School networks and active investors

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School networks and active investors

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To Jossi and my family

Contents

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Jossi and my family, to you I dedicate this thesis.

Introduction

This thesis contains four research papers. The papers were written between the summer of 2006 and the fall of 2009 when I was PhD student in finance at the Stockholm School of Economics. Parts of the third paper were completed during the academic year 2008/2009 when I was visiting Harvard University's Economics Department. Similarly, both the first and the second papers were written as a whole during my visit at Harvard.

As the title suggests, this thesis is concerned with social networks and active investors. Each of the four research papers touches upon these topics in some way.

The first two research papers examine the effects of social networks on investments and returns in the US venture capital industry. While the first paper focuses on the relationships that exist between intermediaries and entrepreneurs, the second paper studies the social networks that exist between investors and entrepreneurs. In the third paper Samuel Lee and I seek to explain a number of empirical facts about the private equity market. The final paper which was my first research paper studies the involvement and engagement objectives of an activist investor operating in an institutional environment characterized by concentrated ownership.

Below follows brief summaries of each paper.

Paper 1: Alma mater matters: The value of school ties in the venture capital industry

Venture capital markets are characterized by the large information gap that exists between those who need financing and those who provide financing. Sometimes this information gap favors entrepreneurs, who know more about their inventions and technologies. Other times it favors venture capitalists, who oftentimes know more about the commercialization, business or financing processes. In the end, the fear of such information gaps may prevent otherwise profitable transactions from taking place.

Social networks can reduce such information gaps and facilitate these transactions and thereby influence the allocation of capital in the venture capital markets. Furthermore, if social networks render some individuals an information advantage vis-à-vis other, then those who enjoy the information advantage should earn abnormal returns on this information (Grossman and Stiglitz (1976)). Therefore, social networks should also affect returns.

In this paper I examine the role of social networks tied to academic institutions between intermediaries and entrepreneurs in the venture capital industry and estimate their economic value.

Using a unique dataset with all early stage venture capital investments made by U.S. venture capital firms in U.S. portfolio companies during 2002 I show that having

a shared academic background increases the likelihood of matching between entrepreneurs and venture capitalists by 57%. Similarly, the likelihood of matching between different venture capitalists increases by 42% when they attended the same academic institution in the past. This suggests that social networks do indeed affect the allocation of capital. I then show that social networks tied to academic institutions improve portfolio company performance. In particular, the likelihood that portfolio company investments result in initial public offerings or acquisitions increases by 42% when the venture capitalist and the entrepreneur attended the same Top 3 academic institution in the past. Taken together, these findings imply that social networks tied to academic institutions reduce information gaps between venture capitalists and entrepreneurs.

Paper 2: Unveiling the secrets of the academy: Alumni networks and university endowment success

Anecdotal evidence suggests that university endowments are important investors for venture capital firms both in the private equity- and the venture capital markets (Swensen (2009)). Yet, little is known why they are so important. In this paper I propose a potential explanation of why this might be the case and derive a testable hypothesis. Simply put, former alumni feel very strongly about their alma mater after graduation. Against this background, one might argue that, ceteris paribus, entrepreneurs prefer venture capital firms where their alma mater is a limited partner. Although in general venture capital firms choose which entrepreneurs to finance, superior entrepreneurs always choose which venture capital firms get to finance them. Thus, by becoming a limited partner with a venture capital firm, university endowments render venture capital firms preferential access to those superior entrepreneurs who are their alumni.

A straightforward prediction of this argument is that: when university endowments become limited partners with venture capital firms, portfolio company performance improves when the entrepreneurs are alumni of (and hence connected to) the corresponding universities relative to when they are not (and hence non-connected).

I test this hypothesis using a differences-in-differences design where I compare initial public offering rates between connected- and non-connected venture capital investments in a treated- and an untreated cohort. My results suggest that the likelihood of resulting in an initial public offering increases by 6% more for connected portfolio companies relative to non-connected ones. Since the unconditional sample mean of initial public offerings is 10%, this is commensurate to a 60% increase in the unconditional initial public offering probability. This effect consists of two separate and potentially different effects, however. First, the effect of obtain a new university endowment as a limited partner, second, the effect of losing an already existing university endowment as a limited partner. Further analysis shows that the main effect is mostly driven by the latter.

Paper 3: Goldrush Dynamics of Private Equity

In this paper, Samuel Lee and I seek to explain a number of empirical facts about the private equity market. A private equity firm is a specialized investment firm which buys, reorganizes, and sells companies. To this end, it raises a private equity fund. The fund looks for suitable target companies and, when a company is found, bargains with

its shareholders over the price at which it can buy (a control stake in) the company. Once in control, the fund takes measures to improve the firm in order to profitably re-sell it in the future. Because private equity funds have a finite lifetime, fund activity can fluctuate considerably over time depending on whether existing funds are succeeded by follow-on funds and on whether new funds enter the market.

We develop a simple model which captures the above features. A fixed number of companies becomes improvable, and the improvement can (only) be implemented by private equity firms. The true gains from reorganizing the companies are unknown but they can be inferred from the outcomes of completed reorganizations. Finally, there are many private equity firms which differ in their ability to manage a fund. Over time, each firm must repeatedly decide whether to run a fund or not. The predictions of the model are consistent with empirical evidence. (1) Overall fund activity follows wave patterns, whereby periods of little activity are occasionally interrupted by a period of growth (slow boom) followed by a crash (sudden bust). After events that generate high reorganization gains, the few private equity funds that are initially active earn promising returns, which attracts more funds to the market (learning). At the same time, as more funds enter, the pool of target companies is depleted faster (attrition), which ultimately leads from the boom to the bust. (2) Fund activity and the valuation levels of target companies move together. When the market becomes more bullish about the reorganization gains, potential target companies increase in value, which in turn affects the negotiations between funds and those companies. Thus, a rise in market confidence not only attracts more private equity funds but also raises the price that these funds must pay to buy companies. (3) A period in which the funds as a whole performed well—on the one hand—increases entry in the next period and—on the other hand—decreases subsequent performance by raising prices. That it, good industry performance precedes high entry, which in turn precedes low industry performance. (4) Because private equity firms differ in ability, there are persistent performance differences among funds. More interestingly, entry and exit by funds follow a last-in-first-out pattern: the least capable firms are the latest to enter and, by the same token, the earliest to exit. At any point in time, the first-time funds (the latest entrants) are thus the worst performers. If the boom continues, their follow-on funds relatively improve as even less capable firms enter the market. The least capable firms enter after highly profitable periods, when valuation levels are high, and during what later turn out to "peak" periods. Firms that raise their first fund during such periods are unlikely to raise a follow-on fund. (5) At a given point in time, variation in the size of funds reflects variation in the ability of the private equity firms that run them. Fund size and fund profitability are therefore positively correlated across contemporaneous funds. In contrast, across time, variation in the size of a fund reflects variation in market expectations. When markets become more bullish, a fund increases in size but its profitability drops because of higher prices and the higher costs of running a larger fund. Thus, fund size and fund profitability are negatively correlated across consecutive funds run by the same firm. (6) When markets are bullish, prices rise not only because of higher valuation levels but also because of increased fund competition.

When market expectations overshoot, it can thus happen that "too much capital chases too few deals."

Paper 4: Ownership Matters: A Clinical Study of Cevian Capital

In this paper I study the involvement and engagement objectives of an activist investor operating in an institutional environment characterized by concentrated ownership. It highlights the heterogeneity of the investor's activism and its focus on operational improvements. It emphasizes the ownership structure of the portfolio companies as important determinants of investor activism. Using a carefully selected set of peer companies, it is possible to show that the investor targets undervalued companies with operational slack that maintain open ownership structures. In particular, by avoiding to invest in companies with other active owners, e.g. families and industrial owners, and seeking to invest in companies with more institutional holdings, the investor ensures that there is not only scope for improvements. There is also a reasonable chance of exercising control.

Papers

PAPER 1

Alma mater matters: The value of school ties in the venture capital industry

Abstract. This paper examines the role and estimates the economic value of social networks tied to academic institutions in the venture capital industry. I show that having a shared academic background increases the likelihood of matching between entrepreneurs and venture capitalists by 57%. Similarly, a shared academic background increases the likelihood of matching between different venture capitalists by 42% when they syndicate portfolio company investments. Finally, a shared academic background improves portfolio company performance. For example, when an entrepreneur and a venture capitalist attended the same Top 3 academic institution, the likelihood that the investment will result in an initial public offering or acquisition increases by 42%. This is the incremental effect of having attended the same Top 3 academic institution. Taken together, these results provide strong evidence that shared academic backgrounds help reduce information gaps in the venture capital industry.
Keywords: Social networks, connections, matching, venture capital, entrepreneurship
JEL codes: G24, G3, L1, L2

1. Introduction

Anecdotal evidence suggests that social networks are important in the venture capital industry (Gompers and Lerner (2001)). Still, research in finance so far has given little consideration to this question. Two exceptions are Sorenson and Stuart (2001) and Hochberg, Ljungqvist, and Lu (2007). They show that social networks formed when venture capitalists syndicate portfolio company investments affect outcomes in the venture capital industry. Less is known about the effects of social networks tied to academic institutions.

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The novel contribution of this paper is to introduce social networks of the latter type into the analysis of the likelihood of matching and performance in the venture capital industry. More specifically, first I examine the role of social networks in the matching between entrepreneurs and venture capitalists on a sample of venture capital investments. Then I examine how social networks affect the matching between different venture capitalists when they syndicate portfolio company investments on a sample of syndicated venture capital investments. Finally, I look at the economic effect of social networks on portfolio company performance. For this purpose I assemble a unique dataset with all early stage venture capital investments made by U.S. venture capital firms in U.S. portfolio companies during 2002. The final sample consists of 735 distinct investments rounds made by 456 venture capital firms in 651 portfolio companies.

My results show that, after controlling for venture capital firm, portfolio company, and investment round characteristics, the likelihood of matching between entrepreneurs and venture capitalists increases by 57% (or equivalently with 0.29%) when they attended the same academic institution. Closer inspection reveals that this effect is stronger for smaller and younger venture capital firms and for Non-Ivy League and Non-Top 3 academic institutions.[1] Similarly, when different venture capitalists syndicate portfolio company investments, the likelihood of matching increases by 42% (or equivalently with 0.23%) when they attended the same academic institution. This effect is stronger for Top 3 academic institutions, however. Finally, having a shared academic background improves portfolio company performance. In particular, when the academic institution is Top 3, the likelihood that the investment will result in an initial public offering or acquisition increases by 42% (or equivalently with 14%). This is the incremental effect of having attended the same Top 3 academic institution and is therefore over and above the effect of having an entrepreneur and a venture capitalist from different Top 3 academic institutions. Taken together, these results provide strong evidence that shared academic backgrounds help reduce information gaps in the venture capital industry. A back of the envelope calculation emphasizes the economic impact of this effect. For example, consider a situation where there are only two possible future states of the world and ignore discounting. In one state the portfolio company investment is successful and results in an initial public offering or acquisition worth $113 M. In the other state the portfolio company investment fails and it is worth

[1] Top 3 academic institutions refer to Harvard University, Stanford University, and University of California. See Table (6) for a more exhaustive description.

zero. In this stylized case, having a shared academic background increase the present value of the portfolio company investments by roughly \$16 M.[2]

These results complement a number of recent studies on the impact of social networks in corporate finance. To name a few, directors' social networks have been shown to influence the composition and quality of boards (Kramarz and Thesmar (2006)) as well as the level of executive pay (Barnea and Guedj (2007)); investment bankers' social networks affect investment banks' market shares in mergers and acquisitions and equity capital markets (Bradley and Clarke (2008)). More closely related to my study are Cohen, Frazzini, and Malloy (2007) and Cohen, Frazzini, and Malloy (2008). By linking mutual fund managers' investment behavior and equity analysts' stock recommendations to social networks tied to academic institutions they show that these social networks influence how information flow into public equity markets. While my study uses a similar social network as Cohen, Frazzini, and Malloy (2008), it is applied differently. In particular, they focus on public equity markets whereas I focus on venture capital markets.

For that reason, my study is also related to the literature on venture capital. This literature has studied the monitoring role of venture capitalists (Gorman and Sahlman (1989), Lerner (1995), and Bottazzi, Rin, and Hellmann (2007)); specificities in venture capital contracts (Gompers (1995), Kaplan and Stromberg (2003), and Kaplan and Strömberg (2004)); the syndication of venture capital investments (Lerner (1994)); and the role of venture capital in innovation (Kortum and Lerner (2000) and Lerner and Strömberg (2008)). Closer related to my study are Sorenson and Stuart (2001) and Hochberg, Ljungqvist, and Lu (2007). They examine how social networks, formed when venture capitalists syndicate portfolio company investments, affect outcomes in the venture capital industry. While the former focuses on the geographical distribution of portfolio company investments, the latter focuses on performance. My study differs from these in several ways. Firstly, the social networks are different. Secondly, they focus on the relationship between their social networks and the geographical distribution and performance of portfolio company investments. I focus on the relationship between my social networks and the likelihood matching between entrepreneurs and venture capitalists as well as portfolio company performance. The main contribution of my study is to show that social networks tied to academic institutions reduce information gaps between entrepreneur and venture capitalists. The main support for this interpretation is that these social networks lead to superior portfolio company performance. Nonetheless, my study also explains how syndicates are formed in the venture

[2] Brav and Gompers (1997) study a sample of all venture capital backed initial public offerings between 1972 and 1992. The average size of these initial public offerings was \$113 M expressed in 1992 dollars.

capital industry. For example, I show that the likelihood of matching between different venture capitalists increases when they attended the same academic institution when they syndicate portfolio company investments.

The rest of this paper is organized as follows. Section 2 provides a brief discussion of why social networks tied to academic institutions should affect the likelihood of matching and performance in the venture capital industry. Section 3 describes the data used in this study and explains how I construct my sample. Section 4 outlines my empirical methodology and presents the results from the empirical analysis on matching in the venture capital industry. Section 5 presents the results from the empirical analysis on portfolio company performance. Finally, Section 6 summarizes and offers some concluding remarks.

2. Why should social networks matter?

Venture capital markets are distinguished by the large information gap that exists between those who need financing and those who provide financing. Sometimes this information gap favors entrepreneurs, who know more about their inventions and technologies. Other times it favors venture capitalists, who oftentimes know more about the commercialization, business or financing processes. Ultimately, the fear of such information gaps prevent otherwise profitable transactions. By reducing such information gaps, social networks make possible some investments that would otherwise not have been possible. For example, when entrepreneurs and venture capitalists are part of the same social network, search and transaction costs associated with identifying and evaluating portfolio company investments are lower. Similarly, when two different venture capitalists are part of the same social network, costs of investing together are lower. As a result, social networks should be expected to influence the matching between entrepreneurs and venture capitalists as well as the matching between different venture capitalists when they syndicate portfolio company investments.

As mentioned above, this study examines the role social networks tied to academic institutions through past education choices. Thus, in the context of social networks tied to academic institutions a natural prediction is as follows:

HYPOTHESIS 1. *Entrepreneurs and venture capitalists that attended the same academic institution in the past are more likely to invest together. Similarly, different venture capitalists that attended the same academic institution in the past are more likely to syndicate portfolio company investments together.*

Furthermore, if social networks render some individuals an information advantage vis-à-vis other, then those who enjoy the information advantage should earn abnormal returns on this information (Grossman and Stiglitz (1976)). Therefore, portfolio

company investments where entrepreneurs and venture capitalists belong to the same social network should be expected to perform better than those where they are not. As a result, the second hypothesis:

HYPOTHESIS 2. *Portfolio company performance should improve when an entrepreneurs and a venture capitalist have attended the same academic institution in the past.*

The main objective of this study is to test Hypothesis (1) and (2). In the empirical analysis I first show that social networks tied to academic institutions are positively related to the matching between entrepreneurs and venture capitalists as well as between different venture capitalists when they syndicate portfolio company investments. I then show that social networks tied to academic institutions improve portfolio company performance.

3. Data

3.1. Sample construction. In order to empirically test Hypothesis (1) and (2) I assemble a cross section with all early stage venture capital investments made by U.S. venture capital firms in U.S. portfolio companies in 2002.[3]

First, I look at the matching between entrepreneurs and venture capitalists and between different venture capitalists when they syndicate portfolio company investments. Because I only observe those investments that actually took place, I have to consider the issue of potential investments (syndications). When I construct my set of potential investments (syndications), I draw from past research on the venture capital industry. For example, Gompers and Lerner (2001) argue that venture capitalists specialize in specific industries and geographical markets.[4]

Based on this observation I formulate two rules to select potential venture capitalists. The following example explains the procedure:

Consider the investment in APT Therapeutics, Inc., a biotech startup in Missouri. A potential venture capitalist for this investment would have to be in my cross section of investments from 2002 and should have invested in a biotech startup in Missouri at least once during the last five years.[5]

Second, I look at the performance of venture capital investments. For this purpose I focus on those investments that actually took place, notably my cross section of investments from 2002. In both cases, since this study examines social networks tied

[3] Early stage investments are coded as Seed, Startup, Early Stage, First Stage, or Other Early by VentureXpert.

[4] Specialization is one reason why venture capitalists are able to invest in situations with severe information gaps to begin with.

[5] In robustness checks I relax the second requirement and the results are unaffected.

to academic institutions, I require an education background on at least one of the entrepreneurs and at least one of the venture capitalists who invested in the portfolio company.[6]

The data used in this study comes from several different sources. In particular, the data on venture capital investments comes from the VentureXpert database (now owned by Thomson Financial). It provides information on venture capital and private equity firms, funds, portfolio companies, executives and directors, and limited partners. Investments and commitments dates back to 1969 and include over $15,000$ venture capital and private equity firms, $27,000$ funds, and over $70,000$ portfolio companies. Venture capital firms, funds, and portfolio companies relate to each other in the following way. Venture capital firms are management companies that manage funds. While funds usually have limited lifetimes (e.g. $10-12$ years), venture capital firms usually have infinite lifetimes. Portfolio companies represent the businesses that venture capital firms invest in through their funds.

This data is supplemented with the education background of the portfolio companies' entrepreneurs and the venture capitalists who served on the portfolio companies' board of directors. I define entrepreneurs as the non-venture capitalist founding members of the portfolio companies. Specifically, I require that the entrepreneurs were part of the founding members during the portfolio company founding year and that they were not employed by the venture capital firms that financed the portfolio company. The identity of the entrepreneurs and the venture capitalists and their education background comes from various different sources like VentureXpert, ZoomInfo, LinkedIn, Company Insight Center (CIC), old portfolio company websites, REGDEX documents and IPO prospectuses.[7]

ZoomInfo is a business intelligence search engine with information on industries, companies, people, products and services and covers over 5 million companies and 45 million individuals. LinkedIn is a web-based network of professionals and companies

[6] I focus on the education background of the portfolio companies' entrepreneurs and the venture capitalists who served on the portfolio companies' board of directors. I look at entrepreneurs instead of the chief executive officer or president because portfolio companies that obtain venture capital financing often experience a change in management whereby the original management team is replaced with a seasoned management team. This new management team might have other relationships with the venture capital firm that I do not want to measure. Still, in practice the entrepreneur is often the chief executive officer, the president and/or the chief technology officer of the portfolio company. On the venture capital firm side I focus on the venture capitalists who served on the portfolio companies' board of directors. I do so because venture capital firms often assign one (or two) of their partners to their portfolio companies' board of directors. These partners are responsible for the investments and work closely with the portfolio companies' management teams.

[7] I use an internet archive machine to visit old portfolio company and venture capital firm websites. REGDEX is a notice of sale of securities pursuant to Regulation D, Section 4(6), and/or uniform limited offering exemption. It filed with the U.S. Securities and Exchange Commission.

from around the world that today has over 38 million members from 170 industries and over 200 countries worldwide. LinkedIn is voluntary to join, but when joining you create a profile that summarizes your education and professional expertise and background. Finally, Company Insight Center is a web-based business and financial intelligence resource that combines BusinessWeek's editorial content with Capital IQ's research to provide data on companies, industries and key executives. When none of these sources contain information about the entrepreneurs and their education background, I search the World Wide Web in a last attempt to assemble this information. The final sample consists of 735 investment rounds made by 456 different venture capital firms in 651 different portfolio companies.

The definition and construction of the specific variables used in the empirical analysis are reported in the Data appendix.

3.2. Sample description. Table (1) and (2) present descriptive statistics for the final sample of venture capital firms, portfolio companies, entrepreneurs and venture capitalists. The sample consists of 456 venture capital firms and 651 portfolio companies. The majority of venture capital firms are private equity firms that invest their own capital (80% of all venture capital firms). The average venture capital firm is 10 years old and manages around $1.1 billion. Meanwhile, the average portfolio company is 2.5 years old and 40% of the portfolio companies operate in computer related industries. Up to now 60% of all portfolio companies remain active, 4.3% has gone public, and 27% have been acquired. The total number of investment rounds is 735 of which 60% are new investments and 40% are follow-on investments. The average amount invested per round is $4.4 million. Finally, the total number of entrepreneurs is 1197 (or 1.8 per portfolio company) while the total number of venture capitalists is 957 (or 2.1 per venture capital firm). Table (3) presents summary statistics and a correlation matrix for the main variables used in the subsequent analysis.

3.3. Most connected academic institutions. To get a sense of how connected my sample of entrepreneurs and venture capitalists is to different academic institutions, Table (6) lists the 10 most connected academic institutions for entrepreneurs and venture capitalists respectively. An entrepreneur is connected to an academic institution if he/she attended it during either undergraduate or graduate studies. Similarly, a venture capitalist is connected to an academic institution if he/she attended it during undergraduate or graduate studies. Entrepreneurs are most connected academic University of California (representing 5.1% of the total number of connections) followed by Stanford University and Harvard University. Meanwhile, venture capitalists are most

connected to Harvard University (representing 11.3% of the total number of connections) followed by Stanford University and University of California. Finally, Ivy League represents 24.6% and 11.6% of the total number of connections for venture capitalists and entrepreneurs respectively.

4. Matching in the venture capital industry

4.1. Empirical methodology. This section examines the effect of social networks tied to academic institutions on the likelihood of matching between entrepreneurs and venture capitalists as well as between different venture capitalists when they syndicate portfolio company investments. To estimate this effect I propose the following linear probability model:

$$y_{ij} = \alpha + \beta School\ tie_{ij} + \Gamma X_{ij} + \delta_{ij} + \theta_i + \lambda_i + \varepsilon_{ij}, \tag{4.1}$$

where y is a dummy that equals one for actual investments (syndications) and zero for potential investments (syndications), α is a constant, *School tie* is a dummy that equals one when the venture capitalist has attended the same academic institution as any of the portfolio company's entrepreneurs, X represents a vector of covariates, and ε is an error term. The remaining variables in equation (4.1) are fixed effects for academic institutions and portfolio company states and industries. Finally, when estimating equation (4.1), I account for a general correlation structure between different observations for the same portfolio company or venture capital firm by double-clustering standard errors at the portfolio company- and venture capital firm level. This approach ensures conservative estimates of standard errors and thereby minimizes the risk of Type 1 errors.[8]

4.2. Results.

4.2.1. *Entrepreneurs and venture capitalists.* Table (6) presents the results from estimations of (4.1) with different sets of covariates. Robust t-statistics are reported in brackets. The dependent variable, *Investment*, is a dummy that equals one for actual investments and zero for potential investments. The main independent variable of interest, *School tie*, is a dummy that equals one when the venture capitalist has attended the same academic institution as any of the portfolio company's entrepreneurs.

[8] All dependent variables in this study are binary. Still, the presented estimates are obtained from ordinary least squares regressions. Because these estimates are consistent but not efficient, this approach results in conservative estimates of the associated standard errors (Wooldridge (2002)). In unreported robustness checks I estimate probit and conditional logit models and confirm that the results remain unchanged.

Overall, the findings in Table (6) suggest that venture capitalists and entrepreneurs are more likely to match when they have attended the same academic institution in the past. This effect is both statistically and economically significant. More specifically: After controlling for venture capital firm-, portfolio company-, and investment characteristics, the likelihood of matching between venture capitalists and entrepreneurs increases by 57% (or equivalently with 0.29%) when they attended the same academic institution in the past.

4.2.2. *Robustness of results.* The findings reported above suggest that on average venture capitalists and entrepreneurs are more likely to match when they have attended the same academic institution in the past. To verify the robustness of these findings I conduct a series of robustness checks. In particular, two straightforward checks examine how these findings relate to venture capital firm experience and academic institution quality.[9]

Venture capital firm experience. Table (7) presents the results from estimations of (4.1) after including two additional interaction terms. The first one, *School tie∗Firm size*, is the product of *School tie* and *Firm size*. Similarly, the second one, *School tie∗Firm age*, is the product of *School tie* and *Firm age*. I find a negative and statistically significant relationship between the dependent variable and the interaction terms. This implies that having attended the same academic institution in the past matter more for smaller and younger venture capital firms in the matching between entrepreneurs and venture capitalists. One plausible explanation for this result is that social networks tied to academic institutions and other professional social networks act as substitutes. For example, when venture capitalists start out their career, they use the social networks closest to them, like those tied to academic institutions. As they gain more professional experience, they rely increasingly on other professional social networks, like those formed when syndicating portfolio company investments. As a result, larger and older venture capital firms rely more on professional social networks and less on social networks tied to academic institutions.

Academic institution quality. Table (8) presents the results from estimations of (4.1) for different measures of *School tie*. More specifically, I consider four different measures of *School tie* to capture salient characteristics of the academic institution quality. These are *Ivy League tie*, *Non-Ivy League tie*, *Top 3 tie*, and *Non-Top 3 tie*.[10]

[9] In addition to the robustness checks included below, the Selection model appendix presents results for estimations of two stage selection models à la Heckman (1979).

[10] Top 3 refers to the most connected academic institutions. These are Harvard University, Stanford University, and University of California.

Each of these variables is derived from *School tie*. For example, *Ivy League tie* is the product between *School tie* and a dummy that equals 1 when the academic institution responsible for the connection is Ivy League.

The findings in Table (8) suggest that academic institution quality matters. More specifically, the coefficients in front of *Non-Ivy League tie* and *Non-Top 3 tie* are positive and statistically significant, whereas the coefficients in front of *Ivy League tie* and *Top 3 tie* are statistically indistinguishable from zero. This suggests that entrepreneurs and venture capitalists are more likely to match when they attended the same academic institution, but only when the academic institution is Non-Ivy League or Non-Top 3.

In summary, the results from this subsection suggest that social networks tied to academic institutions are positively related to the likelihood of matching between entrepreneurs and venture capitalists. More specifically, the likelihood of matching increases by 57%, when the entrepreneur and the venture capitalist have attended the same academic institution in the past. Closer inspection reveals that this effect is stronger for smaller and younger venture capital firms compared to larger and older ones. Finally, these results are mainly driven by Non-Ivy League and Non-Top 3 academic institutions.

4.2.3. *Different venture capitaltsts.* While the previous findings relate to the matching between venture capitalists and entrepreneurs, this subsection examines the matching between different venture capitalists as they syndicate portfolio company investments. Table (9) presents the results from estimations of equation (4.1) with different sets of covariates. Robust t-statistics are reported in brackets. The dependent variable, *Syndication*, is a dummy that equals one for actual syndications and zero for potential syndications. The main independent variable of interest, *School tie*, equals one when the lead- and non-lead venture capitalist have attended the same academic institution in the past.

By and large, the findings in Table (9) imply that different venture capitalists are more likely to match when they have attended the same academic institution in the past. This effect is both statistically significant and economically relevant. In particular: After controlling for lead- and non-lead venture capital firm-, portfolio company-, and investment characteristics, the likelihood of matching between different venture capitalists increases by 42% (or equivalently with 0.23%) when they attended the same academic institution.

4.2.4. *Robustness of results.* The above findings imply that in general different venture capitalists are more likely to match when they have attended the same academic institution in the past. To confirm the robustness of these findings I perform a series

of robustness checks. Like before, two simple checks examine how these findings relate to non-lead venture capital firm experience and academic institution quality.[11]

Non-lead venture capital firm experience. Table (10) presents the results for estimations of equation (4.1) with the inclusion of two new covariates. The first one, *School tie∗Firm size*, is the product of *School tie* and *Non-lead Firm size*. Similarly, the second one, *School tie∗Firm age*, is the product of *School tie* and *Non-lead Firm age*. While I find a negative relationship between the dependent variable and the interaction terms, the effect is statistically indistinguishable from zero. This suggests that social networks tied to academic institutions play an equally important role in the matching between different venture capitalists for small- and large- and young- and old venture capital firms.

Academic institution quality. Table (11) presents the results from estimations of equation (4.1) for the same measures of *School tie* as above. The findings in Table (11) suggest that academic institution quality matters for the matching between different venture capitalists. More precisely, the coefficient in front of *Top 3 tie* is positive and statistically significant, whereas the coefficients in front of *Ivy League tie*, *Non-Ivy League tie* and *Non-Top 3 tie* are statistically indistinguishable from zero. This suggests that different venture capitalists are more likely to match when they attended the same academic institution in the past, but only when the academic institution is Top 3.

Taken together, the findings in this subsection suggest that social networks tied to academic institutions are positively related to the likelihood of matching between different venture capitalists when they syndicate portfolio company investments. In particular, the likelihood of matching increases by 42%, when the lead and non-lead venture capitalist have attended the same academic institution in the past. Finally, a closer look reveals that these results are mainly driven by Top 3 academic institutions.

5. Portfolio company performance

5.1. Empirical methodology. The previous section examines the relationship between social networks tied to academic institutions and matching in the venture capital industry. While this relationship is important to understand what drives financing and risk sharing in the venture capital industry, the question begs whether social networks tied to academic institutions also improve portfolio company performance. The objective of this subsection is to address this question. To estimate this effect I propose the following linear probability model:

[11] In addition to the robustness checks included below, the Selection model appendix presents results for estimations of two stage selection models à la Heckman (1979).

$$y_{ij} = \alpha + \beta School\ tie_{ij} + \Gamma X_{ij} + \theta_i + \lambda_i + \varepsilon_{ij}, \tag{5.1}$$

where y is a dummy that equals one when the portfolio company's current situation is coded as either "Went Public" or "Acquisition" by VentureXpert, α is a constant, *School tie* is a dummy that equals one when the venture capitalist has attended the same academic institution as any of the portfolio company's entrepreneurs, X represents a vector of covariates, and ε is an error term. The remaining variables in equation (5.1) are fixed effects for portfolio company states and industries. Finally, as above, when estimating equation (5.1), I account for a general correlation structure between different observations for the same portfolio company or venture capital firm by double-clustering standard errors at the portfolio company- and venture capital firm level. This way I minimize the risk of Type 1 errors by using conservative estimates of standard errors.

5.2. Results. Table (12) presents the results from estimations of equation (5.1) with different sets of covariates. Robust t-statistics are reported in brackets. The dependent variable, *Performance*, is a dummy that equals one when the portfolio company's current situation is coded as either "Went Public" or "Acquisition" by VentureXpert. Although this is a coarse measure of investment outcomes, it is frequently used in the venture capital literature. For example, Gompers and Lerner (1998), Bottazzi, Rin, and Hellmann (2007), and Hochberg, Ljungqvist, and Lu (2007) all define portfolio company success in this way.[12] The main independent variable of interest, *School tie*, is the same as above.

The findings in Table (12) suggest that there is an economically relevant positive relationship between social networks tied to academic institutions and portfolio company performance.[13] The estimated effect is statistically indistinguishable from zero, however.

5.2.1. *Robustness of the results.* The findings above imply that on average portfolio company performance improves when the venture capitalist and the entrepreneur have attended the same academic institution in the past. To verify the robustness of these

[12] Gompers and Lerner (1998) compare this measure of portfolio company success to the more narrow definition that excludes acquisitions and find that the different measures give qualitatively similar results.

[13] In particular, the coefficient in front of $School\ tie_{ij}$ suggests that the likelihood that the investment will result in an initial public offering or acquisition increases by 24% (or equivalently with 8%) when the venture capitalist and the entrepreneur attended the same academic institution in the past.

findings I carry out a series of robustness checks. In particular, a straightforward check examines how these findings relate to academic institution quality.[14]

Academic institution quality. Table (13) presents the results from estimations of equation (5.1) for the same measures of *School tie* as above.

By and large, the findings in Table (13) imply that academic institution quality matters for portfolio company performance. In particular, the coefficient in front of *Top 3 tie* is positive and statistically significant, whereas the coefficients in front of *Ivy League tie*, *Non-Ivy League tie* and *Non-Top 3 tie* are statistically indistinguishable from zero. This suggests that social networks tied to academic institutions improve portfolio company performance, but only when the academic institution is Top 3.

In particular, the interpretation and economic effect of these findings are as follows: The findings in column 5 implies that the likelihood that the investment will result in an initial public offering or acquisition increases by 42% when the entrepreneur and venture capitalist have attended the same Top 3 academic institution in the past. Still, this estimate is confounded by the effect of having an entrepreneur and a venture capitalist from a Top 3 academic institution. Therefore, column 6 includes separate controls for whether or not the entrepreneur or the venture capitalist attended a Top 3 academic institution. In this specification, the coefficient in front of *School tie* measures the incremental effect of having attended the same Top 3 academic institution over and above the effect of having an entrepreneur and a venture capitalist from a Top 3 academic institution. Finally, the findings in column 6 implies that the likelihood that the investment will result in an initial public offering or acquisition increases by 42% when the entrepreneur and venture capitalist have attended the same Top 3 academic institution.

In summary, the results from this section suggest that social networks tied to academic institutions also improve portfolio company performance. This finding is particularly strong when the academic institution is Top 3. Then, the likelihood that the investment will result in an initial public offering or acquisition increases by 42% when the entrepreneur and venture capitalist attended the same academic institution in the past. This effect is over and above the effect of having an entrepreneur and a venture capitalist from a Top 3 academic institution. Taken together, these results provide strong evidence that social networks tied to academic institutions help reduce information gaps prevalent in the venture capital industry.

[14] In addition to the robustness checks included below, the Selection model appendix presents results for estimations of two stage selection models à la Heckman (1979).

6. Conclusions

The primary objective of this study is to show that social networks tied to academic institutions reduce information gaps in the venture capital industry. For this purpose, I first establish a positive relationship between social networks tied to academic institutions and matching in the venture capital industry. More specifically, I show that the likelihood of matching between entrepreneurs and venture capitalists increases by 57% when they attended the same academic institution in the past. Similarly, the likelihood of matching between different venture capitalists increases by 42% when they attended the same academic institution in the past. I then show that social networks tied to academic institutions improve portfolio company performance. In particular, the likelihood that portfolio company investments result in initial public offerings or acquisitions increases by 42% when the venture capitalist and the entrepreneur attended the same Top 3 academic institution in the past. Taken together, these findings imply that social networks tied to academic institutions reduce information gaps between venture capitalists and entrepreneurs.

Appendix

Selection model. One benefit of studying social networks tied to academic institutions is that they are formed long before the actual investment takes place. As a result, they are relatively uncorrelated with present investment decisions of profit maximizing venture capitalists. Nonetheless, potential selection issues have to be considered. In this study, the main concern is whether the estimated positive correlation between *School tie* and *Investment*, *Syndication*, or *Performance* is caused by some omitted variable. To address this issue, I estimate a two stage selection model à la Heckman (1979). As always, a perfect instrument for *School tie* is hard to imagine. Still, based on Ackerberg and Botticini (2002) and Bottazzi, Rin, and Hellmann (2007) I consider two different exclusionary restrictions. Firstly, I include portfolio company state and venture capital firm state interactions in the (first stage) selection equation, but not in the (second stage) outcome equation (Bottazzi, Rin, and Hellmann (2007)). Secondly, I include portfolio company state and industry as well as portfolio company state and stage interactions in the selection equation, but not in the outcome equation (Ackerberg and Botticini (2002)). After estimating the selection equation I predict the likelihood of being selected for the outcome equation and compute the associated Inverse Mills ratio. Finally, I include the Inverse Mills ratio when I estimate the outcome equation. Below I describe the observations used in the selection and outcome equations in the setting of: Matching in the venture capital industry and Portfolio company performance.

Entrepreneurs and venture capitalists. The selection equation uses all actual and potential investments. The outcome equation uses all actual investments, but only those potential investments where the venture capitalist has invested in the same state and industry as the portfolio company at least once during the last five years. Table (14) presents the results from estimations of the selection model under the exclusionary restrictions described above. Although a better instrument for *School tie* is desirable, the selection model does not change the conclusions from the baseline specification.

Different venture capitalists. The selection equation uses all actual and potential syndications. The outcome equation uses all actual syndications, but only those potential syndications where the non-lead venture capitalist has invested in the same state and industry as the portfolio company at least once during the last five years. Table (15) presents the results from estimations of the selection model under the aforementioned exclusionary restrictions. Like above, the selection model does not change the conclusions from the baseline specification.

