ID to correct for a bias in standard errors.

In order to investigate the ‘grandstanding’ effect of Hypothesis 1*b*, first, the model as described before is employed, with the inclusion of Young_VC. The resulting estimate can tell whether the likeliness that a young and old VC firm exits through an IPO is different on the overall. Next, in order to identify whether young VC firms are also more likely to proceed to an IPO earlier compared to older firms — one of the key points of the actual ‘grandstanding’ hypothesis as introduced by Gompers (1996) — a different type of model is employed. First, a new dependent variable is created, which is named CompAge_IPO.

¹⁰From Figure 3 in Appendix A, it becomes clear that there are large disparities between both the number of IPOs issued and the amount of equity invested per region and industry.

Next, a similar set-up of the model is used as before, despite that the dependent variable has changed and that an OLS regression is employed instead of Relogit.

The validity of hypotheses 1a, 2, 3, and 4 is tested by the use of a Relogit model which is specified in model (1). The standard errors are corrected for clustering around a company ID, as outlined above.

$$\begin{aligned}
 IPO = & \alpha + \beta_1 Experience + \beta_2 FirmCap + \beta_3 Fund_Size + \beta_4 Syndication + \\
 & \beta_5 Captive + \beta_6 Public + \beta_7 Round_Number + \beta_8 Investment + \\
 & \sum_{i=1}^{18} \beta_{i+8} Region_i + \sum_{i=1}^{16} \beta_{i+27} Industry_i + \sum_{i=1}^{19} \beta_{i+43} Year_i
 \end{aligned} \tag{1}$$

To assess whether Hypothesis 1b holds, an OLS model is employed, which is described in model (2). Again, standard errors are clustered at the portfolio company level.

$$\begin{aligned}
 CompAge_IPO = & \alpha + \beta_1 \mathbf{Young_VC} + \beta_2 Experience + \beta_3 FirmCap + \\
 & \beta_4 Fund_Size + \beta_5 Syndication + \beta_6 Captive + \beta_7 Public + \\
 & \beta_8 Round_Number + \beta_9 Investment + \sum_{i=1}^{18} \beta_{i+9} Region_i + \\
 & \sum_{i=1}^{16} \beta_{i+28} Industry_i + \sum_{i=1}^{19} \beta_{i+44} Year_i
 \end{aligned} \tag{2}$$

The output of the Relogit models is quite difficult to interpret on itself. Basically, one can only infer whether the estimator of a certain explanatory variable is positively or negatively related to the dependent variable. In spite of that, there is a possibility to present the same output in a more appealing and understandable manner. Instead of reporting the coefficient of a certain variable, the effect on the probability that the event — portrayed by the dependent variable — occurs can be displayed. These probabilities are calculated using *setx* (King et al., 2000) and *Relogitq* (Tomz et al., 2003) and are provided in addition to the other estimation outputs.

This method proceeds as follows. First, a Relogit model is run, specified in model (1). Then, by the use of *setx*, a value for each of the explanatory variables is specified and the probability of a baseline model can be calculated¹¹. In order to separate out the effect on the probability of an IPO, one variable is allowed to change at a time, after which

¹¹The values of all the explanatory variables in the baseline model are held constant at their mean. A baseline model allows to determine the effect of a change in a certain variable on the dependent variable, while holding the others constant. *E.g.*, in order to determine the impact of Experience on IPO, all variables are set at their mean, except Experience, which is allowed to deviate by one or two standard errors from its mean. Next, the effect on the probability by changing Experience can be compared to the initial probability, provided by the baseline model.

a percentage change compared to the baseline model is derived. Since the computed probabilities are derived from Bayesian simulations, each of the probabilities are based on the average of ten calculations by *Relogitq*.

5.2 Correlation and Multicollinearity

The correlations depicted in Table 4 aid in determining a preliminary association between the variables. The relationships between IPO and the variables FirmCap, Fund_Size, and Syndication show the expected relation. Experience is also positively related, as anticipated. While the sign of Public_VC is as expected, the relationship between IPO and Independent_VC and IPO and Captive_VC is opposite of what was hypothesised before.

Prior to employing the data in the analysis, an important issue need to be dealt with. Namely, a potential problem is that of multicollinearity. If it is present in the data, this might pose a serious problem. Multicollinearity entails that independent variables are highly correlated with each other. Even though the reliability of the model as a whole is not affected, in effect, this results in biased coefficients and standard errors. In this case, it is not clear which independent variable causes what effect on the dependent variable. When the variables are perfectly correlated, the standard errors are even inflated to infinity.

In order to test for multicollinearity, first, a model should be estimated. Subsequently, *Variance inflation Factors* (ViF) or the *Tolerance*¹² are consulted to see whether it is present. A simple regression model is applied here, since the statistical package does not allow to retrieve collinearity statistics after a *Relogit* model is estimated¹³.

As a rule of thumb, a ViF of 10 or higher indicates severe multicollinearity. However, when looking at ViF statistics, they should be considered in the context of other factors that might have an impact on the variance of the model (O'Brien, 2007). Derived from unreported results, the rule of thumb is not much of an issue here, since the majority of ViFs lie between 1 and 2 with a few peaks of approximately 3. The highest ViF statistic reported is 4.15. Accordingly, no measures have to be taken to deal with multicollinearity.

Now that the in and outs of the data and methodology are explained in detail, the next section will cover the empirical results.

¹²The *Tolerance* is simply the reciprocal of ViF. It is calculated as $1 - R^2$, while ViF is derived by $\frac{1}{1-R^2}$.

¹³Even though the dependent variable is binary, this does not matter for the test statistics for collinearity. The test is only conducted for the predictors, not the model itself.

