Does Venture Capitalist Quality Affect Corporate Governance?

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Abstract

This paper investigates the effect of venture capitalist (VC) quality on the corporate governance of portfolio companies, focusing on board characteristics and financial reporting quality. I develop a new metric to measure VC quality, using data that are obtainable for virtually all VC firms. This metric is highly correlated with VC funds' financial returns, and with the likelihood of successful exits through initial public offerings or trade sales. Companies backed by higher quality VCs have larger, more independent boards of directors, and have increased VC presence on the board, even after controlling for endogeneity. After going public, companies backed by higher quality VCs have lower abnormal accruals and a lower likelihood of financial restatement. Overall, the results suggest that higher quality VCs help establish better governance at companies in which they invest.

I. Introduction

This paper investigates the effect of venture capitalist (VC) quality on the corporate governance of portfolio companies. This work fills a gap in the literature on the governance role of VCs, which has treated VCs as a uniform class and has overlooked differences across VCs. Recognizing and understanding the effects of these quality differences is also important for entrepreneurs seeking venture funding, for limited partner (LP) investors in venture capital funds, and potentially for investors in initial public offerings (IPOs).

A substantial literature has developed about venture capital, reflecting its importance as a source of financing for U. S. companies.[1] Prior research has examined the governance role of VCs, portraying them as active investors who closely monitor and provide strategic and managerial guidance to the businesses in which they invest (Sahlman 1990, Lerner 1995, Hellman and Puri 2002). Extant research mostly compares VC to non-VC-backed companies, thus implicitly treating all VCs as one uniform class (Hsu 2004). However, there are widely perceived differences in VC quality (Sørensen 2007). There are large differences in financial returns that VC funds provide to their LPs, with strong persistence within VC firms (Kaplan and Schoar 2005). VCs also differ in the strength of syndication networks that they establish when co-investing with other VCs (Hochberg et al 2006). When faced with multiple VC financing offers, entrepreneurs prefer to affiliate with more reputable VCs (Hsu 2004).

In this paper, I use a large sample, archival approach to examine the effect of VC quality on the corporate governance of their portfolio companies. Ideally, a VC firm's quality would be measured by the internal rate of return (IRR) of its funds. However, VCs usually keep IRR data

[1] Over the past 20 years, more than one-third of all IPOs in the U. S. have been VC-backed (Morsfield and Tan 2006). Well-known VC-backed companies include FedEx, Genentech, Intel, Amgen, Cisco, Microsoft, Apple, eBay, and Google (Source: NVCA website, <http://www.nvca.org >, accessed December 22, 2006).

confidential (Gompers and Lerner 1999).[2] I develop a measure to differentiate higher quality from lower-tier VCs, using data that are available for a large cross-section of VCs: (1) the number of prior deals that each VC has made (deal experience), and (2) the number of VCs participating in each of these deals (syndication intensity). Intuitively, these factors are related to VC quality. First, as VCs invest in more companies, they acquire the expertise needed to guide them towards a successful outcome. The number of past investments is therefore an important contributor to VC quality.[3] Second, VCs syndicate deals because, by subjecting a deal to the approval of more than one reviewer, syndication may lead to better selection of investments (Sah and Stiglitz 1986, Lerner 1994a). Syndication activity is therefore also an important contributor to VC quality because it indicates that a VC's opinion is valued by its peers.

The quality score for each VC is computed as the product of prior deal experience and average syndication intensity (and represents the total number of VCs participating in all deals that the VC has previously made). VCs with a higher score are viewed as having higher quality. This score can be interpreted as the size of the "super-syndicate" involving all of the VC's past investments. The measure is nonlinear in both deal experience and syndication intensity, it can be easily calculated at any point in time, and it uses data that are obtainable for virtually all VC firms. I validate the metric where data are available and show that the quality score is highly correlated with the IRR of VC funds. Also, investments by VCs with higher quality scores have a higher probability of an IPO or trade sale (acquisition by another company), the most favorable investment outcomes.

[2] The lack of transparency in the venture capital industry, and in private equity more generally, has been the subject of much recent debate. Although the availability of IRR data is generally improving, with some prominent LPs such as Calpers and Utimco publicly disclosing the performance of VC funds in which they have invested, reliable and comprehensive data is still very difficult to obtain.

[3] The dollar amount deployed by a VC would be an alternative measure of deal experience that also indicates the extent to which LPs have entrusted their capital to the VC. However, lack of reliable and comprehensive data again hinders large sample studies. In comparison, identifying the companies in which a VC has invested is relatively straightforward.

I find that companies receiving investments from higher quality VCs have larger boards of directors, a higher proportion of independent directors, and a higher likelihood of having a VC on their board. One possible explanation for the findings is that VCs invest in startups based partly on unmeasured factors that are related to the governance features observed (Sørensen 2007).[4] Econometrically, in order to address this endogeneity concern, I use an instrumental variables approach. The instruments for VC quality that I use are VCs' financial performance (IRRs achieved by their funds), and the rate at which they achieve IPO or trade sale exits. The results are robust to the instrumental variables specification.

Further, for the sub-sample of portfolio companies that have been taken public, those backed by higher quality VCs exhibit less aggressive financial reporting, reflected in lower abnormal accruals and a lower rate of subsequent financial restatements. The difference in abnormal accruals is most pronounced in the period surrounding the expiration of IPO lockups, suggesting that lower-tier VCs are more inclined than higher quality VCs to allow a lapse in their monitoring when they are about to dispose of their shares, and permit their companies to report financial results more aggressively to potential new investors. Companies backed by lower-tier VCs behave as aggressively as non-VC-backed companies in their financial reporting. The probability of any fiscal quarter since IPO being restated in a company belonging to one of these two categories is almost 50% higher than for a similar company backed by a higher quality VC. Overall, the evidence points to high quality VCs having a beneficial influence on the corporate governance of their portfolio companies.

This paper contributes to the literature on the value-added roles of VCs as a determinant of corporate governance outcomes. I add to the literature by examining variation across VCs in

[4] These factors may include the background of the entrepreneur, characteristics of the founding team, the manner in which the deal came to the VC's attention, or the existence of earlier, informal rounds of financing by angel investors.

addition to performing VC versus non-VC comparisons. With respect to financial reporting quality, recent research has shown that IPO-year abnormal accruals are lower for VC-backed IPO firms (Hochberg 2005, Morsfield and Tan 2006). By examining VC quality, I show that this effect is attributable to a small number of VCs. Companies backed by lower-tier VCs have abnormal accruals that are as high as those of non-VC-backed IPO firms.