Portfolio company performance. The selection equation uses the same observations as the outcome equation in "Entrepreneurs and venture capitalists". The outcome

equation uses actual investments. Table (16) presents the results from estimations of the selection model under the exclusionary restrictions described above. Again, the selection model confirms the conclusions from the baseline specification.

Data. The specific variables used in the empirical analysis are defined as follows:
Dependent variables.

- *Investment* is a dummy that equals one for those investments that actually took place and zero for potential investments.
- *Syndication* is a dummy that equals one for those syndications that actually took place and zero for potential syndications.
- *Performance* is a dummy that equals one whenever the portfolio company's current situation is coded as either "Went Public" or "Acquisition" by VentureXpert.

Independent variables.

- *School tie* is a dummy that equals one for those investments where the venture capitalist has attended the same academic institution as any of the portfolio company's entrepreneurs. In the matching between lead- and non-lead venture capitalists, it equals one for those syndications where the non-lead venture capitalist has attended the same academic institution as the lead venture capitalists.
- *Ivy League tie*, *Non-Ivy League tie*, *Top 3 tie*, *Non-top 3 tie* are dummies that equals one for those investments where the venture capitalist has attended the same academic institution as any of the portfolio company's entrepreneurs and this academic institution is an Ivy League, Non-Ivy League, etc.
- *Ivy League venture capitalist* and *Ivy League entrepreneur* are dummies that equals one when the venture capitalist and the entrepreneur has attended an Ivy League academic institution. Similarly for *Non-Ivy League*, *Top 3*, *Non-top 3*.
- *Distance* is the natural logarithm of the geographical distance (in miles) between the centre points of the portfolio company's- and venture capital firm's five digit zip codes+1.
- *Deal size* is the natural logarithm of the amount invested in the company during 2002 measured in millions of dollars+1.
- *Company age* is the natural logarithm of the difference between 2003 and the portfolio company's founding year.
- *Seed/Startup* is a dummy that equals one when the investment is classified as a seed- or startup investment by VentureXpert.

- *Firm age* is the natural logarithm of the difference between 2003 and the venture capital firm's founding year.
- *Firm size* is the natural logarithm of the venture capital firm's reported capital under management measured in millions of dollars+1.
- *Firm experience* is the natural logarithm of the total number of domestic rounds the venture capital firm has participated in during the last five years. This includes all types of private equity deals such as buyouts, mezzanine, etc.[15]
- *Independent firm* is a dummy that equals one when the venture capital firm is classified as Private Equity Firm Investing Own Capital by VentureXpert.

In addition to these variables most regressions include fixed effects to control for *academic institutions*, *portfolio company states*, *and portfolio company industries*.

Calculation of the geographical distance. Some regressions include a control for geographical distance. This variable is calculated using the same methodology as in Sorenson and Stuart (2001).

$$d_{ij} = C\left\{\arccos\left[\sin\left(lat_i\right)\sin\left(lat_j\right) + \cos\left(lat_i\right)\cos\left(lat_j\right)\cos\left(\left|long_i - long_j\right|\right)\right]\right\},$$

where latitude (lat) and longitude ($long$) are the centroids of 5-digit US zipcodes measured in radians and $C = 3,437$ represents the earth's radius.

[15] Sørensen (2007) argue that the number of rounds in which a venture capital firm has participated is a superior measure of venture capital firm experience relative to firm age since it inter alia accounts for important aspects such as venture capital firm activity and preferred investment stage.

Tables

Table 1: Descriptive statistics I: Venture capital firms, portfolio companies, and investment rounds

This table presents descriptive statistics as of September 2008 for the full sample of venture capital firms, portfolio companies, and investment rounds. My data consists of all early stage venture capital investments made by U.S. venture capital firms into U.S. portfolio companies in 2002. For an investment to be included in the sample, I require an education background on at least one of the entrepreneurs and at least one of the venture capitalists who invested in the portfolio company.

Panel A: Firm discriptive statistics	Freq.	Percent	Cum.
Firm type			
Private Equity Firm Investing Own Capital	367	80,48	80,48
Affiliate/Subsidary of Oth. Financial.	13	2,85	83,33
Corporate Venture Program	11	2,41	85,74
Investment/Merchant Bank Subsidiary	9	1,97	87,71
Other	56	12,29	100
Total	456	100	
Panel B: Company discriptive statistics			
Company stage level			
Early Stage	554	85,10	85,10
Startup/Seed	97	14,90	100
Total	651	100	
Company industry group			
Computer Related	276	42,4	42,4
Medical/Health/Life Science	97	14,9	57,3
Communications and Media	83	12,75	70,05
Semiconductors/Other Electronic	74	11,37	81,42
Biotechnology	67	10,29	91,71
Non-High-Technology	54	8,29	100
Total	651	100	
Company situation			
Active	388	59,6	59,6
Acquisition	173	26,57	86,17
Defunct	44	6,76	92,93
Went Public	28	4,3	97,23
Other	18	2,76	99,99
Total	651	100	
Company public status			
Private	471	72,35	72,35
Subsidiary	130	19,97	92,32
Public	28	4,3	96,62
Defunct	21	3,23	99,85
Registration	1	0,15	100
Total	651	100	
Panel C: Investment discriptive statistics			
New or follow on investment			
F	293	39.86	39.86
N	442	60.14	100.00
Total	735	100.00	

Table 2: Descriptive statistics II: Venture capital firms, portfolio companies, investment rounds, and individuals

This table presents descriptive statistics as of September 2008 for the full sample of venture capital firms, portfolio companies, and investment rounds. My data consists of all early stage venture capital investments made by U.S. venture capital firms into U.S. portfolio companies in 2002. For an investment to be included in the sample, I require an education background on at least one of the entrepreneurs and at least one of the venture capitalists who invested in the portfolio company.

Panel A: Firm descriptive statistics II	N	mean	sd	min	p50	max
Firm reported capital under management	424,00	1137,02	4893,57	0,00	199,00	82661,00
Firm founding year	456,00	1992,54	11,53	1850,00	1997,00	2003,00
Panel B: Company descriptive statistics II						
Company founding year	604,00	1999,52	4,02	1939,00	2000,00	2003,00
Panel C: Investment descriptive statistics II						
Round number	735,00	1,73	1,12	1,00	1,00	9,00
Estimated round total investment	735,00	4,43	4,90	0,00	3,00	43,50
Disclosed round total investment	735,00	4,41	4,90	0,00	3,00	43,50
Panel D: Individual descriptive statistics II						
Number of entrepreneurs	1197,00					
Number of venture capitalists	957,00					

Table 3: Descriptive statistics III: Summary statictics for the main variables

This table presents summary statistics for the main variables used in this study. Panel A presents means and standard deviations. Panel B presents a correlation matrix. My data consists of all early stage venture capital investments made by U.S. venture capital firms into U.S. portfolio companies in 2002. For an investment to be included in the sample, I require an education background on at least one of the entrepreneurs and at least one of the venture capitalists who invested in the portfolio company. Performance is a dummy that equals one whenever the portfolio company's current situation is coded as either "Went Public" or "Acquisition" by Venture Economics. School tie is a dummy that equals one for those investments where the venture capitalist has attended the same academic institution as any of the portfolio company's entrepreneurs. Distance is the natural logarithm of the geographical distance (in miles) between the centre points of the portfolio company's- and venture capital firm's five digit zip codes+1. Deal size is the natural logarithm of the amount invested in the company during 2002 measured in millions of dollars+1. Company (Firm) age is the natural logarithm of the difference between 2003 and the portfolio company's (venture capital firm's) founding year. Seed/Startup is a dummy that equals one when the investment is classified as a seed- or startup investment by Venture Economics. Firm size is the natural logarithm of the venture capital firms reported capital under management measured in millions of dollars+1. Independent firm is a dummy that equals one when the venture capital firm is classified as Private Equity Firm Investing Own Capital by Venture Economics.

Panel A: Mean and standard deviations	N	mean	sd	min	max
Performance	989	0.33	0.47	0.00	1.00
School tie	989	0.14	0.34	0.00	1.00
Distance	960	-2.63	2.51	-16.79	0.85
Firm size	954	6.22	1.78	0.00	11.32
Firm age	986	2.22	0.88	0.00	5.03
Independent firm	989	0.84	0.36	0.00	1.00
Deal size	989	1.50	0.78	0.00	3.70
Company age	940	0.88	0.65	0.00	3.22
Seed/Startup	989	0.15	0.36	0.00	1.00

Panel B: Correlation matrix		1	2	3	4	5	6	7	8	9
Performance	1	1								
School tie	2	0.05	1							
Distance	3	0.01	-0.13	1						
Firm size	4	0.05	-0.02	0.14	1					
Firm age	5	0.09	0.01	0.13	0.58	1				
Independent firm	6	0.11	0.06	-0.01	0.18	0.08	1			
Deal size	7	0.14	0.00	0.08	0.43	0.26	0.12	1		
Company age	8	0.07	-0.07	0.05	-0.20	-0.13	-0.07	-0.16	1	
Seed/Startup	9	-0.07	0.04	0.01	-0.05	-0.01	-0.02	-0.21	-0.25	1

Table 4: Univariate tests

This table presents the results for simple tests of equal means across different subsamples. My data consists of all (observed) actual and (unobserved) potential early stage venture capital investments made by U.S. venture capital firms into U.S. portfolio companies in 2002. For each actual portfolio company investment, potential venture capitalists fulfill two requirements: Firstly, they are in my cross section of investments from 2002. Secondly, they have invested in the same state and industry as the portfolio company at least once during the last five years. Panel A compares differences in means between actual- and potential investments. Panel B compares differences in means between actual investments with and without school ties. Performance is a dummy that equals one whenever the portfolio company's current situation is coded as either "Went Public" or "Acquisition" by Venture Economics. School tie is a dummy that equals one for those investments where the venture capitalist has attended the same academic institution as any of the portfolio company's entrepreneurs. Distance is the natural logarithm of the geographical distance (in miles) between the centre points of the portfolio company's- and venture capital firm's five digit zip codes+1. Deal size is the natural logarithm of the amount invested in the company during 2002 measured in millions of dollars+1. Company (Firm) age is the natural logarithm of the difference between 2003 and the portfolio company's (venture capital firm's) founding year. Seed/Startup is a dummy that equals one when the investment is classified as a seed- or startup investment by Venture Economics. Firm size is the natural logarithm of the venture capital firms reported capital under management measured in millions of dollars+1. Independent firm is a dummy that equals one when the venture capital firm is classified as Private Equity Firm Investing Own Capital by Venture Economics.

Panel A: Comparing actual- to potential investments					
Variable	Actual Investments	Potential investments	t	Pr(T < t)	Pr(|T| > |t|)
School tie	0.135	0.094	**-4.465**	0.000	0.000
Distance	-2.633	-1.198	**19.955**	1.000	0.000
Firm size	6.220	6.898	**13.076**	1.000	0.000
Firm age	2.221	2.503	**10.993**	1.000	0.000
Independent firm	0.844	0.862	1.619	0.947	0.105
Deal size	1.499	1.355	**-5.716**	0.000	0.000
Company age	0.880	0.886	0.292	0.615	0.771
Seed/Startup	0.131	0.133	0.165	0.566	0.869
Panel B: Comparing actual investments with school ties to actual investments without school ties					
Variable	School tie = 1	School tie = 0	t	Pr(T < t)	Pr(|T| > |t|)
Performance	0.391	0.322	-1.564	0.059	0.118
Distance	-3.410	-2.510	**3.828**	1.000	0.000
Firm size	6.165	6.229	0.383	0.649	0.702
Firm age	2.242	2.218	-0.294	0.385	0.769
Independent firm	0.902	0.835	**-1.983**	0.024	0.048
Deal size	1.486	1.501	0.213	0.584	0.831
Company age	0.772	0.897	**1.996**	0.977	0.046
Seed/Startup	0.128	0.132	0.125	0.550	0.900

Table 5: Descriptive statistics: Academic institutions

This table presents the top 10 most connected academic institutions in my sample of entrepreneurs and venture capitalists. My data consists of all early stage venture capital investments made by U.S. venture capital firms into U.S. portfolio companies in 2002. For an investment to be included in the sample, I require an education background on at least one of the entrepreneurs and at least one of the venture capitalists who invested in the portfolio company. An individual is connected to an academic institution if he/she holds either an undergraduate or a graduate degree from that institution.

Panel A: top ten most connected academic institutions, 2002.

Venture capitalists				Entrepreneurs			
Rank	Academic institution	Number of investors	%	Rank	Academic institution	Number of entrepreneurs	%
1	Harvard University	255	11,3	1	University of California	110	5,1
2	Stanford University	182	8,1	2	Stanford University	98	4,5
3	University of California	108	4,8	3	Harvard University	79	3,7
4	University of Pennsylvania	94	4,2	4	M.I.T.	70	3,2
5	M.I.T.	77	3,4	5	Indian Institute of Technology	36	1,7
6	Dartmouth College	48	2,1	6	California State University	35	1,6
7	Northwestern University	45	2,0	7	Cornell University	34	1,6
8	Princeton University	43	1,9	8	University of Chicago	30	1,4
9	University of Chicago	42	1,9	9	University of Pennsylvania	30	1,4
10	Columbia University	36	1,6	10	University of Texas	29	1,3
Other		1328	58,8	Other		1604	74,4
Ivy League		559	24,8	Ivy League		249	11,6
Total		2258	100,0	Total		2155	100,0

Table 6: Entrepreneurs and venture capitalists

This table presents results for ordinary least squares regressions. My data consists of all (observed) actual and (unobserved) potential early stage venture capital investments made by U.S. venture capital firms into U.S. portfolio companies in 2002. For each actual portfolio company investment, potential venture capitalists fulfill two requirements: Firstly, they are in my cross section of investments from 2002. Secondly, they have invested in the same state and industry as the portfolio company at least once during the last five years. The dependent variable, Investment, is a dummy that equals one for those investments that actually took place and zero for potential investments. School tie is a dummy that equals one for those investments where the venture capitalist has attended the same academic institution as any of the portfolio company's entrepreneurs. Distance is the natural logarithm of the geographical distance (in miles) between the centre points of the portfolio company's- and venture capital firm's five digit zip codes+1. Deal size is the natural logarithm of the amount invested in the company during 2002 measured in millions of dollars+1. Company (Firm) age is the natural logarithm of the difference between 2003 and the portfolio company's (venture capital firm's) founding year. Seed/Startup is a dummy that equals one when the investment is classified as a seed- or startup investment by Venture Economics. Firm size is the natural logarithm of the venture capital firms reported capital under management measured in millions of dollars+1. Independent firm is a dummy that equals one when the venture capital firm is classified as Private Equity Firm Investing Own Capital by Venture Economics. All regressions include school-, state- and industry dummies. Standard errors are double clustered at the venture capital firm and portfolio company level and robust t-statistics are presented in brackets.

	1	2	3	4	5	6
School tie	**0.0038**	**0.003**	**0.003**	**0.0029**	**0.0028**	**0.0029**
	[4.645]	[3.761]	[3.726]	[3.611]	[3.529]	[3.644]
Distance		**-0.0017**	**-0.0016**	**-0.0017**	**-0.0017**	**-0.0017**
		[-11.78]	[-11.01]	[-11.53]	[-10.80]	[-10.82]
Firm size			**-0.001**			**-0.001**
			[-5.673]			[-5.286]
Firm age			**-0.0015**			**-0.0015**
			[-5.296]			[-4.876]
Independent firm			-0.0009		-0.0005	-0.0007
			[-1.440]		[-0.881]	[-1.057]
Deal size				**0.002**	**0.002**	**0.002**
				[5.669]	[5.711]	[5.726]
Company age				0.0005	0.0005	**0.0007**
				[1.294]	[1.277]	[1.715]
Seed/Startup				0.0008	0.0008	0.0007
				[1.204]	[1.225]	[1.149]
Firm experience					**-0.0024**	
					[-8.593]	
Observations	192165	190863	188556	177202	177202	175076
R-squared	0.016	0.018	0.019	0.02	0.021	0.02
State fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Academic institution fixed effects	Yes	Yes	Yes	Yes	Yes	Yes

Table 7: Entrepreneurs and venture capitalists: Large vs small- & old vs young VC firms

This table presents results for ordinary least squares regressions. My data consists of all (observed) actual and (unobserved) potential early stage venture capital investments made by U.S. venture capital firms into U.S. portfolio companies in 2002. For each actual portfolio company investment, potential venture capitalists fulfill two requirements: Firstly, they are in my cross section of investments from 2002. Secondly, they have invested in the same state and industry as the portfolio company at least once during the last five years. The dependent variable, Investment, is a dummy that equals one for those investments that actually took place and zero for potential investments. School tie is a dummy that equals one for those investments where the venture capitalist has attended the same academic institution as any of the portfolio company's entrepreneurs. Distance is the natural logarithm of the geographical distance (in miles) between the centre points of the portfolio company's- and venture capital firm's five digit zip codes+1. Deal size is the natural logarithm of the amount invested in the company during 2002 measured in millions of dollars+1. Company (Firm) age is the natural logarithm of the difference between 2003 and the portfolio company's (venture capital firm's) founding year. Seed/Startup is a dummy that equals one when the investment is classified as a seed- or startup investment by Venture Economics. Firm size is the natural logarithm of the venture capital firms reported capital under management measured in millions of dollars+1. Independent firm is a dummy that equals one when the venture capital firm is classified as Private Equity Firm Investing Own Capital by Venture Economics. School tie*Firm size is the product between School tie and Firm size. Similarly, School tie*Firm age is the product between School tie and Firm age. All regressions include school-, state- and industry dummies. Standard errors are double clustered at the venture capital firm and portfolio company level and robust t-statistics are presented in brackets.

	1	2
School tie	**0.0127**	**0.0075**
	[2.775]	[2.323]
Distance	**-0.0017**	**-0.0017**
	[-10.75]	[-10.80]
Firm size	**-0.0008**	**-0.001**
	[-4.459]	[-5.272]
Firm age	**-0.0014**	**-0.0013**
	[-4.844]	[-4.053]
Independent firm	-0.0007	-0.0007
	[-0.998]	[-1.037]
Deal size	**0.002**	**0.002**
	[5.748]	[5.736]
Company age	**0.0007**	**0.0007**
	[1.722]	[1.708]
Seed/Startup	0.0007	0.0007
	[1.135]	[1.144]
School tie*Firm size	**-0.0014**	
	[-2.405]	
School tie*Firm age		**-0.0018**
		[-1.647]
Observations	175076	175076
R-squared	0.02	0.02
State fixed effects	Yes	Yes
Industry fixed effects	Yes	Yes
Academic institution fixed effects	Yes	Yes

Table 8: Entrepreneurs and venture capitalists: Ivy League & most connected academic institutions

This table presents results for ordinary least squares regressions. My data consists of all (observed) actual and (unobserved) potential early stage venture capital investments made by U.S. venture capital firms into U.S. portfolio companies in 2002. For each actual portfolio company investment, potential venture capitalists fulfill two requirements: Firstly, they are in my cross section of investments from 2002. Secondly, they have invested in the same state and industry as the portfolio company at least once during the last five years. The dependent variable, Investment, is a dummy that equals one for those investments that actually took place and zero for potential investments. Ivy League tie, Non-Ivy League tie, Top 3 tie, Non-top 3 tie are dummies that equals one for those investments where the venture capitalist has attended the same academic institution as any of the portfolio company's entrepreneurs and this academic institution is an Ivy League, Non-Ivy League, etc. Distance is the natural logarithm of the geographical distance (in miles) between the centre points of the portfolio company's- and venture capital firm's five digit zip codes+1. Deal size is the natural logarithm of the amount invested in the company during 2002 measured in millions of dollars+1. Company (Firm) age is the natural logarithm of the difference between 2003 and the portfolio company's (venture capital firm's) founding year. Seed/Startup is a dummy that equals one when the investment is classified as a seed- or startup investment by Venture Economics. Firm size is the natural logarithm of the venture capital firms reported capital under management measured in millions of dollars+1. Independent firm is a dummy that equals one when the venture capital firm is classified as Private Equity Firm Investing Own Capital by Venture Economics. All regressions include school-, state- and industry dummies. Standard errors are double clustered at the venture capital firm and portfolio company level and robust t-statistics are presented in brackets.

	1	2	3	4
Ivy League tie	0.0008			
	[0.657]			
Non-Ivy League tie		**0.0039**		
		[3.754]		
Top 3 tie			0.0012	
			[1.569]	
Non-Top 3 tie				**0.0059**
				[3.198]
Distance	**-0.0017**	**-0.0017**	**-0.0017**	**-0.0017**
	[-10.88]	[-10.80]	[-10.83]	[-10.88]
Firm size	**-0.001**	**-0.001**	**-0.001**	**-0.001**
	[-5.294]	[-5.279]	[-5.297]	[-5.270]
Firm age	**-0.0015**	**-0.0015**	**-0.0015**	**-0.0015**
	[-4.877]	[-4.875]	[-4.877]	[-4.881]
Independent firm	-0.0007	-0.0007	-0.0007	-0.0007
	[-1.061]	[-1.030]	[-1.063]	[-1.045]
Deal size	**0.002**	**0.002**	**0.002**	**0.002**
	[5.713]	[5.716]	[5.718]	[5.730]
Company age	**0.0007**	**0.0007**	**0.0007**	**0.0007**
	[1.734]	[1.734]	[1.731]	[1.726]
Seed/Startup	0.0007	0.0007	0.0007	0.0007
	[1.138]	[1.129]	[1.150]	[1.104]
Observations	175076	175076	175076	175076
R-squared	0.02	0.02	0.02	0.02
State fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
Academic institution fixed effects	Yes	Yes	Yes	Yes

Table 9: Different venture capitalists

This table presents results for ordinary least squares regressions. My data consists of all (observed) actual and (unobserved) potential early stage venture capital syndications made by U.S. venture capital firms when investing in U.S. portfolio companies in 2002. For each actual portfolio company investment, potential non-lead venture capitalists fulfill two requirements: Firstly, they are in my cross section of investments from 2002. Secondly, they have invested in the same state and industry as the portfolio company at least once during the last five years. The dependent variable, Syndication, is a dummy that equals one for those syndications that actually took place and zero for potential syndications. School tie is a dummy that equals one for those syndications where the lead and non-lead venture capitalists have attended the same academic institution. Distance is the natural logarithm of the geographical distance (in miles) between the centre points of the portfolio company's- and venture capital firm's five digit zip codes+1. Deal size is the natural logarithm of the amount invested in the company during 2002 measured in millions of dollars+1. Company (Firm) age is the natural logarithm of the difference between 2003 and the portfolio company's (venture capital firm's) founding year. Seed/Startup is a dummy that equals one when the investment is classified as a seed- or startup investment by Venture Economics. Firm size is the natural logarithm of the venture capital firms reported capital under management measured in millions of dollars+1. Independent firm is a dummy that equals one when the venture capital firm is classified as Private Equity Firm Investing Own Capital by Venture Economics. All regressions include school-, state- and industry dummies. Standard errors are double clustered at the non-lead venture capital firm and portfolio company level and robust t-statistics are presented in brackets.

	1	2	3	4	5	6
School tie	**0.0027**	**0.0022**	**0.0022**	**0.0023**	**0.0023**	**0.0023**
	[2.457]	[1.960]	[1.998]	[2.014]	[2.004]	[2.056]
Distance: Lead-Non-lead		-0.0003	**-0.0004**	-0.0003	-0.0003	-0.0003
		[-1.555]	[-1.618]	[-1.301]	[-1.228]	[-1.373]
Distance: Lead-company		**0.0003**	**0.0003**	**0.0002**	**0.0002**	**0.0003**
		[3.018]	[3.831]	[1.749]	[1.923]	[3.085]
Distance: Non-lead-company		**-0.0016**	**-0.0015**	**-0.0016**	**-0.0015**	**-0.0015**
		[-5.609]	[-5.223]	[-5.546]	[-5.352]	[-5.167]
Lead size			0.0004			0
			[0.742]			[-0.0741]
Non-lead size			**-0.0022**			**-0.0021**
			[-4.767]			[-4.483]
Lead age			-0.0001			0.0001
			[-0.334]			[0.219]
Non-lead age			**-0.0023**			**-0.0022**
			[-3.327]			[-3.063]
Lead independent firm			0.0025		0.0009	0.0015
			[1.198]		[0.452]	[0.677]
Non-lead independent firm			-0.0008		-0.0017	-0.0009
			[-0.540]		[-1.109]	[-0.612]
Deal size				**0.0013**	**0.0012**	**0.0014**
				[2.035]	[1.736]	[2.019]
Company age				-0.0002	-0.0002	-0.0001
				[-0.428]	[-0.535]	[-0.260]
Seed/Startup				0.0016	0.0015	0.0003
				[1.122]	[0.929]	[0.197]
Lead experience					-0.0003	
					[-0.631]	
Non-lead experience					**-0.0037**	
					[-5.974]	
Observations	58174	52155	51595	50595	50595	50048
R-squared	0.021	0.02	0.022	0.02	0.022	0.022
State fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Academic institution fixed effects	Yes	Yes	Yes	Yes	Yes	Yes

Table 10: Different venture capitalists: Large vs small- & old vs young VC firms

This table presents results for ordinary least squares regressions. My data consists of all (observed) actual and (unobserved) potential early stage venture capital syndications made by U.S. venture capital firms when investing in U.S. portfolio companies in 2002. For each actual portfolio company investment, potential non-lead venture capitalists fulfill two requirements: Firstly, they are in my cross section of investments from 2002. Secondly, they have invested in the same state and industry as the portfolio company at least once during the last five years. The dependent variable, Syndication, is a dummy that equals one for those syndications that actually took place and zero for potential syndications. School tie is a dummy that equals one for those syndications where the lead and non-lead venture capitalists have attended the same academic institution. Distance is the natural logarithm of the geographical distance (in miles) between the centre points of the portfolio company's- and venture capital firm's five digit zip codes+1. Deal size is the natural logarithm of the amount invested in the company during 2002 measured in millions of dollars+1. Company (Firm) age is the natural logarithm of the difference between 2003 and the portfolio company's (venture capital firm's) founding year. Seed/Startup is a dummy that equals one when the investment is classified as a seed- or startup investment by Venture Economics. Firm size is the natural logarithm of the venture capital firms reported capital under management measured in millions of dollars+1. Independent firm is a dummy that equals one when the venture capital firm is classified as Private Equity Firm Investing Own Capital by Venture Economics. School tie*Firm size is the product between School tie and Non-lead size. Similarly, School tie*Firm age is the product between School tie and Non-lead age. All regressions include school-, state- and industry dummies. Standard errors are double clustered at the non-lead venture capital firm and portfolio company level and robust t-statistics are presented in brackets.

	1	2
School tie	0.0118	0.0039
	[1.409]	[0.777]
Distance: Lead-Non-lead	-0.0003	-0.0003
	[-1.348]	[-1.376]
Distance: Lead-company	**0.0003**	**0.0003**
	[3.095]	[3.114]
Distance: Non-lead-company	**-0.0015**	**-0.0015**
	[-5.166]	[-5.167]
Lead size	-0.0001	0
	[-0.0906]	[-0.0744]
Non-lead size	**-0.0019**	**-0.0021**
	[-4.065]	[-4.475]
Lead age	0.0001	0.0001
	[0.201]	[0.207]
Non-lead age	**-0.0022**	**-0.0021**
	[-3.079]	[-2.717]
Lead independent firm	0.0015	0.0015
	[0.681]	[0.673]
Non-lead independent firm	-0.0009	-0.0009
	[-0.615]	[-0.617]
Deal size	**0.0014**	**0.0014**
	[2.035]	[2.022]
Company age	-0.0001	-0.0001
	[-0.268]	[-0.263]
Seed/Startup	0.0003	0.0003
	[0.208]	[0.195]
School tie*Non-lead size	-0.0013	
	[-1.210]	
School tie*Non-lead age		-0.0006
		[-0.341]
Observations	50048	50048
R-squared	0.022	0.022
State fixed effects	Yes	Yes
Industry fixed effects	Yes	Yes
Academic institution fixed effects	Yes	Yes

Table 11: Different venture capitalists: Ivy League & most connected academic institutions

This table presents results for ordinary least squares regressions. My data consists of all (observed) actual and (unobserved) potential early stage venture capital syndications made by U.S. venture capital firms when investing in U.S. portfolio companies in 2002. For each actual portfolio company investment, potential non-lead venture capitalists fulfill two requirements: Firstly, they are in my cross section of investments from 2002. Secondly, they have invested in the same state and industry as the portfolio company at least once during the last five years. The dependent variable, Syndication, is a dummy that equals one for those syndications that actually took place and zero for potential syndications. Ivy League tie, Non-Ivy League tie, Top 3 tie, Non-top 3 tie are dummies that equals one for those syndications where the lead and non-lead venture capitalists have attended the same academic institution and this academic institution is an Ivy League, Non-Ivy League, etc. Distance is the natural logarithm of the geographical distance (in miles) between the centre points of the portfolio company's- and venture capital firm's five digit zip codes+1. Deal size is the natural logarithm of the amount invested in the company during 2002 measured in millions of dollars+1. Company (Firm) age is the natural logarithm of the difference between 2003 and the portfolio company's (venture capital firm's) founding year. Seed/Startup is a dummy that equals one when the investment is classified as a seed- or startup investment by Venture Economics. Firm size is the natural logarithm of the venture capital firms reported capital under management measured in millions of dollars+1. Independent firm is a dummy that equals one when the venture capital firm is classified as Private Equity Firm Investing Own Capital by Venture Economics. All regressions include school-, state- and industry dummies. Standard errors are double clustered at the non-lead venture capital firm and portfolio company level and robust t-statistics are presented in brackets.

	1	2	3	4
Ivy League tie	0.0027			
	[1.468]			
Non-Ivy League tie		**0.0023**		
		[1.604]		
Top 3 tie			**0.0022**	
			[1.745]	
Non-Top 3 tie				0.003
				[1.119]
Distance: Lead-Non-lead	-0.0003	-0.0003	-0.0003	-0.0003
	[-1.421]	[-1.385]	[-1.391]	[-1.409]
Distance: Lead-company	**0.0003**	**0.0003**	**0.0003**	**0.0003**
	[3.124]	[3.101]	[3.081]	[3.110]
Distance: Non-lead-company	**-0.0015**	**-0.0015**	**-0.0015**	**-0.0015**
	[-5.168]	[-5.165]	[-5.168]	[-5.166]
Lead size	0	-0.0001	0	0
	[-0.0845]	[-0.0949]	[-0.0781]	[-0.0899]
Non-lead size	**-0.0021**	**-0.0021**	**-0.0021**	**-0.0021**
	[-4.486]	[-4.473]	[-4.484]	[-4.484]
Lead age	0.0001	0.0001	0.0001	0.0001
	[0.224]	[0.235]	[0.224]	[0.226]
Non-lead age	**-0.0022**	**-0.0022**	**-0.0022**	**-0.0022**
	[-3.065]	[-3.066]	[-3.062]	[-3.071]
Lead independent firm	0.0015	0.0015	0.0015	0.0015
	[0.665]	[0.699]	[0.673]	[0.690]
Non-lead independent firm	-0.0009	-0.0009	-0.0009	-0.0009
	[-0.611]	[-0.605]	[-0.616]	[-0.609]
Deal size	**0.0014**	**0.0014**	**0.0014**	**0.0014**
	[2.050]	[2.032]	[2.013]	[2.043]
Company age	-0.0001	-0.0001	-0.0001	-0.0001
	[-0.279]	[-0.262]	[-0.246]	[-0.289]
Seed/Startup	0.0003	0.0003	0.0003	0.0003
	[0.193]	[0.200]	[0.211]	[0.177]
Observations	50048	50048	50048	50048
R-squared	0.022	0.022	0.022	0.022
State fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
Academic institution fixed effects	Yes	Yes	Yes	Yes

Table 12: Portfolio company performance

This table presents results for ordinary least squares regressions. My data consists of all (observed) actual early stage venture capital investments made by U.S. venture capital firms into U.S. portfolio companies in 2002. The dependent variable, Performance, is a dummy that equals one whenever the portfolio company's current situation is coded as either "Went Public" or "Acquisition" by Venture Economics. School tie is a dummy that equals one for those investments where the venture capitalist has attended the same academic institution as any of the portfolio company's entrepreneurs. Distance is the natural logarithm of the geographical distance (in miles) between the centre points of the portfolio company's- and venture capital firm's five digit zip codes+1. Deal size is the natural logarithm of the amount invested in the company during 2002 measured in millions of dollars+1. Company (Firm) age is the natural logarithm of the difference between 2003 and the portfolio company's (venture capital firm's) founding year. Seed/Startup is a dummy that equals one when the investment is classified as a seed- or startup investment by Venture Economics. Firm size is the natural logarithm of the venture capital firms reported capital under management measured in millions of dollars+1. Independent firm is a dummy that equals one when the venture capital firm is classified as Private Equity Firm Investing Own Capital by Venture Economics. All regressions include state- and industry dummies. Standard errors are double clustered at the venture capital firm and portfolio company level and robust t-statistics are presented in brackets.

	1	2	3	4	5	6
School tie	0.0708	0.0789	0.0787	0.0771	0.0723	0.0755
	[1.292]	[1.426]	[1.382]	[1.387]	[1.292]	[1.345]
Distance		0.0054	0.004	0.0022	0.0022	0.0017
		[0.742]	[0.529]	[0.294]	[0.285]	[0.220]
Firm size			-0.0049			-0.0194
			[-0.410]			[-1.499]
Firm age			0.0292			0.0427
			[1.197]			[1.681]
Independent firm			**0.1272**		**0.0953**	**0.1214**
			[2.377]		[1.888]	[2.315]
Deal size				**0.0883**	**0.084**	**0.0882**
				[2.748]	[2.521]	[2.482]
Company age				0.0493	0.0518	0.048
				[1.229]	[1.287]	[1.189]
Seed/Startup				-0.0075	-0.0035	-0.0043
				[-0.110]	[-0.0514]	[-0.0617]
Firm experience					0.0013	
					[0.0938]	
Observations	989	960	926	911	911	879
R-squared	0.075	0.077	0.091	0.1	0.105	0.115
State fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes

Table 13: Portfolio company performance: Ivy League & most connected academic institutions

This table presents results for ordinary least squares regressions. My data consists of all (observed) actual early stage venture capital investments made by U.S. venture capital firms into U.S. portfolio companies in 2002. The dependent variable, Performance, is a dummy that equals one whenever the portfolio company's current situation is coded as either "Went Public" or "Acquisition" by Venture Economics. Ivy League tie, Non-Ivy League tie, Top 3 tie, Non-top 3 tie are dummies that equals one for those investments where the venture capitalist has attended the same academic institution as any of the portfolio company's entrepreneurs and this academic institution is an Ivy League, Non-Ivy League, etc. Distance is the natural logarithm of the geographical distance (in miles) between the centre points of the portfolio company's- and venture capital firm's five digit zip codes+1. Deal size is the natural logarithm of the amount invested in the company during 2002 measured in millions of dollars+1. Company (Firm) age is the natural logarithm of the difference between 2003 and the portfolio company's (venture capital firm's) founding year. Seed/Startup is a dummy that equals one when the investment is classified as a seed- or startup investment by Venture Economics. Firm size is the natural logarithm of the venture capital firms reported capital under management measured in millions of dollars+1. Independent firm is a dummy that equals one when the venture capital firm is classified as Private Equity Firm Investing Own Capital by Venture Economics. All regressions include state- and industry dummies. Standard errors are double clustered at the venture capital firm and portfolio company level and robust t-statistics are presented in brackets.