Table 4: Correlations

Variable	Correlations										
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
(1) IPO	1										
(2) FirmCap	0.0364*	1									
(3) Fund_Size	0.0068**	0.2986*	1								
(4) Syndication	0.0988*	0.0013	-0.0997*	1							
(5) Age	0.0121*	0.0973*	0.1543*	-0.0039	1						
(6) Young_VC	-0.0346*	-0.1159*	-0.1040*	0.0348*	-0.5764*	1					
(7) Experience	0.0167*	0.3093*	0.2527*	-0.0022	0.4522*	-0.3696*	1				
(8) Independent	-0.0097*	-0.0839*	0.0321*	-0.0871*	-0.0179*	-0.0502*	0.0738*	1			
(9) Captive_VC	0.0198*	0.1184*	-0.0124*	0.1007*	0.0192*	0.0467*	-0.0435*	-0.9201*	1		
(10) Public_VC	-0.0235*	-0.0686*	-0.0526*	-0.0231*	-0.0012	0.0118*	-0.0820*	-0.3063*	-0.0911*	1	
(11) CompAge_IPO	-	*** 0.0692*	0.0772*	-0.0724*	0.0185*	-0.0300*	-0.0323*	-0.0111	0.0115	0.0001	1

Notes: Correlations for all explanatory variables tested in the different hypotheses are displayed. For space and clarity reasons, control variables are omitted, but are available upon request.

* Significant at a 1% significance level.

** Significant at a 5% significance level.

*** No correlation is provided since CompAge_IPO is only present if IPO=1.

6 Results and Discussion

To begin with, this section first accommodates an overview of the empirical results. Thereafter, the results are discussed in more detail.

6.1 Results

An overview of the models, followed by their corresponding estimation output is presented below. The results are listed per hypothesis. Since Relogit is not a maximum likelihood estimator, the log likelihood is not reported in the estimation outputs. Furthermore, because by the implementation of Relogit the fit of the model is sacrificed in exchange for a reduction in its bias, goodness-of-fit statistics, like the pseudo- R^2 , are not provided.

First, model (1) is tested. The results can be found in Table 5, which provides the estimation output for hypotheses 1a, 2, 3, and 4.

Consider Hypothesis 1a. Although the effect of Experience is positive, it can be concluded that its impact on IPO is not significant. It seems therefore that it is irrelevant whether the investor was involved in previous funding rounds or not. A preliminary explanation is that experienced staff of a VC firm might decide to leave the firm and start an investment boutique by themselves.

In the Appendix, section B, the output for Age as a proxy for experience is portrayed. Comparing the results to those obtained for model (1), it can be concluded that there is not much of a difference. Both proxies are highly insignificant. However, since it was argued that experience measured by the number of funding rounds previously involved in would be a better predictor than Age and because the overall effects on the model differ slightly, Experience is chosen as the ‘correct’ estimator.

Following from Table 5, a positive relation between both FirmCap and IPO and Fund_Size and IPO is found. However, Hypothesis 2 is only partially confirmed; only the effect of Fund_Size is significant. This indicates that, even though the result for FirmCap is positive, only the ability/reputation of the fund’s manager can be considered to be essential for the likelihood of an IPO.

The data also confirms the hypothesised association between Syndication and IPO, which is the query of Hypothesis 3. The positive direction points at the synergetic effects which are likely to arise when more firms are involved in the investment ¹⁴. With

¹⁴This result should be interpreted rather carefully though. Since Syndication is measured at funding round level, it actually needs to be corrected for clustering at the round level. However, results are robust to clustering at either company or round level; similar effects are obtained. Also, conclusions remain unchanged when a proxy for syndication measured at company level is employed. Furthermore, when the analysis is conducted at a round level, that is, the measure of syndication in addition with the control

complementary skills, the probability of success is expected to increase.

Hypothesis 4 is partly supported by the data. It actually seems that captive VC firms are more likely to issue an IPO compared to independent VCs. However, the result is not significant. In addition, compared to independent firms, public VC organisations are negatively associated with the likelihood to exit an investment through an IPO. The result is significant at a 5% significance level.

Even though it is not the topic of one of the hypotheses, the effect of Round_Number is worth pointing out. Previous studies presented a clear positive influence of the round number on an IPO. When the analysis is clustered at funding round level, this is also the case here.

Table 5: Determinants of an IPO

Explanatory Variables (Dependent variable: IPO)	Statistics			
	Coefficient	Standard Error	z-Value	p-Value
Constant	-1.809696	0.1423719	-12.71	0.000
Experience	0.0000627	0.0000674	0.93	0.352
FirmCap	3.08e-06	2.38e-06	1.30	0.195
Fund_Size	0.000284	0.0000393	7.22	0.000
Syndication	0.0470345	0.0079856	5.89	0.000
Captive	0.0605297	0.0443469	1.36	0.172
Public	-0.2079182	0.1021071	-2.04	0.042
Round_Number	0.0071972	0.0130056	0.55	0.580
Investment	0.0035869	0.0009547	3.76	0.000
Region dummy Variables	Yes			
Industry dummy Variables	Yes			
Year dummy Variables	Yes			
Number of Observations	100,796			
Number of Clusters	19,423			

Notes: Estimation output obtained by the use of a Relogit model. The dependent variable is IPO. Displayed standard errors are robust and control for small sample bias and rare events. The results are adjusted for clustering at portfolio company level. For each of the four types of dummy variables, one dummy is excluded from the model, in order to prevent perfect multicollinearity, in this case also referred to as the dummy variable trap.

With regard to Hypothesis 1b, a different model is tested, which is described in model (2). In effect, this hypothesis measures the impact of the perceived reputation of the VC firm, which might provide an incentive to ‘grandstand’ and lead young VC firms to issue IPOs earlier compared to older, established VC firms. First, it is tested whether young VC firms are also more likely to issue an IPO compared to older firms. From unreported results, it becomes clear that this is not the case. In fact, conclusions derived earlier (see Table 5) remain unchanged by the inclusion of Young_VC in the analysis. Therefore, variables are specified for a particular funding round, syndication still has a significant, positive effect.

it is left out of model (1) since *Young_VC* is only used to test for a specific element of ‘grandstanding’ and turned out to be of negligible influence.

Next, by the use of model (2) it is assessed whether young VCs issue IPOs with younger portfolio companies, compared to older firms¹⁵. Table 6 confirms the hypothesised relation between the time-to-IPO and the age of the investing firm. At a 1% significance level, portfolio companies supported by young VC firms are approximately 432 days younger than older VCs at the issuance of an IPO. Although this evidence is less impressive compared to that presented by Gompers (1996) (companies were taken public almost two years earlier by young VC firms), the theory of grandstanding is supported.