This paper also adds to our understanding of the longer term effects of VCs. Hellman and Puri (2002) find that VCs affect the pre-IPO development of startups in areas such as human resource policies, the adoption of stock option plans, the hiring of a marketing VP, and the replacement of the founder with an outside CEO. This paper finds that VC influence is also reflected in board characteristics and financial reporting quality, even years after the companies have gone public.

Finally, this paper makes a methodological contribution. Prior research has used several proxies for VC quality or reputation, and researchers usually consider the effect of each proxy separately from the others (Hsu 2004, Barry et al. 1990). I propose a new, simple-to-construct measure that classifies VCs parsimoniously into groups, using their past investment and co-investment patterns. I show that VCs classified into the top quartile of this measure exhibit superior performance in several ways: they generate better financial returns for their LPs, their portfolios have superior IPO or trade sale exit rates, and they also contribute to better governance characteristics in their portfolio companies.

The rest of the paper is organized as follows: Section II develops empirical predictions about how higher quality VCs differ from lower-tier VCs. Section III describes the construction of the dataset, empirical tests conducted, and the main analyses. Section IV concludes.

II. Development of empirical predictions

A. Institutional setting

VCs are intermediaries who aggregate money from several sources, typically institutions such as pension funds, insurance companies, endowments, foundations, and banks. The dominant legal structure for venture funds is the limited partnership, with the VC acting as the general partner, while the investors are limited partners who have little influence on the management of the funds. VCs usually charge a two percent annual management fee, and retain 20 percent of the profits they make on their portfolio investments (Gompers and Lerner 1999).

Having obtained commitments for funds from their LPs, VCs invest the money in young companies developing innovative technologies that are projected to grow very fast (Fenn et al. 1997). VCs usually influence the management of the companies they finance and closely monitor them (Gorman and Sahlman 1989). This close monitoring by VCs is a valuable form of support and guidance for relatively inexperienced entrepreneurs. VCs negotiate complex control rights, including board representation rights, at the time of their investment and utilize sophisticated mechanisms to monitor and advise their companies (Kaplan and Stromberg 2003).

B. The governance role of VCs

VCs do not manage the day-to-day operations of the businesses they invest in; instead, they intensively monitor the managers of those businesses (Gorman and Sahlman 1989). When there is a gap in the management team, VC involvement increases. Lerner (1995) finds that the board representation of VCs increases around the time of CEO turnover, while the number of other outsiders remains the same. In the absence of direct monitoring by VCs, companies employ substitute control mechanisms. Engel et al. (2002) find that, compared to companies with no VC involvement, those with direct monitoring by VCs make less use of accounting and stock based

measures as explicit performance criteria in CEO compensation contracts. VCs usually secure board representation rights in the initial negotiations, including contingency clauses that increase these rights in adverse conditions. Acting through the board of directors, VCs have the power to hire and fire the senior management of their portfolio companies (Kaplan and Stromberg 2003).

VC influence also extends to board characteristics and financial reporting quality of companies after they have gone public. At the time of IPO, VC-backed companies have more independent outsiders and fewer inside and instrumental directors (commercial bankers, lawyers, accountants, and consultants, who advise the company) (Baker and Gompers 2003). Hochberg (2005) finds that VC-backed IPO companies have more independent boards, audit and compensation committees, and a higher likelihood of separating the roles of CEO and chairman of the board, higher stock market reaction to the announcement of poison pill adoption, as well as lower earnings management in the year of the IPO. Morsfield and Tan (2006) find that IPO-year abnormal accruals are lower for VC-backed companies after controlling for IPO lockup provisions and partial cashing out by VCs subsequent to the IPO, implying that VCs improve financial reporting quality.

C. Corporate governance, board characteristics and financial reporting quality

One important function of corporate governance is to ensure the quality of the financial reporting process, and an important player in the corporate governance 'mosaic' is the board of directors (Cohen et al. 2004). The notion of financial reporting quality itself remains a vague concept, however, despite the fact that the Sarbanes-Oxley Act of 2002 requires auditors to discuss the quality of financial reporting methods and not just their acceptability.[5] Prior literature has assessed financial reporting quality through earnings management, financial restatements,

[5] Section 404 of the Sarbanes-Oxley Act requires that annual reports must contain an assessment made by management of "the effectiveness of the internal control structure and procedures of the issuer for financial reporting," together with an attestation by the auditor.

and instances of fraud. Klein (2002) finds lower earnings management in companies with a majority-independent board and/or audit committee, and suggests that boards structured to be more independent of the CEO are more effective in monitoring the corporate financial accounting process. Dechow et al. (1996) find that companies subject to enforcement action by the SEC (identified through Accounting and Auditing Enforcement Releases) have less independent boards and audit committees.

D. VC quality

Most research on venture capital treats all VCs as one uniform group. However, there are widely perceived differences in quality among VCs.[6] Hsu (2004) surveys a small sample of early-stage startups that have received multiple VC financing offers, and finds that entrepreneurs are three times more likely to accept offers from higher reputation VCs, and are willing to accept a 10-14% discount on the valuation of their business.[7] Differences in VC quality are also manifested in substantial differences in the financial returns that VCs produce for their LPs (Kaplan and Schoar 2005). When VCs take their companies public, the capital markets appear to recognize variations in VC quality: the amount of IPO underpricing is lower for issuers backed by higher quality VCs (Barry et al. 1990).

Assessing VC quality is difficult, especially for outsiders. It is reasonable to expect, however, that industry insiders have better information regarding the quality of their peers.

[6] The related literature on other classes of financial intermediaries has also documented differences among, for example, financial analysts (Stickel 1992), investment banks (Carter and Manaster 1990), and external auditors (Beatty 1989). The perceived quality differences among those other intermediaries is often explicit and observed by the marketplace (as evidenced by analyst rankings, bulge bracket investment banks, or big four auditors). This suggests a similar quality distinction among VCs. However, VC intermediaries are notorious for their lack of transparency, making it difficult to assess their quality. This may partly explain why extant research has largely ignored heterogeneity among VCs.

[7] The past 15 years have seen tremendous growth in the amount of capital invested in the private equity asset class (which includes venture capital). Total funds committed to venture capital totaled just over $5 billion in 1990 and had grown to $45 billion by 2005, with a high of $154 billion in 2000 alone. (Source: Fund commitment report generated by Venture Economics, <http://www.venturexpert.com>, accessed December 27, 2006.) As a result, entrepreneurs with good ideas often receive financing offers from multiple VCs.