	1	2	3	4	5	6	7	8
Ivy League tie	-0.0107	-0.0193						
	[-0.112]	[-0.191]						
Ivy League venture capitalist		0.0002						
		[0.00309]						
Ivy League entrepreneur		0.0131						
		[0.387]						
Non-Ivy League tie			0.0953	0.0969				
			[1.510]	[1.533]				
Non-Ivy League venture capitalist				0.0025				
				[0.0487]				
Non-Ivy League entrepreneur				-0.0149				
				[-0.465]				
Top 3 tie					**0.134**	**0.1423**		
					[1.837]	[1.945]		
Top 3 venture capitalist						-0.0114		
						[-0.199]		
Top 3 entrepreneur						-0.0021		
						[-0.0606]		
Non-Top 3 tie							-0.0224	-0.0158
							[-0.296]	[-0.204]
Non-Top 3 venture capitalist								-0.0219
								[-0.381]
Non-Top 3 entrepreneur								-0.0222
								[-0.655]
Distance	0.0005	0.0004	0.0017	0.0016	0.002	0.0019	0.0004	0.0009
	[0.0629]	[0.0489]	[0.220]	[0.206]	[0.254]	[0.242]	[0.0549]	[0.118]
Firm size	-0.0205	-0.0207	-0.0194	-0.0196	-0.0202	-0.0202	**-0.021**	**-0.021**
	[-1.576]	[-1.595]	[-1.496]	[-1.517]	[-1.557]	[-1.563]	[-1.601]	[-1.642]
Firm age	**0.0442**	**0.0433**	**0.0426**	**0.0416**	**0.0424**	**0.0425**	**0.0443**	**0.0438**
	[1.746]	[1.706]	[1.673]	[1.640]	[1.670]	[1.673]	[1.753]	[1.726]
Independent firm	**0.1261**	**0.127**	**0.1225**	**0.1234**	**0.1228**	**0.1235**	**0.1266**	**0.1236**
	[2.404]	[2.439]	[2.344]	[2.377]	[2.344]	[2.338]	[2.410]	[2.319]
Deal size	**0.0899**	**0.0904**	**0.0895**	**0.0901**	**0.0855**	**0.0864**	**0.0894**	**0.0864**
	[2.508]	[2.516]	[2.535]	[2.542]	[2.421]	[2.403]	[2.523]	[2.388]
Company age	0.046	0.0463	0.0478	0.0483	0.0471	0.0476	0.0457	0.0453
	[1.134]	[1.139]	[1.178]	[1.189]	[1.170]	[1.170]	[1.125]	[1.104]
Seed/Startup	-0.0001	0.0008	-0.0037	-0.0029	-0.0025	-0.0017	0.0005	-0.0011
	[-0.000883]	[0.0112]	[-0.0541]	[-0.0423]	[-0.0364]	[-0.0242]	[0.00736]	[-0.0156]
Observations	879	879	879	879	879	879	879	879
R-squared	0.112	0.112	0.115	0.115	0.117	0.118	0.112	0.113
State fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 14: Entrepreneurs and venture capitalists: A selection model

This table presents results for a two stage selection model à la Heckman (1979). In the selection equation, my data consists of all (observed) actual and (unobserved) potential early stage venture capital investments made by U.S. venture capital firms into U.S. portfolio companies in 2002. For each actual portfolio company investment, potential venture capitalists are in my cross section of investments from 2002. The dependent variable in the selection equation is a dummy that equals one for those investments that actually took place and zero for potential investments. In the outcome equation, my data consists of all (observed) actual and (unobserved) potential early stage venture capital investments made by U.S. venture capital firms into U.S. portfolio companies in 2002. For each actual portfolio company investment, potential venture capitalists fulfill two requirements: Firstly, they are in my cross section of investments from 2002. Secondly, they have invested in the same state and industry as the portfolio company at least once during the last five years. The dependent variable in the outcome equation, Investment, is a dummy that equals one for those investments that actually took place and zero for potential investments. School tie is a dummy that equals one for those investments where the venture capitalist has attended the same academic institution as any of the portfolio company's entrepreneurs. Distance is the natural logarithm of the geographical distance (in miles) between the centre points of the portfolio company's- and venture capital firm's five digit zip codes+1. Deal size is the natural logarithm of the amount invested in the company during 2002 measured in millions of dollars+1. Company (Firm) age is the natural logarithm of the difference between 2003 and the portfolio company's (venture capital firm's) founding year. Seed/Startup is a dummy that equals one when the investment is classified as a seed- or startup investment by Venture Economics. Firm size is the natural logarithm of the venture capital firms reported capital under management measured in millions of dollars+1. Independent firm is a dummy that equals one when the venture capital firm is classified as Private Equity Firm Investing Own Capital by Venture Economics. All regressions include school-, state- and industry dummies. Standard errors are double clustered at the venture capital firm and portfolio company level and robust t-statistics are presented in brackets.

	Selection	Outcome	Selection	Outcome
School tie	**0.0108**	**0.0028**	**0.0147**	**0.0029**
	[3.100]	[3.478]	[4.314]	[3.602]
Distance	**-0.0194**	**-0.0012**	**-0.0691**	**-0.0015**
	[-5.085]	[-7.749]	[-38.59]	[-7.858]
Firm size	**0.1109**	**-0.0017**	**0.096**	**-0.0013**
	[58.93]	[-5.842]	[61.06]	[-3.346]
Firm age	**0.1067**	**-0.0022**	**0.0968**	**-0.0017**
	[42.15]	[-5.287]	[43.66]	[-3.778]
Independent firm	0.004	-0.0004	0.0019	-0.0007
	[0.698]	[-0.610]	[0.499]	[-1.051]
Deal size	0.0053	**0.0021**	**-0.0041**	**0.002**
	[1.161]	[5.799]	[-2.161]	[5.765]
Company age	0.0067	**0.0007**	**0.0049**	**0.0007**
	[1.197]	[1.623]	[1.851]	[1.658]
Seed/Startup	0.0108	0.0008	**-0.0627**	0.0008
	[0.976]	[1.316]	[-6.094]	[1.197]
Inverse Mills ratio		**-0.0215**		-0.0077
		[-3.423]		[-0.983]
Observations	461532	175034	500632	175076
R-squared		0.02		0.02
State fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
Academic institution fixed effects	Yes	Yes	Yes	Yes
	Identification in the selection equation			
Company state-Firm state interactions	Yes			
Company state-industry and state-stage interactions			Yes	

Table 15: Different venture capitalists: A selection model

This table presents results for a two stage selection model à la Heckman (1979). In the selection equation, my data consists of all (observed) actual and (unobserved) potential early stage venture capital syndications made by U.S. venture capital firms into U.S. portfolio companies in 2002. For each actual portfolio company investment, potential non-lead venture capitalists are in my cross section of investments from 2002. The dependent variable in the selection equation is a dummy that equals one for those syndications that actually took place and zero for potential syndications. In the outcome equation, my data consists of all (observed) actual and (unobserved) potential early stage venture capital syndications made by U.S. venture capital firms into U.S. portfolio companies in 2002. For each actual portfolio company investment, potential non-lead venture capitalists fulfill two requirements: Firstly, they are in my cross section of investments from 2002. Secondly, they have invested in the same state and industry as the portfolio company at least once during the last five years. The dependent variable, Syndication, is a dummy that equals one for those syndications that actually took place and zero for potential syndications. School tie is a dummy that equals one for those syndications where the lead and non-lead venture capitalists have attended the same academic institution. Distance is the natural logarithm of the geographical distance (in miles) between the centre points of the portfolio company's- and venture capital firm's five digit zip codes+1. Deal size is the natural logarithm of the amount invested in the company during 2002 measured in millions of dollars+1. Company (Firm) age is the natural logarithm of the difference between 2003 and the portfolio company's (venture capital firm's) founding year. Seed/Startup is a dummy that equals one when the investment is classified as a seed- or startup investment by Venture Economics. Firm size is the natural logarithm of the venture capital firms reported capital under management measured in millions of dollars+1. Independent firm is a dummy that equals one when the venture capital firm is classified as Private Equity Firm Investing Own Capital by Venture Economics. All regressions include school-, state- and industry dummies. Standard errors are double clustered at the non-lead venture capital firm and portfolio company level and robust t-statistics are presented in brackets.

	Selection	Outcome	Selection	Outcome
School tie	**0.0108**	**0.0028**	**0.0147**	**0.0029**
	[3.100]	[3.478]	[4.314]	[3.602]
Distance	**-0.0194**	**-0.0012**	**-0.0691**	**-0.0015**
	[-5.085]	[-7.749]	[-38.59]	[-7.858]
Firm size	**0.1109**	**-0.0017**	**0.096**	**-0.0013**
	[58.93]	[-5.842]	[61.06]	[-3.346]
Firm age	**0.1067**	**-0.0022**	**0.0968**	**-0.0017**
	[42.15]	[-5.287]	[43.66]	[-3.778]
Independent firm	0.004	-0.0004	0.0019	-0.0007
	[0.698]	[-0.610]	[0.499]	[-1.051]
Deal size	0.0053	**0.0021**	**-0.0041**	**0.002**
	[1.161]	[5.799]	[-2.161]	[5.765]
Company age	0.0067	**0.0007**	**0.0049**	**0.0007**
	[1.197]	[1.623]	[1.851]	[1.658]
Seed/Startup	0.0108	0.0008	**-0.0627**	0.0008
	[0.976]	[1.316]	[-6.094]	[1.197]
Inverse Mills ratio		**-0.0215**		-0.0077
		[-3.423]		[-0.983]
Observations	461532	175034	500632	175076
R-squared		0.02		0.02
State fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
Academic institution fixed effects	Yes	Yes	Yes	Yes
	Identification in the selection equation			
Lead and Non-Lead firm state interactions	Yes			
Company state-industry and state-stage interactions			Yes	

Table 16: Portfolio company performance: A selection model

This table presents results for a two stage selection model à la Heckman (1979). In the selection equation, my data consists of all (observed) actual and (unobserved) potential early stage venture capital investments made by U.S. venture capital firms into U.S. portfolio companies in 2002. For each actual portfolio company investment, potential venture capitalists fulfill two requirements: Firstly, they are in my cross section of investments from 2002. Secondly, they have invested in the same state and industry as the portfolio company at least once during the last five years. The dependent variable in the selection equation, Investment, is a dummy that equals one for those investments that actually took place and zero for potential investments. In the outcome equation, my data consists of all (observed) actual early stage venture capital investments made by U.S. venture capital firms into U.S. portfolio companies in 2002. The dependent variable in the outcome equation, Performance, is a dummy that equals one whenever the portfolio company's current situation is coded as either "Went Public" or "Acquisition" by Venture Economics. School tie is a dummy that equals one for those investments where the venture capitalist has attended the same academic institution as any of the portfolio company's entrepreneurs. Top 3 tie is a dummy that equals one for those investments where the venture capitalist has attended the same academic institution as any of the portfolio company's entrepreneurs and this academic institution is Top 3. Distance is the natural logarithm of the geographical distance (in miles) between the centre points of the portfolio company's- and venture capital firm's five digit zip codes+1. Deal size is the natural logarithm of the amount invested in the company during 2002 measured in millions of dollars+1. Company (Firm) age is the natural logarithm of the difference between 2003 and the portfolio company's (venture capital firm's) founding year. Seed/Startup is a dummy that equals one when the investment is classified as a seed- or startup investment by Venture Economics. Firm size is the natural logarithm of the venture capital firms reported capital under management measured in millions of dollars+1. Independent firm is a dummy that equals one when the venture capital firm is classified as Private Equity Firm Investing Own Capital by Venture Economics. All regressions include state- and industry dummies. Standard errors are double clustered at the venture capital firm and portfolio company level and robust t-statistics are presented in brackets.

	Selection	Outcome	Selection	Outcome	Selection	Outcome	Selection	Outcome
School tie	**0.0015**	0.0746	**0.0013**	0.0742				
	[3.562]	[1.321]	[3.466]	[1.317]				
Top 3 tie					**0.0011**	**0.1426**	**0.001**	**0.1434**
					[1.965]	[1.945]	[1.821]	[1.954]
Top 3 venture capitalist					-0.0004	-0.0108	-0.0003	-0.0117
					[-1.438]	[-0.189]	[-1.431]	[-0.205]
Top 3 entrepreneur					-0.0003	-0.0011	-0.0004	-0.0007
					[-1.025]	[-0.0323]	[-1.484]	[-0.0216]
Distance	**-0.0008**	0.0031	**-0.0008**	0.0035	**-0.0008**	0.0034	**-0.0009**	0.0042
	[-7.566]	[0.369]	[-14.53]	[0.392]	[-7.613]	[0.406]	[-14.66]	[0.473]
Firm size	**-0.0005**	-0.018	**-0.0005**	-0.0192	**-0.0004**	-0.0187	**-0.0005**	-0.0199
	[-3.643]	[-1.369]	[-5.013]	[-1.468]	[-3.581]	[-1.425]	[-4.884]	[-1.532]
Firm age	**-0.0007**	**0.0448**	**-0.0008**	**0.0452**	**-0.0007**	**0.0446**	**-0.0008**	**0.0455**
	[-3.112]	[1.743]	[-3.804]	[1.759]	[-3.073]	[1.736]	[-3.752]	[1.771]
Independent firm	0	**0.1182**	0.0001	**0.1182**	0	**0.1209**	0.0001	**0.1202**
	[-0.0964]	[2.224]	[0.275]	[2.235]	[-0.0408]	[2.260]	[0.341]	[2.255]
Deal size	**0.0014**	**0.0858**	**0.0013**	**0.0864**	**0.0014**	**0.0836**	**0.0013**	**0.0839**
	[9.991]	[2.361]	[10.23]	[2.353]	[10.21]	[2.277]	[10.42]	[2.267]
Company age	-0.0001	0.0486	-0.0001	0.047	-0.0001	0.0481	-0.0001	0.0464
	[-0.863]	[1.205]	[-1.039]	[1.163]	[-0.743]	[1.184]	[-0.921]	[1.141]
Seed/Startup	0.0005	-0.007	**0.0028**	-0.0085	**0.0005**	-0.0046	**0.0959**	-0.0066
	[1.541]	[-0.101]	[2.050]	[-0.120]	[1.774]	[-0.0668]	[4.786]	[-0.0929]
Inverse Mills ratio		-0.703		-0.7777		-0.7532		-0.9598
		[-0.801]		[-0.504]		[-0.873]		[-0.627]
Observations	156711	868	174297	876	156711	868	174297	876
R-squared		0.11		0.11		0.11		0.114
State fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Academic institution fixed effects								
				Identification in the selection equation				
Company state-Firm state interactions	Yes				Yes			
Company state-industry and state-stage interactions			Yes				Yes	

PAPER 2

Unveiling the secrets of the academy: Alumni networks and university endowment success

ABSTRACT. This paper shows that when university endowments become limited partners with venture capital firms, the performance of their connected portfolio companies improve relative to non-connected ones. Portfolio companies are connected when any of their entrepreneurs attended the corresponding universities for undergraduate- or graduate studies. In a differences-in-differences design I compare initial public offering rates between connected- and non-connected venture capital investments in a treated- and an untreated cohort and estimate this effect to be 6%. Since the unconditional sample mean of initial public offerings is 10%, this is commensurate to a 60% increase in the unconditional initial public offering probability. This effect consists of two separate and potentially different effects, however. First, the effect of obtain a new university endowment as a limited partner, second, the effect of losing an already existing university endowment as a limited partner. Further analysis shows that the main effect is mostly driven by the latter. These results continue to hold in a rich set of robustness checks.
Keywords: Social networks, university endowments, connections, venture capital, limited partner performance puzzle
JEL codes: G24, G3, I22, L1, L2

1. Introduction

Over the past decade, university endowments outperformed other types of institutional investors in their private equity investments. Lerner, Schoar, and Wongsunwai (2007) refer to this as the limited partner performance puzzle. What are the causes behind this puzzle? Given the profound impact university endowments have on society, surprisingly, research in finance and economics so far has given little consideration to this question.[1] Two recent exceptions are Brown, Garlappi, and Tiu (2008) and Lerner,

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[1] From an education point of view, many universities rely heavily on the income from their endowments. Therefore, endowments play an important role in maintaining the academic excellence of many universities. Successful endowments enable their universities to reduce effective tuition rates

Schoar, and Wang (2008). These studies rely on data aggregated by asset class (like public equity, fixed income, private equity) to examine what drives university endowment success. While this research suggests that measures of academic ranking like alumni loyalty are positively correlated with university endowment performance, little is known about causality. Even less is known about the specific mechanisms through which alumni affect performance.

This study tests the hypothesis that when university endowments invest in venture capital firms, then the performance of connected portfolio companies improve relative to non-connected ones. Portfolio companies are connected when any of their entrepreneurs attended the corresponding universities for undergraduate- or graduate studies. For this purpose, I construct a treatment-control sample with U.S. venture capital investments made by the 20 largest U.S. university endowments. The resulting dataset consists of 910 new venture capital investment made between 1986 and 2003. These investments were made by 59 different funds managed by 24 different venture capital firms.

My results show that when a university endowment invest in (hence becomes a limited partner with) a venture capital firm, then the performance of connected portfolio companies improve by 6% relative to non-connected ones. Since the unconditional sample mean of initial public offerings is 10%, this is commensurate to a 60% increase in the unconditional initial public offerings probability. This is a considerable economic effect. This effect consists of two separate and potentially different effects, however. The first one is the effect of obtain a new university endowment as a limited partner, while the second one is the effect of losing an already existing university endowment as a limited partner. Further analysis shows that the main effect is mostly driven by the latter.

In broad terms, this study is related to the literature on institutional investors and the part of it that focuses university endowments.[2] Until recently, its main concern has been to understand the nature of the university endowments' investment processes, with little attention paid to actual performance.[3] Still, Brown, Garlappi, and Tiu (2008) use

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and increase admissions, thereby broadening the access to elite education. From a finance point of view, university endowments are important institutional investors responsible for a significant amount of assets. For example, by the end of 2005, U.S. university endowments had $1.3 trillion in asset under management. Meanwhile, they also have several unique features that distinguish them from other institutional investors like investment strategy and organizational structure.

[2] For an overview of the management and organizational structure of university endowments see Swensen (2009), Acharya and Dimson (2007), and Lerner (2007).

[3] While Tobin (1974), Litvack, Malkiel, and Quandt (1974), Dybvig (1999), and Dimmock (2006) have analyzed university endowments investment processes, Carpenter (1956) and Davidson (1971) examined university endowment returns. Acharya and Dimson (2007)

data aggregated by asset class to examine the role of asset allocation on university endowment performance. Similarly, Lerner, Schoar, and Wang (2008) examine the drivers of university endowment success. Taken together, these studies suggest that asset allocation decisions differ substantially across different university endowments and for the same university endowment over time. Meanwhile, university endowment performance is related to the degree of active portfolio management, the size of the university endowment, the quality of the university student body, and the use of alternative asset classes like private equity. While these studies focus on trends in the performance and asset allocation of university endowments, my study examines the causal effect of university endowments' alumni networks on the performance of their private equity investments. Therefore, even closer to my study is the literature that examines institutional investors in the private equity markets. For example, Lerner, Schoar, and Wongsunwai (2007) study the performance and investment strategies of different institutional investors in private equity markets. They find that different types of institutional investors have experienced dramatically different performance. In particular, the average return of private equity funds that university endowments invested in was nearly 14% greater than the return of the average private equity fund in their sample. Tentative results also suggest that university endowment performance is positively correlated with measures of academic ranking like alumni loyalty. My study differs from this one in several respects. Firstly, their tentative evidence that university endowment performance is positively correlated with alumni loyalty serves as my starting point. From there, my study examines one particular mechanism through which alumni networks could affect the university endowment performance. Secondly, while they focus on correlations, my study is concerned with causality. Using a differences-in-differences approach I try to estimate the causal effect of alumni networks on university endowment performance in their venture capital investments.

The rest of this paper is organized as follows. Section 2 provides a brief discussion of how alumni networks tied to university endowments could affect university endowment performance. Section 3 describes the data used in this study and explains how I construct my sample. Section 4 outlines my identification strategy. Section 5 presents the results from the empirical analysis. Finally, Section 6 summarizes and offers some concluding remarks.

2. Institutional background: Investors, intermediaries and issuers

This study examines the investments by a specific player in the venture capital- and private equity market. Therefore, to better understand how this fits into the venture

capital literature, this section provides an overview of the organized venture capital market.

In broad terms the organized venture capital market can be vertically divided into three levels. These are issuers, intermediaries, and investors. Starting from the bottom there are issuers of venture capital. Traditionally, these are young companies characterized by high uncertainty. They are often early stage companies developing novel technologies and are projected to have very high growth rates in the future, of course accompanied by a high degree of risk. Meanwhile, there are also later stage companies with several years of sales that enter into new expansion phases. At the next level there are intermediaries. They are often organized as limited partnerships. Under the limited partnership agreement, institutional investors are limited partners (with limited control over the investment process) and professional venture capitalists are the general partners (with effective control over the investment process). In most cases the general partners are associated with a partnership management firm such as Highland Capital Partners. Still, some management firms are affiliated with financial institutions (e.g. investment banks, insurance companies, etc.). These are usually structured and managed differently. Limited partnerships typically have a lifetime of 10-12 years during which the institutional investors forego virtually all control over the management of the partnership. At the top level there are investors. They are predominantly institutions and the largest ones are public and private pension funds followed by endowments and foundations.

2.1. Facts about university endowments. The specific topic of this study is venture capital Investments by university endowments. This is different from private equity investments in general which includes leveraged buyouts, mezzanine finance and alike. Nonetheless, university endowments were among the first investors in venture capital markets and most invest through intermediaries like the limited partnerships described above and during the period 1986-1992 endowments and foundations represented around 12% of the total contribution to venture capital (Fenn, Liang, and Prowse (1995)).[4]

In the time series, the present allocations to venture capital are similar to those during the mid 1990s. In the cross section, the allocation to venture capital is positively correlated with endowment size and larger university endowments allocate a substantially larger fraction of their portfolio to venture capital than smaller ones do (2005 NACUBO endowment study).

[4] This can be compared to public and private pension funds which together represented around 45%.

3. Why university endowments matter for venture capital firms?

Anecdotal evidence suggests that university endowments are important investors for venture capital firms both in the private equity- and the venture capital markets. Yet, little is known why they are so important. This section offers a potential explanation and derives a testable hypothesis.

The hypothesis starts from the observation that apart from religious organizations, academic institutions are the largest beneficiary form individuals' charitable donations. In fact, over 1 in every 7 dollars donated in 2005 went to academic institutions. This suggests that individuals feel strongly about their alma mater after graduation. Meanwhile, entrepreneurs tend to give more than other alumni.[5]

A natural way for entrepreneurs to give back to their alma mater is through business relationships. This could be achieved through joint ventures or by simply having their alma mater as an investor. This way, in the event of success, entrepreneurs and their alma mater would share the fortunes and glory surrounding successful business venturing.

Against this background, it is conceivable that entrepreneurs might prefer venture capital firms where their alma mater is a limited partner. For instance, when an entrepreneur chooses between two otherwise identical venture capital firms, she/he prefers to go with the one where her/his alma mater is a limited partner.[6] Meanwhile, although in general venture capital firms choose which entrepreneurs to finance, superior entrepreneurs always choose which venture capital firms get to finance them. As a consequence, venture capital firms compete for superior entrepreneurs.

In that case, by becoming a limited partner with a venture capital firm, university endowments render venture capital firms preferential access to those superior entrepreneurs who are their alumni. A straightforward prediction of this hypothesis is as follows:

HYPOTHESIS 1. *When university endowments become limited partners with venture capital firms, portfolio company performance improve when the entrepreneurs are alumni of the corresponding universities relative to when they are not.*

[5] In 2005, 15% of all charitable donations ($38.6 billion) were given to academic institutions. The largest recipient, religious organizations, received 36% ($93.2 billion) (GivingUSAFoundation (2006)).

[6] In related work on the venture capital industry Hsu (2004) shows that entrepreneurs have prefer for more reputable venture capital firms. In fact, entrepreneurs accept lower valuations from more reputable venture capital firms since they expect higher future valuations. In other words, entrepreneurs prefer a smaller slice of a larger pie than a larger slice of a smaller pie. Indeed, prestigious limited partners like university endowments contribute to venture capital firms' reputation. My study suggests that this reputation effect is stronger among the corresponding universities alumni.

The primary goal of my study is to test this hypothesis. For this purpose, I use a differences-in-differences strategy and as always in a differences-in-differences design I make a treatment-control comparison. Finally, to verify the robustness of my results, I also split and collapse the sample in various ways.

4. Data

4.1. Sample construction. Basically, the differences-in-differences estimate compares a change in a treatment group to a change in a control group. Accordingly, there are two dimensions in the differences-in-differences setup. The archetypical example in applied econometrics uses "states" and "time". While the first dimension defines the treatment- and the control groups, the second one defines the treatment event and therefore the treatmeted cohort. The way these two dimensions are defined in this study can be most easily explained with an example:

In year 2000 Harvard Management Company, Inc. invested (and therefore was a limited partner) in the fund Highland Capital Partners V Family. This was an early stage fund managed by the venture capital firm Highland Capital Partners LLC. It was also the follow-on- and predecessor fund to two other early stage funds managed by the same venture capital firm, notably Highland Capital Partners IV Family and Highland Capital Partners VI Family. These funds were raised in 1998 and 2001 respectively. Importantly, Harvard Management Company, Inc. did not invest (and therefore was not a limited partner) in either the follow-on- or the predecessor fund. After having raised their capital, all three funds invested in different portfolio companies and, in general, the unit of analysis in this study is a new portfolio company investment.

Before defining the treatment- and the control group as well as the treatment event consider the structure of the previous example. At least one university endowment (in this case Harvard Management Company, Inc.) invested in a fund and, crucially, did not invest in either its follow-on- or its predecessor fund.

I define the treatment event as the university endowment's investment in the fund. Accordingly, the treated cohort consists of all portfolio company investments made by that fund. In the above example, this corresponds to the portfolio company investments made by the fund Highland Capital Partners V Family. Meanwhile, the untreated cohort consists of the portfolio company investments made by either its follow-on- or its predecessor fund. Again, using the above example, this corresponds to the portfolio company investments made by the funds Highland Capital Partners IV Family and Highland Capital Partners VI Family. This defines the treated and the untreated cohorts.

The treatment group is determined by the university endowment that invested in the fund and consists of all portfolio company investments (both from the treated- and the untreated cohort) where at least one of the entrepreneurs is a graduate from the corresponding university. In the above example, this corresponds to the portfolio company investments made by Highland Capital Partners V Family, Highland Capital Partners IV Family or Highland Capital Partners VI Family where any of the entrepreneurs attended Harvard University for her/his undergraduate- or graduate studies. Similarly, the control group consists of the portfolio company investments where none of the entrepreneurs attended Harvard University for her/his undergraduate- or graduate studies.

As a result, in the above example, the portfolio company investments made by Highland Capital Partners V Family where at least one of the entrepreneurs is a graduate from Harvard University receive the treatment. All other portfolio company investments do not. More generally, if several university endowments had invested in the fund, but not in the follow-on- or the predecessor fund, then the portfolio company investments made by Highland Capital Partners V Family where at least one of the entrepreneurs is a graduate from any of the corresponding universities receive the treatment while the other portfolio company investments do not. This defines the treatment- and the control group.

To empirically test Hypothesis (1) I construct a treatment-control sample with U.S. venture capital investments made by the 20 largest U.S. university endowments. Thus, I start by selecting the 20 largest U.S. university endowments in 2000 measured by market value of endowment assets. For each university endowment (e.g. Harvard Management Company, Inc.), I then identify the funds it invested in (e.g. Highland Capital Partners V Family), their venture capital firms (e.g. Highland Capital Partners LLC), their direct follow-on funds (e.g. Highland Capital Partners VI Family), and their direct predecessor funds (e.g. Highland Capital Partners IV Family). Of these funds, I select the set of funds where the university endowment invested but did not invest in either the follow-on- or the predecessor fund. When there exists both a follow-on- and predecessor fund I select all three funds (the actual fund, its follow-on- and its predecessor fund). Still, in some cases there is no "valid" follow-on- or predecessor fund. In those cases I select the fund where the university endowment invested and either the follow-on- or the predecessor fund where the university endowment did not invest. Next, I identify these funds' portfolio company investments.

Finally, to identify the treatment- and the control group I assemble information about the portfolio company entrepreneurs' undergraduate and graduate education.

The final treatment-control sample with U.S. venture capital investments made by the 20 largest U.S. university endowments consists of 910 new portfolio company investments made between 1986 and 2003. These investments were made by 59 funds managed by 24 venture capital firms.

For this sample of venture capital investments I collect data from several different sources. In particular, the university endowments are selected using the National Association of College and University Business Officers (NACUBO) endowment studies which include 2,500 public and private institutions. NACUBO has conducted voluntary surveys of member schools regarding endowment returns and investment characteristics on an annual basis since the 1970s. The venture capital investments comes from VentureXpert (now owned by Thomson Financial) which provides information on limited partners (e.g. university endowments), venture capital and private equity firms, funds, portfolio companies, executives and directors. The investments and commitments dates back to 1969 and include over 15,000 venture capital and private equity firms, 27,000 funds, and over 70,000 portfolio companies.

This data is supplemented with information about the identity of the portfolio companies' entrepreneurs and their education background. I define an entrepreneur as a non-venture capitalist founding member of a portfolio company. Specifically, I require that the entrepreneur was a founding member during the portfolio company founding year and that she/he was not employed by any of the venture capital firms that financed the portfolio company. The identity of the entrepreneurs and their education background comes from various different sources like VentureXpert, ZoomInfo, LinkedIn, Company Insight Center (CIC), old portfolio company websites, REGDEX documents and IPO prospectuses.[7]

ZoomInfo is a business intelligence search engine with information on industries, companies, people, products and services and covers over 5 million companies and 45 million individuals. LinkedIn is a web-based network of professionals and companies from around the world that today has over 38 million members from 170 industries and over 200 countries worldwide. LinkedIn is voluntary to join, but when joining you create a profile that summarizes your education and professional expertise and background. Finally, Company Insight Center is a web-based business and financial intelligence resource that combines BusinessWeek's editorial content with Capital IQ's research to provide data on companies, industries and key executives. When none of these sources contain information about the entrepreneurs and their education background, I search the World Wide Web in a last attempt to assemble this information.

[7] I use an internet archive machine to visit old portfolio company websites. REGDEX is a notice of sale of securities pursuant to Regulation D, Section 4(6), and/or uniform limited offering exemption. It filed with the U.S. Securities and Exchange Commission.

The definition and construction of the specific variables used in the empirical analysis are reported in the Data Appendix.

4.2. Sample description. Panel A, B and C of Table (1) present descriptive statistics for the final sample of venture capital firms, funds and portfolio companies, respectively. All 24 venture capital firms are independent private equity firms. Basically, this means that they operate as independent asset management firms and not as subsidiaries to investment banks or alike. Meanwhile, almost all funds focus on early- and balanced stage investments. Finally, over half of the investments are in the "Communications and Media" or "Computer Related" industries. On the whole, the distribution of investments across different industries is consistent with the fact that venture capital firms tend to focus on industries characterized by greater levels of asymmetric information and intangible assets. As of May 2009, 37% of the portfolio company investments had resulted in acquisitions and 11% had gone public.

Panel A, B, C and D of Table (2) present descriptive statistics on the size and founding year of venture capital firms and funds as well as the size and year of different investment rounds. While the average venture capital firm was founded in 1986 and manages US$3.1 B, the average fund was founded in 1998 and had US$392 M at its disposal. Because most venture capital firms manage more than one fund, venture capital firm size is larger than fund size.

Summary statistics for the main variables used in the empirical analysis are presented in Table (3). Panel A provides distributional measures such as means, standard deviations, and percentiles for the variables. The dependent variable throughout the empirical analysis is *IPO* or a derivative thereof. Its mean equals 0.11, suggesting that the sample average initial public offering rate is 11%. Meanwhile, the two main effects throughout the empirical analysis are *Investment* and *Connected*. Their means equal 0.43 and 0.18 respectively. This suggests that 43% of the observations belong to the treated cohort and 18% belong to the treatment group. Panel B presents the correlation matrix for the same variables.

Table (4) takes the analysis a bit further and compares differences in means after having split the sample along two distinct dimensions. First, Panel A of Table (4) presents univariate tests for differences in means between the treated- and the untreated cohort. While *Connected* is the same in the treated- and the untreated cohort, *IPO* is significantly lower in the treated cohort. Thus, the treatment- and the control group are evenly distributed over the treated- and the untreated cohort whereas the average success rate is lower in the treated cohort.

Of the control variables, *Firm size* and *Fund size* differ significantly between the treated- and the untreated cohort.[8]

Second, Panel B of Table (4) presents univariate tests for differences in means between the treatment- and the control group. Both *Investment* and *IPO* are the same in the treatment- and the control group. This suggests that the treated- and the untreated cohort are evenly distributed between the treatment- and the control group and that the average success rate is the same across the two groups. Finally, *Firm size*, *Firm age*, and *Company age* differ significantly between the two groups.

4.3. University endowments and academic connections. Before turning to the empirical analysis Table (5) lists the twenty largest university endowments ranked by fiscal year 2000 market value of endowment assets. Besides ranking the university endowments in fiscal year 2000, this table provides information on endowment size, the ranking by fiscal year 2005, and whether or not VentureXpert has information about the university endowments venture capital investments. Meanwhile, Table (6) presents the distribution of university connections across the sample of entrepreneurs. Throughout this study, an entrepreneur is connected to a university if she/he attended it for undergraduate- or graduate studies. The most connected university is Stanford University (with 9.0% of the total number of connections) followed by University of California (with 8.9% of the total number of connections) and Harvard University (with 4.7% of the total number of connections). Together they represent 22.6% of the total number of connections. For the sake of comparison, Ivy League universities represent 12.7% of the total number of connections.

5. Empirical methodology

As mentioned previously, I use a differences-in-differences design and make a treatment-control comparison. While the previous section defined the treatment- and the control group as well as the treatment event, this section describes my identification strategy and estimation methodology.

Throughout the empirical analysis, the dependent variable is a measure of the outcome of a venture capital firm's portfolio company investment. This outcome can either be a success, in which case the variable equals one, or it can be a failure, in which case the variable equals zero. More specifically, I define the outcome of a single portfolio company investment as a success whenever the portfolio company situation is coded as "Went Public" by VentureXpert.[9]

[8] *IPO* is a dummy variable equal to 1 whenever the Company situation is coded as "Went Public" by VentureXpert.

[9] Due to a general lack of detailed performance data for private companies, this is the most frequently used proxy for actual portfolio company performance in the venture capital literature.

I then use the treatment-control sample described above to test Hypotesis (1). More specifically, I compare the change in portfolio company performance in the treatment group to the change in portfolio company performance in the control group between the treated- and the untreated cohort.

Since the treatment-control sample consists of portfolio company investments made by venture capital firms where the 20 largest U.S. university endowments has invested, identification comes from whether or not a portfolio company is connected (through it's entrepreneurs) to any of these universities in the treated cohort. The key identifying assumption is that trends in portfolio company performance would be the same for the treatment- and the control group in the absence of treatment. Finally, to estimate this effect I propose the following linear regression model:

$$Y_{kic} = \alpha + \gamma I_i + \lambda C_c + \beta \left(I_i \cdot C_c \right) + \Gamma X_{kic} + \varepsilon_{kic} \tag{5.1}$$

Equation (5.1) contains two main effects, one for the treatment- and the control group and one for the treated- and the untreated cohort as well as an interaction term that marks observations from the treatment group in the treated cohort. The differences-in-differences estimate is captured by the coefficient in front of the interaction term. Moreover, in Equation (5.1) α is a constant, I (i.e. *Investment*) is a dummy for investments in the treated cohort, C (i.e. *Connected*) is a dummy that switches on for investments in the treatment group, X is a vector with control variables, and ε is an error term that follows the standard normal distribution.[10]

6. Results

This section reports the results from the empirical analysis which aims at testing Hypothesis (1). That is, I investigate if when a university endowment becomes a limited partner with a venture capital firm, then that venture capital firm's portfolio company performance improves when the entrepreneur(s) are alumni of that university relative to when they are not. The way I test this is essentially to compare changes in portfolio

Still, sometimes "good" acquisitions are added to successful outcomes. In those cases, an acquisition is defined as "good" whenever the acquisition price was at least a certain multiple (e.g. 2) of the paid in capital. However, previous research has shown that adding "good" acquisitions to successful outcomes does not matter qualitatively for the results. Finally, a few recent papers with access to private data use detailed information about actual cash flows to study the performance of private equity funds (e.g. Kaplan and Schoar (2005), Ljungqvist, Richardson, and Wolfenzon (2008), and Gottschalg and Phalippou (2009)).

[10] This formulation of the differences-in-differences model offers a convenient way to construct differences-in-differences estimates and standard errors. A further advantage of this formulation is that it is easy to add additional covariates in this framework (Wooldridge (2002) and Angrist and Pinschke (2008)).

company performance in a treatment- and a control group between a treated- and an untreated cohort. In fact, this is exactly what the unconditional sample means does.

6.1. Unconditional sample means. Figure (1) presents unconditional sample means of *IPO* for the treatment- and the control group in the treated- and the untreated cohort. The differences-in-differences estimate equals the difference in average *IPO* between the treatment- and the control group in the treated- and the untreated cohort. From Figure (1) this difference is $(9 - 6) - (11 - 14) = 6\%$, supporting Hypothesis (1).This suggests that when a university endowment becomes a limited partner with a venture capital firm, then the performance of connected portfolio companies improve relative to non-connected ones. In particular, the likelihood of succeeding for connected portfolio companies improve by more than 6% relative to non-connected ones. This is a significant economic effect.