Table 6: Grandstanding (Hypothesis 1b)

Explanatory Variables (Dependent variable: <i>CompAge_IPO</i>)	Statistics			
	Coefficient	Standard Error	<i>t</i> -Value	<i>p</i> -Value
Constant	2,552.923	303.7065	8.41	0.000
Young_VC	-432.8785	87.23933	-4.96	0.000
Experience	-169.873	39.08972	-4.35	0.000
FirmCap	88.06185	23.97565	3.67	0.000
Fund_Size	66.02392	30.33811	2.18	0.030
Syndication	-32.08131	13.60143	-2.36	0.018
Captive	144.5135	102.7423	1.41	0.160
Public	-40.90751	187.2299	-0.22	0.827
Round_Number	82.3278	23.24256	3.54	0.000
Investment	12.83634	47.58857	0.27	0.787
Region dummy Variables	Yes			
Industry dummy Variables	Yes			
Year dummy Variables	Yes			
Number of Observations	15,745			
Number of Clusters	2,128			
R^2	0.1052			
Root MSE	2,898.7			

Notes: Estimated output is obtained by the use of OLS regression. The dependent variable is *CompAge_IPO*. LN-values are used for the variables *Experience*, *FirmCap*, *Fund_Size*, and *Investment*, such that the corresponding standard errors are (close to) a normal distribution. The standard errors are robust and are adjusted for clustering around a company ID. For each of the four types of dummy variables, one dummy is excluded from the model, in order to prevent perfect multicollinearity, in this case also referred to as the dummy variable trap. Only those observations are included for which an IPO occurred. The total number of observations where an IPO date is present is 22,989. Missing values due to non-disclosure and due to using LN-values (log of zero results in a missing value) cause the regression sample size to be reduced to 15,745.

¹⁵Note that only those observations are included where *IPO*=1. Furthermore, observations with a negative company age are removed from the analysis. ViF statistics are consulted to check for multicollinearity; none of the statistics is higher than 2.45, so this is not a problem. Because OLS regression requires a (close to) homoskedastic distribution of the residuals, LN values are used for the variables *Experience*, *FirmCap*, *Fund_Size*, and *Investment*. In addition, the analysis is clustered at the portfolio company level.

6.2 Probabilities

Probabilities allow to interpret the impact of certain variables on IPO in a more understandable manner. Probabilities based on a one standard deviation change are depicted in Table 7, while Table 8 displays the probabilities based on a two standard deviation change from the mean.

Table 7: Probabilities (One Standard Deviation)

Explanatory Variables	Probabilities			
	Low	Change w.r.t. Baseline model (%)	High	Change w.r.t. Baseline model (%)
Experience	0.14249	(-1.59)	0.14693	(1.47)
FirmCap	0.14202	(-1.92)	0.14741	(1.81)
Fund_Size	0.12993	(-10.3)	0.16010	(10.6)
Syndication	0.12160	(-16.0)	0.17057	(17.8)
Captive	0.14357	(-0.85)	0.15122	(4.44)
Public	0.14527	(0.33)	0.12168	(-16.0)
Round_Number	0.14236	(-1.68)	0.14697	(1.50)
Investment	0.12314	(-15.0)	0.16030	(10.7)
Baseline Model	0.14480			

Notes: The cell entries represent the estimated probability of an IPO with a one standard deviation change in the particular variable, holding all other variables constant at their means. *Low* stands for a one standard deviation decrease from the mean, while *High* represents a one standard deviation increase. The baseline model presents the probability of an IPO holding all variables constant at their means. With respect to the different VC firm types, *Low* and *High* are assigned value 0 and 1, respectively. The percentage change compared to the baseline model is indicated in parentheses. All probabilities are controlled for region, industry, and year by their respective dummies.

The baseline model predicts that an IPO will take place at about 14.48% of all investments, holding all variables constant at their mean. Furthermore, more or less the same information is provided by Tables 7 and 8 in comparison with the Relogit estimation outputs derived earlier. The effect of an increase in Experience is rather small, for both a one standard deviation change as well as a two standard deviation change. The chance that an IPO occurs is affected upwards by only 1.47% (Table 7) or by 2.92% (Table 8), respectively.

FirmCap contributes positively (although not significantly) to the probability, but compared to the impact of Fund_Size, its effect is rather minor. In fact, an IPO is 3.62% more likely to occur with a two standard deviation increase in FirmCap, while it is even 22.3% (Table 8) more likely to happen by a similar increase in Fund_Size.

The effect of syndication is well worth mentioning. With a reduction of one or two standard errors, the likelihood of an IPO is decreased a lot. On the opposite, the *High* states present a substantial increase in the probability of an IPO. It should be noted that

Table 8: Probabilities (Two Standard Deviations)

Explanatory Variables	Probabilities			
	Low	Change w.r.t. Baseline model (%)	High	Change w.r.t. Baseline model (%)
Experience	0.14039	(-3.04)	0.14912	(2.98)
FirmCap	0.13935	(-3.76)	0.15003	(3.62)
Fund_Size	0.11690	(-19.3)	0.17709	(22.3)
Syndication	0.10219	(-29.4)	0.20041	(38.4)
Captive	0.14357	(-0.85)	0.15122	(4.44)
Public	0.14527	(0.33)	0.12168	(-16.0)
Round_Number	0.14012	(-3.23)	0.14915	(3.01)
Investment	0.10754	(-25.7)	0.18172	(25.5)
Baseline Model	0.14480			

Notes: *Low* stands for a two standard deviation decrease from the mean, while *High* represents a two standard deviation increase. Please refer to Table 7 for other notes.

inferences made are not completely accurate because the analysis is clustered at company level, but the results are indicative of their impact¹⁶.

Compared to independent VC firms, the probability that the event takes place when the VC firm is captive is not that different. However, when the investor is a public VC organisation, the probability that the investment is exited through an IPO is reduced by 16.0%.

Although it is not the subject matter of one of the hypotheses, it is interesting to see that the size of the investment can lead to a considerable change in the probability of an IPO; from -15.0% to about 10.7% (Table 7).