Interactions between VCs can provide valuable information about relative quality. Deal syndication is easily observed and is common practice among VCs (Lerner 1994a). When deciding whether to make a first-round investment, VCs have very little information about the new prospect. In these situations, a VC who finds a promising deal tends to syndicate the deal with other VCs with similar experience (Lerner 1994a).[8] Participation in a first-round syndicate implies that a VC has successfully persuaded other VCs or has been invited to co-invest in a new prospect, and is therefore likely to be an important contributor to VC quality. Furthermore, syndication networks facilitate sharing of information and other resources among VCs, which can help add value to portfolio companies, for example through an expanded range of customers and formation of strategic alliances with other portfolio companies (Hochberg et al. 2006).

E. Hypotheses

Prior studies have generally concluded that VCs play a positive role on governance. Once they have decided to back an entrepreneur, they add value by closely monitoring the managers and by providing strategic and managerial guidance. In the words of one VC, "We venture capitalists like to think of ourselves as giants striding across the technology landscape, showering money on terrific young entrepreneurs, adding value, creating jobs, nurturing real companies. We are financial samurai." (Anderson 2005). However, VCs are not all equally effective in these roles. Entrepreneurs often use the pejorative term 'vulture capitalists' to describe VCs who seek financial gains for themselves at the expense of business founders or other investors. A higher quality VC should have both better ability and a greater incentive to protect its reputation by establishing good governance practices in its portfolio companies. My first hypothesis is that companies that received initial funding from higher quality VCs will exhibit better governance.

[8] In later rounds, when more information is available, VCs syndicate both with their peers as well as with less experienced VCs (Lerner 1994a).

When VCs seek to exit their investments, the information and agency problems that the VCs faced vis-à-vis the entrepreneurs shift to the new prospective external investor, and VCs' and founders' interests become more aligned. IPOs represent a highly visible form of exit for VCs. Virtually all IPOs nowadays feature lockup agreements. Under these voluntary agreements between underwriters and issuers (i.e. not mandated by any SEC rules or legislation), insiders and other pre-IPO shareholders agree not to sell their shares for a specified period, typically 180 days following the IPO. Hence the IPO lockup expiration represents the first opportunity for both founders and VCs to exit their investments.[9] Opportunistic VCs might be tempted, for their own financial gains, to allow a temporary lapse in monitoring to permit their portfolio companies to present their financial performance in a better light to new prospective investors. However, this is less likely for higher quality VCs, who have an incentive to protect their reputations. My second hypothesis is that, for portfolio companies that have gone public, those backed by higher quality VCs will exhibit less opportunistic financial reporting in the period leading up to lockup expiration.

III. Data and empirical tests

A. Data

I construct the main dataset from the Thomson Venture Economics database. I extract information on the first round of venture capital financing received by young companies (classified in Venture Economics as being in the seed, startup, or early stage at the time of investment). Focusing on first-round investments has several advantages: (1) This is the first time that entrepreneurs are dealing with VCs and facing the choice of which ones to use as a

[9] Note also that VCs often return capital to their LPs in the form of shares of the newly public company instead of cash. The incentives for VCs are still to distribute these shares at a time when they are highly priced, since this will reflect in enhanced fund returns when the VCs report their funds' performance to their LPs.

source of financing. In later rounds, the lead VC may invite other VCs to participate, but by then, the entrepreneur has little say in these decisions; (2) VCs face the most uncertainty about a startup's prospects when they are about to make the initial investment, and they are likely to invite other VCs who they believe can add the most value in order to maximize the probability of a successful outcome. I use this dataset to construct a VC quality measure that reflects past deal experience and syndication intensity for each VC, as described in section III B.

I identify 12,721 VC-company pairs representing first-round investments in 8,600 US companies by 1,386 US-based VCs between 1990 and 2004. On average, each startup receives first-round funding from 1.5 VCs. I obtain a list of board members for each portfolio company as of the most recent update conducted by Venture Economics.[10] I also collect information on whether the board member is independent (classified as non-managing in Venture Economics), whether the CEO is also a founder of the company, and whether the CEO is also the chairman of the board. I crosscheck and supplement the Venture Economics data using proxy statements for companies that have gone public. I then calculate the size of the board for each company, the number of independent directors, the fraction of the board comprised of independent directors, and the number of VCs sitting on the board, if any. Data on board characteristics are available for 6,991 companies (81% of the sample companies).[11]

[10] These dates range from 2002 to 2006. Venture Economics updates information on portfolio companies whenever there is a triggering event that results in a database entry. For instance, a portfolio company that went public several years ago will have its information updated if it acts as an investor in a venture that is tracked by Venture Economics. I repeat all the analyses involving board data after excluding stale and potentially unreliable information by restricting the latest update field to dates falling in 2005 or later, and I obtain very similar results.

[11] As a cross-check and to guard against potential data reliability issues, I also obtain board information from an independent source, VentureOne (I thank John Gabbert, VentureOne's Managing Director, for providing the data). VentureOne provided data for 4,665 companies in the sample, and the following board characteristics were available: board size, number of independent directors, fraction of board comprised of independent directors, number of VCs on board, and information on whether the founder was also a member of the board. I obtain similar results about the effect of VC quality if I use the VentureOne data. For example, tests of differences of means across top-quartile and lower-tier VCs produce results that mirror those presented in Panel A of Table 4, except that the difference for number of independent directors is not significant at conventional levels (p-value of 0.11).

Table 1 Panel A shows the status as of September 2006 of the 8,600 portfolio companies, broken down by cohort year of investment. As expected, the majority of recent investments made after 2000 are still active investments. Less than 9% of companies in the sample have successfully been taken public, 28% have been exited by means of trade sales, while the failure rate in terms of liquidated or inactive investments is 15%.[12] The average holding period for investments that resulted in an IPO is 3.4 years, and 3.8 years for trade sales.

Table 1 Panel B shows the industry composition of the sample. Biotechnology and medical investments are proportionally more represented in IPO exits, whereas Internet-specific investments only account for 18% of IPOs while making up 24% of all investments. The reverse pattern can be seen in liquidated and inactive investments, where relatively few are in the biotechnology and medical fields, whereas 41% of all liquidated and inactive investments are in Internet-specific industries.

Panel C of Table 1 shows descriptive statistics for board characteristics. The average board size is 4.4, with 65% of the average board being comprised of independent directors. The initial VCs still have seats on the board (as of September 2006) in 69% of the sample. In those companies where VCs still have board representation, as many as four VCs sit on the board, with two VCs being the median. A founder stays on as CEO in only 6% of cases, whereas 15% of the time, the CEO is also the chairman of the board.