6.2. Individual investment level. While Figure (1) provides preliminary support for Hypothesis (1), a comparison of sample means does not lend itself to test for statistical significance. I therefore use the regression framework in Equation (5.1) to estimate β and its standard error. To begin with I use the entire treatment-control sample to estimate the average treatment effect. I then examine whether obtaining a new university endowment as a limited partner has the same (but opposite) effect as loosing an already existing university endowment as a limited partner. Because I have both follow-on- and predecessor funds, I can estimate these effects separately by discarding follow-on- and predecessor funds respectively.

6.2.1. *Average effect.* To estimate the average effect I use the entire treatment-control sample. Thus, the treated cohort consists of all portfolio company investments made by funds where the university endowments actually invested and hence were limited partners. Meanwhile, the untreated cohort consists of all portfolio company investments made by the previous funds' follow-on- and predecessor funds where the university endowments did not invest and hence were not limited partners. Table (7) presents the results for different combinations of covariates and fixed effects. The estimated coefficients are statistically significant in almost all specifications and particularly in the full specification in column 10. Therefore, the above estimated economic effect is also statistically significant. Moreover, the point estimates closely match those derived from Figure (1). This result corroborates the preliminary finding in Figure (1).

The above result implies that on average when a university endowment invest in a venture capital firm, then the performance of connected portfolio companies improve relative to non-connected ones. This average effect consists of two separate and potentially different effects, however. The first one is the effect of obtain a new university

endowment as a limited partner, while the second one is the effect of losing an already existing university endowment as a limited partner. Still, whether or not these effects are equal in magnitude is an empirical matter. I examine these two effects separately by discarding the follow-on- and the predecessor funds respectively.

6.2.2. *Actual fund vs. Predecessor fund.* When comparing funds where the university endowments actually invested to their predecessor funds where the university endowments did not invest, Hypothesis (1) predicts that the performance of connected portfolio companies should improve relative to non-connected ones. I estimate this effect using a subset of the previous treatment-control sample. While the treated cohort remains the same as above, the untreated cohort now consists of all portfolio company investments made by the previous funds' predecessor funds where the university endowments did not invest and hence were not limited partners. The estimates are presented in Table (8) for different combinations of covariates and fixed effects. Although the estimated coefficients are not statistically significant their magnitude is equivalent to one of the main effects, notably *Investment*.

6.2.3. *Actual fund vs. Follow-on fund.* While the previous section examined the effect of obtaining a new university endowment as a limited partner, this section estimates the effect of losing an already existing university endowment as a limited partner. Again, when comparing funds where the university endowments actually invested to their follow-on funds where the university endowments did not invest, Hypothesis (1) predicts that the performance of connected portfolio companies should improve relative to non-connected ones. To estimate this effect I use a different subset of the treatment-control sample. Like before, the treated cohort remains the same. The untreated cohort consists of all portfolio company investments made by the previous funds follow-on funds where the university endowments did not invest and hence were not limited partners, however. Table (9) presents the results for different combinations of covariates and fixed effects. The estimated coefficients are both statistically and economically significant in all specifications and particularly in the full specification 10.

In sum, when comparing funds where the university endowments actually invested to either their predecessor funds or their follow-on funds where they did not invest, performance of connected portfolio companies improve relative to non-connected ones. This improvement is most pronounced when comparing funds where the university endowments actually invested to their follow-on funds where they did not invest, however.

6.3. Aggregate management firm level. In the individual investment level analysis, standard errors were double clustered at the portfolio company- and venture capital firm level. Still, the question begs how many independent observations there are.

If investments by the same venture capital firm are not independent, then the standard errors from the previous analysis could be too small and the estimates only seemingly significant. To address this issue, instead of analyzing individual investments, I average all my variables at the venture capital firm level across the treatment- and the control group over the treated- and the untreated cohort. This procedure roughly reduces the sample size by a factor of 10, thereby reflecting the concern of too many seemingly independent observations in the above analysis. The corresponding linear regression model is:

$$Y_{jic} = \alpha + \gamma I_i + \lambda C_c + \beta \left(I_i \cdot C_c\right) + \Gamma X_{jic} + \varepsilon_{jic} \tag{6.1}$$

As in Equation (5.1), Equation (6.1) contains two main effects, one for the treatment- and the control group and one for the treated- and the untreated cohort. It also contains the interaction term marking observations from the treatment group in the treated cohort and the differences-in-differences estimate is captured by the coefficient in front of this interaction term. Similarly, α is a constant, I (i.e. *Investment*) is a dummy for investments in the treated cohort, C (i.e. *Connected*) is a dummy that switches on for investments in the treatment group, X is a vector with control variables, and ε is an error term that follows the standard normal distribution. However, the unit of analysis is different from the previous section. Instead of looking at the individual investment level, now the unit of analysis is the venture capital firm. More specifically, if j represents a venture capital firm and k represents the individual investments made by that venture capital firm, then for any variable Z, $Z_{jic} = \sum_k Z_{kic}|i,c/\sum_k 1|i,c$.

Repeating the analysis at the individual investment level analysis, I first estimate the average treatment effect. and then examine whether obtaining a new university endowment as a limited partner has the same (but opposite) effect as loosing an already existing university endowment as a limited partner.

6.3.1. *Average effect.* Table (10) presents the estimates of the average effect for different combinations of covariates and fixed effects. While the estimated coefficients are not statistically significant, they are in the same order of magnitude as both main effects.

6.3.2. *Actual fund vs. Predecessor fund.* The results for the effect of obtaining a new university endowment as a limited partner are presented in Table (11) for different combinations of covariates and fixed effects. Like the analysis at the individual investment level, the estimated coefficients are economically but not statistically significant.

6.3.3. *Actual fund vs. Follow-on fund.* Finally, Table (12) presents the results for the effect of losing an already existing university endowment as a limited partner for

different combinations of covariates and fixed effects. Once again, the estimated coefficients are both economically and statistically significant.

In summary, the aggregate firm level analysis confirms the results from the individual investment level analysis. That is, when comparing funds where the university endowments actually invested to either their predecessor funds or their follow-on funds where they did not invest, performance of connected portfolio companies improve relative to non-connected ones and this result is mainly driven by the latter comparison.

6.4. Robustness checks. This section performs two types of robustness tests. In the first one I estimate a latent variable model that accounts for the binary nature of my dependent variable and show that the results goes through unchanged. In the second one I use the variation in endowment ranking and redo the analysis for different sets of university endowments. In general, this exercise corroborates the results from the baseline analysis and when I restrict the analysis to university endowments with higher rankings the results are even stronger.

6.4.1. *A latent variable model.* In the individual investment level analysis, the dependent variable is binary and ordinary least squares estimates are consistent, but inefficient (*REF*). Therefore, as a robustness check I estimate the following latent variable model:

$$Y^*_{kic} = \alpha + \gamma I_i + \lambda C_c + \beta \left(I_i \cdot C_c\right) + \Gamma X_{kic} + \varepsilon_{kic},\ Y_{kic} = 1\left[Y^*_{kic} > 0\right] \tag{6.2}$$

On the whole, Equation (6.2) is identical to Equation (5.1) and the differences-in-differences estimate is still captured by the coefficient in front of the interaction term. However, the error term, ε, follows the logistic distribution. This model is both consistent and efficient. Table (13)-(15) present the results for different combinations of covariates and fixed effects. By and large, the results from the latent variable model confirm those from the baseline linear regression model, suggesting that the results are not driven by the specific choice of model.

6.4.2. *Alternative set of university endowments.* In the baseline analysis I construct a treatment-control sample with U.S. venture capital investments made by the 20 largest U.S. university endowments. Still, these university endowments differ substantially in size (see Table (5)). Therefore, as a further robustness check, I redo the above analysis at the individual investment level as well as at the aggregate firm level for a treatment-control sample with U.S. venture capital investments made by the 10 and 5 largest U.S. university endowments as well as for Harvard University, Stanford University and the University of California which are the three most connected academic institutions in my sample (see Table (6)). Table (16)-(21) presents the results using

the treatment-control sample with U.S. venture capital investments made by the 10 largest U.S. university endowments for different combinations of covariates and fixed effects.[11] Again, these results confirm the results from the baseline empirical analysis. Moreover, now the results for the average effect at the aggregate firm level become statistically significant as well.

In conclusion, these robustness checks corroborate the results from the baseline analysis.

7. Conclusions

This paper shows that when a university endowment invest in (hence becomes a limited partner with) a venture capital firm, then the performance of connected portfolio companies improve relative to non-connected ones. Portfolio companies are connected when any of their entrepreneurs attended the corresponding universities for undergraduate- or graduate studies. Specifically, the likelihood of resulting in an initial public offering increases by 6% more for connected portfolio companies relative to non-connected ones. Since the unconditional sample mean of initial public offerings is 10%, this is commensurate to a 60% increase in the unconditional initial public offerings probability. This is a considerable economic effect. This effect consists of two separate and potentially different effects, however. The first one is the effect of obtain a new university endowment as a limited partner, while the second one is the effect of losing an already existing university endowment as a limited partner. Further analysis shows that the main effect is mostly driven by the latter.

[11] Unreported results using the U.S. venture capital investments made by the 5 largest U.S. university endowments and for Harvard University, Stanford University and the University of California yield qualitatively and quantitatively similar results.

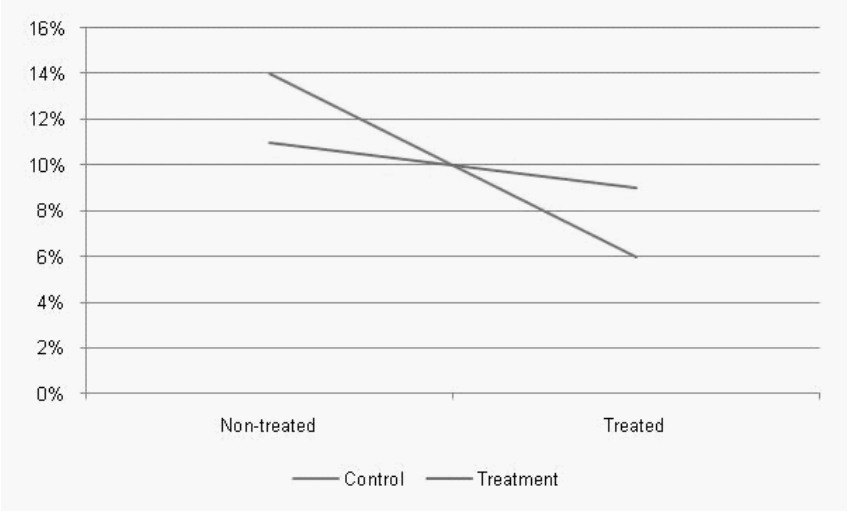
Appendix

Data. The specific variables used in the empirical analysis are defined as follows:

- *IPO* is a dummy that switches on whenever the portfolio company situation is coded as "Went Public" by VentureXpert.
- *Investment* is a dummy that switches on for the treated cohort (i.e. actual investments).
- *Connected* is a dummy for observations in the treatment group (i.e. connected investments).
- *DD* is the product of *Investment* of *Connected*.
- *Firm size* is the natural logarithm of the venture capital firm's capital under management in million $US +1.
- *Firm age* is the natural logarithm of the difference between the venture capital firm's founding year and the year of the investment +1.
- *Fund size* is the natural logarithm of the venture capital fund's capital under management in million $US +1.
- *Company age* is the natural logarithm of the difference between the portfolio company's founding year and the year of the investment +1.

In addition to these variables most regressions include fixed effects to control for *round year*, *venture capital firm*, *firm year*, *investment stage*, and *industry*.

Figure 1: Uncontitional samles means of *IPO*



Figures

Tables

Table 1: Descriptive statistics I: Firms, funds and companies

This table presents descriptive statistics as of May 2009 for the entire treatment-control sample of venture capital firms, funds, portfolio companies, and investment rounds. The sample consists of U.S. venture capital investments made by the 20 largest U.S. university endowments into U.S. portfolio companies. For an investment to be included in the sample, I require an education background for at least one of the corresponding portfolio company's entrepreneurs.

Panel A: Firm discriptive statistics	Freq.	Percent	Cum.
Firm type			
Private Equity Firm	24	100.0	100.0
Total	24	100.0	
Panel B: Fund discriptive statistics			
Fund investment stage focus			
Balanced Stage	17	28.8	28.8
Early Stage	36	61.0	89.8
Expansion	1	1.7	91.5
Later Stage	5	8.5	100.0
Total	59	100.0	
Fund sequence type			
Follow-on	56	94.9	94.9
New	3	5.1	100.0
Total	59	100.0	
Panel B: Company discriptive statistics			
Company stage level			
Buyout/Acquisition	14	1.9	1.9
Early Stage	223	29.6	31.5
Expansion	294	39.0	70.5
Later Stage	106	14.1	84.6
Other	45	6.0	90.6
Startup/Seed	71	9.4	100.0
Total	753	100.0	
Company industry group			
Biotechnology	50	6.6	6.6
Communications and Media	168	22.3	29.0
Computer Related	316	42.0	70.9
Medical/Health/Life Science	73	9.7	80.6
Non-High-Technology	62	8.2	88.8
Semiconductors/Other Elect	84	11.2	100.0
Total	753	100.0	
Company situation			
Acquisition	280	37.2	37.2
Active	234	31.1	68.3
Defunct	123	16.3	84.6
Went Public	86	11.4	96.0
Other	30	4.0	100.0
Total	753	100.0	

Table 2: Descriptive statistics II: Firms, funds, companies, and investments

This table presents descriptive statistics as of May 2009 for the entire treatment-control sample of venture capital firms, funds, portfolio companies, and investment rounds. The sample consists of U.S. venture capital investments made by the 20 largest U.S. university endowments into U.S. portfolio companies. For an investment to be included in the sample, I require an education background for at least one of the corresponding portfolio company's entrepreneurs.

Panel A: Firm descriptive statistics II	N	mean	sd	min	p50	max
Firm capital under management	24	3094.5	4444.4	200.0	1871.6	19918.0
Firm founding year	24	1986.2	9.6	1968.0	1985.0	2000.0
Panel B: Fund descriptive statistics II						
Fund capital under management	58	392.2	313.0	25.0	298.5	1600.0
Fund founding year	59	1998.1	3.3	1986	1999	2003
Panel C: Company descriptive statistics II						
Company founding year	695	1997.1	5.2	1953	1999	2003
Panel D: Investment descriptive statistics II						
Round number	776	1.9	1.4	1	1	13
Estimated round total investment	768	14.2	16.0	0.0	9.5	160.0
Round year	776	1999.4	3.0	1986	2000	2003

Table 3: Summary statistics and correlation matrix for main variables

This table presents summary statistics for the main variables used in this study. Panel A presents means and standard deviations. Panel B presents a correlation matrix. The sample consists of U.S. venture capital investments made by the 20 largest U.S. university endowments into U.S. portfolio companies. For an investment to be included in the sample, I require an education background for at least one of the corresponding portfolio company's entrepreneurs. IPO is a dummy that equals one whenever the portfolio company's current situation is coded as "Went Public" by VentureXpert. Investment is a dummy that equals one for the treated cohort. Connected is a dummy that equals one for the treatment group. DD is an interaction term equal to the product of Investment and Connected. Company (Firm) age is the natural logarithm of the difference between the investment round year and the portfolio company's (venture capital firm's) founding year+1. Firm (Fund) size is the natural logarithm of the venture capital firm's (fund's) reported capital under management measured in millions of dollars+1.

Panel A: Summary statistics	N	mean	sd	min	max
IPO	802	0.11	0.32	0	1
Investment	802	0.43	0.50	0	1
Connected	802	0.18	0.39	0	1
DD	802	0.07	0.26	0	1
Firm size	802	7.60	0.97	5.30	9.90
Firm age	802	2.55	0.80	0.00	3.58
Fund size	791	5.85	0.83	3.26	7.38
Company age	741	0.88	0.73	0.00	3.78

Panel B: Correlation matrix		1	2	3	4	5	6	7	8
Performance	1	1							
Investment	2	-0.10	1						
Connected	3	0.01	-0.01	1					
DD	4	0.00	0.35	0.56	1				
Firm size	5	-0.05	-0.03	-0.06	0.00	1			
Firm age	6	-0.02	-0.04	-0.15	-0.06	0.42	1		
Fund size	7	-0.17	0.24	0.03	0.15	0.43	0.21	1	
Company age	8	0.05	-0.01	-0.09	-0.07	0.10	0.09	-0.10	1

Table 4: Univariate tests for differences in means

This table presents the results for simple tests of equal means across different subsamples of the entire treatment-control sample. The sample consists of U.S. venture capital investments made by the 20 largest U.S. university endowments into U.S. portfolio companies. For an investment to be included in the sample, I require an education background for at least one of the corresponding portfolio company's entrepreneurs. Panel A compares differences in means between the treated and the untreated cohorts. Panel B compares differences in means between the treatment and the control groups. IPO is a dummy that equals one whenever the portfolio company's current situation is coded as "Went Public" by VentureXpert. Investment is a dummy that equals one for the treated cohort. Connected is a dummy that equals one for the treatment group. Company (Firm) age is the natural logarithm of the difference between the investment round year and the portfolio company's (venture capital firm's) founding year+1. Firm (Fund) size is the natural logarithm of the venture capital firm's (fund's) reported capital under management measured in millions of dollars+1.

Panel A: Comparing pre vs. post					
	Investment				
	No	Yes	t	Pr(T < t)	Pr(|T| > |t|)
IPO	0.14	0.07	**2.98**	1.00	0.00
Connected	0.19	0.18	0.27	0.61	0.79
Firm size	7.65	7.53	**1.78**	0.96	0.07
Firm age	2.57	2.51	1.13	0.87	0.26
Fund size	5.69	6.13	**-7.42**	0.00	0.00
Company age	0.91	0.85	1.10	0.86	0.27
Panel B: Comparing connected vs. non-connected					
	Connected				
	No	Yes	t	Pr(T < t)	Pr(|T| > |t|)
IPO	0.11	0.12	-0.09	0.46	0.93
Investment	0.39	0.37	0.27	0.61	0.79
Firm size	7.65	7.41	**2.64**	1.00	0.01
Firm age	2.62	2.24	**5.31**	1.00	0.00
Fund size	5.85	5.88	-0.43	0.34	0.67
Company age	0.92	0.73	**2.70**	1.00	0.01

Table 5: 20 largest university endowments: Rank, size, and data availability

This table presents a ranking of U.S. public and private university endowments by fiscal year 2000 market value of endowment assets. Endowment funds are measured in thousands of dollars.

All institutions ranked by fiscal year 2000 market value of endowment assets				
Rank	University endowment/Academic institution	Endowment funds	Rank 2005	In VentureXpert
1	Harvard Management Company, Inc.	18,844,338	1	Yes
2	Yale University	10,084,900	2	Yes
3	University of Texas Investment Management Company, The	10,013,175	4	Yes
4	Stanford Management Company	8,649,475	3	Yes
5	Princeton University	8,398,100	5	No
6	Massachusetts Institute of Technology	6,475,506	6	No
7	University of California	5,639,777	7	Yes
8	Emory University	5,032,683	11	Yes
9	Columbia University	4,263,972	8	Yes
10	Washington University in Saint Louis	4,234,599	13	Yes
11	Texas A&M University	4,205,849	9	No
12	University of Chicago	3,828,664	15	Yes
13	University of Michigan	3,468,372	10	Yes
14	Cornell University	3,436,926	17	Yes
15	Rice University	3,372,458	19	No
16	Northwestern University	3,368,233	14	Yes
17	University of Pennsylvania	3,200,812	12	Yes
18	University of Notre Dame	3,089,007	18	No
19	Duke Endowment, The	2,663,891	16	No
20	Dartmouth College	2,490,376	22	Yes

Table 6: Descriptive statistics: Academic institutions

This table presents the top 10 most connected academic institutions in the sample of entrepreneurs. The sample consists of U.S. venture capital investments made by the 20 largest U.S. university endowments into U.S. portfolio companies. For an investment to be included in the sample, I require an education background for at least one of the corresponding portfolio company's entrepreneurs. An individual is connected to an academic institution if he/she holds either an undergraduate or a graduate degree from that institution.

Top ten most connected academic institutions			
		Entrepreneurs	
Rank	Academic institution	Number of entrepreneurs	%
1	University of California	208	9.0
2	Stanford University	205	8.9
3	Harvard University	109	4.7
4	M.I.T.	91	3.9
5	California State University	68	2.9
6	University of Texas	54	2.3
7	Indian Institute of Technology	51	2.2
8	Cornell University	34	1.5
9	University of Pennsylvania	33	1.4
10	Yale University	33	1.4
Other		1424	61.6
Ivy League		294	12.7
Total		2310	100.0

Table 7: Differences-in-Differences: Individual investment level; Average effect; ols

This table presents the results from ordinary least squares regressions at the individual investment level. The treatment-control sample consists of U.S. venture capital investments made by the 20 largest U.S. university endowments into U.S. portfolio companies. For an investment to be included in the sample, I require an education background for at least one of the corresponding portfolio company's entrepreneurs. In this table, the treated cohort consists of all portfolio company investments made by funds where the university endowments actually invested and hence were limited partners. Meanwhile, the untreated cohort consists of all portfolio company investments made by the previous funds' predecessor- or follow-on funds where the university endowments did not invest and hence were not limited partners. The dependent variable, IPO, is a dummy that equals one whenever the portfolio company's current situation is coded as "Went Public" by VentureXpert. Investment is a dummy that equals one for the treated cohort. Connected is a dummy that equals one for the treatment group. DD is an interaction term equal to the product of Investment and Connected. Standard errors are double clustered at the portfolio company- and venture capital firm level and robust t-statistics are presented in brackets.

	1	2	3	4	5	6	7	8	9	10
Investment	**-0.08**	**-0.05**	**-0.09**	**-0.07**	**-0.08**	**-0.05**	**-0.09**	**-0.06**	**-0.07**	**-0.06**
	[-3.071]	[-2.119]	[-3.811]	[-2.715]	[-2.977]	[-2.217]	[-3.697]	[-2.248]	[-2.141]	[-2.103]
Connected	-0.03	-0.04	-0.04	-0.05	-0.03	-0.04	-0.04	-0.05	**-0.05**	-0.05
	[-0.680]	[-1.084]	[-1.274]	[-1.198]	[-0.646]	[-1.089]	[-1.262]	[-1.527]	[-1.686]	[-1.374]
DD	0.05	**0.07**	**0.08**	0.07	0.06	**0.07**	**0.08**	**0.09**	**0.09**	**0.1**
	[1.330]	[1.950]	[1.828]	[1.520]	[1.383]	[1.949]	[1.854]	[2.034]	[1.839]	[1.827]
Observations	910	910	910	910	910	910	910	910	910	833
R-squared	0.014	0.092	0.099	0.067	0.019	0.095	0.104	0.154	0.17	0.21
Controls										Yes
Round year FE		Yes				Yes		Yes	Yes	Yes
Firm FE				Yes					Yes	Yes
Stage FE					Yes	Yes	Yes	Yes	Yes	Yes
Industry FE			Yes				Yes	Yes	Yes	Yes

Table 8: Differences-in-Differences: Individual investment level; Actual- vs. Predecessor fund; ols

This table presents the results from ordinary least squares regressions at the individual investment level. The treatment-control sample consists of U.S. venture capital investments made by the 20 largest U.S. university endowments into U.S. portfolio companies. For an investment to be included in the sample, I require an education background for at least one of the corresponding portfolio company's entrepreneurs. In this table, the treated cohort consists of all portfolio company investments made by funds where the university endowments actually invested and hence were limited partners. Meanwhile, the untreated cohort consists of all portfolio company investments made by the previous funds' predecessor funds where the university endowments did not invest and hence were not limited partners. The dependent variable, IPO, is a dummy that equals one whenever the portfolio company's current situation is coded as "Went Public" by VentureXpert. Investment is a dummy that equals one for the treated cohort. Connected is a dummy that equals one for the treatment group. DD is an interaction term equal to the product of Investment and Connected. Standard errors are double clustered at the portfolio company- and venture capital firm level and robust t-statistics are presented in brackets.

	1	2	3	4	5	6	7	8	9	10
Investment	**-0.06**	**-0.04**	**-0.08**	**-0.06**	**-0.06**	**-0.05**	**-0.08**	**-0.06**	**-0.06**	-0.06
	[-2.684]	[-2.011]	[-3.460]	[-2.429]	[-2.500]	[-2.064]	[-3.322]	[-2.134]	[-1.752]	[-1.552]
Connected	0	-0.01	-0.01	0	0.01	-0.01	-0.01	-0.01	-0.01	-0.01
	[0.0861]	[-0.330]	[-0.196]	[-0.107]	[0.125]	[-0.284]	[-0.140]	[-0.284]	[-0.278]	[-0.132]
DD	0.02	0.05	0.04	0.02	0.03	0.05	0.05	0.06	0.05	0.06
	[0.489]	[1.139]	[0.912]	[0.486]	[0.527]	[1.138]	[0.959]	[1.242]	[1.070]	[1.039]
Observations	808	808	808	808	808	808	808	808	808	738
R-squared	0.011	0.098	0.092	0.073	0.015	0.102	0.096	0.153	0.182	0.221
Controls										Yes
Round year FE		Yes				Yes		Yes	Yes	Yes
Firm FE				Yes					Yes	Yes
Stage FE					Yes	Yes	Yes	Yes	Yes	Yes
Industry FE			Yes				Yes	Yes	Yes	Yes

Table 9: Differences-in-Differences: Individual investment level; Actual- vs. Follow-on fund; ols

This table presents the results from ordinary least squares regressions at the individual investment level. The treatment-control sample consists of U.S. venture capital investments made by the 20 largest U.S. university endowments into U.S. portfolio companies. For an investment to be included in the sample, I require an education background for at least one of the corresponding portfolio company's entrepreneurs. In this table, the treated cohort consists of all portfolio company investments made by funds where the university endowments actually invested and hence were limited partners. Meanwhile, the untreated cohort consists of all portfolio company investments made by the previous funds' follow-on funds where the university endowments did not invest and hence were not limited partners. The dependent variable, IPO, is a dummy that equals one whenever the portfolio company's current situation is coded as "Went Public" by VentureXpert. Investment is a dummy that equals one for the treated cohort. Connected is a dummy that equals one for the treatment group. DD is an interaction term equal to the product of Investment and Connected. Standard errors are double clustered at the portfolio company- and venture capital firm level and robust t-statistics are presented in brackets.

	1	2	3	4	5	6	7	8	9	10
Investment	**-0.14**	-0.08	**-0.15**	**-0.12**	**-0.14**	**-0.09**	**-0.16**	**-0.1**	-0.09	-0.06
	[-2.499]	[-1.527]	[-2.687]	[-1.662]	[-2.410]	[-1.749]	[-2.767]	[-1.911]	[-1.345]	[-1.179]
Connected	**-0.15**	**-0.16**	**-0.16**	**-0.18**	**-0.16**	**-0.17**	**-0.17**	**-0.2**	**-0.19**	**-0.22**
	[-2.787]	[-2.290]	[-3.172]	[-3.024]	[-2.723]	[-2.522]	[-3.445]	[-3.019]	[-2.696]	[-2.917]
DD	**0.18**	**0.18**	**0.2**	**0.2**	**0.19**	**0.2**	**0.21**	**0.23**	**0.22**	**0.27**
	[3.248]	[2.539]	[3.653]	[3.236]	[3.112]	[2.685]	[3.697]	[3.126]	[2.766]	[3.372]
Observations	510	510	510	510	510	510	510	510	510	472
R-squared	0.034	0.075	0.111	0.073	0.061	0.098	0.138	0.181	0.193	0.239
Controls										Yes
Round year FE		Yes				Yes		Yes	Yes	Yes
Firm FE				Yes					Yes	Yes
Stage FE					Yes	Yes	Yes	Yes	Yes	Yes
Industry FE			Yes				Yes	Yes	Yes	Yes

Table 10: Differences-in-Differences: Aggregate VC firm level; Average effect; ols

This table presents the results from ordinary least squares regressions at the venture capital firm level. Compared to the individual investment level analysis, in this table all variables are averaged at the venture capital firm level across the treatment and the control groups over the treated and the untreated cohorts. The treatment-control sample (with data at the individual investment level) consists of U.S. venture capital investments made by the 20 largest U.S. university endowments into U.S. portfolio companies. For an investment to be included in the sample, I require an education background for at least one of the corresponding portfolio company's entrepreneurs. In this table, the treated cohort consists of all portfolio company investments made by funds where the university endowments actually invested and hence were limited partners. Meanwhile, the untreated cohort consists of all portfolio company investments made by the previous funds' predecessor- or follow-on funds where the university endowments did not invest and hence were not limited partners. The dependent variable, IPO, is the average of a dummy that equals one whenever the portfolio company's current situation is coded as "Went Public" by VentureXpert. Investment is the average of a dummy that equals one for the treated cohort. Connected is the average of a dummy that equals one for the treatment group. DD is the average of an interaction term equal to the product of (the corresponding dummy to) Investment and (the corresponding dummy to) Connected. Standard errors are clustered at the venture capital firm level and robust t-statistics are presented in brackets.

	1	2
Investment	**-0.06**	-0.04
	[-1.627]	[-1.293]
Connected	**-0.07**	**-0.07**
	[-2.287]	[-2.287]
DD	0.05	0.06
	[1.354]	[1.511]
Observations	77	75
R-squared	0.069	0.095
Fund size		Yes

Table 11: Differences-in-Differences: Aggregate VC firm level; Actual- vs. Predecessor fund; ols

This table presents the results from ordinary least squares regressions at the venture capital firm level. Compared to the individual investment level analysis, in this table all variables are averaged at the venture capital firm level across the treatment and the control groups over the treated and the untreated cohorts. The treatment-control sample (with data at the individual investment level) consists of U.S. venture capital investments made by the 20 largest U.S. university endowments into U.S. portfolio companies. For an investment to be included in the sample, I require an education background for at least one of the corresponding portfolio company's entrepreneurs. In this table, the treated cohort consists of all portfolio company investments made by funds where the university endowments actually invested and hence were limited partners. Meanwhile, the untreated cohort consists of all portfolio company investments made by the previous funds' predecessor funds where the university endowments did not invest and hence were not limited partners. The dependent variable, IPO, is the average of a dummy that equals one whenever the portfolio company's current situation is coded as "Went Public" by VentureXpert. Investment is the average of a dummy that equals one for the treated cohort. Connected is the average of a dummy that equals one for the treatment group. DD is the average of an interaction term equal to the product of (the corresponding dummy to) Investment and (the corresponding dummy to) Connected. Standard errors are clustered at the venture capital firm level and robust t-statistics are presented in brackets.

	1	2
Investment	**-0.06**	-0.03
	[-1.832]	[-1.120]
Connected	-0.05	-0.04
	[-1.166]	[-0.962]
DD	0.03	0.03
	[0.667]	[0.648]
Observations	76	74
R-squared	0.055	0.112
Fund size		Yes

Table 12: Differences-in-Differences: Aggregate VC firm level; Actual- vs. Follow-on fund; ols

This table presents the results from ordinary least squares regressions at the venture capital firm level. Compared to the individual investment level analysis, in this table all variables are averaged at the venture capital firm level across the treatment and the control groups over the treated and the untreated cohorts. The treatment-control sample (with data at the individual investment level) consists of U.S. venture capital investments made by the 20 largest U.S. university endowments into U.S. portfolio companies. For an investment to be included in the sample, I require an education background for at least one of the corresponding portfolio company's entrepreneurs. In this table, the treated cohort consists of all portfolio company investments made by funds where the university endowments actually invested and hence were limited partners. Meanwhile, the untreated cohort consists of all portfolio company investments made by the previous funds' follow-on funds where the university endowments did not invest and hence were not limited partners. The dependent variable, IPO, is the average of a dummy that equals one whenever the portfolio company's current situation is coded as "Went Public" by VentureXpert. Investment is the average of a dummy that equals one for the treated cohort. Connected is the average of a dummy that equals one for the treatment group. DD is the average of an interaction term equal to the product of (the corresponding dummy to) Investment and (the corresponding dummy to) Connected. Standard errors are clustered at the venture capital firm level and robust t-statistics are presented in brackets.

	1	2
Investment	-0.18	-0.17
	[-1.576]	[-1.369]
Connected	**-0.21**	**-0.21**
	[-2.095]	[-2.029]
DD	**0.2**	**0.2**
	[1.767]	[1.757]
Observations	56	54
R-squared	0.183	0.186
Fund size		Yes

Table 13: Differences-in-Differences: Individual investment level; Average effect; logit

This table presents the results from logit regressions at the individual investment level. The treatment-control sample consists of U.S. venture capital investments made by the 20 largest U.S. university endowments into U.S. portfolio companies. For an investment to be included in the sample, I require an education background for at least one of the corresponding portfolio company's entrepreneurs. In this table, the treated cohort consists of all portfolio company investments made by funds where the university endowments actually invested and hence were limited partners. Meanwhile, the untreated cohort consists of all portfolio company investments made by the previous funds' predecessor- or follow-on funds where the university endowments did not invest and hence were not limited partners. The dependent variable, IPO, is a dummy that equals one whenever the portfolio company's current situation is coded as "Went Public" by VentureXpert. Investment is a dummy that equals one for the treated cohort. Connected is a dummy that equals one for the treatment group. DD is an interaction term equal to the product of Investment and Connected. Standard errors are double clustered at the portfolio company- and venture capital firm level and robust t-statistics are presented in brackets.

	1	2	3	4	5	6	7	8	9	10
Investment	**-0.91**	**-0.64**	**-1.21**	**-0.85**	**-0.93**	**-0.67**	**-1.21**	**-0.91**	**-0.98**	**-0.89**
	[-3.153]	[-2.115]	[-4.093]	[-2.679]	[-3.073]	[-2.227]	[-3.895]	[-2.246]	[-1.989]	[-1.849]
Connected	-0.25	-0.39	-0.48	-0.46	-0.24	-0.38	-0.47	**-0.55**	**-0.64**	**-0.64**
	[-0.617]	[-1.046]	[-1.344]	[-1.090]	[-0.585]	[-0.990]	[-1.322]	[-1.888]	[-2.191]	[-1.734]
DD	0.63	**0.88**	**0.99**	0.78	0.67	**0.9**	**1.05**	**1.15**	**1.1**	**1.36**
	[1.407]	[2.040]	[1.852]	[1.545]	[1.466]	[2.034]	[1.834]	[1.985]	[1.662]	[2.021]
Observations	910	903	886	832	910	903	886	879	825	751
Controls										Yes
Round year FE		Yes				Yes		Yes	Yes	Yes
Firm FE				Yes					Yes	Yes
Stage FE					Yes	Yes	Yes	Yes	Yes	Yes
Industry FE			Yes				Yes	Yes	Yes	Yes

Table 14: Differences-in-Differences: Individual investment level; Actual- vs. Predecessor fund; logit

This table presents the results from logit regressions at the individual investment level. The treatment-control sample consists of U.S. venture capital investments made by the 20 largest U.S. university endowments into U.S. portfolio companies. For an investment to be included in the sample, I require an education background for at least one of the corresponding portfolio company's entrepreneurs. In this table, the treated cohort consists of all portfolio company investments made by funds where the university endowments actually invested and hence were limited partners. Meanwhile, the untreated cohort consists of all portfolio company investments made by the previous funds' predecessor funds where the university endowments did not invest and hence were not limited partners. The dependent variable, IPO, is a dummy that equals one whenever the portfolio company's current situation is coded as "Went Public" by VentureXpert. Investment is a dummy that equals one for the treated cohort. Connected is a dummy that equals one for the treatment group. DD is an interaction term equal to the product of Investment and Connected. Standard errors are double clustered at the portfolio company- and venture capital firm level and robust t-statistics are presented in brackets.

	1	2	3	4	5	6	7	8	9	10
Investment	**-0.77**	**-0.62**	**-1.15**	**-0.78**	**-0.76**	**-0.64**	**-1.14**	**-1**	**-1.14**	**-1.23**
	[-2.791]	[-1.977]	[-3.866]	[-2.573]	[-2.608]	[-2.097]	[-3.607]	[-1.936]	[-1.757]	[-1.703]
Connected	0.04	-0.17	-0.13	-0.05	0.06	-0.12	-0.08	-0.12	-0.2	-0.13
	[0.0877]	[-0.356]	[-0.363]	[-0.125]	[0.138]	[-0.243]	[-0.221]	[-0.278]	[-0.469]	[-0.238]
DD	0.35	0.69	0.67	0.39	0.38	0.68	0.71	0.92	0.88	1.04
	[0.759]	[1.435]	[1.266]	[0.745]	[0.798]	[1.388]	[1.250]	[1.528]	[1.246]	[1.325]
Observations	808	801	784	734	808	801	784	777	727	577
Controls										Yes
Round year FE		Yes				Yes		Yes	Yes	Yes
Firm FE				Yes					Yes	Yes
Stage FE					Yes	Yes	Yes	Yes	Yes	Yes
Industry FE			Yes				Yes	Yes	Yes	Yes

Table 15: Differences-in-Differences: Individual investment level; Actual- vs. Follow-on fund; logit

This table presents the results from logit regressions at the individual investment level. The treatment-control sample consists of U.S. venture capital investments made by the 20 largest U.S. university endowments into U.S. portfolio companies. For an investment to be included in the sample, I require an education background for at least one of the corresponding portfolio company's entrepreneurs. In this table, the treated cohort consists of all portfolio company investments made by funds where the university endowments actually invested and hence were limited partners. Meanwhile, the untreated cohort consists of all portfolio company investments made by the previous funds' follow-on funds where the university endowments did not invest and hence were not limited partners. The dependent variable, IPO, is a dummy that equals one whenever the portfolio company's current situation is coded as "Went Public" by VentureXpert. Investment is a dummy that equals one for the treated cohort. Connected is a dummy that equals one for the treatment group. DD is an interaction term equal to the product of Investment and Connected. Standard errors are double clustered at the portfolio company- and venture capital firm level and robust t-statistics are presented in brackets.