6.3 Discussion

6.3.1 Hypothesis 1a

In Section 3.3.1, it was already concluded that experience, measured by the age of the firm, does not have a significant influence on an IPO (Cumming et al., 2006; Giot and Schwienbacher, 2007). The latter study argued that experience is not something which comes automatically by putting in many years of work, but that skills associated with

¹⁶When clustering around funding round level, the baseline probability of an IPO=0.14473. With a one standard deviation change in Syndication, the likelihood of an IPO is affected by -15.8% and 17.9%, for the *Low* and *High* state, respectively. For a two standard deviation change, this is -29.6% and 38.5%, respectively. Comparing these probabilities to those presented in Tables 7 and 8, it can be concluded that the influence is almost similar. With funding round data only, the effect is a little reduced, but still rather influential compared to other factors.

success are difficult to grasp on. Since the proxy for experience applied in this study also does not have a significant impact on the probability of an IPO, it seems that it is also difficult to acquire the ‘right’ skills by being involved in many investments. This statement needs some further explanation, which is derived from a study by Gompers et al. (2006). Empirical evidence actually indicated that skill is an important component of success, both on an entrepreneurial level, as well as on VC level. But, as argued in the study, the effect of experience is only of importance for particular investments. For example, unproven entrepreneurs greatly benefit by the contribution of experienced VC firms. Sørensen (2007) also pointed out that highly experienced VC firms are better able to select the most promising companies and add value. This will increase the probability that the company turns out a success. But, on the other side, entrepreneurs who had successfully operated a company before do not gain much, if any, from the support of an experienced VC firm; the probability of success is not any different between receiving support from a top-tier or lower-tier VC firm. This might indicate that these ‘serial’ entrepreneurs already have the required skills to develop a company in a satisfactory way and know what they are doing. Looking at information asymmetries, it can be concluded that unproven entrepreneurs benefit from experienced VCs because they have the ability to screen ‘success stories’ before hand, have insight in all aspects of the particular market the company is about to operate in, and can assess the prospects and possibilities of the company. It seems indeed reasonable that a foresight to this extent is difficult to grasp on. On the contrary, the quality of proven entrepreneurs can be assessed by most investors. Therefore, it is likely that inexperienced VCs finance an already successful entrepreneur, who is looking for capital only, and thereby can be associated with success. Accordingly, it can be argued that experience is irrelevant to exit an investment through an IPO per se. In spite of that, it is clear that it does contribute to success when supporting unproven entrepreneurs.

Nonetheless, another effect might be in place as well. For example, currently, experience is only measured at firm level, both in this study, as well as in Gompers et al. (2006). However, it is not the firm which makes the decision to invest in a certain portfolio company, but instead, its staff decides to do so. More specifically, the managers in charge of an investment fund have the authority to act. Therefore, experience measured on a manager’s basis might actually be more indicative. For example, top-performing managers might find it more attractive to leave their current employer and start a VC firm by themselves. Taking this into account, young VC firms, led by these experienced staff members, might actually issue IPOs (or achieve success in another way), without having many years of experience or having been involved in many funding rounds before. *I.e.*,

experience measured on firm level does not really indicate anything¹⁷. This might also be derived from the effect of Experience on the probability of an IPO, as the difference between the *Low* and *High* state is small. Future research might address this issue and investigate whether the explanation provided by Gompers et al. (2006) still holds.

In addition, Hochberg et al. (2007) found that the effect of experience on success is greatly reduced or even eliminated when controlling for the VC firm's network. This is an indication that complementary skills outweigh the beneficial effects of experience on success.

To conclude, the reason why Experience in this study does not have a significant effect can have a few sources. The most likely cause is that the firm's experience is not decisive, but instead, the experience of the staff members is what counts. Secondly, it also depends in what type of company is invested in. If the entrepreneurs already have the skill to make the company a success, the experience of the VC firm does not matter. Inexperienced VCs may deliver successful investments by investing in proven entrepreneurs, and do not really need the skills which are needed to select and nurture new entrepreneurial companies.

6.3.2 Hypothesis 1b

In this data set, some 'grandstanding' by young VC firms is present. Nonetheless, it is not as strong as the results obtained by Gompers (1996). Possibly, experienced venture capitalists decided to start-up a VC firm on their own and do not need to gain in reputation as much as newcomers, by issuing an IPO early. However, the findings are in line with the results by Lee and Wahal (2004), who found a positive relation between the age of the VC firm and the age of the portfolio company at the IPO date. Moreover, Table 6 might present somewhat more evidence in support of grandstanding; a 1% increase in FirmCap and Fund_Size yield an increase in the portfolio company's age at the IPO date of about 88 and 66 days, respectively. Generally, large, established (*i.e.* older) VC firms also have larger amounts of capital under management and are also more likely to establish larger funds.

On the other hand, inexperienced VC firms join a (larger) syndicate when investing compared to experienced VC firms, who might even decide to invest alone. Some elaboration on this follows in Section 6.3.4, which discusses the effect of syndication. Accordingly, it can be argued that inexperienced VCs have less influence on the exit strategy and therefore the grandstanding effect is rather limited.

¹⁷Of course, it is likely to attribute to other scopes of the firm, like its reputation, but that is beyond the interest of this particular study.

6.3.3 Hypothesis 2

As expected, the capital the VC firm has under its management, or the fund size administered by the managers is positively related to the number of IPOs. However, only the effect of Fund_Size is significant. The effect of Fund_Size is possibly more important than the influence of FirmCap, because eventually, the investments originate from the fund. Fund managers with strong capabilities are able to attract larger amounts of capital from investors. Due to their skills, these managers are likely to invest successfully and thus, there is a positive relation between the size of the fund and the number of IPOs. In addition, Cumming et al. (2006) suggested that entrepreneurs with a higher ability tend to seek financing from this type of funds. For example, because they are able to develop and have in mind more promising projects, which need adequate financing. A similar argument holds for FirmCap, although to a somewhat lesser extent. Generally, it is likely that fund size and the total capital under management are positively related, which means that higher ability firms are likely to attract larger amounts of capital (see the correlations depicted in Table 4).