Panel D of Table 1 shows mean and median board characteristics for portfolio companies classified according to their status as of September 2006. The mean (median) board size for companies going public is 6.2 (7), higher than for any other category of VC-financed companies. On average, 77% of directors at VC-financed companies going public are classified as

[12] The liquidated or inactive figure is likely to be understated. Portfolio companies classified as "still active" in Venture Economics also include "zombies" – companies that the VCs have lost interest in, but that are able to maintain an independent existence.

independent, also higher than the overall average proportion of 65% for all categories combined. VC board representation drops after portfolio companies have been taken public (1.7 VCs per board on average) or sold in private transactions (1.8 VCs per board), when compared to private and still active investments (2 VCs per board). Only 2% of companies that have gone public have a founder remaining as the CEO, but the CEO takes on the role of chairman of the board more often in companies that went public (30%) than for those remaining private (13%).

Table 2 contains descriptive statistics for the 1,386 VCs who provided first-round financing to the sample companies. The number of first-round investments made in the period 1990-2004 ranges from one to 192, with a median of three. The average IPO conversion rate enjoyed by a VC, i.e., the fraction of first-round investments that resulted in a subsequent IPO, is 7%, whereas the average conversion rate for trade sales is much higher, at 24%. On average, 53% of first-round investments are still held in the VC's portfolio as of September 2006. The picture does not change appreciably if I weight each investment by the proportion of dollars invested in the portfolio company to total dollars invested by the VC over the sample period.

In terms of geographical location of the VC, the northeast region of the United States (including New York and Boston) and the west (including Silicon Valley in California) are equally well represented, with approximately one third of all VCs in the sample headquartered in each of those two regions.

B. VC quality

In this section, I describe the calculation of the quality score. I collect data on variables that have been used in prior research as proxies for VC quality: the amount of capital under management, the age of the VC firm, the number of venture investments made in early-stage and seed startups, split into first and later rounds, and the average size of the syndicates that invested

in those deals.[13] Table 3 Panel A shows descriptive statistics for the VCs in the sample. The average VC in the sample started in the venture capital business in 1993, with the oldest starting as long ago as 1911 and the youngest raising its first fund in 2004. The skewness in the distribution of VC size is pronounced, whether measured in terms of capital under management or in number of investments. For example, the number of companies in which a VC invested (whether a first or a later round) ranges from one to 1,355, with a median value of 11. When restricted to first rounds only, the range is between one and 311, with a median value of four. The average size of a first-round investment syndicate is 2.9 (2.2 for all rounds), again with substantial variation across VCs.

Panel B shows pairwise correlations among these variables. The correlation matrix shows that age, size (as measured by capital under management), and number of investments are more highly correlated with one another than syndicate size. I also conduct a principal-components factor analysis of these variables, and the results confirm these initial findings. Two factors have eigenvalues greater than one. As shown in Table 3 Panel C, the variables for age, capital under management, and number of prior deals have the highest loadings for the first factor, and the variables for syndicate size load the most significantly in the second factor.

The results of the preceding analysis suggest that a VC's deal experience and syndication intensity are two underlying dimensions that reflect its quality. I further simplify these two

[13] Hsu (2004) uses the number of deals that a VC has made in the startup's industrial segments as his main proxy for VC reputation. For robustness purposes, he also uses fundraising frequency (number of prior funds the VC has raised per year of operation), number of boards per general VC partner, and two subjective ratings provided by his survey respondents, VC network resources and VC reputation ranking. Barry et al. (1990) and Baker and Gompers (2003) use measures that are specific to IPO settings. Barry et al. use the number of VCs with pre-IPO equity positions in IPO companies as a proxy for the quality of VC monitoring. As robustness checks, they also consider the length of time the lead VC has served on the board of the IPO company, the age of the lead VC, the percentage of the issuer's equity held by VCs, the number of prior deals in which the lead VC participated, and the amount of capital managed by the VC. In Baker and Gompers, the proxy for VC reputation is the reputation rank of the underwriters associated with the VC in prior IPOs. In both Hsu and Barry et al., the different proxies used yield results that are generally consistent with their hypotheses but of varying strengths.

variables into a single quality score for each VC.[14] In any given year, the score is the sum of the total number of VCs that are members of syndicates in which the VC is also a member and which invested in first-round startups. I compute this measure using all available data on each VC's entire investment history.[15] As an illustration, consider the calculation of the quality score for Benchmark Capital. Benchmark was founded in 1995. In its first year, the firm made four first-round investments, only one of which was made with a co-investing VC. The quality score is calculated as 5 ((3x1) + (1x2)), and Benchmark is classified as a lower-tier VC in that year. In 1996, the firm made 7 additional first-round investments, two of which involved one other VC, and one deal with two co-investing VCs. The quality score in 1996 is therefore 16 ({(4x1) + (2x2) + (1x3)} + 5). In 1997, Benchmark made 7 new first-round investments, only one of which was a solo investment. Three deals involved one other VC, and the remaining three deals each involved two co-investing VCs. The 1997 score for Benchmark is calculated as ({(1x1) + (3x2) + (3x3)} + 16) = 32, which placed the firm in the top quartile in that year, where it has remained since.

There are several advantages to using this score as a measure of VC quality. First, it can be calculated at any point in time. Second, unlike the IRR of past funds, which would be a nice measure of VC quality, the quality score uses data that are obtainable for virtually all VCs. Third, there is an intuitive interpretation of the aggregate score, which can be thought of as the

[14] I repeat all my analyses using the individual components instead of this aggregate score. In the regressions of board characteristics (discussed in section III D), each component is significant on its own if used as an independent variable in lieu of the quality score, but if both are included as regressors, deal experience ceases to be significant at conventional levels in some specifications, whereas syndication intensity remains highly significant. I also repeat the analyses using the factor scores for the two principal components generated using the full set of quality proxies (i.e. age, capital under management, number of prior deals and syndication intensity in those deals, both for all rounds combined and for first rounds separately), and I obtain similar results to those reported in this paper.

[15] This ensures that a quality score can be computed for every VC that was active in the every year of the sample period, including the first year.

size of the "super-syndicate" involving all of the VC's first-round investments to date.[16] Fourth, it allows for VC preferences for syndication. Syndication intensity (measured as the number of VC investors per deal, averaged over all of a VC's past deals) is a good indication of the VC's standing among its peers if it reflects the VC's ability to attract other sophisticated investors; however, a few well-known and highly successful VCs, such as Sequoia, choose not to syndicate very often, even though many other VCs would like to co-invest with them. By incorporating the number of past deals as well as syndication intensity per deal in the quality score, I ensure that VCs that tend not to syndicate can receive a high rating through the number of past deals made. Indeed, in my sample, well-known VCs such as Benchmark, Draper Fisher Jurvetson, and Technology Crossover Ventures are placed in the second lowest quartile of syndication intensity, but are ranked in the top quartile of the aggregate quality score because they have been highly successful at identifying opportunities and have invested in a large number of deals. Likewise, a few VCs rank in the top quartile of syndication intensity, but rank in the third overall quality quartile because they have made very few investments.