	1	2	3	4	5	6	7	8	9	10
Investment	**-1.36**	**-0.75**	**-1.64**	**-1.26**	**-1.45**	**-0.97**	**-1.8**	**-1.52**	-1.4	-0.44
	[-3.144]	[-1.803]	[-3.516]	[-1.731]	[-3.135]	[-1.977]	[-3.533]	[-2.025]	[-1.320]	[-0.329]
Connected	**-1.53**	**-1.66**	**-1.81**	**-1.79**	**-1.69**	**-1.91**	**-2**	**-2.44**	**-2.59**	**-3.21**
	[-1.766]	[-1.773]	[-2.285]	[-1.988]	[-1.861]	[-1.987]	[-2.263]	[-2.028]	[-2.053]	[-2.348]
DD	**1.92**	**2**	**2.4**	**2.17**	**2.11**	**2.25**	**2.73**	**3.14**	**3.07**	**4.14**
	[1.957]	[1.795]	[2.321]	[2.039]	[2.022]	[1.938]	[2.260]	[2.048]	[1.966]	[2.687]
Observations	510	504	500	432	510	504	500	494	426	378
Controls										Yes
Round year FE		Yes				Yes		Yes	Yes	Yes
Firm FE				Yes					Yes	Yes
Stage FE					Yes	Yes	Yes	Yes	Yes	Yes
Industry FE			Yes				Yes	Yes	Yes	Yes

Table 16: Differences-in-Differences: Individual investment level; Average effect; ols; 10 largest university endowments

This table presents the results from ordinary least squares regressions at the individual investment level. The treatment-control sample consists of U.S. venture capital investments made by the 10 largest U.S. university endowments into U.S. portfolio companies. For an investment to be included in the sample, I require an education background for at least one of the corresponding portfolio company's entrepreneurs. In this table, the treated cohort consists of all portfolio company investments made by funds where the university endowments actually invested and hence were limited partners. Meanwhile, the untreated cohort consists of all portfolio company investments made by the previous funds' predecessor- or follow-on funds where the university endowments did not invest and hence were not limited partners. The dependent variable, IPO, is a dummy that equals one whenever the portfolio company's current situation is coded as "Went Public" by VentureXpert. Investment is a dummy that equals one for the treated cohort. Connected is a dummy that equals one for the treatment group. DD is an interaction term equal to the product of Investment and Connected. Standard errors are double clustered at the portfolio company- and venture capital firm level and robust t-statistics are presented in brackets.

	1	2	3	4	5	6	7	8	9	10
Investment	**-0.1**	**-0.07**	**-0.11**	**-0.09**	**-0.1**	**-0.07**	**-0.12**	**-0.08**	**-0.09**	**-0.09**
	[-3.699]	[-2.786]	[-4.764]	[-3.406]	[-3.667]	[-2.932]	[-4.657]	[-2.887]	[-2.692]	[-2.647]
Connected	-0.04	-0.05	-0.05	-0.06	-0.04	-0.05	-0.05	**-0.06**	**-0.06**	-0.07
	[-0.885]	[-1.213]	[-1.345]	[-1.247]	[-0.908]	[-1.257]	[-1.395]	[-1.639]	[-1.823]	[-1.494]
DD	**0.08**	**0.09**	**0.11**	**0.09**	**0.08**	**0.1**	**0.12**	**0.13**	**0.12**	**0.14**
	[1.905]	[2.424]	[2.716]	[2.116]	[2.013]	[2.433]	[2.720]	[2.731]	[2.553]	[2.299]
Observations	819	819	819	819	819	819	819	819	819	751
R-squared	0.02	0.094	0.096	0.069	0.025	0.098	0.101	0.152	0.168	0.208
Controls										Yes
Round year FE		Yes				Yes		Yes	Yes	Yes
Firm FE				Yes					Yes	Yes
Stage FE					Yes	Yes	Yes	Yes	Yes	Yes
Industry FE			Yes				Yes	Yes	Yes	Yes

Table 17: Differences-in-Differences: Individual investment level; Actual- vs. Predecessor fund; ols; 10 largest university endowments

This table presents the results from ordinary least squares regressions at the individual investment level. The treatment-control sample consists of U.S. venture capital investments made by the 10 largest U.S. university endowments into U.S. portfolio companies. For an investment to be included in the sample, I require an education background for at least one of the corresponding portfolio company's entrepreneurs. In this table, the treated cohort consists of all portfolio company investments made by funds where the university endowments actually invested and hence were limited partners. Meanwhile, the untreated cohort consists of all portfolio company investments made by the previous funds' predecessor funds where the university endowments did not invest and hence were not limited partners. The dependent variable, IPO, is a dummy that equals one whenever the portfolio company's current situation is coded as "Went Public" by VentureXpert. Investment is a dummy that equals one for the treated cohort. Connected is a dummy that equals one for the treatment group. DD is an interaction term equal to the product of Investment and Connected. Standard errors are double clustered at the portfolio company- and venture capital firm level and robust t-statistics are presented in brackets.

	1	2	3	4	5	6	7	8	9	10
Investment	**-0.08**	**-0.07**	**-0.11**	**-0.08**	**-0.09**	**-0.07**	**-0.11**	**-0.09**	**-0.09**	**-0.1**
	[-3.837]	[-2.890]	[-4.816]	[-3.551]	[-3.647]	[-3.043]	[-4.683]	[-3.088]	[-2.664]	[-2.299]
Connected	-0.01	-0.02	-0.02	-0.01	-0.01	-0.02	-0.01	-0.02	-0.02	-0.02
	[-0.149]	[-0.463]	[-0.348]	[-0.262]	[-0.129]	[-0.448]	[-0.327]	[-0.428]	[-0.433]	[-0.322]
DD	0.05	0.07	0.07	0.05	0.05	0.07	**0.08**	**0.09**	**0.09**	0.1
	[0.955]	[1.433]	[1.586]	[0.990]	[1.014]	[1.456]	[1.658]	[1.758]	[1.617]	[1.463]
Observations	717	717	717	717	717	717	717	717	717	656
R-squared	0.017	0.104	0.088	0.074	0.021	0.107	0.093	0.152	0.181	0.22
Controls										Yes
Round year FE		Yes				Yes		Yes	Yes	Yes
Firm FE				Yes					Yes	Yes
Stage FE					Yes	Yes	Yes	Yes	Yes	Yes
Industry FE			Yes				Yes	Yes	Yes	Yes

Table 18: Differences-in-Differences: Individual investment level; Actual- vs. Follow-on fund; ols; 10 largest university endowments

This table presents the results from ordinary least squares regressions at the individual investment level. The treatment-control sample consists of U.S. venture capital investments made by the 10 largest U.S. university endowments into U.S. portfolio companies. For an investment to be included in the sample, I require an education background for at least one of the corresponding portfolio company's entrepreneurs. In this table, the treated cohort consists of all portfolio company investments made by funds where the university endowments actually invested and hence were limited partners. Meanwhile, the untreated cohort consists of all portfolio company investments made by the previous funds' follow-on funds where the university endowments did not invest and hence were not limited partners. The dependent variable, IPO, is a dummy that equals one whenever the portfolio company's current situation is coded as "Went Public" by VentureXpert. Investment is a dummy that equals one for the treated cohort. Connected is a dummy that equals one for the treatment group. DD is an interaction term equal to the product of Investment and Connected. Standard errors are double clustered at the portfolio company- and venture capital firm level and robust t-statistics are presented in brackets.

	1	2	3	4	5	6	7	8	9	10
Investment	**-0.14**	-0.07	**-0.15**	**-0.12**	**-0.14**	**-0.09**	**-0.15**	**-0.1**	-0.09	-0.05
	[-2.515]	[-1.480]	[-2.648]	[-1.596]	[-2.431]	[-1.673]	[-2.724]	[-1.799]	[-1.259]	[-0.987]
Connected	**-0.15**	**-0.15**	**-0.16**	**-0.18**	**-0.16**	**-0.17**	**-0.17**	**-0.19**	**-0.19**	**-0.21**
	[-2.635]	[-2.167]	[-3.031]	[-2.851]	[-2.606]	[-2.385]	[-3.314]	[-2.878]	[-2.562]	[-2.674]
DD	**0.18**	**0.19**	**0.21**	**0.22**	**0.2**	**0.2**	**0.22**	**0.24**	**0.23**	**0.28**
	[3.314]	[2.583]	[3.760]	[3.298]	[3.183]	[2.706]	[3.769]	[3.142]	[2.800]	[3.133]
Observations	468	468	468	468	468	468	468	468	468	433
R-squared	0.036	0.08	0.103	0.074	0.063	0.103	0.13	0.175	0.188	0.235
Controls										Yes
Round year FE		Yes				Yes		Yes	Yes	Yes
Firm FE				Yes					Yes	Yes
Stage FE					Yes	Yes	Yes	Yes	Yes	Yes
Industry FE			Yes				Yes	Yes	Yes	Yes

Table 19: Differences-in-Differences: Aggregate VC firm level; Average effect; ols; 10 largest university endowments

This table presents the results from ordinary least squares regressions at the venture capital firm level. Compared to the individual investment level analysis, in this table all variables are averaged at the venture capital firm level across the treatment and the control groups over the treated and the untreated cohorts. The treatment-control sample (with data at the individual investment level) consists of U.S. venture capital investments made by the 10 largest U.S. university endowments into U.S. portfolio companies. For an investment to be included in the sample, I require an education background for at least one of the corresponding portfolio company's entrepreneurs. In this table, the treated cohort consists of all portfolio company investments made by funds where the university endowments actually invested and hence were limited partners. Meanwhile, the untreated cohort consists of all portfolio company investments made by the previous funds' predecessor- or follow-on funds where the university endowments did not invest and hence were not limited partners. The dependent variable, IPO, is the average of a dummy that equals one whenever the portfolio company's current situation is coded as "Went Public" by VentureXpert. Investment is the average of a dummy that equals one for the treated cohort. Connected is the average of a dummy that equals one for the treatment group. DD is the average of an interaction term equal to the product of (the corresponding dummy to) Investment and (the corresponding dummy to) Connected. Standard errors are clustered at the venture capital firm level and robust t-statistics are presented in brackets.

	1	2
Investment	**-0.07**	**-0.06**
	[-2.009]	[-1.837]
Connected	**-0.08**	**-0.08**
	[-2.582]	[-2.564]
DD	**0.08**	**0.08**
	[1.846]	[1.898]
Observations	71	69
R-squared	0.087	0.096
Fund size		Yes

Table 20: Differences-in-Differences: Aggregate VC firm level; Actual- vs. Predecessor fund; ols; 10 largest university endowments

This table presents the results from ordinary least squares regressions at the venture capital firm level. Compared to the individual investment level analysis, in this table all variables are averaged at the venture capital firm level across the treatment and the control groups over the treated and the untreated cohorts. The treatment-control sample (with data at the individual investment level) consists of U.S. venture capital investments made by the 10 largest U.S. university endowments into U.S. portfolio companies. For an investment to be included in the sample, I require an education background for at least one of the corresponding portfolio company's entrepreneurs. In this table, the treated cohort consists of all portfolio company investments made by funds where the university endowments actually invested and hence were limited partners. Meanwhile, the untreated cohort consists of all portfolio company investments made by the previous funds' predecessor funds where the university endowments did not invest and hence were not limited partners. The dependent variable, IPO, is the average of a dummy that equals one whenever the portfolio company's current situation is coded as "Went Public" by VentureXpert. Investment is the average of a dummy that equals one for the treated cohort. Connected is the average of a dummy that equals one for the treatment group. DD is the average of an interaction term equal to the product of (the corresponding dummy to) Investment and (the corresponding dummy to) Connected. Standard errors are clustered at the venture capital firm level and robust t-statistics are presented in brackets.

	1	2
Investment	**-0.08**	**-0.05**
	[-2.251]	[-1.673]
Connected	-0.06	-0.06
	[-1.370]	[-1.270]
DD	0.05	0.06
	[1.072]	[1.137]
Observations	70	68
R-squared	0.069	0.096
Fund size		Yes

Table 21: Differences-in-Differences: Aggregate VC firm level; Actual- vs. Follow-on fund; ols; 10 largest university endowments

This table presents the results from ordinary least squares regressions at the venture capital firm level. Compared to the individual investment level analysis, in this table all variables are averaged at the venture capital firm level across the treatment and the control groups over the treated and the untreated cohorts. The treatment-control sample (with data at the individual investment level) consists of U.S. venture capital investments made by the 10 largest U.S. university endowments into U.S. portfolio companies. For an investment to be included in the sample, I require an education background for at least one of the corresponding portfolio company's entrepreneurs. In this table, the treated cohort consists of all portfolio company investments made by funds where the university endowments actually invested and hence were limited partners. Meanwhile, the untreated cohort consists of all portfolio company investments made by the previous funds' follow-on funds where the university endowments did not invest and hence were not limited partners. The dependent variable, IPO, is the average of a dummy that equals one whenever the portfolio company's current situation is coded as "Went Public" by VentureXpert. Investment is the average of a dummy that equals one for the treated cohort. Connected is the average of a dummy that equals one for the treatment group. DD is the average of an interaction term equal to the product of (the corresponding dummy to) Investment and (the corresponding dummy to) Connected. Standard errors are clustered at the venture capital firm level and robust t-statistics are presented in brackets.

	1	2
Investment	-0.18	-0.17
	[-1.546]	[-1.355]
Connected	**-0.21**	**-0.21**
	[-2.072]	[-1.915]
DD	**0.2**	**0.21**
	[1.811]	[1.823]
Observations	53	51
R-squared	0.171	0.168
Fund size		Yes

PAPER 3

Goldrush Dynamics of Private Equity

with Samuel Lee

ABSTRACT. We present a simple dynamic model of entry and exit in a private equity market with heterogeneous fund managers, a depletable stock of target companies, and learning about investment profitability. Its predictions match a number of stylized facts: Aggregate fund activity follows waves with endogenous transitions from booms to busts. Supply and demand in the private equity market are inelastic, and the supply comoves with investment valuations. High industry performance precedes high entry, which in turn precedes low industry performance. Differences in fund performance are persistent, first-time funds underperform the industry, and the first-time funds that are raised in boom periods are unlikely to be succeeded by follow-on funds. Fund performance and fund size are positively correlated across private equity firms, but negatively correlated across consecutive funds by the same firm. Finally, boom periods can make "too much capital chase too few deals."

1. Introduction

Capital commitments and investments in the private equity industry are cyclical. This has been documented for the venture capital industry by Gompers and Lerner (2000) and Lerner (2002), and for the buyout industry by Kaplan and Stein (1993) and Kaplan and Stromberg (2009). To give a recent example, the global buyout volume shrunk from around $527 billion in early 2007 to around $124 billion by mid-2008. Such boom-bust patterns suggest that the private equity business is transitory, expanding and contracting as the opportunities for profitable control investments emerge and disappear.

We develop a simple model which captures this transient nature. It produces waves which endogenously transition from booms to busts. Furthermore, the dynamics of entry, prices and returns *within* a wave match a wide range of empirical patterns: the inelasticity of private equity supply to private equity demand and vice versa; the

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procyclicality of capital inflow and investment valuations; persistent performance differences across private equity firms; the underperformance of first-time funds; the positive (negative) relationship between entry and past industry returns (subsequent industry returns); the positive (negative) relationship between fund performance and fund size in the cross-section (in the time-series); and the notion of "too much capital chasing too few deals."[1]

The basic idea behind the model is to liken private equity waves to goldrushes. A goldrush starts with the discovery of gold which attracts gold diggers who settle nearby in the hope of making a fortune. As more gold is extracted over time, more gold diggers migrate to the area until all claims are staked. When the gold reserves dry up, the gold diggers either retire or migrate to the next discovery.[2] Our model essentially draws an analogy between gold discoveries and the emergence of private equity investment opportunities, gold diggers and private equity firms, claims and investments, as well as gold and investment returns.

In the model, a fixed population of companies becomes improvable because of a latent productivity shock. To keep matters simple, the improvement can only be realized by private equity firms, investment firms specialized in acquiring and reorganizing companies. To do so, a private equity firm must raise a private equity fund, find a target company, and negotiate a price at which the company's shareholders are willing to sell the company. There are many private equity firms that repeatedly decide whether to raise a fund to acquire a company, i.e, whether to enter the private equity market. Each firm's entry decision depends on its own management ability, the number of available target companies, and the expected gains from reorganization. Importantly, the true expected gains are unknown but can be partially inferred from past investment outcomes. This learning process creates a link between past and current entry decisions.

The model yields a private equity wave under the plausible assumption that—absent positive experiences—the market's (prior) expectations are low. In that case, only few private equity funds are raised at the outset. When the true shock is low, these early funds earn disappointing returns, and investment activity subsequently

[1] These empirical patterns are documented by Gompers and Lerner (2004), Gompers and Lerner (2000), Kaplan and Schoar (2005), Acharya, Franks, and Servaes (2007), and Ljungqvist, Hochberg, and Vissing-Jorgensen (2009). The reported performance patterns in private equity stands in stark contrast to the evidence in the mutual fund industry (Malkiel (1995); Berk and Green (2004)) and the investment management industry (Busse, Goyal, and Wahal (2006)).

[2] An example is the Klondike Goldrush. In August 1896, gold was discovered in the Klondike river. By the summer of 1897, the nearby town of Dawson had grown to a population of 3,500. Around that time, steamships unloaded about one and half million dollars worth of Klondike gold in San Francisco and Seattle. Within half a year, the population of Dawson climbed to over 30,000. In the summer of 1899, the goldrush was officially over.

subsides. Conversely, when the true shock is high, the early funds earn promising returns, which attracts other private equity firms into the market. As fund activity rises, the magnitude of the shock is revealed at a faster rate, which in turn accelerates entry. This feedback loop between learning and entry fuels the boom. The countereffect is that the influx of new funds depletes the pool of target companies faster. The accelerating attrition ultimately leads to the bust.

The wave pattern reflects the inelasticity of demand and supply in the private equity market. Since the demand for private equity arises from exogenous shocks, it does not respond positively to supply. On the contrary, increases in supply reduce the demand faster. The supply of private equity is inelastic because the private equity firms only learn gradually about the profitability of investing. The *speed of learning* depends on the degree of investment specificity and on the market's prior beliefs. The more idiosyncratic a target company is, the less informative is its reorganization outcome about the prospects of reorganizing other companies. Furthermore, if the market ex ante perceives a high shock as very unlikely, it is more reluctant to interpret successful outcomes as a sign of general profitability. The *speed of entry* depends on the skill distribution among private equity firms. For instance, a skill pyramid with "few at the top, and many at the bottom" produces few entrants when expectations are low but many entrants when expectations are high. The combination of slow learning with a skill pyramid leads to waves with slow starts, explosive booms and sudden crashes.

When the market becomes more confident about the expected reorganization value, potential target companies increase in value, which in turn affects the negotiations between funds and target shareholders. Thus, a rise in market confidence not only attracts more private equity funds to the market but also raises the price that these funds must pay to acquire target companies. In other words, aggregate fund activity and valuation levels are jointly determined by market expectations and hence move together, consistent with the evidence in Kaplan and Stein (1993) and Gompers and Lerner (2000). However, even when expectations increase, the *true* profitability remains unaffected by learning. That is, higher valuation levels do not imply that investments are more profitable. In fact, as valuations increase relative to "fundamentals", average fund profitability declines during a wave. This decline is reinforced by the entry of less skilled private equity firms. Similarly, the model yields a rationale for the positive relationship between entry and past industry performance, and for the negative relationship between entry and subsequent fund performance, documented by Kaplan and Schoar (2005). High industry performance today raises market confidence, which increases fund activity tomorrow and—at the same time—decreases future fund performance via higher prices.

At the fund level, the heterogeneity among private equity firms immediately implies persistent differences in fund performance: a fund that has outperformed the industry is likely to continue to outperform the industry with its follow-on funds. A more interesting prediction of the model is that a private equity firm's time of entry is related to its quality. In any period, only the private equity firms above a certain threshold quality raise a fund, and the threshold is decreasing in the level of market confidence. Dynamically, this means that entry and exit follow a last-in-first-out pattern: As the level of market confidence varies over time, the least skilled private equity firms are always the latest to enter and, by the same token, always the first to exit the market. Thus, at any point in time, the first-time funds (the latest entrants) underperform the industry. However, their follow-on funds—if the boom continues—improve in relative performance as private equity firms of even lower quality will enter the market. The lowest-quality firms enter after highly profitable periods, when valuation levels are high, and during periods in which fund activity will ex post turn out to have peaked. Due to the last-in-first-out pattern, such firms are likely to exit the market soon after. Or putting it differently, funds first raised in boom times are less likely to see follow-on funds. These predictions are consistent with the evidence in Kaplan and Schoar (2005).

Kaplan and Schoar (2005) also study the relation between fund size and fund profitability and report that the relationship is—on the one hand—positive and concave across different funds, and—on the other hand— negative across consecutive funds of the same private equity firm. While the baseline model assumes a uniform and constant fund size, these patterns naturally arise in an extension that allows private equity firms to run larger funds at an increasing marginal cost. The firms' marginal cost functions reflect their management ability. For any given level of market confidence, cross-sectional variation in size is driven by variation in ability: larger funds are managed by better private equity firms, which is the reason why they are more profitable. By contrast, for a given firm (quality), time variation in fund size is driven by time variation in market confidence, i.e., purely by learning. When market confidence is higher, a private equity fund makes more acquisitions. At the same time, the fund pays higher prices (due to increased valuation levels) and operates at a higher average cost (due to its larger size). Thus, as the true profitability of investing is time-invariant, the fund's true expected profit (per investment) is inversely related to its size during a wave.

Finally, we study the effects of fund competition in a simple model extension which incorporates search frictions into the private equity market. In the presence of such frictions, a fund's bargaining power vis-à-vis a target company is weaker when there are more competing funds or fewer target companies in the market. This reinforces

the link between market confidence and acquisition prices: when the market becomes more confident, the prices rise not only because a target's total expected reorganization value increases but also because the entry of new funds shifts bargaining power to the targets. Compared to the absence of competition, fund profitability drops faster as a result of fund entry or target attrition, i.e., when "more money chases fewer deals." Such congestion effects slow down entry and precipitate exit so that fund activity both builds up and declines more gradually than in the basic model. Thus, fund competition affects neither the boom-bust pattern nor the last-in-first-out pattern of fund activity, but it "smoothes" the wave.

The phenomenon of waves has previously been analyzed theoretically by Jovanovic and Rousseau (2002), Shleifer and Vishny (2003) and Rhodes-Kropf and Robinson (2008) in the context of mergers and acquisitions; and by Inderst and Muller (2004) and Michelacci and Suárez (2004) in the context of venture capital markets. These papers address neither the role of learning and attrition nor the endogenous *intra*-wave dynamics of investment, prices, and returns.

We are not the first to study the impact of learning on financial decisions. For instance, learning models have been used to explain financial innovations (Persons and Warther (1997)), stock market prices (Timmermann (1993), Timmermann (1996); Veronesi (1999); Pastor and Veronesi (2009)), going public decisions (Pastor, Taylor, and Veronesi (2006); He (2007)), and business cycles (Veldkamp (2005); Van Nieuwerburgh and Veldkamp (2006)). Contemporaneous work by Ljungqvist, Hochberg, and Vissing-Jorgensen (2009) and Glode and Green (2009) also incorporates learning into a model of the private equity market. In both models, fund investors (limited partners) learn about the ability of fund managers (general partners). By contrast, in our model, fund managers learn about market conditions which affect the profitability of private equity investments.

The remainder of the paper is organized as follows. Section 2 presents the basic model. Section 3 derives the competitive Markov equilibrium. Section 4 analyzes the equilibrium dynamics. Section 5 presents the model extensions which incorporate fund size and fund competition. Section 6 concludes the paper.

2. Model

Consider a risk-neutral economy in discrete time, $t \in \mathbb{Z}_0^+$, with a fixed population of $\mathcal{N}$ companies. Initially, each company is run by an incumbent manager, and its discounted dividend value under the incumbent manager is normalized to 0.

In period 0, the economy experiences a latent productivity shock. The shock makes each company—if appropriately reorganized—improvable. A company's value after reorganization, V, is gamma-distributed with shape parameter $\alpha > 0$ and scale parameter $1/\beta > 0$. The mean of the gamma distribution, $\overline{V} = \alpha/\beta$, reflects the expected reorganization value. We assume that α is commonly known, whereas β is unobserved. Since a lower β translate into a higher expected reorganization value, this implies that the market is uncertain about the magnitude of the shock. The market's initial beliefs about β are also represented by a gamma distribution, with known shape and inverse scale parameters $\tau > 0$ and $1/\gamma > 0$ respectively.[3]

We assume that the incumbent managers cannot generate the value improvement. We also abstract from the possibility that they procure the necessary human capital through consulting services or the labor market. Instead, let there be $\mathcal{M}$ outside management teams who can carry out this task provided that they make a control investment in the company and set up the necessary operations. We henceforth refer to these potential investor-managers as private equity firms.[4]

In every period $t \geq 1$, each private equity *firm* decides whether or not to enter the market for corporate control for the duration of that period. To enter, the firm must raise and operate a fund which imposes a per-period cost (e.g., due to search activities, due diligence, negotiations, legal expenses). The cost is fixed but varies across private equity firms: $C_1 < C_2 < \cdots < C_{\mathcal{M}}$. For later use, we define a continuously increasing function $C(\cdot)$ with $C(i) = C_i$ for all $i \in \{1, 2, \ldots, \mathcal{M}\}$. This function reflects the talent distribution among private equity managers and is commonly known. To ensure interior equilibria, let $C(1) = 0$ and $C(\mathcal{M}) = \infty$.[5]

A private equity *fund* seeks to invest in companies. We assume that (human) resource or time constraints impose a limit on the number of investments that a fund can undertake simultaneously. To keep matters simple, we normalize this limit to one company per period. (Endogenous limits are discussed in section 5.1.) In every period, each active fund is paired with a potential target (or portfolio) company. Once paired, they negotiate the price at which the fund can purchase (a control stake in) the company. Negotiations are modeled as Nash bargaining with $\omega \in (0, 1)$ denoting

[3] For our purposes, the gamma distribution is attractive because it rules out negative value improvements and allows for a tractable Baysian analysis. The qualitative results should carry over to any stochastic setting with parameter uncertainty where high realizatons lead Bayesian agents to increase their expectations about the mean of the underlying probability distribution.

[4] Private equity funds often enforce changes in the governance of their portfolio firms (Gertner and Kaplan (1996); Acharya, Hahn, and Kehoe (2009); Cornelli and Karakas (2008)). Acharya, Hahn, and Kehoe (2009) report that one-third of CEOs in buyout targets are fired in the first 100 days.

[5] The formulation of heterogeneity in terms of cost is not to be taken too literally. Similar results obtain when private equity firms instead differ in their ability to improve their portfolio companies. We choose the cost formulation because it makes the analysis more tractable.

the relative bargaining power of the fund. If a negotiation fails, the involved parties part and neither is paired again in the ongoing period. Otherwise, the fund purchases and reorganizes the company. A reorganized company harbors no further potential for improvement. Thus, there is attrition.

$M_t \leq \mathcal{M}$ and $N_t \leq \mathcal{N}$ respectively denote the number of private equity funds (operated) and potential target companies (available) *in* period t. For $M_t > N_t$, we adopt the convention that the most efficient funds are paired with a company first. Similarly, for $M_t < N_t$, we adopt the convention that those companies which have been in negotiations previously are paired with a fund first.

The timing of the model is as follows. In period 0, everyone in the economy learns about the occurrence of the shock but does not observe its magnitude, i.e. β. In each subsequent period $t \geq 1$, events unfold in the below order:

(1) Everyone enters the period with beliefs $\overline{V}_t = E_t(\overline{V})$.
(2) All private equity firms decide whether to raise a fund for the current period.
(3) Funds are paired with a target company and bargain over the purchase price.
(4) Funds that have successfully negotiated the price acquire their targets.
(5) Acquired companies are reorganized and their new value becomes public.
(6) Everyone updates their beliefs.

3. Equilibrium

The key decisions in the model are the private equity firms' repeated decisions of whether or not to raise a fund. Let $a_t^i \in \{1, 0\}$ denote firm i's decision in period t, where $a_t^i = 1$ if the firm decides to raise a fund, and $a_t \equiv (a_t^1, \ldots, a_t^{\mathcal{M}})$. We assume competitive behavior and rational expectations. That is, each private equity firm ignores its own impact on *aggregate* variables but has unbiased expectations about (the evolution of) these variables.

In each period t, the history of all previous investment outcomes is commonly known. The history has a *direct* impact on the payoffs from t onward only through its impact on the state variables $\overline{V}_t$ and N_t. Given a state $(\overline{V}_t, N_t)$, firm i chooses a_t^i to maximize the sum of its discounted expected future per-period profits:

$$\Pi^i(a_t, \overline{V}_t, N_t) = \mathrm{E}_t \left[\sum\nolimits_{\tau=t}^{\infty} \delta^{\tau - t} \pi_\tau^i(a_\tau, \overline{V}_\tau, N_\tau) \,\middle|\, \overline{V}_t, N_t \right]$$

where $\pi_t^i(a_t, \overline{V}_t, N_t)$ is i's period-t profit, and $\delta \in [0, 1]$ is the discount factor.

Our analysis focuses on Markov strategies which depend on the history solely through the current state of the world (see Maskin and Tirole, 2001). In a Markov equilibrium, the optimal entry strategies and the equilibrium profits can therefore be

written as $a_t^* = a_t(\overline{V}_t, N_t)$ and $\Pi^i(a_t^*, \overline{V}_t, N_t)$. Given optimal future behavior, this allows us to decompose $\Pi^i(a_t, \overline{V}_t, N_t)$ into the profit from the current period and a future "franchise" value:

$$\pi_t^i(a_t, \overline{V}_t, N_t) + \delta \mathrm{E}_t[\Pi^i(a_{t+1}^*, \overline{V}_{t+1}, N_{t+1}) \,|\overline{V}_t, N_t].$$

Importantly, i's decision today affects the future only through its impact on the aggregate state variables $\overline{V}_{t+1}$ and N_{t+1}. Under competitive behavior, each private equity firm ignores this (intertemporal) impact. Consequently, the firm treats the entry decisions in different periods like *independent* options—behaving de facto *as if* it were myopic. Intuitively, the private equity firm perceives the impact of its current investment on future market conditions as so small that its sole decision criterion is the immediate profit.[6]

The dynamics of the competitive Markov equilibrium are the focus of the present paper. The key driver of these dynamics is a feedback loop between entry decisions and market conditions: entry today depends on how market conditions have evolved, which in turn depends on past entry decisions. Therefore, we subsequently analyze entry decisions for given market conditions, and in turn market conditions for a given history of entry decisions.

3.1. Entry decisions. To determine entry in period t for a given state $(\overline{V}_t, N_t)$, we must first determine the outcome of the ensuing bargaining stage. Let P_t^i denote the purchase price that the fund (of firm) i and its potential target company bargain over. Furthermore, let O_t^i and O_t^c respectively denote the outside options (threat points) of the fund and the company. The Nash bargaining solution is given by

$$P_t^i = \arg\max(\overline{V}_t - P_t^i - O_t^i)^\omega (P_t - O_t^c)^{1-\omega}. \tag{3.1}$$

To derive the bargaining solution, we need to specify the outside options. For the quasi-myopic fund, the outside option is to save the amount—rather than to invest it in the company—for one period at the risk-free rate, which yields P_t/δ. Its current outside option is today's net present value of saving the amount, which is $O_t^i = \delta\,(P_t/\delta) - P_t = 0$. By contrast, the target company's outside option is the expected payoff from returning to the market in the hope of being acquired in the future. Suppose that a company which has been in negotiations previously is certainly paired with a fund in the next period. (This holds in equilibrium: a unilateral deviator would be the only

[6] The assumption of competitive behavior has two principal consequences: On the one hand, firms with negative expected current profits do not take into account the possibility of active *experimentation*. As a result, they become *adaptive* learners (Van Nieuwerburgh and Veldkamp (2006); Veldkamp (2005)). On the other hand, firms with positive expected current profits neglect the possibility of *procrastinating* entry to learn more from information produced by others.

such company, and would hence be paired with fund 1 in the next period). As in the literature on search markets, a deviator's payoff from a future match is the payoff from a successful deal, i.e., the future "inside" option. Thus, the company's current outside option is $O_t^c = \delta E_t[P_{t+1}]$.

Given these outside options, the Nash bargaining solution is $P_t = (1-\omega)\overline{V}_t + \omega\delta E_t[P_{t+1}]$. To get a closed-form solution, we conjecture an equilibrium outcome in which the price is a *linear* function of $\overline{V}_t$ such that $P_t = \psi\overline{V}_t$. Since $E_t[\overline{V}_{t+1}] = \overline{V}_t$ (by the Law of Iterated Expectations), it then follows that $E_t[P_{t+1}] = E_t[\psi\overline{V}_{t+1}] = \psi\overline{V}_t = P_t$. Thus, *if* P_t is a linear function of $\overline{V}_t$, it is a martingale. Conversely, if P_t is a martingale, the Nash bargaining solution is indeed linear in $\overline{V}_t$: substituting $E_t[P_{t+1}] = P_t$ into the bargaining solution yields

$$P_t = \frac{1-\omega}{1-\omega\delta}\overline{V}_t. \tag{3.2}$$

Thus, $\psi = \frac{1-\omega}{1-\omega\delta)}$ is a rational equilibrium outcome. Consistent with intuition, a more patient firm (lower δ) bargains for a higher price ($\partial\psi/\partial\delta > 0$). Furthermore, since a failure to agree is inefficient, all negotiations lead to a transaction.

Having derived the bargaining solution, we now turn to the entry decision. A quasi-myopic private equity firm raises a fund (only) if the current expected profit from investing is positive. That is, the firm enters the market if $C_i \leq \overline{V}_t - P_t = (1-\psi)\overline{V}_t$ and is sure to be matched with a target company. Since this is true for all private equity firms, there exists a cut-off cost C_{i^*} such that all and only firms with $C_i \leq C_{i^*}$ raise a fund. In fact, i^* is equivalent to M_t, the total number of funds raised in t. It is defined by $C(i^*) = (1-\psi)\overline{V}_t$ as long as $i^* < N_t$; and by $i^* = N_t$ otherwise.

LEMMA 1. *There exists a competitive Markov equilibrium in which all and only private equity firms with* $C_i \leq C(M_t) = \min\{(1-\psi)\overline{V}_t, C(N_t)\}$ *enter the market for corporate control with a fund in period* t. *The number of funds* M_t *is increasing in* $\overline{V}_t$ *but decreasing in* N_t, *while the acquisition price* P_t *is increasing in* $\overline{V}_t$.

The equilibrium is intuitive: More talented private equity managers are more inclined to enter so that, in every period, the relatively "best" private equity firms raise a fund. Furthermore, more private equity funds are raised when the expected reorganization value is higher (or the funds have more bargaining power). The number of funds is also (weakly) increasing in the target stock N_t, i.e., the number of available target companies. Though the target stock only matters when it becomes a binding constraint ($N_t \leq M_t$). In section 5.2, we discuss possible channels for market congestion, which can cause the attrition in the target stock to have a more continuous impact on fund activity.

3.2. Market conditions. Lemma 1 characterizes the equilibrium outcome for a given state process $\{\overline{V}_t, N_t\}$. We now turn to the determination of this process. The target stock N_t monotonically decreases as more and more investments are completed. More specifically, if M^t denotes the number of investments consummated prior to t, the target stock at the beginning of period t is $N_t = \mathcal{N} - M^t$.