However, besides that the perceived skills of the manager seem to be important, it might be the case that the reputation of the manager is valued highly as well. *E.g.*, managers who pull off to create a good return from year to year probably do not have a difficulty in raising a large fund in the next year. Linking to Hypothesis 1a, it can be argued that these managers have the opportunity to invest in both proven entrepreneurs, who do not necessarily require support from the investor as in an advisory role, but are mainly in need of financial support, and unproven ones. As was posed above, serial-entrepreneurs are more associated with success compared to first-time entrepreneurs or those who failed earlier (Gompers et al., 2006). Investing in both types of entrepreneurs, skilled managers can achieve more success, gain in reputation, and raise even higher funds in the next period.

6.3.4 Hypothesis 3

From the empirical results, it can be concluded that Syndication has a major impact on the investment's success. Possible explanations are risk diversification, lack of resources, and information sharing. The first might be rather arbitrary, as there is not a clear reason why a fund diversifies (Casamatta and Haritchabalet, 2007). Usually, the people who invest in funds are limited partners, who only invest part of the capital under their management in a particular fund, or the venture capital industry on itself. Therefore, risk is already diversified. Furthermore, risk diversification can be achieved by managing multiple investment funds. However, Manigart et al. (2006) found that syndication takes place

mainly because of risk sharing, diversification, and also the opportunity to take part in larger deals which would not have been possible otherwise, instead of selecting and managing specific deals. Some support for these financial motives are also found from — unreported — correlations between Syndication and Investment; it is positive and significant. Also, by investing in multiple target companies by joining in different syndicates, company-specific risk can be cancelled out.

Resource constraints are likely to increase the level of syndication for later stages, since generally, larger investments are needed at that time.

Finally, the availability of information is an important factor which drives syndication (Casamatta and Haritchabalet, 2007). It was already discussed that potential investments are carefully screened and selected (Sahlman, 1990) and monitored after the investment is executed (Hellmann and Puri, 2002). The experience of the venture capitalist allows it to select the most promising projects, but also determines the extent to which it is involved in the investment (Casamatta and Haritchabalet, 2007)¹⁸. According to Casamatta and Haritchabalet (2007), involvement increases with VC's perceived quality of the company. Furthermore, this study argued that the process of selecting, screening, and next, monitoring of the possible investments is much more efficient with syndication, because it aids in the information gathering process. However, the level of syndication varies by the experience of the VC. For example, highly experienced VCs are better off investing alone. Because they have quite an accurate estimation of the company's future, a second opinion by another investor would cost too much, since this introduces competition or requires a co-investment contract (Casamatta and Haritchabalet, 2007). A similar reasoning is provided in Lockett and Wright (2001). On the other hand, inexperienced VCs do gain from syndication.

In addition, for uncertain markets or industries, it is found that the level of syndication increases (Bygrave, 1987). Since the US venture capital market mainly focuses on innovative, uncertain industries, like biotechnology and software, the observed positive effect of syndication on IPO is conform expectations. As can be seen from the results, there is a huge difference between a *Low* and *High* state of syndication. This shows that in an uncertain environment, the benefits of multiple views on and contributions to the investment are large. In case of uncertainty, second (or more) opinions reduce risk due to sharing of information and increase the probability of success. This is linked to Bygrave (1987, 1988) who pointed out that syndication led to a reduction in financial risk and the sharing of VC firm-specific resources, such as information. Figure 4 in the Appendix (Section B.2) clearly shows the importance of syndication in the US venture

¹⁸This study provides a theoretical model of the importance of syndication in the venture capital industry. Experience is measured at a venture capitalist level.

capital market. Inexperienced VC firms generally join in the largest syndicates, because they do not have the experience or knowledge yet to develop the portfolio company fruitfully by themselves. Although the level of syndication decreases for higher experienced investors, it appears to flatten at a certain level of syndication. From this, it can be concluded that information sharing is an important asset in uncertain markets. Furthermore, by combining knowledge and complementary skills, the time-to-IPO is reduced (Giot and Schwienbacher, 2007). This is indicative for a learning process which is sped up by syndication; the initial investor does not have to sort everything out by himself, but is assisted by the co-investor(s).

Moreover, from Table 6 it can be concluded that the level of syndication is negatively related to the time-to-IPO. As discussed above, on the one hand, this might be caused by a reduction in uncertainty. On the other hand, it might be attributed to complementary skills. In the event that investors with different backgrounds invest in the same company, much of the required knowledge to turn the investment into a success is already present.

6.3.5 Hypothesis 4

The results presented in Section 6.1 indicate that the probability of an IPO is somewhat similar for both independent and captive firms. First of all, it can be argued that, since both types concentrate their investments on a particular or related industry, they can add much value to the portfolio company (Sahlman, 1990). Although captive VCs usually invest with the intention to create synergies with the company, and exit predominantly through acquisitions, there might actually develop some events in which it is more profitable to sell the investment through an IPO compared to acquiring it as a subsidiary. For example, at some point, the involvement of the parent company in the investment has added so much value, that issuing an IPO is a more rational decision. In the event that the product supplied by the intended subsidiary becomes the new product standard in the market, issuing an IPO is more reasonable. Also, captive firms might have a different time horizon to exit their investments compared to independent firms (Wright and Robbie, 1996). The result in Table 6 might provide an indication for this. Portfolio companies supported by captive VCs were about 144 days older compared to those supported by independent VCs. It should be pointed out that the result is not significant though. Nonetheless, the finding that there is no difference between the likelihood of issuing an IPO by captive or independent VCs is not likely to be driven by corporate VCs, as an acquisition is by far their most used profitable exit strategy. But, the variable *Captive_VC* consists of both corporate VCs as well as financial institutions. Those financial institutions, like banks or insurance firms, tend to invest shortly before an exit opportunity (Wright and Robbie, 1996), and thus the likelihood of success is increased. Since both corporate and financial

VCs are referred to as Captive_VC, it is not that strange to conclude that there is not a genuine difference in the probability of an IPO between independent and captive VC firms.