The construction of the quality score discussed above ignores several features of VC deals that also reflect quality. It assigns equal weights to all of a VC's past investments, irrespective of how long ago the investment was made. It also does not take into account whether a VC participates in a syndicate as a lead or non-lead investor. The lead VC typically assembles the syndicate and has the closest ties to the portfolio company, and therefore it may have a greater degree of influence on the company's development. It is possible to define the quality score by assigning weights based on recency or whether the VC took a lead role in the syndicate. In this spirit, I construct alternative variants of the quality score that only consider investments

[16] Note that a co-investing VC can appear multiple times in this "super-syndicate."

made in the most recent five or ten years (effectively assigning zero weights to deals made before the cut-off points). The results reported in this paper are unaffected by these choices.

The aggregate score appears to capture a dimension of VC quality that is different from either age or size, both of which have been used in prior research as proxies for quality. In unreported plots, I graph VC age and size separately against the quartiles of quality score, and both plots display a distinct nonlinearity, with the youngest and smallest VCs being in intermediate quartiles, and not the lowest quartile.[17] The VC quality score ranges from one (for those VCs that made only one first-round investment, and did so by themselves) to 879 (very active VCs that specialize in early-stage investments and/or co-invest heavily in those first rounds).[18] The average score for the sample as a whole is 31.

Panel D of Table 3 shows the progression of the VC quality score and its components over time. The rising trend in number of active VCs reflects the rapid growth of the venture capital industry over the period. The cumulative number of first-round investments per average VC reached a low of 12.2 per VC in 2002, which is consistent with the "money chasing deals" phenomenon associated with the latter part of the sample period. This trend can also be seen in the quality score. In the initial four or five years of the sample period, the mean quality score hovers around 47. The years between 1994 and 2000 are characterized by a sharp decline in the quality score to around 29, and this level is maintained starting from 2000. One interpretation of this trend is that many low quality VCs entered the market in the period between 1994 and 2000, but there was no further dilution of overall VC quality following the dot-com crash. Since VC funds have a ten-year lifespan, I do not yet observe the lower quality VCs leaving the market. Another interesting pattern is the steady decrease in average syndicate size (calculated on a

[17] The nonlinearity is especially pronounced for size. The mean amounts of capital under management for VCs falling in the lowest through highest quartiles of the quality score are: 485, 366, 365, and 1,126 (in $m).
[18] VCs with a score of one may be later-round specialists.

cumulative basis) from 2.8 in 1990 to 2.2 in the 2000s, which means that more recent deals are not attracting investment syndicates comparable in size to those of a decade and a half ago.

I assess VC quality through a relative measure. I rank all VCs that were active in any given year by the quality score and I refer to VCs in the first quartile as "top-quartile VCs." This method results in a greater number of VCs joining the top-quartile category in periods when the number of active VCs is increasing, as was the case throughout the sample period. The quartile ranking is relatively stable at the VC level. The mean (median) annual change in quartile ranking for an individual VC is 0.07 (zero).[19]

C. Validating the quality score

In this section, I explore how VC performance is related to the quality score. I assess VC performance by calculating the exit outcomes for their investments. VCs make profits from companies in their investment portfolio by taking them public (on average generating value multiples of 2.95x after a 4.2-year mean holding period) or by selling them in private transactions (at an average 1.4x value multiple after 3.7 years) (Lerner, 1994b).[20] I also collect the IRRs of funds raised by VCs and compute an average IRR for all the funds managed by each VC. I am able to find IRR data from Private Equity Intelligence for 207 VCs.[21]

For each year, I form quartile rankings of the VCs based on their quality scores. Table 3 Panel E shows that top-quartile VCs differ significantly from VCs in the lowest three quartiles in terms of their likelihood of achieving a successful exit either through an IPO or a trade sale, and

[19] It is sometimes claimed that a small number of VCs are responsible for producing most of the returns in the industry (for example, see Helft 2006). By allowing a greater number of VCs to be classified as high quality in periods of boom, I am less likely to observe differences between high and low quality VCs. An interesting exercise would be to only select a fixed number of VCs to be classified as high quality in each year (e.g. the top 100), and examine the stability of this alternative categorization scheme and its effects on this paper's results.

[20] Value multiple refers to the ratio of the value of the VC's stake at exit to the total undiscounted amount invested by the VC. For example, if a VC invests $10m in a portfolio company (possibly over several rounds), and the value of the VC's stake is $25m when exit takes place, the value multiple will be 2.5x.

[21] See Lerner et al. (2007) for a discussion of this source of IRR data.

also in the returns that they generate for their LPs. Since the bottom three quartiles do not differ significantly from one another, in the rest of the paper, I refer to them collective as lower-tier VCs, and I compare them as a group to those falling in the top quartile.

In Panel F, I show separately the effect of having a top-quartile VC as initial investor on the likelihood of a portfolio company going public, being sold privately, and for either outcome. The performance differences between top-quartile and lower-tier VCs persist even after controlling for industry, the amount invested by the VC, and the geographical proximity of VCs and their portfolio companies. Interestingly, the likelihood of an IPO exit, but not a trade sale, is higher for portfolio companies receiving greater dollar amounts of investment from the backing VCs. In addition, when the VC and portfolio company are located in the same geographic region of the United States, there is a greater likelihood of a trade sale exit, but a lower likelihood of an IPO exit. These additional control factors have little influence on the top-quartile VC effect on exit outcomes or IRRs. These results suggest that, for an entrepreneur in search of first-round venture financing, the quality score developed in this paper is a reasonable criterion for choosing among VCs, since it is highly correlated with an eventual successful outcome in the form of an IPO or a trade sale, as well as with the VCs' financial performance.

Finally, I examine the possibility that companies obtain higher quality VCs in subsequent rounds. If such upgrades occur frequently, the quality of first-round VCs may be less relevant to explain the governance outcomes of portfolio companies. Out of the 8,600 companies in the sample, 5,243 companies raised funds from VCs in additional rounds. New VCs frequently join the VC syndicate (3,165 companies raised later-round funding from VCs that were not members of the first-round syndicate). For each of these 5,243 companies, I identify the VC with the highest quality score in the first round and in later rounds. An upgrade takes place when the top

scoring VC in the first-round syndicate is a lower-tier VC, and the top scoring VC in any of the subsequent rounds is a top-quartile VC. I find that VC upgrading is not frequent: only 736 cases (14% of 5,243) involve upgrades.