Past investment also allows market participants to make inference about the true β, i.e., to learn about the magnitude of the shock. In this respect, the revenue generated by each reorganization represents a noisy signal about $\overline{V}$. We assume that reorganization revenues are observable to other market participants. This assumption is not to be taken literally, since private equity firms are in practice known to be secretive about their returns. Rather, it parsimoniously captures the notion that information about superior profitability leaks—at least informally—to other potential targets or to investors who are interested in starting their own private equity funds. The information spillover is central to the dynamics, as it creates a intertemporal link between past performance and future market entry.

Let v_j denote the revenue generated by investment j. A history of investment outcomes is $\mathcal{H}_t = \{v_j\}_{j=1}^{M^t}$, and the historic average is $\overline{v}^t = \sum_{j=1}^{M^t} (v_j/M^t)$. Given a history $\mathcal{H}_t$, the posterior distribution of $\overline{V}$ is *inverse* gamma with shape and scale parameters $\tau + M^t\alpha$ and $\alpha\,(\gamma + M^t\overline{v}^t)$ respectively. (Details of the Bayesian updating process are provided in Appendix A.) In period t, the market's expectations about the reorganization value are equal to the mean of the inverse gamma distribution, $\overline{V}_t = E(V\,|\mathcal{H}_t)$, or more precisely

$$\overline{V}_t = \frac{\alpha\,(\gamma + M^t\overline{v}^t)}{\tau + M^t\alpha - 1}. \tag{3.3}$$

The conditional expectation (3.3) contains all distributional parameters except β, about which inference is being made. Recall that α is the known shape parameter of the V-distribution, whereas τ and $1/\gamma$ are the parameters of the distribution representing the market's initial (period-0) beliefs about the true β.

LEMMA 2. *$\overline{V}_t$ is ceteris paribus (i) increasing in $\overline{v}^t$, (ii) increasing in M^t if and only if $\overline{v}^t \geq \alpha\gamma/(\tau - 1)$, and (iii) increasing in α and γ but decreasing in τ.*

Current expectations increase with the historic average, because good past outcomes indicate that the reorganization value is high. In addition, if the historic average is high (low) relative to initial expectations, current expectations increase (decrease) in the number of past investments. The reason is that additional observations increase the precision of the estimate (in either direction). Finally, current expectations are higher when the initial expectations $\overline{V}_0 = E(\alpha/\beta\,|\mathcal{H}_0)$ were high, which explains why they are

increasing in α and decreasing in $E(\beta) = \tau/\gamma$. In the subsequent analysis, we assume that $\overline{V}_0$ is strictly positive, though very small. This is meant to capture that, absent positive experiences, the market is sceptical about the prospects of reorganization.

4. Dynamics

We now study entire equilibrium paths to characterize the dynamics of aggregate fund activity, prices and returns. A conceptual difficulty is that, even for a given β, the economy evolves stochastically so that there is no *unique* equilibrium path. To describe "typical" properties of an equilibrium path, we characterize the path that is obtained when every reorganization yields the mean revenue $\overline{V}$. We refer to this path (somewhat incorrectly) as the "trend" path, and index it with o.

It is important to bear in mind that the agents in the model are unaware that the deviations from the mean are zero on the trend path. Hence, they update their beliefs as if the reorganization revenues were genuinely random. More precisely, since $\overline{v}^t = \overline{V}$ for all t, market expectations on the trend path evolve according to

$$\overline{V}_t^o = \frac{\alpha(\gamma + M^t\overline{V})}{\tau + M^t\alpha - 1}. \tag{4.1}$$

The expectations monotonically converge to $\overline{V}$ as M^t goes to infinity. The speed of convergence decreases for large absolute values of τ and γ (keeping their ratio constant). Accordingly, one may interpret a large value of $\tau = \bar{z}\gamma$ for constant $\bar{z}$ as a low "signal-to-noise" ratio.

4.1. Waves. In $t = 0$, the economy receives news about the occurrence of the shock and forms prior expectations about the expected reorganization value. For entry to occur, these expectations must exceed $C_1/(1-\psi)$ so that at least private equity firm 1 finds it worthwhile to raise a fund (Lemma 1). Since $C_1 = 0 < \overline{V}_0$, there is initial entry and consequently some learning that can serve as impetus for future entry.

4.1.1. *Learning and attrition.* Given entry, the evolution of fund activity (on the trend path) is determined by the true $\overline{V}$. If $\overline{V}$ is small, the initial reorganizations generate modest revenues, and investment activity remains low. Indeed, for $\overline{V} < \overline{V}_0$, the revenues disappoint the market and investment activity subsides. By contrast, if $\overline{V}$ is large, the market becomes increasingly optimistic because the investments are more profitable than expected. This attracts new funds, which in turn causes the target stock to decline faster. The two effects, *learning* and *attrition*, have countervailing consequences for future fund activity. When the number of funds reaches the number of remaining targets, investment climaxes and then collapses.

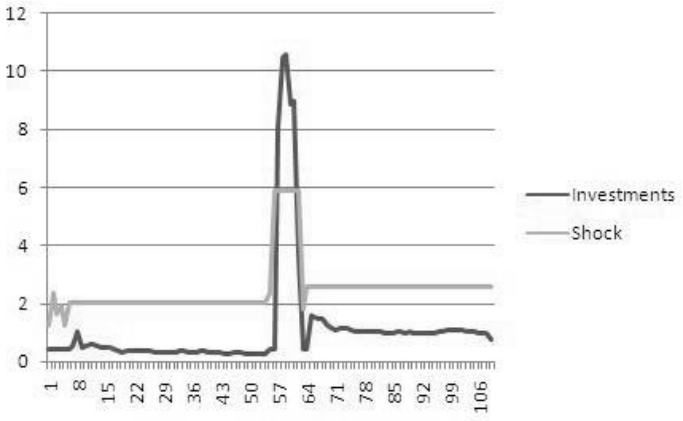

Figure 1: Long-run pattern

The ultimate decline in investments is rather extreme on the trend path. Yet, it epitomizes the wave pattern inherent in any equilibrium path. Even on stochastic paths, investment booms endogenously transition to sudden busts.

PROPOSITION 1. *Expansions in fund activity follow a boom-bust pattern.*

In reality, productivity shocks occur more than once. In most cases, the shocks are probably small with little impact on overall activity. In a few cases, however, the shocks may be large, leading to a wave-like expansion in fund activity. While ex post observed, such waves are ex ante unpredictable. To illustrate such a long-run pattern, we simulate the equilibrium paths for a large number of shocks $\{\beta_k\}$ drawn from a gamma distribution with a high mean τ/γ (so that $\overline{V}_0$ is low). Figure 1 depicts a representative sequence of shocks with the fund activity that followed in their wake. As expected, lengthy periods with little fund activity are interrupted by a rare large wave. Thus, the model can plausibly produce patterns that are consistent with the documented cyclicality of private equity activity (Kaplan and Stein (1993); Lerner (2002); Acharya, Franks, and Servaes (2007); Kaplan and Stromberg (2009)).[7]

4.1.2. *Inelastic supply.* The specific shape of a wave depends on the speed of entry, which in turn depends on the speed of learning and on the skill distribution $C(\cdot)$. On

[7] For instance, venture capital activity expanded during the biotechnology boom in the early 1990s and during the information technology boom in the late 1990s. Similarly, buyout activity experienced high levels in the 1980s and in the mid-2000s.

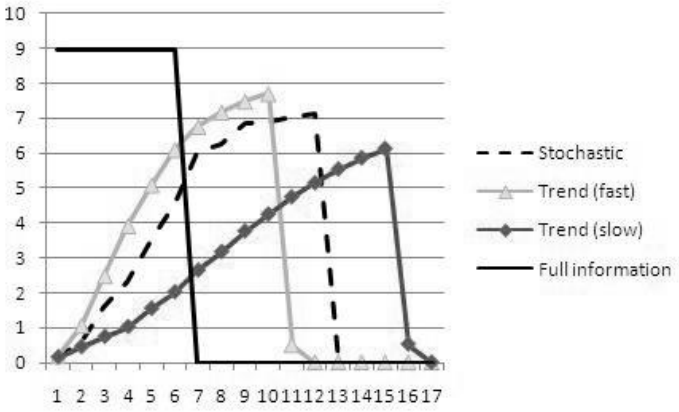

Figure 2: Different speeds of learning.

the one hand, when learning is slow (high $\tau = \bar{z}\gamma$), the market develops confidence more slowly. On the other hand, when skill is scarce (high $C' > 0$ and low $C'' < 0$), private equity firms want to be more confident before they enter. When slow learning and skill scarcity are combined, fund activity incubates slowly, then suddenly booms, and crashes in the end. The boom occurs when market confidence reaches a level that attracts many entrants, which in turn accelerate learning and boosts confidence even further. The crash occurs because, once fund activity reaches its climax, the high rate of attrition rapidly diminishes the target stock. (The magnitude of the wave depends, of course, also on the true $\overline{V}$ and on the initial target stock $\mathcal{N}$.)

Figure 2 depicts four different equilibrium paths following a large shock ($\overline{V} \gg \overline{V}_0$). The plain solid line is the equilibrium path when $\overline{V}$ is immediately observed. The other two solid lines (marked with triangles and diamonds respectively) are trend paths that differ in the speed of learning. Finally, the dashed line depicts the stochastic path that corresponds to the trend path with faster learning. Comparing the different paths bears on the notion of inelastic supply and demand in the private equity market (Gompers and Lerner (2000)). Demand inelasticity is hard-wired into the model. Demand arises due to the exogenous productivity shock; as such, it does not respond to changes in supply. By contrast, supply inelasticity is endogenous. Supply responds slowly to changes in demand because private equity managers do not enter until they are confident enough. Accordingly, supply is less elastic when learning is slower or skill is scarcer.

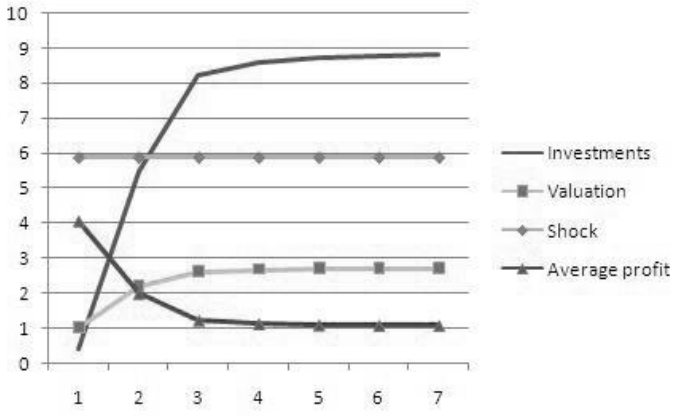

Figure 3: Entry, valuation and average profit.

4.2. Industry. We now describe in more detail how, at the industry level, (i) fund activity relates to valuation levels in the market, (ii) average fund performance evolves during a wave, and (iii) fund activity relates to past and future performance.

4.2.1. *Entry and valuation.* When the market grows more confident about the expected reorganization value, potential target companies increase in value. That is, a rise in market confidence not only attracts more private equity funds to the market but also raises the price that these funds must pay to acquire target companies (Lemma 1).

PROPOSITION 2. *Fund activity and valuation levels increase together.*

Proposition 2 is consistent with Kaplan and Stein (1993) who document that, during the buyout wave in the 1980s, buyout prices rose relative to fundamentals. Gompers and Lerner (2000) find similar results using a large data set comprising private equity investments in different stages and industries from 1987 to 1995. Specifically, they report that capital inflows into the private equity industry coincided with higher valuations of the funds' new investments. Both papers argue that the valuation increases were driven by fund competition rather than by improved investment prospects, suggesting that too much capital was chasing too few attractive investment opportunities.

The model can explain the observed pattern even in the absence of fund competition (which we introduce in section 5.2). Higher entry and higher valuations are *jointly* caused by learning about the expected reorganization value. However, neither effect

coincides with a concurrent or subsequent increase in the actual reorganization value.[8] The top three lines in Figure 3 illustrate these relationships for a trend path.

4.2.2. *Cross-sectional average performance.* In spite of learning, the market expectations $\overline{V}_t$ typically diverge from the true $\overline{V}$. When taking the model to empirical data, this distinction is crucial as observed fund revenues reflect the true $\overline{V}$—as opposed to the *subjective* expectations $\overline{V}_t$. Model predictions about fund performance therefore depend on $\overline{V}$. At the industry level, the *true* (data-generating) process that determines *average* per-period fund profits is $\bar{\pi}_t = \bar{v}_t - P_t - \overline{C}_t$, where $\bar{v}_t$ is the average gross return (reorganization revenue), and $\overline{C}_t = \sum_{i=1}^{M_t} (C_i/M_t)$ reflects average fund quality, in period t.

To see how average per-period fund profits evolve on the trend path, we simply need to set $\bar{v}_t = \overline{V}$, $P_t = P_t^o = \psi \overline{V}_t^o$, $M_t = M_t^o$, and $\overline{C}_t = \overline{C}_t^o = \sum_{i=1}^{M_t^o} (C_i/M_t^o)$. For $\overline{V} > \overline{V}_0$, which induces a wave, we know from (4.1) that market confidence, $\overline{V}_t^o$, monotonically increases over time. This causes prices, P_t^o, and fund activity, M_t^o, to monotonically increase (Lemma 1) but average fund quality, $1/\overline{C}_t^o$, to monotonically decrease (see section 4.3.1). All the while, the *true* expected reorganization value, $\overline{V}$, remains *constant*. The rising prices and the declining quality thus imply that $\bar{\pi}_t^o$ decreases over time.

PROPOSITION 3. *In a wave, average per-period fund performance tends to decrease.*

The line marked with triangles in figure 3 shows the evolution of average fund profits on a trend path. The decrease in average profits is steeper than the increase in prices because of the declining fund quality. It is noteworthy that Proposition 3 is not the result of increased fund competition. It merely requires learning and heterogeneity among private equity firms.

The decline in fund profitability across vintages appears to be at odds with the empirical finding that first-time funds underperform the industry (Kaplan and Schoar (2005)). However, this is not the case if the comparison between first-time and later-time funds is made in the cross-section, or if the comparison between first-time and later-time funds by the same private equity firm is based on the performance *relative* to the industry. Sections 4.3.2 and 4.3.3 elaborate on these points. Nevertheless, the model cannot explain *systematic* increases in the *absolute* performance of consecutive funds by the same private equity firm during a wave.

4.2.3. *Lagged entry-performance correlations.* Kaplan and Schoar (2005) find that capital flows *to* the private equity industry are positively correlated with last period's industry returns but negatively correlated with next period's fund returns. Note that

[8] If the shock to profitability is a shock to future cash flows, the increase in valuation levels corresponds to an increase in valuation multiples, such as the price-earnings ratio.

our model in general exhibits dynamics where industry growth goes together with a decline in fund profits, i.e., where high past performance precedes high(er) future entry and low(er) future performance.

To highlight such dynamics, let us consider a stochastic path for a shock that happens to coincide with the market's initial expectations, $\overline{V} = \overline{V}_0$. The dynamics on the stochastic path are driven by the exogenous random process $\{\overline{v}_t\}$, i.e., the random (average) per-period revenues. As market confidence in the next period, $\overline{V}_{t+1}$, positively depends on the average revenues in the current period, $\overline{v}_t$, the process $\{\overline{v}_t\}$ serves as a "leading" indicator. To see this, note that

$$\overline{v}^t = \frac{M^{t-1}}{M^t}\overline{v}^{t-1} + \frac{M_t}{M^t}\overline{v}_t \quad \text{and} \quad \overline{V}_{t+1} = \frac{\alpha\left(\gamma + M^t\overline{v}^t\right)}{\tau + M^t\alpha - 1}$$

and therefore

$$M_{t+1} = C^{-1}\left[(1-\psi)\,\overline{V}_{t+1}\right], \quad P_{t+1} = \psi\overline{V}_{t+1}, \quad \text{and} \quad \overline{C}_{t+1} = \sum_{i=1}^{M_{t+1}}\left(C_i/M_{t+1}\right)$$

are all increasing in $\overline{v}_t$. That is, via the historic average, high period-t revenues increase market confidence, fund activity, prices, and average costs in period $t+1$.

Now consider the preditive power of $\{\overline{v}_t\}$ with respect to fund i's per-period fund profits $\{\pi_t^i\}$. Given a history up to t, the mean of the true (data-generating) distribution of i's profit in $t+1$ is

$$E_{t+1}\left[\pi_{t+1}^i \middle| \overline{V}_{t+1} = \overline{V}_0\right] = \overline{V}_0 - \psi\frac{\alpha\left(\gamma + M^t\overline{v}^t\right)}{\tau + M^t\alpha - 1} - C_i,$$

which increases in the average period-t revenue $\overline{v}_t$ (via the historic average $\overline{v}^t$). Similarly, consider $\Delta\left(\overline{v}_t\right) \equiv E_{t+1}\left[\overline{\pi}_{t+1}\middle|\overline{V}_{t+1} = \overline{V}_0\right] - \overline{\pi}(t)$, which represents the expected "drop" in average fund profits from t to $t+1$ as a function of $\overline{v}_t$:

$$\Delta\left(\overline{v}_t\right) = \overline{V}_0 - \overline{v}_t + \left(P_t - P_{t+1}\right) + \left(\overline{C}_t - \overline{C}_{t+1}\right).$$

Clearly, $\Delta'\left(\overline{v}_t\right) = -1 - \left(\partial P_{t+1}/\partial\overline{v}_t\right) - \left(\partial\overline{C}_{t+1}/\partial\overline{v}_t\right) < 0$. On the one hand, a higher average revenue today both increases prices ($\partial P_{t+1}/\partial\overline{v}_t > 0$) and decreases average fund quality ($\partial\overline{C}_{t+1}/\partial\overline{v}_t > 0$) tomorrow. On the other hand, since average per-period revenues, $\{\overline{v}_t\}$, are independent draws from distributions with mean $\overline{V}_0$, any realization $\overline{v}_t > \overline{V}_0$ means that the market was "lucky" in t. In comparison, the revenues in $t+1$ are likely to be "corrected" downwards.

PROPOSITION 4. *High industry performance predicts high entry, which in turn predicts lower industry performance.*

Figure 4 illustrates the performance-entry patterns of a stochastic path. One may be tempted to view them as "bad timing" by private equity firms that choose to enter

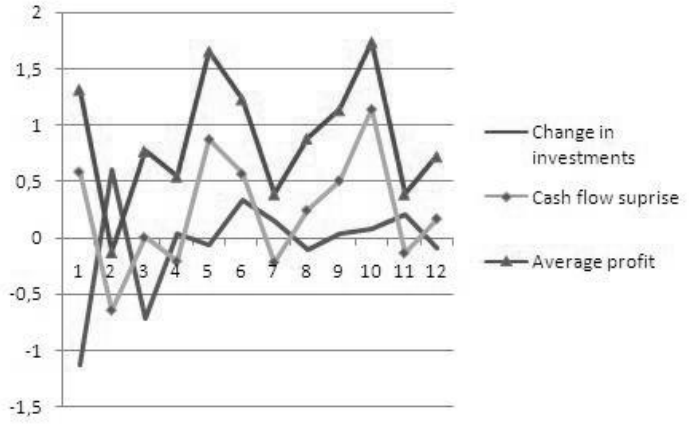

Figure 4: Lagged correlations.

the market when profitability drops, while being absent when profitability is high. However, such patterns emerge naturally in a model with learning, where changes in perceived profitability and in actual profitability do not necessarily go in the same direction.

4.3. Funds. Given skill heterogeneity and entry timing, the model also generates both cross-sectional and time-series predictions about performance at the level of individual funds, to which we turn below.

4.3.1. *Persistent differences and last-in-first-out pattern.* While average profitability declines during a wave, performance differences among private equity firms are persistent. That is, a firm (or a particular fund) that has outperformed the industry likely continues to outperform the industry in subsequent periods. This follows directly from the assumed skill heterogeneity, and is consistent with the empirical evidence (Kaplan and Schoar (2005)).

A more interesting implication of the model is that a private equity firm's quality and its time of entry are related. By Lemma 1, all and only firms above a threshold quality level C_{i^*} enter the market, and this threshold level is increasing in the expected reorganization value $\overline{V}_t$. This implies that, if the market becomes more confident (higher $\overline{V}_t$), the funds raised by newly entering firms are of lower quality than the funds of "incumbent" firms. By the same token, if the market becomes less confident (lower $\overline{V}_t$), the firms that exit—i.e., do not raise a follow-up fund—are of lower quality

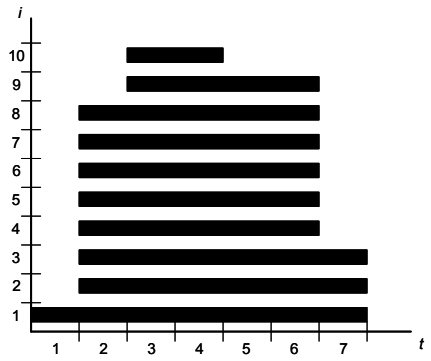

Figure 5: Last in, first out

than the firms that remain in the market. Thus, as $\overline{V}_t$ varies over time, entry and exit follow a last-in-first-out pattern: the least talented are the latest to enter when market conditions improve, and the earliest to exit when the conditions deteriorate. Figure 5 illustrates this for the case of ten partnerships and a stochastic path that lasted for seven periods.

4.3.2. *First-time fund underperformance.* The last-in-first-out pattern endogenously creates a cross-sectional link between a fund's "age" and its performance relative to the industry. For example, first-time funds are run by less skilled managers than contemporaneous later-time funds.

PROPOSITION 5. *Funds with short track records tend to underperform the industry and are less likely to raise follow-on funds.*

Proposition 5 highlights that a positive relationship between the maturity of a private equity fund and its performance need not (solely) be driven by experience gains ("learning-by-doing"). Rather, it may reflect a causal relation between the fund managers' intrinsic abilities and their timing of entry and exit. Note further that many new funds are raised after highly profitable periods (Proposition 4), when valuation levels are high (Proposition 2), and during periods in which fund activity ex post turns out to have peaked (Proposition 1). Given the last-in-first-out pattern, these funds are run by the least qualified managers who are likely to exit the market soon after.

COROLLARY 1. *Funds first raised in boom times are less likely to see follow-on funds.*

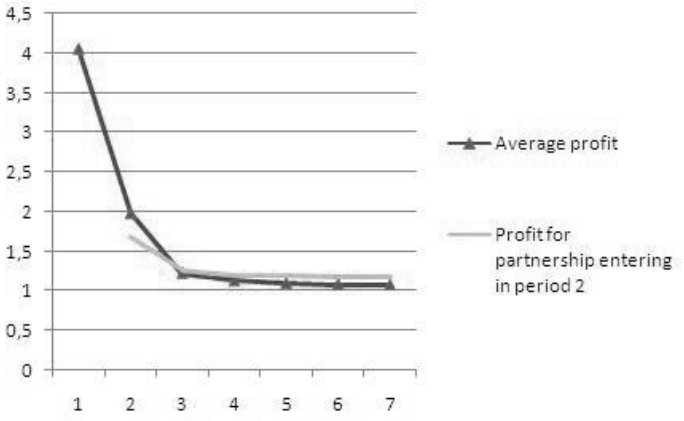

Figure 6: First-time funds.

Proposition 5 and Corollary 1 are both consistent with the evidence in Kaplan and Schoar (2005). Broadly speaking, the predicted last-in-first-out pattern says that many "transient" private equity firms emerge during a wave, while the firms that are left at the end are those that have been around from the beginning.

4.3.3. *Relative improvement over time.* Proposition 5 is a potential explanation for why first-time funds (young private equity firms) underperform the industry in the cross-section. At the time a private equity firm i enters the market with its first fund, it belongs to the least skilled firms in the industry. However, if the boom continues, even less skilled firms enter in subsequent periods. As a result, the relative quality of firm i's follow-on funds improves over time.

PROPOSITION 6. *Consecutive funds tend to improve in relative performance.*

Figure 6 illustrates this result by comparing the average fund profit on a trend path with the profit of a private equity firm that enters the market in period 2. While its first fund performs below average, its follow-on funds outperform the average fund in the industry from period 3 onwards.

5. Extensions

5.1. Fund size. Kaplan and Schoar (2005) also study the relationship between fund size and fund profitability and report two distinct findings: the relationship is positive and concave across different funds, whereas it is negative across funds from

the same private equity firms. Our baseline model is mute on this issue as it assumes a uniform and constant fund size. In this section, we extend the model to allow for variable fund size and show that the above relationships between size and profitability arise naturally.

For simplicity, suppose that $\mathcal{M} = 2$. Each private equity firm $i \in \mathcal{M}$ can now undertake as many investments as desired. However, we assume that a firm's per-period cost of operating a fund is increasing and convex in the number of considered investments. More specifically, let $C_{it}(M_{it}) = (M_{it} + C_i)^2$ where C_i is a constant that reflects the (inverse) quality of firm i, and M_{it} is the number of investments undertaken by firm i in period t.[9]

5.1.1. *Fund size and cross-sectional performance.* As long as $M_t \leq N_t$ is not a binding constraint, the number of investments chosen by private equity firm i in period t satisfies $C_{it}(M_{it}) = (1-\psi)\overline{V}_t$. This yields

$$M_{it} = \sqrt{(1-\psi)\overline{V}_t} - C_i.$$

Since $C_1 < C_2$, this immediately implies that the fund of firm 1 is larger than the fund of firm 2. That is, fund size increases with fund quality.

We measure a fund's profitability by its true expected profit *per investment*

$$\frac{M_{it}(\overline{V} - P_t) - C_{it}(M_{it})}{M_{it}} = \overline{V} - P_t - \frac{(1-\psi)\overline{V}_t}{\sqrt{(1-\psi)\overline{V}_t} - C_i}$$

which is decreasing in C_i. Thus, the larger fund earns a higher return per investment. The reason is that the average cost per investment is lower for the better fund, whereas the true expected revenue per investment $\overline{V} - P_t$ is the same for both funds. Rewriting the expected profit per investment as $\overline{V} - P_t - (1-\psi)\overline{V}_t/M_{it}$ and differentiating twice with respect to M_{it} furthermore shows that the relationship between fund size and fund profitability is concave.

PROPOSITION 7. *Within the cross-section of funds, performance is increasing and concave in fund size.*

This is consistent with the first of the two findings mentioned above. For given market expectations, the better private equity firm raises a larger fund. Fund size and fund profitability are jointly driven by the fund managers' quality, and hence positive correlated. This result relies on the heterogeneity among fund managers but does not exploit the dynamic properties of the model, to which we turn next.

[9] The results also hold for $C_{it}(M_{it}) = M_{it}^2 + C_i$. In this case, a fund's marginal cost per investment is the same across all partnerships. By contrast, under the cost function in the text, a fund's marginal cost per investment decreases in the partnership's talent.

5.1.2. *Fund size and time-series performance.* To examine how a fund size and fund profitability evolve during a wave, consider two arbitrary points in time, t'' and t', such that $\overline{V}_{t''} > \overline{V}_{t'}$. From the above analysis, it follows that (as long as $M_t \leq N_t$ is not a binding constraint) a private equity firm i raises a larger fund in t'' than in t', i.e., $M_{it''} > M_{it'}$. Its true expected profit in t can be written as

$$\overline{V} - P_t - \frac{(M_{it} + C_i)^2}{M_{it}}.$$

Since $P_t = \psi \overline{V}_t$, we know that $P_{t''} > P_{t'}$. Furthermore, $(M_{it} + C_i)^2 / M_{it}$ is increasing in M_{it}. Taken together, this implies that the true expected revenue per investment $\overline{V} - P_t$ is lower in t'' (due to the higher prices), while the average cost per investment is higher in t'' (due to the larger fund size).

PROPOSITION 8. *Across consecutive funds of the same private equity firm, fund performance is decreasing in fund size.*

During a wave, market expectations tend to rise over time. Proposition 8 says that, as a result, private equity firms will raise larger but less profitable funds in the course of a wave. In fact, the decrease in profitability across consecutive funds will be proportional to the increase in size, consistent with the second finding by Kaplan and Schoar (2005).

5.2. Fund competition. One approach to modeling fund competition is to incorporate search frictions into the model. With search frictions, the more parties enter one side of the market, the more difficulty they have in finding alternative trading partners. As a result, bargaining power shifts to the other side of the market.[10]

Such "congestion" effects arising from fund competition tend to reinforce many of the conclusions of our model. To illustrate this, we split the bargaining game in stage 3 into three substages. In substage 3-1, each fund is paired with a company. As before, they bargain over the price at which the fund can acquire the company. Each pair that successfully negotiates the price moves immediately to stage 4. If a negotiation fails, the pair moves to substage 3-2, in which the fund tries to find another target company. The probability of finding a new target is given by the matching function $\phi(m, n)$, where m is the number of funds contemporaneously searching for a new target, and n is the number of available target companies. In substage 3-3, the fund bargains with a newfound target or, when the search fails, resumes negotiations with the previous one. In either case, successful negotiations lead to stage 4. A failure to agree moves the pair to the next period.

[10] Several papers have used this approach to model venture capital markets and merger markets (Inderst and Muller (2004); Michelacci and Suárez (2004); Rhodes-Kropf and Robinson (2008)).

We make standard assumptions about the matching function: $\partial\phi/\partial m < 0$ and $\partial\phi/\partial n > 0$. For a fund, the probability of being matched with a (new) company is lower when there are many other funds on the search, and higher when there are many available target companies. To simplify matters, we further assume that the target companies have all the bargaining power in substage 3-3. Let $\rho \in (0, \delta)$ denote the *intra*-period discount factor between substages 3-1 and 3-3.

We solve the bargaining game for an arbitrary fund i in period t by backward induction. In substage 3-3, any company negotiating with the fund offers the price $\overline{V}_t$, and the fund accepts the offer. In substage 3-1, the initial fund-company pair bargains under the conjecture that all contemporaneous negotiations are successful (which is true in equilibrium). Thus, the fund's and the company's outside options are given by $O_t^i = 0$ and $O_t^c = \rho\left[1 - \phi\left(1, N_t - M_t\right)\right]\overline{V}_t$. (The pool of alternative target companies excludes the $M_t - 1$ companies that are conjectured to successfully negotiate with the other funds and the current negotiation partner.) The Nash bargaining solution (3.1) is then given by $P_t = \psi\overline{V}_t$ where

$$\psi = (1 - \omega) + \omega\rho\left[1 - \phi\left(1, N_t - M_t\right)\right].$$

Given the properties of the matching function, the price is increasing in the number of funds and decreasing in the number of potential targets. In reduced form, we can therefore define the sharing rule as a function $\psi(N_t, M_t)$ where $\partial\psi/\partial N_t > 0$ and $\partial\psi/\partial M_t < 0$. Note that $\psi(N_t, M_t)$ measures the degree of fund competition. It is worth emphasizing that, along with N_t and M_t, the degree of competition endogenously varies over time. For example, by attracting more entry, an increase in market confidence, $\overline{V}_t$, will increase fund competition.

Thus, the key difference to the basic model is that the sharing rule ψ is not time-invariant but increases with entry and attrition. In a model with fund competition, prices therefore increase—and fund profitability deteriorates—faster as more funds enter the market and the target stock is depleted, capturing the idea that profits drop when "more money chases fewer deals." This slows down entry and precipitates exit so that the fund activity both builds up and declines more gradually than in the basic model. In other words, fund competition neither undermines the boom-bust pattern nor the last-in-first-out pattern of fund activity; it merely "smoothes" the wave.

6. Conclusions

The paper presents a model of the private equity market in which heterogenous private equity firms learn about investment profitability from past outcomes and the stock of potential target companies is depletable. We derive the optimal entry and exit

strategies of private equity firms as a function of their ability and market expectations. A characteristic feature of the model is that large expansions in private equity activity occur in waves with endogenous transitions from booms to busts. In addition, the model matches a wide range of stylized facts regarding the dynamics of investment, prices and performance *during* a wave.

Appendix

Derivation of $\overline{V}_t$. We derive $\overline{V}_t$ in a Bayesian updating framework and use the Gamma distribution because it has several appealing properties and is tractable in a Bayesian setting. The specific properties we use when deriving $\overline{V}_t$ are summarized below.

Expected value of the Gamma distribution. Let X be a Gamma distributed random variable with shape parameter α and scale parameter $1/\beta$. The expected value of X is then equal to $\alpha\beta^{-1}$.

Conjugate priors. The gamma distribution is a conjugate prior to itself whenever the likelihood function is a gamma distribution with known shape parameter α and unknown scale parameter $1/\beta$.

The relationship between the Gamma- and the Inverse Gamma distribution. Let X be a Gamma distributed random variable with shape parameter α and scale parameter $1/\beta$ then X^{-1} is Inverse Gamma distributed with shape parameter α and scale parameter β. Moreover, the expected value of X^{-1} is $\beta/(\alpha-1)$.

Scaling. If X is Inverse Gamma distributed with shape parameter α and scale parameter β then the random variable cX, with $c \in R^+$, is Inverse Gamma distributed with shape parameter α and scale parameter $c\beta$.

In our setting we have a random sample $\{x_i\}_{i=1}^n$ from a Gamma distributed random variable X with known shape parameter α and unknown scale parameter $1/\beta$. As a result, the corresponding likelihood function is Gamma distributed with known shape parameter α and unknown scale parameter $1/\beta$. In our setting, the prior for β is also a Gamma distribution with known shape parameter τ and scale parameter $1/\gamma$. Because the Gamma distribution is a conjugate prior to itself whenever the likelihood function is a Gamma distribution with known shape parameter and unknown scale parameter the resulting posterior distribution of β given the random sample $\sum_{i=1}^n X_i$ is a Gamma distribution with a shape parameter equal to $\tau + n\alpha$ and a scale parameter equal to $1/\left(\gamma + \sum_{i=1}^n X_i\right)$.

In our model, the expected value improvement is $\overline{V}_t = E_t\left(\alpha\beta^{-1}\right)$. Therefore, we now use the above relationship between the Gamma- and the Inverse Gamma distribution to find the distribution of the random variable β^{-1} given the random sample $\{x_i\}_{i=1}^n$ It is Inverse Gamma distributed with shape parameter equal to $\tau + n\alpha$ and a scale parameter equal to $\gamma + \sum_{i=1}^n X_i$.

Finally, to find the value of $\overline{V}_t$ we use the scaling property above. It says that the random variable $\alpha\beta^{-1}$ is Inverse Gamma distributed with shape parameter equal to $\tau + n\alpha$ and a scale parameter equal to $\alpha\left(\gamma + \sum_{i=1}^{n} X_i\right)$.

Using the above formula for the expected value of an Inverse Gamma distributed random variable we get the following expression for the value of $\overline{V}_t$:

$$\overline{V}_t = E_t(\alpha\beta^{-1}) = \frac{\alpha\left(\gamma + \sum_{i=1}^{n} X_i\right)}{\tau + n\alpha - 1}.$$

In our model, n is M^t and x_i is v_j. With these substitutions, the above expression is identical to Equation (3.3).

PAPER 4

Ownership Matters: A Clinical Study of Investor Activism

ABSTRACT. This paper studies the involvement and engagement objectives of an activist investor in an institutional environment characterized by concentrated ownership. It highlights the heterogeneity of the investor's activism and its focus on operational improvements. It emphasizes the ownership structure of the portfolio companies as important determinants of investor activism. Using a carefully selected set of peer companies, it is possible to show that the investor targets undervalued companies with operational slack that maintain open ownership structures. In particular, by avoiding to invest in companies with other active owners, e.g. families and industrial owners, and seeking to invest in companies with more institutional holdings, the investor ensures that there is not only scope for improvements. There is also a reasonable chance of exercising control.

1. Introduction

On October 6, 2003, Cevian Capital made its first investment through the fund Cevian Capital I. The target company was the Swedish fashion retail firm Lindex. The shares were acquired through a block purchase from the firm's principal owner. The same day Lindex's share price rose by eight percent. Subsequently, Cevian Capital assumed board representation and engaged in company policy to pursue value enhancing changes. These changes pertained to strategic- and operational issues as well as governance and capital structure. 39 months later Cevian Capital exited the investment by selling its shares in the open market at an IRR of 84%.

This episode illustrates an example of investor activism. Its recent surge has stimulated a debate regarding its benefits and costs. While some believe activist investors help resolve agency conflicts in widely held companies others have referred to them as

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"swarms of locusts" accusing them of pursuing short-term profit-maximizing strategies, asset stripping, and alike.[1]

This paper provides a detailed study of the activism conducted by Cevian Capital; henceforth the investor documenting the investor's governance, engagement objectives and involvement in its portfolio companies and relate them to quantitative measures of performance, efficiency, valuation and ownership structure. Having access to unique data, provided by Cevian Capital, makes it possible to identify latent, but important features of investor activism.