Table 5 and Tables 7 and 8 showed a clear negative relation between Public VCs and IPOs, compared to independent VCs. The negative effect can be explained as follows. First of all, the objectives of these firms are not particularly focused on financial gains. Often, they are aimed at supplying capital in under-developed or lagging regions, to stimulate job growth, or environmental issues (Lovejoy, 1988). However, as argued by Harrison and Mason (2000), more conditions than just a supply of capital are needed in order for businesses to flourish. In addition, fund managers of these firms are often governmental employees or civil servants and do not necessarily have the experience, nor the drive to select the most promising companies, let alone providing them with efficient advice. Sahlman (1990) also pointed out that independent VCs generally concentrate on a particular market, in which they establish a network. Captive VCs tend to be oriented on closely related markets. This focus allows both firm types to provide better advice and have a more in-depth understanding of the market the portfolio company operates in than public VCs, which tend not to have such a specialisation.

Furthermore, the incentive system for public VC firms are not optimally designed for generating success (as measured by an IPO). For example, incentives are fee-based, which is completely different compared to the performance-linked bonuses for independent firms (Leleux and Surlemont, 2003).

Finally, Cumming and MacIntosh (2003) argued that, due to statutory constraints, public VCs tend to invest in lower growth firms, are more likely to exit through buy-backs and secondary sales, and hence receive a lower return on investment. One explanation for this is that these firms are rather constrained in their investment opportunities, as they mainly provide grants (Lerner, 1999).

7 Conclusion

The aim of this research was to determine which factors influence the likelihood of success of a venture capital firm. As it turned out, an IPO is considered to be highest achievable exit vehicle, among both previous research, as well as by VC firms. To the author's knowledge, this is the first study to combine all, or at least the most significant factors influencing the probability that an investment is exited through an IPO. Although only a small part is empirically tested, it does provide a great overview of all the facets. For example, the financial and institutional environment; characteristics regarding the investment, like the round number, size of the investment, and control rights; and the geographical location are found to be important determinants.

The empirical analysis uncovered the following. In line with previous results, experience does not seem to have an influence on an IPO. This is mainly attributed to the fact that inexperienced VC firms have (relatively easy) access to potential successful investments. The quality of proven entrepreneurs is visible to most investors. Those entrepreneurs already know how to develop a company in a successful manner and only seek finance from investors. This cancels-out the effect of experienced VC firms which have the ability to screen potential and advice and develop portfolio companies founded by unproven entrepreneurs such that they can possibly exit through an IPO. Also, the proxy used for experience in this study does not have a different effect on the results compared to experience measured in years.

Some evidence indicated that young VC firms indeed have an incentive to 'grandstand'. Portfolio companies backed by this type of VC firms are slightly more than one year younger at the issuance of an IPO compared to their counterparts supported by older VC firms.

The total amount of capital under management by a VC firm does not seem to have an impact on the number of IPOs. Possibly, the skills of the fund's manager are more important, because the manager is in charge of the investments originating from the particular fund and also is responsible for advice and support to the portfolio company.

The importance of syndicating investments for a successful exit is threefold. First of all, risk can be shared with other investors and the VCs portfolio can be diversified. Second, syndication provides access to more resources. Due to the uncertain character of the market, information sharing and multiple views on the project also increase the probability of success.

No differences are found between independent and captive VCs in the likelihood of issuing an IPO. Since the category for captive VCs also included financial institutions, it might be argued that there is no difference between independent and captive VCs because those institutions tend to invest shortly before an exit opportunity and thus have more

information regarding potential returns. The sign for public VCs is as expected and is significant at a 5% significance level. This might be attributed to the fact that the main goal of public VC organisations is to provide finance and spur development in particular regions, instead of aiming for financial targets only.

7.1 Limitations

There are some limitations to this study. First of all, there were many observations left out of further consideration due to missing values. One possibility is to have them replaced by imputed values, however, as discussed in Section 4, this is not an ideal solution for this data set. Even though removing observations with missing values was emphasised to be the lesser of two evils here, nonetheless, it is quite possible that important information is lost this way. The estimated influence of the determinants of an IPO will probably not reverse in its effect or change very drastically when using complete case analysis, but still, it is conceivable to deviate somewhat from the findings presented in this study.

Since the missing data is missing due to non-disclosure, it would be quite hard to trace. Because the information was not provided in the quarterly surveys of VentureXpert, it is doubtful whether follow-up questionnaires or face-to-face interviews with the managers will have more success. Regarding that absence of information is common in this field of research, maybe future research should anticipate this and make shift with what one has.

In addition, the chosen set-up of the methodology causes that additional observations had to be removed. For example, if Experience would have been measured by the age of the firm, observations where information was present for 'Undisclosed Firm' could have been used. In spite of that, this would only result in an increase in the sample size of approximately 480. Again, missing data might be obtained by extensive research.

Also, IPO is only composed of observations where an IPO date was present. However, there might be companies which will proceed to an IPO in the future, but this is yet unknown. Therefore, potential 'success' might be regarded as 'no success' and result in biased estimates of the variables.

7.2 Future Research

This study specifically focused on an IPO as an indicator of success. But, it was argued that some VC firms issue an IPO while, for example, an acquisition would be more profitable. Also, when having a look at the website of some VCs, so-called 'success stories' include both IPOs and acquisitions. Accordingly, it might be interesting to apply a somewhat different measure as well. The internal rate of return (IRR) might also be an adequate indicator of the successfulness of a VC firm. Since some evidence is found in favour of

the grandstanding hypothesis, therefore, the results obtained from the IRR approach and from the one employed in this study might differ somewhat (*e.g.* due to the early issuance of IPOs by young VC firms in order to ‘grandstand’, underpricing of the stocks sold is likely to occur.). Accordingly, it would be an interesting addition to the results already presented here.

Furthermore, the effect of three different firm types was assessed. Namely, whether captive VCs or public VC organisations were more likely to be associated with success compared to private, independent VC firms. This categorisation allowed to see whether there is a difference between financial, strategic, or public motives to invest. However, besides this distinction, it is also interesting to determine the likelihood of an IPO on a slightly different basis. For example, the influence can be assessed on an actor level. More specifically, one could discern six groups; VC, Business Angel, Corporate VC, Financial Institution, Government, and Other¹⁹. In doing so, the effect of the level of resources available to the investor on the likelihood of an IPO can be assessed. For example, independent private equity firms generally take a very active approach with respect to their investments. They tend to support the portfolio companies with plenty advice. Contrarily, bank affiliated, or captive VCs in general, are less active in guiding their investments.