D. Analysis of board characteristics

Table 4 Panel A shows the results of univariate tests of differences in means of board characteristics for top-quartile and lower-tier VCs. The average number of directors on the board of a company backed by a top-quartile VC is 4.7, and 4.2 for lower-tier VCs. The difference is statistically significant.[22] Similar patterns can be observed for the number and fraction of independent directors sitting on the board, the likelihood of one or more VCs sitting on the board, and the number of VCs on the board in the latter cases. The univariate analysis does not show any difference across the two VC groups for the likelihood that the CEO of the portfolio company is also a founder (6-7%) or the chairman of the board (14-15%).

In Panel B, I compare board characteristics of companies that received backing from lower-tier VCs and those of non-VC-backed companies. I obtain data on non-VC-backed companies from the Venture Economics database. Non-VC-backed companies covered by the Venture Economics database include those that received funding from angel investors or incubators, are corporate subsidiaries, or received financing from banks. In total, I obtained data on 1,571 of those companies. Panel B shows that these types of non-VC-backed companies have an average of 3 directors on the board, compared to 4.2 for companies backed by lower-tier VCs. On average, they have boards that consist of a minority of independent directors (45% compared to 62% for lower-tier VC-backed companies). The CEO is a founder more often in these non-VC-backed companies (8% of the time, compared to 6% for lower-tier VC-backed companies).

[22] Of course, a larger board is not necessarily indicative of better governance. A very large board can hinder effective discussion or lead to reduced accountability for individual directors. Given that the average board size of companies in my sample is 4.4, this concern is unlikely to affect this paper's results.

These results seem to suggest that investment by a VC, even a lower-tier one, is associated with board characteristics that indicate better governance than total absence of VC. These comparisons should be interpreted with care, however, because the comparison sample of non-VC-backed companies in these tests is not representative of all non-VC-backed companies.

In Panel C of Table 4, I report the results of ordinary least squares (OLS) regression analyses, which control for other factors that could explain the observed variations in board characteristics. In these regressions, the unit of analysis is a VC-company pair. Each column shows the results of a regression using the dependent variable listed in the column heading. The set of control variables includes: dummy variables for companies that have gone public or exited through trade sales, a dummy variable equal to one if the VC and portfolio company are located in the same geographic region, the age of the portfolio company, the dollar amount invested in each company by the VC, as well as fixed effects for the year in which the first-round investment took place, and fixed effects for the industry in which the company operates its business. I also include in the sample the 1,571 non-VC-backed companies identified in Venture Economics as described in the preceding paragraph, and a further 2,535 companies that received VC funding only in later rounds.[23]

The first column of results shows that companies backed by top-quartile VCs tend to have larger boards, even after controlling for exit status and all the other control factors mentioned above, and also confirms the univariate results in Panel B that non-VC-backed

[23] The percentage of the 1,571 non-VC backed companies that have gone public (as of September 2006) is 5.7%; 22% have been privately sold, and 55% are still active investments (liquidations account for the remaining cases). The corresponding figures for the 2,535 companies that only received venture funding in later rounds are: 14% have gone public, 30% have been privately sold, and 40% are still active investments. Relatively smaller fractions of non-VC backed companies are in communications and media, computer software and services, and semiconductors, but consumer-related, industrial/energy and the "other products" categories are proportionally more represented among non-VC backed companies compared to the base sample of 8,600 companies that received first-round VC funding. The industry composition of the 2,535 companies that received later-round VC funding is very similar to the base sample of 8,600 companies.

companies have smaller boards. The economic magnitudes of these effects are in line with the univariate comparisons. In addition, the VC quality effect is only weakly present and of smaller magnitude for companies that received VC backing in later rounds, providing further support for the idea that it is in the first round that the quality of investors (as measured by the quality score used in this paper) really matters. Similarly, the coefficients on number and fraction of independent directors are both higher in the presence of VCs and the effect is stronger for top-quartile VCs.

In companies that received venture funding, the likelihood of having a VC on the board and the number of board members who are VCs are both higher if the VC is in the top quartile. Geographic proximity between the VC and the portfolio company increases the likelihood of VC involvement on the board. The involvement of the VC decreases as the portfolio company matures. The greater the amount invested in the portfolio company by the VC, the larger and more independent the board, and the greater the VC representation on the board.

Appointing a founder as the CEO is less likely in VC-backed companies, and there is a weak positive effect for top-quartile VCs. Interestingly, the coefficients on exit outcomes reveal a negative association between keeping the founder as CEO and the likelihood of both an IPO and a trade sale exit. The final column shows that companies backed by top-quartile VCs in the first round are less likely to have the CEO act as chairman of the board. The coefficient on the dummy for companies that exited through an IPO is very large (close to 14%) and significant, indicating that, once public, the combination of CEO and chairman roles becomes more prevalent. Geographical proximity of the VC and portfolio company is associated with a lower probability that the CEO acts as chairman of the board. Both the age of the portfolio company

and total amount invested in the portfolio company are positively associated with the probability of having CEO-chairman duality.

I repeat the analyses in columns 3, 4, 6, and 7 of Panel C using a logit specification instead of OLS, and the results continue to hold. In unreported regressions, I also add a dummy for whether the portfolio company had a big four auditor. Although the sample size decreases by more than one third due to missing data, the presence of a big four auditor is positively related to board size and independence, but the effects of VC quality are still present.

One potential explanation for the above findings is that top-quartile VCs invest in companies that are intrinsically better governed. The residuals in the above regressions would then be correlated with the VC quality variable, and the coefficient estimates would be biased. In order to address this endogeneity concern, I also conduct instrumental variables (IV) regressions, in which I instrument for VC quality using VCs' financial performance (measured through the average IRR achieved by the funds they manage) and their success rate in exiting their investments. In earlier analyses, I showed that these outcomes are highly correlated with VC quality, so they represent good candidates for instruments. It is harder to argue that a VC's financial performance is directly linked to the governance of its portfolio companies. For the IV regressions, I only include companies that received first-round VC funding. Table 4 Panel D shows the results of IV regressions of board characteristics. In all of the regressions, diagnostic statistics show that the instruments used are reasonable. The low values obtained for the Hansen-Sargan J-statistics lend support to the validity of the instruments used. In addition, a test of the joint significance of the instruments generates an F-statistic of 120, indicating that the instruments have substantial predictive power in the first-stage regressions, and are therefore likely to have an effect on the final results. The number of available observations drops sharply

due to missing IRR data, but the effects of VC quality are still present and are in the same direction as in the OLS regressions, although coefficient estimates are statistically less significant but larger in magnitude.[24]

Overall, the above results suggest that higher quality VCs implement larger and more independent boards of directors at their portfolio companies, and are represented on these boards more frequently than lower-tier VCs.