This paper finds that the investor's engagement objectives are versatile and always include several different strategies to unlock value. In all investments the investor identifies changes to governance, capital structure and company strategy and operations. While some strategies for value enhancement appear common across investments such as changes to payout policy and governance, others are adjusted on a case-by-case basis. In particular, changes pertaining to company strategy and operational efficiency are more case specific. At any rate the investor's engagement objectives are very heterogeneous and differ from one investment to the next.

Relating the investor's engagement objectives to quantitative measures suggests that the portfolio companies exhibit operational slack and that they are undervalued relative to their potential. Importantly, their ownership structures are dominated by institutional investors. Moreover, the investor seems to avoid companies with other active owners. In sum, the portfolio companies exhibit both a scope for improvements and an opportunity to gain influence. Save one exception, there is no active owner in place at the time of the initial investment.

The investor's modus operandi is predominantly friendly and the investor aims at exercising control through active board participation and dialogue with management. Often the investor's vision of the portfolio company coincides with management's. However, in the event that the management team does not deliver the desired results, the investor quickly sees to replace management. This suggests that an important role of the investor is to monitor the management and to speed up and certify changes already in place. When deemed necessary, the investor brings in co-investors to leverage its voice and stake. This is intended to add credibility to the investor while increasing its influence. Additional leverage is also anticipated from the inflow of "like-minded" capital once the investment is publicly disclosed. The investor seems to learn about this additional source of leverage during the investment period becoming more aware

[1] This quote is from a speech by Mr. Franz Müntefering, Chairman of the Social Democratic Party (SPD). Later on, the German press published an internal SPD memo listing a dozen "locusts" (including Goldman Sachs and Kohlberg Kravis Roberts & Co.).

of it in later stages. Not surprisingly this coincides with the rapid growth of the hedge fund industry.

Entry is either achieved through block purchases from large owners or through the accumulation of shares in the open market up to the mandatory disclosure level. Exit is either achieved by gradually selling the shares in the open market or by tendering the shares in the event of a tender offer. Finally, in the absence of external events such as the arrival of bids for the portfolio company, the investor's holding period is relatively long and substantial changes to company policy is achieved. However, external events such as bids for the company tend to paralyze other aspects of activism, in favor of evaluating the bid. If the bid offers the investor its required rate of return it exits the investment.

Investor activism has seen many different guises. During the eighties, it appeared in the shape of corporate raiders dictating company policies aloud or as leveraged buyout funds taking public companies private in order to change company policy. Meanwhile, public- and private pension funds exerted pressure on management in publicly listed companies often in the form of behind the scene negotiations. Hitherto, the vast majority of the existing evidence on investor activism focuses on the activism conducted by these investors in the US and UK markets.[2]

A more recent type of investor activist pertains to hedge funds.[3][4] Although hedge fund activism has been most common in the US it has extended into other markets as the amount of capital committed to hedge fund activism has rapidly increased. By now, the phenomenon has captured the attention of academics, managers, as well as policy makers throughout the developed world. However, so far the study of hedge fund activism is limited and has been confined to the US and UK markets.[5]

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[2] The current empirical evidence on investor activism by pension funds is summarized in surveys by Gillan and Starks (1998), Black (1998), and Karpoff (2001). Brav, Jiang, Thomas, and Partnoy (2006) and Klein and Zur (2006) are two large scale studies of hedge fund activism in the US. Finally, Holmstrom and Kaplan (2001) and Lerner (1995) study the governance role of private equity funds in the US.

[3] The wording "hedge fund activism" warrants some comments at this stage. Indeed, the definition of a hedge fund is blurred as it is. It is thus unfortunate to label these activists and consequently putting them under the same roof when, in fact, two investors labeled as hedge fund activists can be two completely different investors, using very different investment strategies. Indeed, many so called hedge fund activists have very few tangencies with what is commonly perceived as a hedge fund. They do not engage in short selling of shares nor do they engage in any other complex trading strategies. Instead, they are simply loosely regulated long only funds with the possibility to engage in short selling etc. Sometimes, these investors have more in common with private equity funds. This is the case for Cevian Capital.

[4] Gillan and Starks (2007) describe the evolution of shareholder activism in the US, emphasizing the emergence of hedge fund activism and its prominent role in US corporate governance.

[5] Recent studies of hedge fund activism include Brav, Jiang, Thomas, and Partnoy (2006), Klein and Zur (2006), Greenwood and Schor (2007) and Becht, Franks, Mayer, and Rossi (2006).

As the literature on law and finance shows, differences in legal origin has lead to differences in investor protection and ownership structure across countries and markets (see La Porta, de Silanes, Shleifer, and Vishny (1998) and La Porta, Lopez-De-Silanes, Shleifer, and Vishny (2002)). These differences can either impede or facilitate investor activism, while also affecting the mode of activism.[6] Indeed, in common-law countries like the US and the UK, whose markets are characterized by relatively strong minority shareholder protection and dispersed ownership, the monitoring role has mainly been carried out by institutional investors such as pension funds and alike. Meanwhile, in civil-law countries such as France and Germany, banks and controlling families have played important monitoring roles. Scandinavia constitutes a separate branch of the civil-law countries. According to La Porta, de Silanes, Shleifer, and Vishny (1998) the Scandinavian countries are similar to each other but distinct from others. Faccio and Lang (2002) examine the ultimate ownership of western European corporations and find that widely held firms are more common in the UK than in continental Europe. However, the Nordic countries displayed the highest fraction of widely held firms among the latter.[7] When examining the pattern of family control, the picture was reversed. Moreover, state control was particularly pronounced in inter alia Norway and Finland.

The focus of this paper is the governance, engagement objectives and involvement by an activist investor in the Nordic region. The investor has provided detailed information pertaining to (i) its engagement objectives and visions for the portfolio companies; (ii) valuations and assessments of potential for improvements; and (iii) its main concerns and risks associated with control.

This paper provides a detailed documentation of the investor's engagement objectives. Examining these engagement objectives suggests that prior to investing; the investor always identifies strategies to enhance the valuation through changes to governance, capital structure, strategy and operations. Some of these are similar across investments. In particular, the investor always identifies a potential to pay out excess cash and aim at strengthening the board of directors. Although always present, other sources of value enhancement vary on a case-by-case basis. For instance, changes pertaining to company strategy and operational efficiency are more case specific.

Having access to the investor's due diligence materials it is possible to identify and make use of the portfolio companies' peers deemed relevant by the investor. These enable a comparison of the investments to the same companies as the investor making it possible to link the investor's engagement objectives to quantifiable characteristics

[6] Ferreira and Matos (2007) and Massa, Ferreira, and Matos (2007) study the role of institutional investors around the world.

[7] Faccio and Lang (2002) show that the fraction of widely held firms in the UK is around 60% while it is around 30-40% in Scandinavia.

of the portfolio companies. Comparing the portfolio companies to two different sets of peers, selected on the basis of the unique data provided by Cevian Capital, reveals that they exhibit relatively more operational slack, they are undervalued relative to their potential, and they maintain an open ownership structure facilitating the potential to influence. Thus, there is a logical link between the investor's engagement objectives and inefficiencies in the portfolio companies. Moreover, comparing the portfolio companies to other undervalued companies with operational slack, it seems that the investor actively avoids companies with existing strong owners such as families, industrial owners or other activist investors.

Examining the investor's engagements suggests that it is predominantly friendly. Often the investor's objectives coincide with those of the management, but if the management team does not deliver the desired results, the investor quickly sees to replace the management. In these cases it appears as if the important role of the investor is to speed up and ensure the duly implementation of existing strategies.

The investor enters its investments either by negotiating block purchases with existing owners or by accumulating shares in the open market, while it exits its investments either by gradually selling off shares in the open market, hoping to avoid a price impact, or by tendering its shares in the event of a tender offer. Linking changes in company policy and improvements in accounting figures it is possible to assess whether or not specific engagements were successful. When the portfolio company is held for a long time substantial changes are achieved to company policy. However, if external events such as bids for the portfolio company arrive and meet the required rate of return for the investor, it can leave the implementation of the changes to the new owners, thereby achieving its required rate of return and saving in on the costs.

This paper complements the existing literature on investor activism as follows: Save one exception, previous studies of hedge fund activism are large sample studies on activism in the US and the UK. The focus of this paper is investor activism outside the US and the UK in an institutional environment characterized by concentrated ownership, often through the use of dual class shares, pyramiding and cross-holdings.

Large sample studies say little about the governance and strategies of these investors. Kahan and Rock (2006) attempts to explain their success by contrasting them to traditional institutional investors such as pension funds and mutual funds. Focusing on the institutional differences between these investors, the paper tries to identify specific features which make hedge funds particularly apt for activism, while at the same time identifying the potential dangers associated with hedge fund activism. Yet another paper tries to explain the initial market reaction to hedge fund activism by future M&A activity, suggesting that hedge fund activism simply signals undervalued

situations to the market and puts portfolio companies up for sale (see Greenwood and Schor (2007)). The only paper on hedge fund activism outside the US is a clinical study of the activism conducted in the UK by the Hermes UK Focus Fund (see Becht, Franks, Mayer, and Rossi (2006)). Given the strategy of the Hermes UK Focus Fund, i.e. mostly engaging in behind the scene negotiations with its portfolio companies, the paper is able to provide a reliable estimate of the returns to shareholder activism.

This paper highlights the heterogeneity of the investor's activism and its focus on operational improvements. It underscores the importance of recognizing ownership type and distribution as determinants of investor activism. This aspect is crucial for any investor seeking to influence company policy. For future research in the topic of investor activism the paper hints at the importance of controlling for the complex ownership structures of potential portfolio companies.

Another issue closely related to investor activism is ownership structure. Both the identity of owners and ownership concentration differs widely across countries (La Porta, de Silanes, Shleifer, and Vishny (1998), La Porta, Lopez-De-Silanes, Shleifer, and Vishny (2002), Faccio and Lang (2002), and Ferreira and Matos (2007)). Anglo-Saxon countries, i.e. the US and the UK, being of common law origin, differ from other countries in several ways. In particular they have well-developed stock markets and are characterized by stronger minority shareholder protection and less concentrated ownership. Most equity is owned by households and institutions other than banks and monitoring is largely delegated to these institutions.

Surprisingly little attention has been devoted to institutional investor activism in non-Anglo-Saxon countries. To some extent this can be explained by the fact that other stakeholders carry out the monitoring duties in these countries, e.g. families and banks. Notwithstanding Giannetti and Laeven (2007) study the effect of institutional investments on company performance in Sweden. More precisely they examine the causal effects of pension fund ownership on firm value, ownership structure, and corporate governance. They find that the effect of institutional ownership depends on the industry structure of the pension funds. In particular they find that company value increases if large independent private or public pension funds increase their equity stakes in the company, but not if smaller pension funds and pension funds affiliated to financial institutions or industry groups do so. They also show that the increased monitoring by these institutions is mainly driven by the appointment of new directors through their participation in the companies' nomination committees.

The reminder of this paper is organized as follows. The next section states the purpose of this study. The paper proceeds with describing the unique dataset and provides background information on Cevian Capital. The ensuing section present and

discuss the findings in this paper. Since many of the conclusions of this paper build on the detailed study of the specific investment cases, each case is summarized and presented in the appendix.

1.1. Purpose of this study. By the objective measures used in large sample studies Cevian Capital appears to be a typical hedge fund activist. The investor invests in public companies; always resulting in news headlines including the investor publicly stating its intention to influence company policy. However, given the vague definition of hedge fund activism, this reveals little about the nature of the investor as an owner and asset manager. Studying Cevian Capital reveals that the investor has very few tangencies with the common perception of a hedge fund. In contrast, apart from investing in the public markets it much resembles a private equity investor. This study documents the investor's role as an owner and asset manager describing its engagement objectives and involvement in its portfolio companies. Having access to unique data provided by Cevian Capital it is possible to investigate important determinants of activism and crucial factors contributing to its success.

2. Data collection

The data used in this study is drawn from both public and private sources including interviews with Cevian Capital employees. Financial data is drawn from Datastream/Worldscope, company- and investment bank reports, while data pertaining to ownership structure is mainly drawn from SIS Ägarservice and company reports. Factiva provides news flows relating to the investor as well as its portfolio companies.[8]

The private information source refers to the investor. Cevian Capital has provided detailed information relating to its investments and investment activities. This includes confidential internal documents such as prospectuses, memos, minutes from telephone conversations and meetings, investment committee reports and due diligence materials. In particular, the investor has provided information about the value enhancing changes it identified before investing in the portfolio company.

2.1. Managing Partner background. The investor's investment strategy is more easily understood by studying the history of its managing partners. Cevian Capital has two managing partners, Christer Gardell and Lars Förberg. Together, they have extensive experience from the investment- and management consulting industry.

[8] SIS Ägarservice tracks ownership changes in publicly listed companies on the Stockholm Stock Exchange, providing detailed data on ownership structure at company level. Data on ownership structure for non-Swedish companies is obtained from company reports, which usually list the identity and participation of its largest owners.

Prior to founding Cevian Capital Mr. Gardell and Mr. Förberg served as Chief Executive Officer and Chief Investment Officer respectively at a listed Swedish investment firm named Custos. During their tenure they developed an activist investment strategy focusing on publicly listed companies. Before joining Custos, both Mr. Gardell and Mr. Förberg acted as Partners at the Swedish private equity firm, Nordic Capital. Prior to working at Nordic Capital Mr. Gardell was a Partner of McKinsey & Co., where he worked on a variety of assignments, including M&A, corporate restructurings, sales improvements, overhead reduction, business process re-engineering, and corporate governance projects across a wide range of industries.

Thus the investor's managing partners have experience from managing publicly listed companies; they have extensive experience from investing, including sourcing, screening, evaluating, structuring, negotiating, and managing and exiting investments; they have extensive experience from corporate restructurings and operational efficiency improvements. Both managing partners also served as Chairman and as board members in several portfolio companies prior to founding Cevian Capital. In short, the managing partners can leverage a long experience of corporate restructuring and operational improvements when they analyze and advice their portfolio companies.

2.2. Cevian Capital. Cevian Capital was established in 2002 and raised its first fund, Cevian Capital I, shortly thereafter. The fund is structured as a typical private equity fund, a limited partnership. The investors act as limited partners and contribute the vast majority of capital whereas the managing partners act as general partners.[9] The capital was committed upfront and drawn down on an as-needed basis.

The committed capital was intended for investments during the first five years with a fund lifetime of eight to ten years. The incentive structure resembles the standard private equity model where the fund charges a management fee around 2 percent of the committed capital and a carried interest of 20 percent. Moreover, the managing partners invest directly into the fund which is standard in the private equity industry. The investors are mainly institutional investors, e.g. pension funds, insurance companies and sponsors, but individuals are also represented.

Finally, in general, the fund does not engage in short selling nor does it leverage up its investments using borrowed capital. This differentiates the fund from pure hedge funds on the one hand, and private equity funds on the other hand.

2.2.1. *Investment philosophy.* Cevian Capital is an active ownership investment firm focusing on the Nordic region. Its strategy is to acquire significant minority stakes in a small number of undervalued publicly listed companies and is often one of

[9] For an overview of the organizational structure of private equity funds see Sahlman (1990) or Fenn, Liang, and Prowse (1995).

the largest shareholders in its portfolio companies. Consequently, the investor manages a highly concentrated portfolio. Coupled with the high powered incentive structure this ensures that the investor maintains strong incentives to monitor each of its investments. On average, the investor retained 2-4 investment professionals per portfolio company.

2.2.2. *Investment process.* Being an active owner with an ambition to influence its portfolio companies' strategies the investor seeks to invest in companies where it believes there is scope for improvements that will enhance company value and deems it likely it will gain influence. Therefore, prior to investing in a company, the investor devotes considerable time and efforts to evaluate and analyze potential investments.

The first stage is the sourcing and screening of investment opportunities. Companies are screened through fundamental financial analysis, identifying undervalued situations with room for improvements and downside protection. Companies which pass this test become subject to an in-depth operational and financial due diligence process in which the investor meet with board members, management and other stakeholders, industry experts, visit company locations, e.g. stores and plants. The information procured during this due diligence process enables the investor to develop an activist plan.

The type of changes varies by investment, but, based on the underlying principle, can be divided into the three main categories Governance, Capital structure and Strategy & Operations. In all investments the investor has identified changes pertaining to each category with focusing on Strategy & Operations.

Governance refers to all changes to the board of directors and the management team, changes to management's incentive structure, and the entry of the investor as an active owner, increasing monitoring.

Capital structure refers to changes to the financial structure and payout policy of the company. This includes the company's leverage ratio, debt restructuring, or the distribution of profits to shareholders.

Strategy & Operations concerns the overall structure of the company and the focus of its operations. Changes might aim at breaking up the existing company structure, e.g. breaking up conglomerates, re-focusing the company's business, e.g. redirect focus of business area, increasing operating profits by improving the cost structure or trimming operating expenses, or improving capital management.

Once, the activist plan is developed, the investor acquires a minority stake in the portfolio company. Typically the investor requests representation on the board of directors and work for changes through this channel. Exit is planned following a proper revaluation of the portfolio company and the investor often recognizes several different exit possibilities.

2.2.3. *Investments.* From its inception to date Cevian Capital I invested in five companies. The initial investments took place between October 2003 and April 2005. Three of the investments have been fully exited. The remaining two are still part of the investor's portfolio.

Table (1) presents summary information regarding the investments' domicile, industry as well as the time and duration of the investments.[10] All investments were in the Nordic region. Three were made in Sweden one in Finland and one in Norway. All portfolio companies belong to different industries, spanning from fashion retail to engineering.

Table (2) provides information on the size of the portfolio companies, the investor's peak ownership, and measures of return on the investments and the status of the investments. The size of the portfolio companies varies substantially and the peak ownership (in %) is lowest for the largest companies. Both measures of return, i.e. IRR and Multiple of capital, are provided by the investor. As of yearend 2007, three of the five investments have been fully exited.

2.3. Investment characteristics. One way to understand the investor's investment strategy is to study the characteristics of its portfolio companies. Finding features specific to these makes it possible to say something about the type of companies that catches the attention of activist investors. Relating these characteristics to changes pursued by the investor makes it possible to evaluate whether or not they seem to make sense.

Having access to the investor's due diligence materials it is possible to use peer companies identified by the investor when evaluating its investment opportunities. Arguably, the investor is an expert in analyzing and finding comparable companies. Therefore, this specific comparison might be particularly relevant from the perspective of the investor and not easily identified by an outsider. Compare the portfolio companies to the same set of firms used by the investor makes it possible to identify some of the specific features of the portfolio companies identified by the investor.

Two different set of peers are used. One is a subset of the other. The first set consists of the portfolio companies' main competitors. Many of the portfolio companies are international firms having some of their main competitors in different countries. For that reason, this set of firms entails foreign as well as domestic competitors.

The second set of peers is a subset of the former, consisting of the portfolio companies' main Nordic competitors. Focusing on this particular subgroup within the

[10] For a more detailed description of the portfolio companies the reader is referred to the individual cases available in the appendix.

main competitors presumably makes the comparison even more relevant, since these companies are exposed to similar business, institutional and political environments.

The portfolio companies are evaluating along three main dimensions. This choice is partly motivated by the investor's investment strategy and is as follows: operational efficiency, relative valuation, and ownership structure.

2.3.1. *Operational efficiency.* Operational efficiency is measured in two ways. First, operating profit margin as measured by Earnings Before Interest and Taxes divided by net sales or revenues (EBIT/Sales). Second, operating expenses which is measures as operating expenses as a fraction of net sales or revenues (OPEX/Sales). Table (3) and (4) report the figures for profit margins and operating expenses respectively. Focusing on the period leading up to the acquisition, the tables suggest that the portfolio companies exhibit operational slack in the sense that they have lower operating margins and higher operating expenses. This holds regardless of which set of peers are used in the comparison.

2.3.2. *Relative valuation.* Relative valuation is measured by the enterprise value divided by net sales or revenues (EV/Sales). Table (5) presents the figures. Compared to both sets of peers the portfolio companies trade on lower EV/Sales-multiples. That is they appear undervalued in relation to their potential.

2.3.3. *Ownership structure.* An important feature highlighted by the investor is the potential to gain influence in its portfolio companies. The possibility to influence is intimately linked to ownership. Two specific aspects of ownership are considered; the distribution of ownership; and the type of owners. Consider the ownership structure shortly before the investor's initial investment in the portfolio company and compare the ownership of the portfolio companies to a specific set of matched firms. The sample is obtained in the following way: Start by selecting the portfolio companies' main Nordic competitors. Each company is assigned a score intended to reflect its attractiveness as an investment for the investor and is the sum of three dummy variables. The first equals one if the company exhibit lower operating profit margin (EBIT/Sales) than the portfolio company. The second dummy variable equals one if the company displays higher operating expenses as a fraction of sales (OPEX/Sales) compared to the portfolio company. The final dummy variable equals one if the relative valuation multiple (EV/Sales) of the company is lower than the one of the portfolio company. Finally, the matched sample is obtained by choosing, for each of the investor's portfolio companies, the main Nordic competitor with the highest score.[11] Arguably, these firms

[11] The ownership structure of the matched firm is considered as close as possible in time to the portfolio company which it is matched.

maintain (i) scope for improvements; (ii) have been identified by the investor as relevant peers; and (iii) are potential investments since they are domiciled in the Nordic region.

Ownership concentration is measured by the participation of the principal owner as well as the combined participation of the five largest owners. Owner types are partitioned into five different categories: Institutional-, Industrial-, Family/Insider-, State owners and other Activists. The distribution of owner types is reported as a fraction of the combined participation of the five largest owners. Together these measures are intended to reflect the investor's prospects to influence its investments. The figures are presented in Table (6).[12]

In all cases the principal owner of the matched firm controls a larger participation than the principal owner in the portfolio company. Furthermore, all firms in the matched sample are either controlled by a different activist or an industrial owner with a strategic interest in the company.

Thus, in general, the investor seems to invest in companies whose ownership structure is characterized by a higher fraction of institutional owners and lower percentage of industrial-, family- or insider ownership compared to the matched sample.

In sum, comparing the portfolio companies to their main (Nordic) competitors suggests that the investor identifies undervalued firms with operational slack. In addition these firms maintain an ownership structure which facilitates influence for the investor.

2.4. Returns to disclosure. To gauge the market's response to the disclosure of the investor's investment Cumulative Abnormal Returns (CARs) are calculated surrounding the disclosure date. CARs are calculated using the standard market model described in MacKinlay (1997) or Brown and Warner (1985). The event date is the first day the market learns about the investor's participation in its portfolio company.[13]

The estimation window starts 120- and ends 30 trading days before the event date in order to ensure that the estimation is unaffected by the investor's involvement. Table (7) reports the CARs for several different event windows. They are economically- and statistically significant and robust to different choices of event windows. The median CAR ranges from 5.9% to 7.5% depending on the event window.

[12] The table presents the results with respect to cash-flow rights. In unreported results voting rights are considered instead. This only accentuates the results.

[13] The exact date is defined as the day when the investor's purchase first appears in the Factiva database. Notice that this, in general, is not the same day as the investor started to buy shares in the portfolio company. In Sweden the mandatory disclose is triggered by a combined participation greater than 5%. Thus before reaching the five percent threshold owners can be anonymous if they wish to be so.

Thus, the market perceives the investor's entry as good, revaluing the company accordingly. Next, the long term profitability of the portfolio companies is examined to see whether or not they experience any significant improvements.

2.5. Entry vs. Exit. Long term performance is measure in two different ways. The first measure is related to the stock market performance during the engagement period. The second one compares the operating performance at entry and exit.

Table (8) presents the internal rate of return, cum-dividend return, and the return in excess of the relevant market and industry respectively. In the table, the market and industry returns are ex-dividend, exaggerating the excess returns of the investments. However, the figures are very large and would not change significantly by including dividends.

Two of the investor's investments were acquired shortly following the investor's entry resulting in a transfer of control, thereby hampering the implementation of the investor's value enhancing program.

The remaining three investments, which were held for a longer time, were subject to close monitoring and active involvement by the investor. All three companies had, at the time of investment, initiated profit improvement programs; although in one case, notably Intrum, this took the form of a leveraged buyout.

Having identified these companies as undervalued and underperforming the investor developed a plan to enhance the valuation of the companies. These plans entailed changes to the board structure often including being represented on the board of directors itself and demands to pay out excess cash to shareholders. However, more importantly the investor pursued changes to company strategy and operations increasing focus on high margin business divisions while scaling back underperforming ones. Efforts were also focused on improving operational efficiency by reducing costs throughout the companies.

The investor monitored management closely to ensure the duly implementation of the desired changes and quickly sought to replace management in case it did not deliver or meet its targets.

Comparing the portfolio companies operating profits at entry to those at exit clearly points to increased profitability during the engagement period (see Table (9)). Also, operational efficiency, as measured by operating profit margin improved. This pattern still remains comparing the development of the investments to the reciprocal of the Nordic competitors during the same period.

2.6. Engagements.

2.6.1. *Board and committee work.* One way in which shareholders can influence corporate policy is by nominating board members. The nomination is carried out by the company's nominating committee. Thus by entering the company's nominating committee shareholders can influence the choice of directors and thereby company policy.[14] Alternatively, shareholders can request an extraordinary general meeting (EGM) demanding representation on the board of directors. This request is not binding for the board of directors unless the request originates from (i) a company accountant, (ii) a single shareholder, or (iii) a group of shareholders commanding at least 10% of the company's paid up voting capital, the board is obliged to hold a meeting.[15]

In three cases, notably Lindex, Intrum and Visma, the investor requested an EGM demanding representation on the board of directors, either alone or in concert with other owners. In the remaining two cases, notably Skandia and Metso, the investor first entered the companies' nominating committees and then assumed representation in the board of directors. In fact, by first entering the nominating committee the investor is able to nominate itself for representation in the board of directors.

Data on the investor's participation in the board of directors and affiliated committees of its portfolio companies is hand collected. Table (10) presents this data. The investor assumed board representation in all cases and frequently participated in committees such as the remuneration- and nominating committee enabling them to directly influence the companies' future strategies in important areas such as the election of new director, remuneration policy, and alike. As members of the board of directors, the investor recurrently meets with the portfolio companies' executives and other owners during the course of the investments.

2.6.2. *Monitoring and incentives. Monitoring*

In general, prior to the investor's entry, the portfolio companies maintain open ownership structures. In three investments 100% of the five largest owners were passive institutional owners. In the remaining two, there was either a private equity investor and a founder or a significant state ownership. Thus, for the first three investments, the investor's entry involved major changes to the distribution of owner types. While the pre entry ownership structure was dominated by passive institutional investors the post entry ownership structure was dominated by an active owner, with stronger incentives to enhance shareholder value and monitor management.

[14] Giannetti and Laeven (2007) study the pension funds' influence on company performance in Sweden and argue that the increased monitoring by these investors is mainly driven by the appointment of new directors through their participation in the companies' nominating committees.

[15] Becht, Franks, Mayer, and Rossi (2006) states that the same holds in the UK. This stands in contrast to the US where the companies' bylaws can deprive the shareholders of the right to call special meetings.

In the other two investments, the investor also played an important role as an active owner. In the company with the private equity investor and the founder, the private equity investor was seeking an exit while the founder intended to reduce his involvement in the company. The active role of the private equity investor was also diminished since the initial public offering. Having entered into an agreement with both principal owners before buying into the company, the entry essentially meant a transfer of control from one active owner to another. Indeed, the private equity investor's main business is not to run public companies. According to the investor, previous exits by the private equity investor had been made through selling off shares in the open market. Buyers were usually hedge funds and passive institutional owners not posing a threat to the investor. Thus it is not clear that an active owner would be in control following the private equity investors exit.

Working closely with management and following the portfolio companies' evolvement, the investor reacts quickly when management fails to deliver. In two of the three investments held for a longer time, the investor successfully sought to replace the CEO after failing to meet the targets.

Incentives

Apart from affecting the governance through increased monitoring activities, the investor directly influenced top managements' incentives. In three cases the investor changed the incentive structure for top management aiming to increase the pay performance sensitivity. In two cases, this was achieved by selling call options, directly owned by the investor, to top executives enabling the investor to alter the incentives without going through the board of directors (see Table (14) and (18)). The investor also directly influenced the remuneration of top management through its participation in the portfolio companies' remuneration committees. The investor was represented in the remuneration committee in four of the five investments.

2.6.3. *Capital structure.* In all investments the investor has identified the potential to distribute excess cash to shareholders either through share redemptions, dividends or public-to-public buyouts. In three investments the investor was able to get the portfolio company to acquiesce to its demand. The two investments that did not experience a change in payout were the same companies that were acquired shortly following the investor's entry.

Dividends and share redemptions are considered to reduce the downside risk and the payback period, the latter resulting in a higher internal rate of return.

2.6.4. *Strategy & Operations.* An important part of the investor's value enhancing strategy is changes aiming to change company strategy and improve operational efficiency. Unlike, the changes to capital structure, which are similar in nature and only differ in magnitude, changes to operations and strategy are more versatile.

Strategy

Two recurring objectives of the investor are breaking up the companies and shifting their business focus. In three investments, the investor recognized a value potential in breaking up the company structure due to conglomerate discounts and lack of synergies. Two of these investments were acquired shortly following the investor's entry. Notwithstanding, in two investments the break up was a serious alternative direction for the company, although none of the companies ultimately changed the company structure.

According to the investor it is not necessarily important to change the structure. What is important from its perspective is that the market changes its perception of the company and revalues it taking this new information into account. For instance, that the market starts thinking in terms of sum-of-the-parts.

The second main objective of the investor is to alter the business focus of the of the portfolio company groups. In all three investments which were held for a longer time, the investor pushed the companies to grow in high margin business areas while closing down or scaling down underperforming businesses. As a consequence the groups' operating margins were significantly improved.

Operations

Improving the cost structure by reducing costs is one of the investor's goals in four investments. In the three investments which were not acquired shortly after the investor's entry several measures were taken to achieve this goal. In fact, all three companies had already launched large scale efficiency improvement programs shortly before the investor's entry, and many of the desired changes sought by the investor coincided with those of existing management. However, the investor did not believe that enough had been done and that the efforts were not reflected in the accounting figures. In short, it did not believe that the programs had succeeded. Thus, after entering these companies the investor supported the changes already laid out by management and monitored their duly implementation.

2.6.5. *Takeovers.* Two of the investor's investments were acquired shortly after the investor's entry. In both investments, the acquisition was initiated by a bid for the entire company by a third party. In both investments the investor had identified a value potential in breaking up the company structure and explicitly named potential

acquirers for the different parts. In one investment one of the bidding parties had been identified as such.

However, the investor does not believe it plays an important, or unique, role in takeover situations and does not invest on the sole basis of a potential takeover. However, it can be that the same characteristics that attract acquirers do attract the investor. As all owners the investor makes a decision on whether or not to tender its shares. Notwithstanding, the investor was one of the first shareholders to publicly declare its liking of the bids and voted on behalf of other owners in one situation.

Finally, from the ex ante assessment of the companies' value improvement potential, it is clear that the bids were in line with the investor's required or estimated rate of return following the completion of the value improvement program. By tendering its shares the investor could save on the costs associated with its active ownership strategy and boost its internal rate of return without compromising its required rate of return. Thus, nothing suggests that the investor is pursuing quick flips for the sake of it.

3. Conclusions

This study provides a detailed examination of the engagement objectives of an activist investor in the Nordic region. From the perspective of large sample studies, this investor resembles a hedge fund activist and our findings confirm the results from earlier large sample studies – that there are positive returns to hedge fund activist engagements. It also supports the finding that hedge fund activism is very versatile. However, this study shows that this holds for single activists as well. Having access to detailed data provided by the investor, it is possible to go beyond the large sample studies and examine the investor and its engagements in more detail.

In many respects, the investor resembles a private equity investor with very few tangencies to hedge funds. This is true both in terms of governance and investment strategies. In particular, it is set up according to the standard private equity model and in general neither use leverage nor engage in short selling.

The investor is deeply involved in its portfolio companies – participating in the board of directors and its associated committees. The entry of the investor often entails a drastic shift in the distribution of owner types, going from an ownership structure dominated by passive institutional owners to one in which an activist owner becomes the principal owner. The modus operandi of the investor is friendly, and often the investor's and managements' opinions coincide. However, more common is that the investor disagrees with the other owners.

Examining the investors due diligence materials it is possible to analyze the portfolio companies from the perspective of the investor. Comparing the investments to a set of

peer companies identified by the investor the portfolio companies exhibit operational slack and appear undervalued. Importantly, they maintain open ownership structures facilitating influence on behalf of the investor. In particular, companies with strong owners seem to be avoided.

Prior to entering a company, the investor identifies several strategies to unlock value in the company. While some of these strategies exhibit similarities across investments, others are case specific. In particular changes to governance and capital structure appear similar while changes to company strategy and operations vary more from one investment to the next.

The investor does not invest hoping that the portfolio company will be acquired. However, if the premium is in line with the investor's required rate of return it can save in on monitoring costs and increases the internal rate of return by tendering its shares.

Tables

Table 1: Summary information regarding the investments made by Cevian Capital I. The table provides information concerning the investments geographical- and industrial focus as well as the investments' duration.

Name	Country	Industry	Entry date	Exit date
Lindex	Sweden	Fashion retail	Oct 2003	Dec 2006
Intrum	Sweden	Credit management services	May 2004	NA
Skandia	Sweden	Life insurance	Nov 2004	Mar 2006
Metso	Finland	Engineering	Apr 2005	NA
Visma	Norway	Software & services	Apr 2005	May 2006

Table 2: Summary information pertaining to the investments made by Cevian Capital I. Sales refers to Group sales the year before Cevian Capital invested in the company. IRR and Multiple are provided by Cevian Capital.

Name	Sales (€)	Peak ownership*	IRR	Multiple	Value (€)**	Status
Lindex	569	16	84	3,6x	128	Exited
Intrum	304	10,1	39	2,9x	87	Not exited
Skandia	10600	3,4	86	2,1x	195	Exited
Metso	4200	NA	120	3,1x	192	Not exited
Visma	230	7,7	147	2,3x	44	Exited

* Including co-investors.
** Realized + unrealized value. Including co-investors.

Table 3: This table presents the difference in EBIT-margin between the portfolio companies and the median value for the main competitors and main Nordic competitors respectively.

	EBIT%						
	-3	-2	-1	0	1	2	3
Lindex - Int Comp	-4,5	-11,6	0,5	-5,1	-10,5	-0,5	-0,1
Lindex - No Comp	4,1	-1,6	0,5	-0,2	-5,1	0,5	-0,1
Intrum - Int Comp	NA	-11,8	-9,1	-25,3	-4,6	0,6	29,1
Intrum - No Comp	-23,4	-17,0	-34,7	-9,6	-7,9	29,1	NA
Metso - Int Comp	-0,8	-9,2	-2,7	0,5	0,3	NA	NA
Metso - No Comp	-8,0	-15,5	-10,3	-6,7	-7,4	NA	NA
Skandia - Int Comp	-1,3	-8,9	-6,4	-6,9	-6,6	NA	NA
Skandia - No Comp	-13,3	-27,9	-21,4	-20,4	-25,7	NA	NA
Visma - Int Comp	11,1	1,4	-2,2	-9,0	NA	NA	NA
Visma - No Comp	14,3	8,2	5,4	-9,0	NA	NA	NA
Median Int	-1,0	-9,2	-2,7	-6,9	-5,6	0,1	14,5
Median No	-8,0	-15,5	-10,3	-9,0	-7,6	14,8	-0,1

Table 4: This table presents the difference in operating expenses as a fraction of net sales or revenues between the portfolio companies and the median value for the main competitors and main Nordic competitors respectively.

	OPEX/Sales						
	-3	-2	-1	0	1	2	3
Lindex - Int Comp	6,3	11,6	7,0	7,9	14,1	1,3	2,4
Lindex - No Comp	1,8	7,2	7,0	7,5	13,3	0,7	2,4
Intrum - Int Comp	NA	9,7	6,1	7,4	3,7	-4,1	-39,0
Intrum - No Comp	16,3	11,7	13,6	7,9	1,1	-39,0	NA
Metso - Int Comp	1,4	4,6	5,5	0,5	0,9	NA	NA
Metso - No Comp	7,4	9,3	9,6	7,1	7,4	NA	NA
Skandia - Int Comp	2,8	4,5	5,9	6,0	-2,9	NA	NA
Skandia - No Comp	10,7	14,0	10,4	14,8	10,3	NA	NA
Visma - Int Comp	3,6	1,7	1,3	8,0	NA	NA	NA
Visma - No Comp	-12,1	-12,5	-7,5	-6,7	NA	NA	NA
Median Int	3,2	4,6	5,9	7,4	2,3	-1,4	-18,3
Median No	7,4	9,3	9,6	7,5	8,8	-19,2	2,4

Table 5: This table presents the difference in enterprise value divided by net sales or revenues between the portfolio companies and the median value for the main competitors and main Nordic competitors respectively.