Finally, there is a need to develop a more accurate proxy for experience. It was already argued that it needs to be specified on the manager’s level instead of on VC firm level. For example, it might be constructed as a mix of the number of successful investment deals taken part in, the number of IPOs being involved with, previous experience as a successful entrepreneur, etcetera. However, considering the private character of this information, it is anticipated that it is time- and resource-consuming to collect and greatly dependent on the willingness of those managers to disclose their particulars.

¹⁹Please refer to Section C in the Appendix for a suggested categorisation.

8 References

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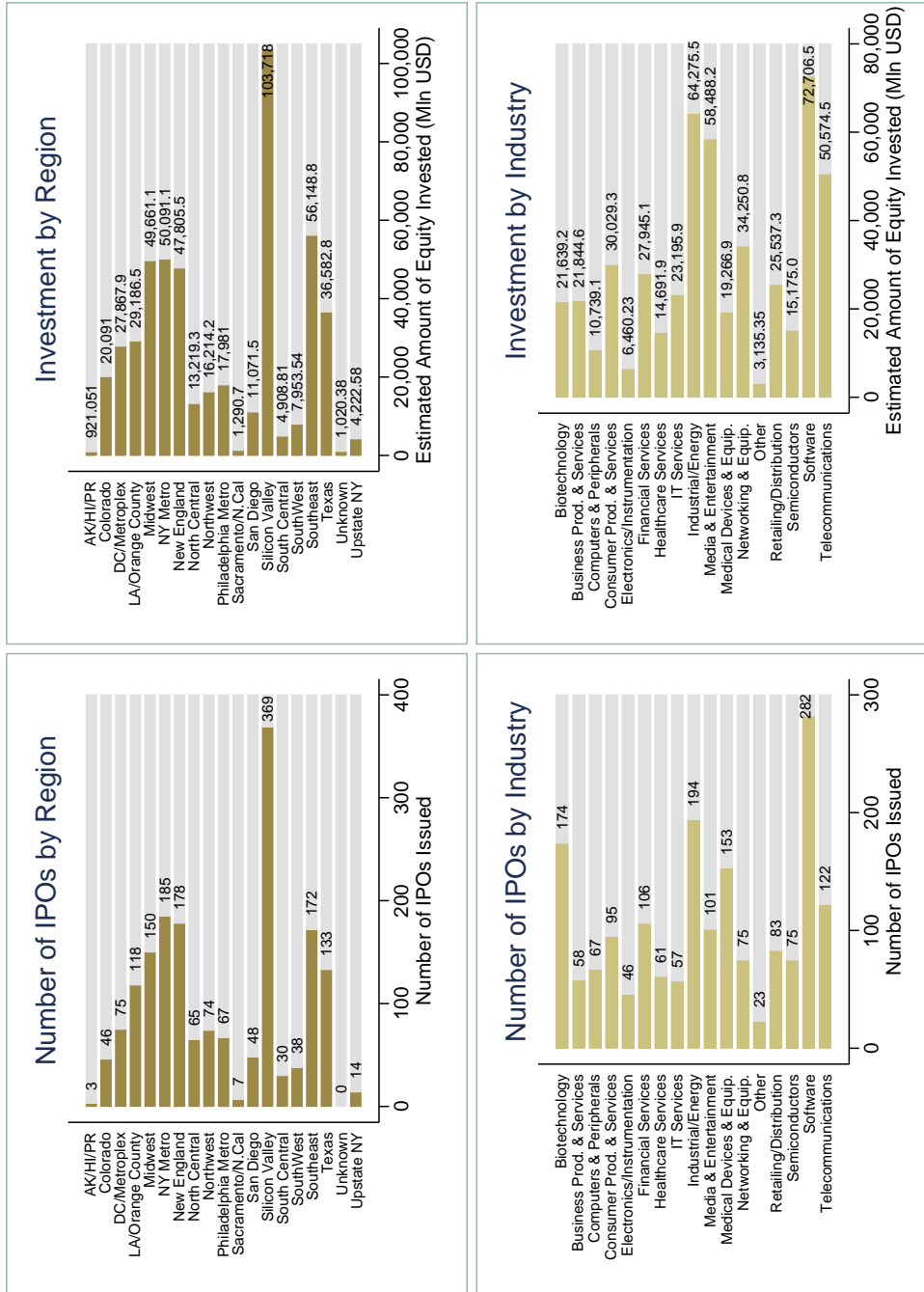
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A Methodology

Figure 3: Region and Industry Differences



Note: A large part of the investments is concentrated in *Silicon Valley* and *Southeast*. The focus is somewhat more dispersed for other regions. IPOs are predominantly issued in *Silicon Valley*. With respect to the MoneyTree industries, it can be concluded that most investments are attracted by *Software*, *Industrial/Energy* and *Media & Entertainment* and a major share of IPOs originate from the *Software*, *Industrial/Energy* and *Biotechnology* industry.

B Results and Discussion

B.1 Hypothesis 1a

To verify that experience in rounds previously involved in is genuinely a better proxy for experience compared to the age of the VC firm, the model is re-run with the following model.

$$\begin{aligned}
 IPO = & \alpha + \beta_1 \mathbf{Age} + \beta_2 \mathbf{FirmCap} + \beta_3 \mathbf{Fund_Size} + \beta_4 \mathbf{Syndication} + \\
 & \beta_5 \mathbf{Captive} + \beta_6 \mathbf{Public} + \beta_7 \mathbf{Round_Number} + \beta_8 \mathbf{Investment} + \\
 & \sum_{i=1}^{18} \beta_{i+8} \mathbf{Region}_i + \sum_{i=1}^{16} \beta_{i+27} \mathbf{Industry}_i + \sum_{i=1}^{19} \beta_{i+43} \mathbf{Year}_i
 \end{aligned} \tag{3}$$

The estimation output is depicted in Table 9. As can be seen, Age does not have a significant impact on the likelihood of an IPO.