E. Analysis of financial reporting quality for IPO sub-sample

For the next series of tests, I focus on a subset of the VCs' portfolio companies, namely the 762 portfolio companies in the sample that went public. I collect data on IPO characteristics and on subsequent equity offerings from Securities Data Corporation (SDC), and I supplement data on IPO lockup provisions from the companies' prospectuses.

Table 5 shows that the average VC-backed IPO company raised $59 million, with an average offer price of $13 per share. 78% of the IPO companies had lockup provisions and, consistent with prior studies, the lockup in over 90% of those companies expired 180 days after the IPO (Field and Hanka 2001). On average, 67% of outstanding shares were subject to lockup. 14% of the companies conducted a seasoned equity offering within one year of their IPO, while 19% did so within two years. The average company that went public received funding from 1.7 VCs in its first round.

For each portfolio company that went public, I identify from SDC a matching non-VC-backed company that conducted an IPO in the U. S. in the same year, is in the same industry, and has the closest return on assets in the year of IPO. I am able to find a match for 613 companies, yielding a total of 1,226 IPO companies. Note that, in contrast to the comparison sample in the

[24] In untabulated regressions that use the same specifications as in Table 4 Panel C but only use observations for companies that received first-round VC funding and for which IRR data is available, the coefficient estimates for VC quality are similar in magnitude and standard errors are smaller than corresponding entries in Panel D.

analysis of board characteristics in section III D, which consisted of non-VC-backed companies tracked by Venture Economics, the present comparison sample is representative of a different set of non-VC-backed companies (in particular, they have gone public). I collect financial statement data for these companies from Compustat, and data compiled by Audit Analytics on financial restatements that were announced between January 2001 and November 2006.[25]

I explore the financial reporting behaviors of companies that went public, focusing on abnormal accruals and financial restatements as indicators of breakdowns in the financial reporting process.[26] I estimate abnormal accruals using a cross-sectional version of the Jones model (Jones 1991, modified as in Dechow et al. 1995). Financial restatements provide more direct evidence of low quality reporting stemming either from past errors or outright fraud.

Abnormal accruals

I consider four distinct time periods in the life cycle of IPO companies, each consisting of four fiscal quarters. Phase 1 is a pre-IPO phase ending on the date of the fiscal quarter immediately preceding the date of the IPO. Phase 2 contains the IPO date and the lockup expiration date for most companies in the sample.[27] Phases 3 and 4 are two subsequent time periods of four quarters each (see Figure 1). Phase 2 has special significance because it is the period during which opportunistic insiders who plan to sell their shares after the expiration of the lockup are likely to engage in aggressive financial reporting in an attempt to boost share prices. Note that constructing the phases in this way for all IPO companies in the sample, including those that did not have lockup provisions, biases against finding results.

[25] Available to subscribers through the Audit Analytics website, <http://www.auditanalytics.com>, accessed November 14, 2006.
[26] I use post-IPO evidence since VC involvement can continue well beyond the IPO. Although VCs typically start to sell or distribute their shareholdings shortly after the IPO lockup expires, many VCs continue to sit on the board of directors for several years afterwards.
[27] 12 companies in the sample have lockups that expire more than 360 days after the IPO date.

Table 6 Panel A shows univariate comparisons of mean abnormal accruals for top-quartile versus lower-tier VC-backed IPO companies. On average, when all four phases are considered, companies that are in the portfolios of lower-tier VCs have small positive average abnormal accruals, whereas companies backed by top-quartile VCs have negative average abnormal accruals. An examination of the different phases reveals that abnormal accruals are positive and large for companies backed by lower-tier VCs in phase 2, which is the period surrounding lockup expiration (these trends are illustrated graphically in Figure 2). This is precisely the time period during which the incentives of management insiders and VCs are aligned when reporting to external parties. On average, a company backed by a lower-tier VC reported higher earnings in phase 2 than a benchmark group consisting of all public companies in the same industry and quarter, amounting to 1.47% of lagged total assets, which corresponds to a 6% higher annualized return on assets (ROA). To place these numbers into perspective, note that the average reported ROA in phase 2 for VC-backed IPO companies in the sample is -4.2% and the median is -1.8%. Phase 2 is the only period during which there is a significant difference in the mean level of abnormal accruals for companies backed by lower-tier and top-quartile VCs.

Panel B compares companies backed by lower-tier VCs and non-VC-backed IPO companies. During phase 2, companies backed by lower-tier VCs have abnormal accruals that are positive and larger in magnitude than non-VC-backed companies, although the difference is not statistically significant. In untabulated tests, I also repeat the above analysis using performance-matched abnormal accruals as suggested by Kothari et al. (2005).[28] I observe the same pattern for performance-matched abnormal accruals.

[28] The performance-matched abnormal accrual for a firm-quarter is defined as the abnormal accrual obtained using the modified Jones model, minus the abnormal accrual of a matching firm identified as being in the same 2-digit SIC group and fiscal quarter that has the closest return on assets in that quarter. Return on assets for matching purposes is net income (Compustat data item 69) divided by total assets at the end of the quarter (item 44).

In Panel C, I conduct regression analyses and control for other factors that could account for the patterns observed. The first column confirms the univariate results in a regression setting. In addition, the coefficient on the interaction of dummy variables for phase 2 and for non-VC-backed IPO companies is negative and weakly statistically significant, suggesting that IPO companies backed by lower-tier VCs have more aggressive financial reporting than non-VC-backed companies in phase 2. In the second column, I add controls for year fixed effects and industry fixed effects, and the results are virtually unchanged. Finally, in the third column, I include a number of additional control variables: return on assets, book to market, leverage, sales growth, firm size, and a dummy for whether the firm conducted a seasoned equity offering within two years of the IPO. These are factors that have been shown in prior research to be potentially linked to abnormal accruals in the context of IPO companies. Although the sample size decreases slightly because of missing data, the phase 2 differences between top-quartile and lower-tier VC-backed companies are still observed, and the economic effects are similar in magnitude to those in the univariate tests. Moreover, compared to lower-tier VC-backed companies, non-VC-backed companies have lower abnormal accruals in phase 2, although the difference is no longer statistically significant in the full model. As with the univariate tests, I repeat the regression analyses using performance-matched abnormal accruals. The conclusions are unchanged.