	EV/Sales						
	-3	-2	-1	0	1	2	3
Lindex - Int Comp	-0,5	-0,7	-0,6	-0,8	-0,9	-0,2	-0,4
Lindex - No Comp	0,3	-0,1	0,0	-0,2	-0,4	-0,2	-0,3
Intrum - Int Comp	NA	NA	-0,4	-1,0	-1,3	-0,3	-2,1
Intrum - No Comp	NA	-1,2	-2,2	-3,2	-2,2	-2,1	NA
Metso - Int Comp	-0,3	-0,3	-0,4	-0,1	0,1	NA	NA
Metso - No Comp	-0,9	-1,2	-0,9	-0,7	-0,6	NA	NA
Skandia - Int Comp	0,1	-0,2	-0,1	-0,3	2,4	NA	NA
Skandia - No Comp	-6,1	-7,5	-9,0	-11,6	-7,0	NA	NA
Visma - Int Comp	0,1	0,3	-0,7	-1,1	NA	NA	NA
Visma - No Comp	0,1	0,3	-0,7	-1,0	NA	NA	NA
Median Int	-0,1	-0,2	-0,4	-0,8	-0,4	-0,3	-1,2
Median No	-0,4	-1,2	-0,9	-1,0	-1,4	-1,1	-0,3

Table 6: This table presents the ownership structure for the investments and a matched sample.

	Block ownership		Distribution of ownership*				
	Principal	5 largest	Inst	Indust	Founder/Insider	State	Activist
Lindex	11,8	42,0	100,0	0,0	0,0	0,0	0,0
Comp	15,9	25,4	31,1	0,0	6,3	0,0	62,6
Intrum	26,1	62,1	0,0	0,0	42,0	0,0	58,0
Comp	39,6	64,8	22,5	77,5	0,0	0,0	0,0
Skandia	5,0	19,8	100,0	0,0	0,0	0,0	0,0
Comp	13,8	41,6	8,4	91,6	0,0	0,0	0,0
Metso	11,5	16,5	30,3	0,0	0,0	69,7	0,0
Comp	50,0	61,4	18,5	81,5	0,0	0,0	0,0
Visma	8,3	29,4	100,0	0,0	0,0	0,0	0,0
Comp	25,6	52,9	21,2	48,4	6,8	0,0	23,6

* As a percentage of the combined participation of the 5 largest owners.

Table 7: This table presents cumulative abnormal returns for various event windows around the disclosure of the investments made by Cevian Capital I.

	[-1;1]	[-2;2]	[-3;3]	[-5;5]
Lindex	9,8	9,7	5,9	6,4
Intrum	4,7	5,9	5,3	6,7
Skandia	7,5	7,3	12,2	10,4
Metso	3,2	4,7	5,0	4,6
Visma	7,8	6,4	6,4	9,0
Median (%)	7,5	6,4	5,9	6,7
z-stat	2,0	2,0	2,0	2,0
% Positive	100	100	100	100

Table 8: This table presents the stock market performance for the investments comparing them to overall country returns as well as industry returns.

Investment*	Industry** Index	Market** Index	Total Return	Market Total Return	Industry Total Return	Excess vs Market	Excess vs Industry
Lindex	Nordic Retail	Sweden	259%	64%	62%	195%	197%
Intrum	Nordic Services	Sweden	223%	56%	104%	167%	119%
Skandia	Nordic Insurance	Sweden	111%	43%	51%	68%	60%
Metso	Nordic Engineering/P&P	Finland	213%	43%	78%	170%	135%
Visma	Nordic Technology	Norway	125%	47%	24%	78%	101%

* The returns for the investments are cum-dividend.
** The returns are ex-dividend.

Table 9: This table presents the operating profit and margin for the investments and their Nordic competitors at entry as well as exit.

	EBIT@Entry	EBIT@Exit	Growth (%)	EBIT%@Entry	EBIT%@Exit	Growth (%)
Lindex	240	599	149,6	4,8	11,5	139,6
Nordic peers	NA	NA	NA	5,5	11,7	112,7
Intrum	428	668	56,1	14,9	20,7	38,9
Nordic peers	NA	NA	NA	31,0	-8,9	-128,7
Metso	200	580	190,0	5,5	9,3	69,1
Nordic peers	NA	NA	NA	13,1	16,8	28,2
Average investments	289	616	131,9	8,4	13,8	82,5
Average Nordic peers	NA	NA	NA	16,5	6,5	4,1
Difference	NA	NA	NA	-8,1	7,3	78,4

Table 10: This table presents Cevian Capital I's participation in its portfolio companies' boards and committees.

	Board		Committees			
	COB	*Director*	*Nominating*	*Remuneration*	*Audit*	*Investment*
Lindex	Yes	Yes	Yes	Yes	Yes	No
Intrum	No	Yes	Yes	Yes	No	Yes
Skandia	No	Yes	Yes	Yes	No	No
Metso	No	Yes	Yes	Yes	No	No
Visma	No	Yes	No	No	No	No

Table 11: This table present revenues and profits for Lindex broken down by business area.

Business areas - annual data	00/01	01/02	02/03	03/04	04/05	05/06
Revenue - SEKm						
Nordic region	4 354	4 652	4 920	4 978	4 936	4 933
Germany	353	379	393	374	266	279
Total	4 707	5 031	5 313	5 352	5 202	5 212
Revenue growth %						
Nordic region	11,2	6,8	5,8	1,2	-0,8	-0,1
Germany	79,2	7,4	3,7	-4,8	-28,9	4,9
Total	14,4	6,9	5,6	0,7	-2,8	0,2
Pre-tax - SEKm						
Nordic region	270	414	378	232	463	650
Germany	-170	-138	-103	-204	-46	-50
Total	100	276	275	28	417	600
Pre-tax margin %						
Nordic region	6,2	8,9	7,7	4,7	10,0	13,2
Germany	-48,2	-36,4	-26,2	-54,5	-17,3	-17,9
Total	2,1	5,5	5,2	0,5	8,0	11,5

Table 12: This table presents Lindex's consolidated profit and loss statement.

P&L - annual data	00/01	01/02	02/03	03/04	04/05	05/06
Revenue	4 707	5 031	5 313	5 352	5 202	5 212
Goods for resale	-2 369	-2 255	-2 322	-2 507	-2 211	-2 137
Gross profit	2 338	2 776	2 991	2 845	2 991	3 075
Gross margin %	49,7	55,2	56,3	53,2	57,5	59,0
Other income	26	35	67	83	79	68
Other operating expenses	-2 112	-2 369	-2 573	-2 694	-2 457	-2 403
Depreciation/impairments	-166	-202	-211	-206	-196	-141
Operating profit (EBIT)	86	240	274	28	417	599
EBIT margin %	1,8	4,8	5,2	0,5	8,0	11,5

Table 13: This table presents different measures of efficiency for Lindex.

Efficiency	00/01	01/02	02/03	03/04	04/05	05/06
Levels - SEKm						
Accounts receivable	336	341	20	18	8	10
Inventory	954	796	880	704	701	724
Inventory turnover rate	2,2	2,5	2,7	2,8	3	3,1
Ratios %						
Inventory/sales	20,3	15,8	16,6	13,2	13,5	13,9
Receivable/sales	8,2	8,2	1,8	1,9	1,8	2,3
Acc.payable/sales	13,4	15,5	14,2	14,5	15,8	14,1
Working capital/sales	15,1	8,4	4,1	2,3	-0,3	2,4

Table 14: This table presents changes in the remuneration of top managment for Lindex.

	00/01	01/02	02/03	03/04	04/05	05/06
CEO						
Shares	NA	NA	6 500	0	0	200 000
Cevian call options	NA	NA	0	60 000	60 000	100 000
Mgmt team						
Shares	NA	NA	28 677	22 273	12 823	282 565
Cevian call options	NA	NA	0	117 500	75 000	153 750
Management team size	NA	NA	16	14	8	7
Shares/manager	NA	NA	1 792	1 591	1 603	40 366
Cevian call options/mamager	NA	NA	0	8 393	9 375	21 964

Table 15: This table presents revenues and profits for Intrum broken down by business area.

Business areas - annual data	2001	2002	2003	2004	2005	2006	2007
Revenue - SEKm							
CC&DS	1 343	1 597	1 732	1 756	1 837	1 915	NA
C&ICS	588	706	665	641	617	567	NA
SLS	66	101	114	NA	NA	NA	NA
OS	224	276	234	216	198	225	NA
Total Credit Management Services	2 221	2 680	2 745	2 613	2 652	2 707	2 852
PDS	136	163	207	258	322	402	574
Internal elimination	-36	-69	-87	-130	-151	-169	-201
Total	2 321	2 775	2 865	2 741	2 823	2 940	3 225
Revenue growth %							
CC&DS	NA	18,9	8,5	1,4	4,6	4,2	NA
C&ICS	NA	20,1	-5,8	-3,7	-3,6	-8,2	NA
SLS	NA	54,0	12,5	NA	NA	NA	NA
OS	NA	23,1	-15,4	-7,4	-8,6	14,0	NA
Total Credit Management Services	NA	20,7	2,4	-4,8	1,5	2,1	5,4
PDS	NA	19,9	26,7	24,9	24,6	25,1	42,6
Total	NA	19,6	3,2	-4,3	3,0	4,1	9,7
EBIT - SEKm							
CC&DS	313	370	398	410	411	472	NA
C&ICS	70	102	57	61	67	48	NA
SLS	-29	-37	-56	NA	NA	NA	NA
OS	15	39	20	-37	-27	-12	NA
Total Credit Management Services	368	474	419	433	451	508	495
PDS	79	84	86	79	108	162	272
Participations in associated companies	-3	7	0	3	1	0	1
Central expenses	-49	-84	-77	-84	-57	-84	-100
Items affecting comparability	-12	-9	-398	0	0	0	0
Total	384	473	30	431	504	587	668
EBIT margin %							
CC&DS	23,3	23,2	23,0	23,3	22,4	24,6	NA
C&ICS	11,8	14,4	8,5	9,4	10,9	8,5	NA
SLS	-43,5	-37,0	-48,8	NA	NA	NA	NA
OS	6,5	14,1	8,6	-17,1	-13,7	-5,1	NA
Total Credit Management Services	16,6	17,7	15,3	16,6	17,0	18,8	17,3
PDS	57,7	51,6	41,4	30,5	33,6	40,2	47,4
Total	16,5	17,0	1,1	15,7	17,8	20,0	20,7
Total excl EOs	17,0	17,3	14,9	15,7	17,8	20,0	20,7

Table 16: This table presents revenues and profits for Intrum broken down by region.

Regional breakdown - annual data							
Revenue - SEKm	2001	2002	2003	2004	2005	2006	2007
Sweden, Norway & Denmark	618	712	729	624	655	656	689
Netherlands, Belgium & Germany	429	562	608	581	577	592	625
Switzerland, Austria & Italy	351	414	351	371	391	397	451
France, Spain & Portugal	126	192	313	318	364	446	510
Finland, Estonia, Latvia & Lithuania	212	246	284	314	356	415	449
United Kingdom & Ireland	485	525	396	370	316	268	274
Poland, Czech Republic, Slovakia & Hungary	102	123	184	162	164	166	228
Total	2 321	2 775	2 865	2 741	2 823	2 940	3 225
Revenue growth %							
Sweden, Norway & Denmark	NA	15,3	2,4	-14,4	4,9	0,1	5,1
Netherlands, Belgium & Germany	NA	31,1	8,2	-4,3	-0,7	2,7	5,5
Switzerland, Austria & Italy	NA	17,9	-15,1	5,5	5,6	1,5	13,6
France, Spain & Portugal	NA	53,1	62,7	1,6	14,4	22,4	14,3
Finland, Estonia, Latvia & Lithuania	NA	16,3	15,2	10,6	13,3	16,5	8,2
United Kingdom & Ireland	NA	8,4	-24,7	-6,4	-14,7	-15,2	2,2
Poland, Czech Republic, Slovakia & Hungary	NA	21,5	49,2	-12,0	1,2	1,5	37,0
Total	NA	19,6	3,2	-4,3	3,0	4,1	9,7
EBIT - SEKm							
Sweden, Norway & Denmark	142	171	167	153	170	192	199
Netherlands, Belgium & Germany	71	61	95	80	116	125	136
Switzerland, Austria & Italy	55	91	44	64	84	88	121
France, Spain & Portugal	-3	7	42	50	73	100	114
Finland, Estonia, Latvia & Lithuania	71	98	107	129	147	175	185
United Kingdom & Ireland	99	115	2	11	-62	-33	-34
Poland, Czech Republic, Slovakia & Hungary	23	22	66	34	36	32	56
Participations in associated companies	-3	7	0	3	1	0	1
Central expenses	-60	-90	-95	-94	-61	-92	-111
Items affecting comparability	-12	-9	-398	0	0	0	0
Total	384	473	30	431	504	587	668
EBIT margin %							
Sweden, Norway & Denmark	22,9	24,0	22,9	24,5	25,9	29,3	28,9
Netherlands, Belgium & Germany	16,6	10,9	15,6	13,8	20,1	21,0	21,7
Switzerland, Austria & Italy	15,8	21,9	12,5	17,3	21,4	22,2	26,9
France, Spain & Portugal	-2,5	3,5	13,5	15,7	20,0	22,4	22,4
Finland, Estonia, Latvia & Lithuania	33,7	39,7	37,6	41,0	41,3	42,1	41,3
United Kingdom & Ireland	20,5	21,9	0,6	3,1	-19,6	-12,5	-12,4
Poland, Czech Republic, Slovakia & Hungary	22,1	17,9	36,0	21,2	22,1	19,5	24,7
Total	16,5	17,0	1,1	15,7	17,8	20,0	20,7

Table 17: This table presents Intrum's consolidated profit and loss statement.

P&L - annual data	2001	2002	2003	2004	2005	2006	2007
Revenue	2 321	2 775	2 865	2 741	2 823	2 940	3 225
Cost of sales	-1 427	-1 755	-1 766	-1 598	-1 680	-1 706	-1 869
Gross earnings	894	1 020	1 099	1 142	1 144	1 234	1 356
Gross margin %	38,5	36,7	38,4	41,7	40,5	42,0	42,1
Sales and marketing expenses	-221	-257	-282	-304	-273	-262	-285
General and Administrative expenses	-275	-288	-389	-411	-368	-386	-404
Items affecting comparability	-12	-9	-398	0	0	0	0
Participation in associated companies	-3	7	0	3	1	0	1
Operating earnings (EBIT)	384	473	30	431	504	587	668
EBIT margin %	16,5	17,0	1,1	15,7	17,8	20,0	20,7
EBIT margin % excl Eos	17,0	17,3	14,9	15,7	17,8	20,0	20,7

Table 18: This table presents changes in the remuneration of top managment for Intrum.

	2001	2002	2003	2004	2005	2006	2007
CEO							
Shares	NA	NA	NA	50 000	50 000	10 000	15 800
Employee options	NA	NA	NA	500 000	500 000	75 000	60 000
Cevian call options	NA	NA	NA	0	0	300 000	300 000
*Mgmt team**							
Shares	NA	NA	NA	937 226	900 323	1 099 277	1 469 877
Employee options	NA	NA	NA	1 750 000	1 400 000	940 000	590 000
Cevian call options	NA	NA	NA	0	0	300 000	400 000
Management team size	NA	NA	NA	10	8	9	11
Shares/manager	NA	NA	NA	93 723	112 540	122 142	133 625
Employee options/manager	NA	NA	NA	175 000	175 000	104 444	53 636
Cevian call options/manager	NA	NA	NA	0	0	33 333	36 364

* In addition to the 300 000 call options to the CEO, 210 000 call options were sold to directors.

Table 19: This table presents revenues and profits for Metso broken down by business area.

Business areas - annual data	2001	2002	2003	2004	2005	2006	2007
Revenue - EURm							
Paper	NA	NA	NA	NA	1842	2092	2925
Minerals	NA	NA	NA	NA	1756	2199	2607
Automation	NA	NA	NA	NA	584	613	698
Valmet Automotive	NA	NA	NA	NA	77	109	85
Corporate Office and other	NA	NA	NA	NA	9	10	NA
Eliminations	NA	NA	NA	NA	-47	-68	-65
Total	NA	NA	NA	NA	4221	4955	6250
Revenue growth %							
Paper	NA	NA	NA	NA	NA	13,6	39,8
Minerals	NA	NA	NA	NA	NA	25,2	18,6
Automation	NA	NA	NA	NA	NA	5,0	13,9
Valmet Automotive	NA	NA	NA	NA	NA	41,6	-22,0
Total	NA	NA	NA	NA	NA	17,4	26,1
EBIT - EURm							
Paper	NA	NA	NA	NA	92	90	137
Minerals	NA	NA	NA	NA	179	298	363
Automation	NA	NA	NA	NA	81	87	99
Valmet Automotive	NA	NA	NA	NA	6	12	8
Corporate Office and other	NA	NA	NA	NA	-23	-29	-27
Total	NA	NA	NA	NA	335	457	580
EBIT margin %							
Paper	NA	NA	NA	NA	5,0	4,3	4,7
Minerals	NA	NA	NA	NA	10,2	13,5	13,9
Automation	NA	NA	NA	NA	13,8	14,1	14,2
Valmet Automotive	NA	NA	NA	NA	7,8	10,7	9,4
Total	NA	NA	NA	NA	7,9	9,2	9,3

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Table 20: This table presents Metso's consolidated profit and loss statement.

P&L - annual data	2001	2002	2003	2004	2005	2006	2007
Revenue	NA	NA	NA	3 602	4 221	4 955	6 250
Cost of sales	NA	NA	NA	-2 673	-3 110	-3 659	-4 702
Gross earnings	NA	NA	NA	929	1 111	1 296	1 548
Gross margin %	NA	NA	NA	25,8	26,3	26,2	24,8
Selling, general and administrative expenses	NA	NA	NA	-798	-794	-846	-972
Other operating income and expenses, net	NA	NA	NA	-11	12	6	1
Share in profits and losses of associated companies	NA	NA	NA	4	1	1	3
Reversal of Finnish pension liability	NA	NA	NA	75	5	0	0
Operating earnings (EBIT)	NA	NA	NA	199	335	457	580
EBIT margin %	NA	NA	NA	5,5	7,9	9,2	9,3

Table 21: This table provides information pertaining to the engagement objectives in Lindex identified by Cevian Capital prior to investing.

Category	Engagement objective
Governance	Restructure the board of directors.
Capital structure	Launch large-scale recapitalization program through: share redemption and/or a "public-to-public" buyout.
Strategy	Close the loss-making German operations. Change strategic focus from growth to cash flow.
Operations	Capitalize on new purchasing/logistic platform. Reduce inventory handling costs in the stores and the number of work hours. Increase gross margins through shorter lead-times. Eliminate extraordinary personell and consulting costs associated with the implementation of the purchasing/logistic system. Tighten cost and capital management in general. Streamline operating costs in Twilfit.

Table 22: This table provides information pertaining to the engagement objectives in Intrum identified by Cevian Capital prior to investing.

Category	Engagement objective
Governance	Regain market confidence hurt by the recent UK accounting scandal.
Capital structure	Potential to increase leverage by more than SEK 1 billion through acquisitions or at least SEK 500 million through cash distribution.
Strategy	Accelerate growth initiatives in high margin Purchased Debt. Grow in markets with weak positions from selected acquisitions. Potential scale-down of underperforming business lines e.g. Sales Ledger and Other Services. Potential for larger acquisitions or business combinations.
Operations	Restore profitability and confidence in the UK subsidiary. Trim the operating cost base by being more selective in initiating new business projects.

Table 23: This table provides information pertaining to the engagement objectives in Metso identified by Cevian Capital prior to investing.

Category	Engagement objective
Governance	Strengthen board of directors. A new large owner taking an active role would improve corporate governance and ownership structure. At present, there are only passive owners such as the Finnish government and foreign institutions. No owners are currently represented on the board.
Capital Structure	The Company has sold several non-core businesses and with the strong cashflows, the investos sees a potential for a recapitalization of the Company going forward.
Strategy	Break-up: Considering the lack of synergies between the businesses and that few investors like both Paper and Minaral businesses, there is a large value potential in separating the main businesses, e.g. by spinning off Minerals to shareholders. It cannot be ruled out that Minerals can be sold to either industrial or financial buyers. Automation and Ventures can be divested in parts, either before or after a break-up.
Operations	Improve profitability in Paper (based on completion of the restructuring program, adjusting cost base for decreased demand) as well as in Minerals (based on demand upswing driven by mining industry). On top of this EBITA margin can benefit more from decreasing capex and ultimately lower depreciation, as the company likely has over invested in recent years. The investor believes that the company has not yet enough capitalized on its strong market position.

Table 24: This table provides information pertaining to the engagement objectives in Skandia identified by Cevian Capital prior to investing.

Category	Engagement objective
Governance	Eliminate overhang discount. Change board of directors. Regain market confidence hurt by the numerous scandals.
Capital structure	Potential to increase leverage by more than SEK 5 billion and distribute the money to shareholders.
Strategy	Turn around Swedish market share by marketing and product development. Support growth countries. Break up the company and find strategic buyers to the separate parts when timing is right. Alternatively, IPO the non-Swedish business on the London Stock Exchange.
Operations	Reduce overhead costs. A cost saving program is in place and has started to yield some results, but there is substantially more to be done.

Table 25: This table provides information pertaining to the engagement objectives in Visma identified by Cevian Capital prior to investing.

Category	Engagement objective
Governance	Take place in board and evaluate restructuring of the board of directors.
Capital structure	Distribute excess cash to current shareholders. Visma has free equity of approximately NOK 1 billion. Redemption or extra dividend possible distribution methods.
Strategy	Evaluate a break-up of the Group to display the fundamental value of the businesses. Strategic appetite for the software division is likeky from European software companies seeking growth opportunities e.g. Sage. Strategic interests expected for the service businesses fro Nordic private equity firms building servicesoutsourcing groups e.g. Ratos, Nordic Capital and Altor. A potential to spin off the Services division(s) would give investors direct exposure to the various businesses and facilitate a take-over of the company. Accelerate growth initiatives. Potential in new services e.g. EDI, introduction of established software products to new markets (e.g. Avendo/CRM etc. to Denmark and Finland) and cross-selling between the divisions. Management targets double the Company's size over the coming years through organic growth and acquisitions. Add-on acquisitions are possible in all countries.
Operations	Tighten cost management in general. Reduce head count (salaries as % of sales should be reduced from 47% to 44-45%). Ensure that costs are actually taking out and synergies are realized in acquired companies. Reduce external consultant and other office expenses.

References

Acharya, S., and E. Dimson (2007): *Endowment Asset Management*. Oxford University Press, Inc., New York.

Acharya, V. V., J. R. Franks, and H. Servaes (2007): "Private Equity: Boom and Bust?," *Journal of Applied Corporate Finance*, 19(4), 44–53.

Acharya, V. V., M. Hahn, and C. Kehoe (2009): "Corporate Governance and Value Creation: Evidence from Private Equity," *SSRN eLibrary*.

Ackerberg, D. A., and M. Botticini (2002): "Endogenous Matching and the Empirical Determinants of Contract Form," *Journal of Political Economy*, 110(3), 564–591.

Angrist, J. D., and J.-S. Pinschke (2008): *Mostly Harmless Econometrics: An Empiricist's Companion*. Princeton University Press, Princeton, New Jersey.

Barnea, A., and I. Guedj (2007): "CEO Compensation and Director Networks," Efa 2007 ljubljana meetings paper, Dipartimento Scienze Economiche, Università di Bologna.

Becht, M., J. R. Franks, C. Mayer, and S. Rossi (2006): "Returns to Shareholder Activism Evidence from a Clinical Study of the Hermes U.K. Focus Fund," ECGI - Finance Working Paper No. 138/2006.

Berk, J., and R. Green (2004): "Mutual Fund Flows and Performance in Rational Markets," *Journal of Political Economy*, 112(6), 1269–1295.

Black, B. S. (1998): "Shareholder Activism and Corporate Governance in the United States," *The New Palgrave Dictionary of Economics and the Law*, 3, 459–465.

Bottazzi, L., M. D. Rin, and T. Hellmann (2007): "Who are the active investors? Evidence from Venture Capital," Working Papers 611, Dipartimento Scienze Economiche, Università di Bologna.

Bradley, Daniel J., C. H.-S. S., and J. Clarke (2008): "Working for the Enemy: An Examination of Investment Banker Job Changes," Discussion paper, Dipartimento Scienze Economiche, Università di Bologna.

Brav, A., and P. A. Gompers (1997): "Myth or Reality? The Long-Run Underperformance of Initial Public Offerings: Evidence from Venture and Nonventure Capital-Backed Companies," *Journal of Finance*, 52(5), 1791–1821.

Brav, A., W. Jiang, R. S. Thomas, and F. Partnoy (2006): "Hedge Fund Activism, Corporate Governance, and Firm Performance," ECGI - Finance Working Paper No. 139/2006.

Brown, K. C., L. Garlappi, and C. I. Tiu (2008): "The Troves of Academe: Asset Allocation, Risk Budgeting, and the Investment Performance of University Endowment Funds," Working Papers FIN-03-07, McCombs Research Paper Series.

Brown, S. J., and J. B. Warner (1985): "Using daily stock returns : The case of event studies," *Journal of Financial Economics*, 14(1), 3–31.

Busse, J. A., A. Goyal, and S. Wahal (2006): "Performance Persistence in Institutional Investment Management," *SSRN eLibrary*.

Carpenter, A. E. (1956): "College and University Endowment Funds: How Much Common?," *Financial Analysts Journal*, 12, 63–65.

Cohen, L., A. Frazzini, and C. Malloy (2007): "The Small World of Investing: Board Connections and Mutual Fund Returns," NBER Working Papers 13121, National Bureau of Economic Research, Inc.

——— (2008): "Sell Side School Ties," NBER Working Papers 13973, National Bureau of Economic Research, Inc.

Cornelli, F., and O. Karakas (2008): "Private equity and corporate governance: Do LBOs have more effective boards?," Working papers series, London Business School.

Davidson, H. A. (1971): "Investing College Endowment Funds: A comparison of Internal and External Management," *Financial Analysts Journal*, 27, 69–74.

Dimmock, S. G. (2006): "Portfolio Choice, Background Risk, and University Endowment Funds," Working paper, Michigan State University.

Dybvig, P. H. (1999): "Using Asset Allocation to Protect Spending," *Financial Analysts Journal*, 55, 49–62.

Faccio, M., and L. H. P. Lang (2002): "The ultimate ownership of Western European corporations," *Journal of Financial Economics*, 65(3), 365–395.

Fenn, G. W., N. Liang, and S. Prowse (1995): "The economics of the private equity market," Discussion paper.

Ferreira, M. A., and P. P. Matos (2007): "The Colors of Investors' Money: The Role of Institutional Investors Around the World," Discussion paper.

Gertner, R., and S. N. Kaplan (1996): "The value maximizing board," Working papers series, University of Chicago.

Giannetti, M., and L. A. Laeven (2007): "Pension Reform, Ownership Structure, and Corporate Governance: Evidence from a Natural Experiment," ECGI - Finance Working Paper No. 181/2007.

Gillan, S. L., and L. T. Starks (1998): "A Survey of Shareholder Activism: Motivation and Empirical Evidence," *Contemporary Finance Digest*, 2, 10–34.

——— (2007): "The Evolution of Shareholder Activism in the United States," *Journal of Applied Corporate Finance*, 19(1), 55–73.

GivingUSAFoundation (2006): Giving USA 2006.

Glode, V., and R. C. Green (2009): "Information Spillovers and Performance Persistence in Private Equity Partnerships," *SSRN eLibrary*.

Gompers, P., and J. Lerner (2000): "Money chasing deals? The impact of fund inflows on private equity valuation," *Journal of Financial Economics*, 55(2), 281–325.

Gompers, P. A. (1995): "Optimal Investment, Monitoring, and the Staging of Venture Capital," *Journal of Finance*, 50(5), 1461–89.

Gompers, P. A., and J. Lerner (1998): "The Determinants of Corporate Venture Capital Successes: Organizational Structure, Incentives, and Complementarities," NBER Working Papers 6725, National Bureau of Economic Research, Inc.

——— (2001): *The money of invention: how venture capital creates new wealth*. Harvard Business School Press, Boston, Massachusetts.

——— (2004): *The Venture Capital Cycle*. The MIT Press, Cambridge, Massachusetts.

Gorman, M., and W. A. Sahlman (1989): "What do venture capitalists do?," *Journal of Business Venturing*, 4(4), 231–248.

Gottschalg, O., and L. Phalippou (2009): "The Performance of Private Equity Funds," *Review of Financial Studies*, 22(4), 1747–1776.

Greenwood, R. M., and M. Schor (2007): "Investor Activism and Takeovers," Discussion paper.

Grossman, S. J., and J. E. Stiglitz (1976): "Information and Competitive Price Systems," *American Economic Review*, 66(2), 246–53.

He, P. (2007): "A Theory of IPO Waves," *Review of Financial Studies*, 20(4), 983–1020.

Heckman, J. (1979): "Sample Selection Bias as a Specification Error," *Econometrica*, 47(1), 153–61.

Hochberg, Y. V., A. Ljungqvist, and Y. Lu (2007): "Whom You Know Matters: Venture Capital Networks and Investment Performance," *Journal of Finance*, 62(1), 251–301.

Holmstrom, B., and S. N. Kaplan (2001): "Corporate Governance and Merger Activity in the United States: Making Sense of the 1980s and 1990s," *Journal of Economic Perspectives*, 15(2), 121–144.

Hsu, D. H. (2004): "What Do Entrepreneurs Pay for Venture Capital Affiliation?," *Journal of Finance*, 59(4), 1805–1844.

Inderst, R., and H. M. Muller (2004): "The effect of capital market characteristics on the value of start-up firms," *Journal of Financial Economics*, 72(2), 319–356.

Jovanovic, B., and P. L. Rousseau (2002): "The Q-Theory of Mergers," *American Economic Review*, 92(2), 198–204.

Kahan, M., and E. B. Rock (2006): "Hedge Funds in Corporate Governance and Corporate Control," Research Paper No. 06-16, U of Penn, Inst for Law & Econ.

Kaplan, S. N., and A. Schoar (2005): "Private Equity Performance: Returns, Persistence, and Capital Flows," *Journal of Finance*, 60(4), 1791–1823.

Kaplan, S. N., and J. C. Stein (1993): "The Evolution of Buyout Pricing and Financial Structure in the 1980s," *The Quarterly Journal of Economics*, 108(2), 313–57.

Kaplan, S. N., and P. Stromberg (2003): "Financial Contracting Theory Meets the Real World: An Empirical Analysis of Venture Capital Contracts," *Review of Economic Studies*, 70(2), 281–315.

——— (2009): "Leveraged Buyouts and Private Equity," *Journal of Economic Perspectives*, 23(1), 121–46.

Kaplan, S. N., and P. Strömberg (2004): "Characteristics, Contracts, and Actions: Evidence from Venture Capitalist Analyses," *Journal of Finance*, 59(5), 2177–2210.

Karpoff, J. M. (2001): "The Impact of Shareholder Activism on Target Companies: A Survey of Empirical Findings," Discussion paper.

Klein, A., and E. Zur (2006): "Entrepreneurial Shareholder Activism: Hedge Funds and Other Private Investors," Law and Economics Research Paper No. 06-41, NYU.

Kortum, S., and J. Lerner (2000): "Assessing the Contribution of Venture Capital to Innovation," *RAND Journal of Economics*, 31(4), 674–692.

Kramarz, F., and D. Thesmar (2006): "Social Networks in the Boardroom," IZA Discussion Papers 1940, Institute for the Study of Labor (IZA).

La Porta, R., F. L. de Silanes, A. Shleifer, and R. W. Vishny (1998): "Law and Finance," *Journal of Political Economy*, 106(6), 1113–1155.

La Porta, R., F. Lopez-De-Silanes, A. Shleifer, and R. Vishny (2002): "Investor Protection and Corporate Valuation," *Journal of Finance*, 57(3), 1147–1170.

Lerner, J. (1994): "The Syndication of Venture Capital Investments," *Financial Management*, 23(3).

Lerner, J. (1995): "Venture Capitalists and the Oversight of Private Firms," *Journal of Finance*, 50(1), 301–18.

——— (2002): "Boom and bust in the venture capital industry and the impact on innovation," *Economic Review*, (Q4), 25–39.

——— (2007): "Yale University Investment Office: August 2006," Harvard Business School Case no. 9-807-073.

Lerner, J., A. Schoar, and J. Wang (2008): "Secrets of the Academy: The Drivers of University Endowment Success," NBER Working Papers 14341, National Bureau of Economic Research, Inc.

Lerner, J., A. Schoar, and W. Wongsunwai (2007): "Smart Institutions, Foolish Choices: The Limited Partner Performance Puzzle," *Journal of Finance*, 62(2), 731–764.

Lerner, Josh, S.-M., and P. J. Strömberg (2008): "Private Equity and Long-Run Investment: The Case of Innovation," Nber working paper no. w14623.

Litvack, J. M., B. G. Malkiel, and R. E. Quandt (1974): "A Plan for the Definition of Endowment Income," *American Economic Review*, 64(2), 433–37.

Ljungqvist, A., Y. V. Hochberg, and A. Vissing-Jorgensen (2009): "Informational Hold-Up and Performance Persistence in Venture Capital," *SSRN eLibrary*.

Ljungqvist, A., M. Richardson, and D. Wolfenzon (2008): "The Investment Behavior of Buyout Funds: Theory and Evidence," NBER Working Papers 14180, National Bureau of Economic Research, Inc.

MacKinlay, A. C. (1997): "Event Studies in Economics and Finance," *Journal of Economic Literature*, 35(1), 13–39.

Malkiel, B. G. (1995): "Returns from Investing in Equity Mutual Funds 1971 to 1991," *Journal of Finance*, 50(2), 549–72.

Massa, M., M. A. Ferreira, and P. P. Matos (2007): "Shareholders at the Gate? Cross-Country Evidence on the Role of Institutional Investors in Mergers and Acquisitions," Discussion paper.

Michelacci, C., and J. Suárez (2004): "Business Creation and the Stock Market," *Review of Economic Studies*, 71(2), 459–481.

Pastor, L., L. Taylor, and P. Veronesi (2006): "Entrepreneurial Learning, the IPO Decision, and the Post-IPO Drop in Firm Profitability," NBER Working Papers 12792, National Bureau of Economic Research, Inc.

Pastor, L., and P. Veronesi (2009): "Technological revolutions and stock prices," *American Economic Review*, 99(4), 1451–1483.

Persons, J. C., and V. A. Warther (1997): "Boom and Bust Patterns in the Adoption of Financial Innovations," *Review of Financial Studies*, 10(4), 939–67.

Rhodes-Kropf, M., and D. T. Robinson (2008): "The Market for Mergers and the Boundaries of the Firm," *Journal of Finance*, 63(3), 1169–1211.

Sahlman, W. A. (1990): "The structure and governance of venture-capital organizations," *Journal of Financial Economics*, 27(2), 473–521.

Shleifer, A., and R. W. Vishny (2003): "Stock market driven acquisitions," *Journal of Financial Economics*, 70(3), 295–311.

Sorenson, O., and T. E. Stuart (2001): "Syndication Networks and the Spatial Distribution of Venture Capital Investments," *The American Journal of Sociology*, 106(6), 1546–1588.

Swensen, D. F. (2009): *Pioneering Portfolio Management: an unconventional approach to institutional investment*. Free Press, New York.

Sørensen, M. (2007): "How Smart Is Smart Money? A Two-Sided Matching Model of Venture Capital," *Journal of Finance*, 62(6), 2725–2762.

Timmermann, A. (1996): "Excess Volatility and Predictability of Stock Prices in Autoregressive Dividend Models with Learning," *Review of Economic Studies*, 63(4), 523–57.

Timmermann, A. G. (1993): "How Learning in Financial Markets Generates Excess Volatility and Predictability in Stock Prices," *The Quarterly Journal of Economics*, 108(4), 1135–45.

Tobin, J. (1974): "What Is Permanent Endowment Income?," *American Economic Review*, 64(2), 427–32.

Van Nieuwerburgh, S., and L. Veldkamp (2006): "Learning asymmetries in real business cycles," *Journal of Monetary Economics*, 53(4), 753–772.

Veldkamp, L. L. (2005): "Slow boom, sudden crash," *Journal of Economic Theory*, 124(2), 230–257.

Veronesi, P. (1999): "Stock Market Overreaction to Bad News in Good Times: A Rational Expectations Equilibrium Model," *Review of Financial Studies*, 12(5), 975–1007.

Wooldridge, J. (2002): *Econometric Analysis of Cross Section and Panel Data*. The MIT Press, Cambridge, Massachusetts.

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Books

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