Table 9: Determinants of an IPO

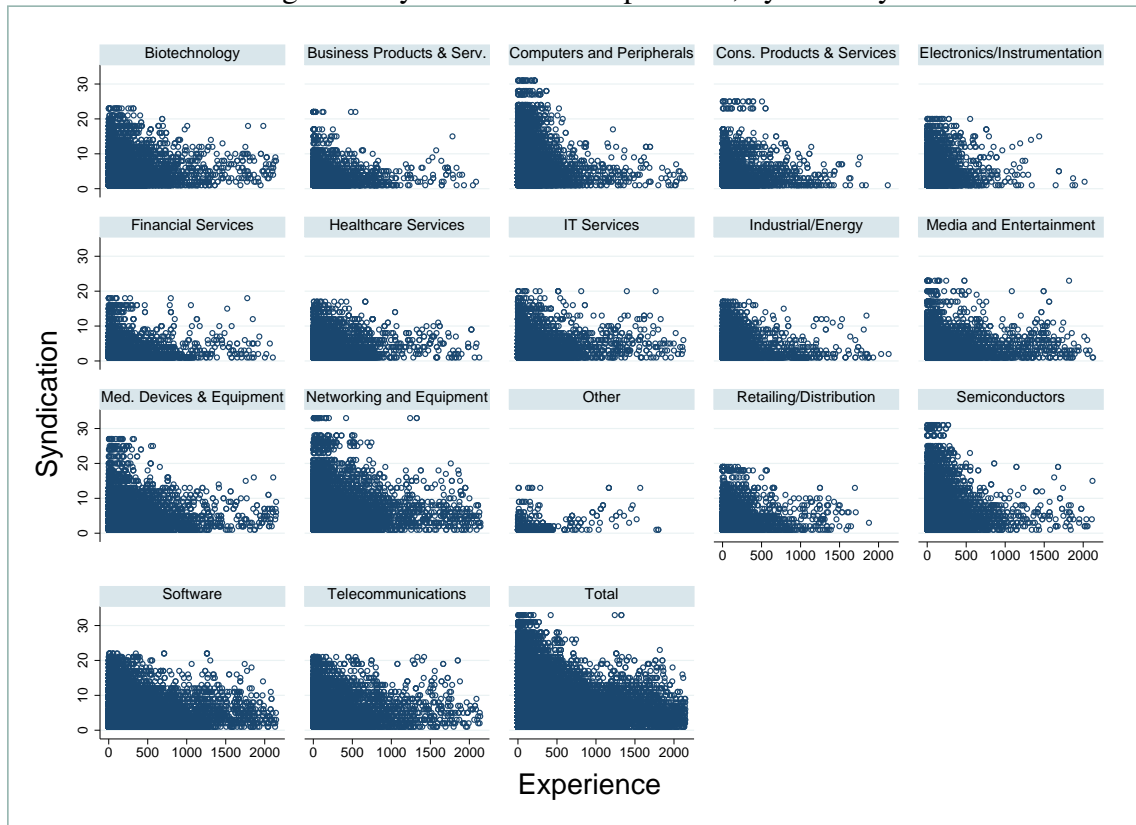
Explanatory Variables (Dependent variable: IPO)	Statistics			
	Coefficient	Standard Error	z-Value	p-Value
Constant	-1.819121	0.1433541	-12.69	0.000
Age	5.99e-06	4.34e-06	1.38	0.168
FirmCap	2.84e-06	2.38e-06	1.19	0.233
Fund_Size	0.0002837	0.0000374	7.59	0.000
Syndication	0.0464519	0.0080108	5.80	0.000
Captive	0.0477134	0.0447858	1.07	0.287
Public	-0.2225868	0.1026949	-2.17	0.030
Round_Number	0.0072434	0.0129624	0.56	0.576
Investment	0.0037343	0.0010063	3.71	0.000
Region dummy Variables	Yes			
Industry dummy Variables	Yes			
Year dummy Variables	Yes			
Number of Observations	100,484			
Number of Clusters	19,378			

Notes: Estimation output obtained by the use of a Relogit model. The dependent variable is IPO. Displayed standard errors are robust and control for small sample bias and rare events. The results are adjusted for clustering at the portfolio company level. For each of the four types of dummy variables, one dummy is excluded from the model, in order to prevent perfect multicollinearity, in this case also referred to as the dummy variable trap. Inclusion of Age as a proxy for experience attributes to a slight decrease in observations compared to Table 5, due to missing observations in Age.

B.2 Hypothesis 3

The importance of syndication in uncertain markets becomes clear from the graphs in Figure 4. It can be concluded that inexperienced VC firms join larger syndicates and the level of syndication reduces in experience, but seems to stabilise at a certain level. This reflects that sharing information is considered to be valuable.

Figure 4: Syndication vs. Experience, by Industry



Note: The figure displays the level of syndication by experience for each of the MoneyTree industries. The graph *Total* presents the overall level of syndication by experience.

C Future Research

Hypothesis 4 investigates the effects of the different VC firm types on an IPO. The analysis in this study made a distinction between VC firms based on the source of the capital the firm invests. However, there is another possibility to categorise VCs as well. For example, a grouping can be created according to what type of investor the VC firm is. The following categories are suggested:

- (a) *Private Equity VC*. Consists of 'Private Equity Firm'.
- (b) *Business Angel*. Represented by 'Angel Group' and 'Individuals'.
- (c) *Corporate VC*. Includes 'Corporate PE/Venture'.
- (d) *Financial Institution*. Comprises of 'Bank Affiliated', 'Endowment, Foundation or Pension Fund', and 'Insurance Firm Affiliate'.
- (e) *Government Affiliated*. Encompasses 'Government Affiliated Program', 'Incubator /Development Program', 'SBIC', and 'University Program'.
- (f) *Other*. Covers 'Investment Management Firm', 'Other', 'Private Equity Advisor or Fund of Funds', and 'Service Provider'.

By dividing the different VCs based on their investment type, it can be assessed whether different effects are in place regarding the likelihood of an IPO.