Overall, these results suggest that, in the period surrounding lockup expiration, top-quartile VC-backed IPO companies have significantly less aggressive accruals than lower-tier VC-backed companies.

Financial restatements

The Audit Analytics database tracks financial restatements announced from 2001 onwards. In the following analysis, I focus on 182 VC-backed and 182 matching non-VC-backed companies that went public starting from 2000. I identify companies in this sub-sample that restated their financial statements, the date of the restatement announcement, the quarters affected by the restatement, and the effect on earnings (i.e., whether positive or negative). I exclude instances where the restatement resulted in higher earnings.[29] Table 7 shows univariate comparisons of financial restatements for VC-backed companies, separating top-quartile from lower-tier VCs, and for matching non-VC-backed IPO companies. Panel A shows that, for VC-backed companies, the probability of a restatement affecting a fiscal quarter at any time since IPO is 5.5% if backed by a top-quartile VC, but is significantly higher at 8.6% if backed by lower-tier VCs. A similar pattern is observed if only the first two fiscal years post-IPO are considered. When these companies restate their financial statements, the effect is more severe for lower-tier VCs, as measured by the number of fiscal quarters affected by the restatement (on average, six quarters are affected by restatements made by companies backed by lower-tier VCs, compared to four quarters for top-quartile VCs).

In Panel B of Table 7, companies backed by lower-tier VCs are shown to be as likely to suffer financial restatements as non-VC-backed companies, both over their entire history since IPO to date, and in the two fiscal years immediately following IPO. Non-VC-backed companies need to restate a greater number of fiscal quarters, on average.

Overall, the results from the abnormal accruals and financial restatements analyses support the second hypothesis that, in the period surrounding lockup expiration, top-quartile VC-

[29] There are very few such cases in my sample. Including them in the analysis does not affect the results.

backed companies have less aggressive financial reporting than lower-tier VC-backed companies.

F. Caveats and limitations

There are several caveats and limitations to the results obtained in this paper. In determining VC quality, the quality score that I use ignores characteristics of VC deals that may also be related to VC quality. It does not take into account whether a VC participates in a syndicate as a lead or non-lead investor, it assigns equal weights to all prior deals regardless of when they were made, and it is biased upwards for lower-tier VCs who may be less selective in the companies they back or in their co-investors. It is therefore a very noisy measure of VC quality.

The governance features examined in this study, namely characteristics of the board of directors and financial reporting quality, do not represent a comprehensive picture of VCs' interactions with their portfolio companies. A much richer study would consider not only the form but also the substance of VC board representation, for example, which committees of the board the VCs are involved in (such as the audit and compensation committees), and the precise mechanisms they use to monitor the managers of their portfolio companies.

There are also limitations on the interpretation of causality in terms of the effect of VC quality on the corporate governance of portfolio companies. By considering only first-round investments, which arguably is a time when all VCs face similar uncertainties about the prospect (including its future governance characteristics), I attempt to minimize the possibility of sorting (in the sense that top-quartile VCs only invest in companies with better governance) (Sørensen 2007). However, it is possible that a first-round investment by a VC is preceded by one or more informal rounds involving angel investors whose presence or identity may influence the VC's

decision. Econometrically, I attempt to account for endogeneity by using an instrumental variables approach and I show that the results for board characteristics continue to hold.[30] Nevertheless, I cannot completely rule out the possibility that some of the results are due to sorting effects.

There are also other factors that could influence the nature, extent, and timing of manipulative behaviors by companies around lockup expiration. An examination of actual trading patterns by insiders, including VCs, during these time periods would yield further insights and provide stronger and more direct evidence in support of this paper's findings. One other limitation is that this analysis examines only one aspect of communications that newly public companies have with the market, namely through financial statements issued and filed with the SEC. Companies also communicate with the financial markets through news releases (both mandatory and voluntary) outside of the financial statements, and these communications may or may not coincide with the quarterly earnings announcements. A more complete study could consider voluntary disclosure behaviors of companies backed by different quality VCs.

IV. Conclusion

In this paper, I examine variations in corporate governance of startup companies that received first-round venture capital funding, and I show that their board characteristics and financial reporting quality are related to the quality of their VC backers. I propose a new measure of VC quality, using the number of prior investments a VC has made, and the number of VCs syndicating those deals. The analysis shows striking differences between the VC groups formed using this measure. When backed by higher quality VCs, startups subsequently have larger

[30] Sørensen (2007) estimates the effect of VC experience on IPO probabilities. In his setting, which is different from the one in this paper, he has no available instrumental variables and he proposes a structural two-sided matching model as an alternative method of separating the effects of VC influence and sorting.

boards with more independent directors, and benefit from increased presence of the investing VCs on their boards. For the subset of companies that achieve an IPO, those backed by higher quality VCs have less aggressive financial reporting, manifested through lower abnormal accruals in the period after the IPO and surrounding the lockup expiration, and lower rates of financial restatement. These findings suggest that when entrepreneurs seek venture funding, whom they choose as a backing VC can have longer term governance implications for their companies.

The findings in this paper raise some interesting questions that would reward future research. Further investigation of the VC quality measure is a potentially fruitful area. By the nature of its construction, the quality score will be high for VCs with extreme high values of either deal experience or syndication intensity (or both). This paper does not distinguish between VCs that fall in the high deal experience/low syndication and high syndication/low deal experience categories. These natural groupings of VC firms may reflect different strategies being pursued. It would be instructive to investigate the determinants and consequences of these different strategies.

It would also be interesting to explore whether VCs are tempted to exercise the influence they have over their companies' management to obtain advantages for themselves. For example, do VCs actively engage in opportunistic behaviors around lockup expiration dates? How do horizon considerations affect these behaviors? A company's management will expect to be around for many years after the IPO. In many companies, a substantial fraction of the compensation and wealth of the top executives takes the form of stock options or restricted stock that are subject to vesting periods of several years. If these executives behave opportunistically at the time of the IPO and are caught, they are putting at risk not only the stake that they own at the

time of the IPO, but also future additions to their equity in the company. In contrast, VCs have shorter horizons. Once their lockup expires, VCs are free to sell or distribute shares in the IPO company, eventually off-loading their entire equity stake. Do these different horizons translate into different opportunistic behaviors by VCs and corporate insiders at the time of IPO?

Other fruitful avenues to investigate would be to examine other forms of communication between companies and the market. Do companies use different forms of communication before and after they go public? To what extent do companies that exhibit manipulative behaviors with accrual reporting make use of alternative communication methods such as the nature, extent, and timing of voluntary disclosures, issuance of earnings forecasts by management, and use of pro-forma reporting, and do they exhibit similar manipulative tendencies when using these other forms of corporate communications?

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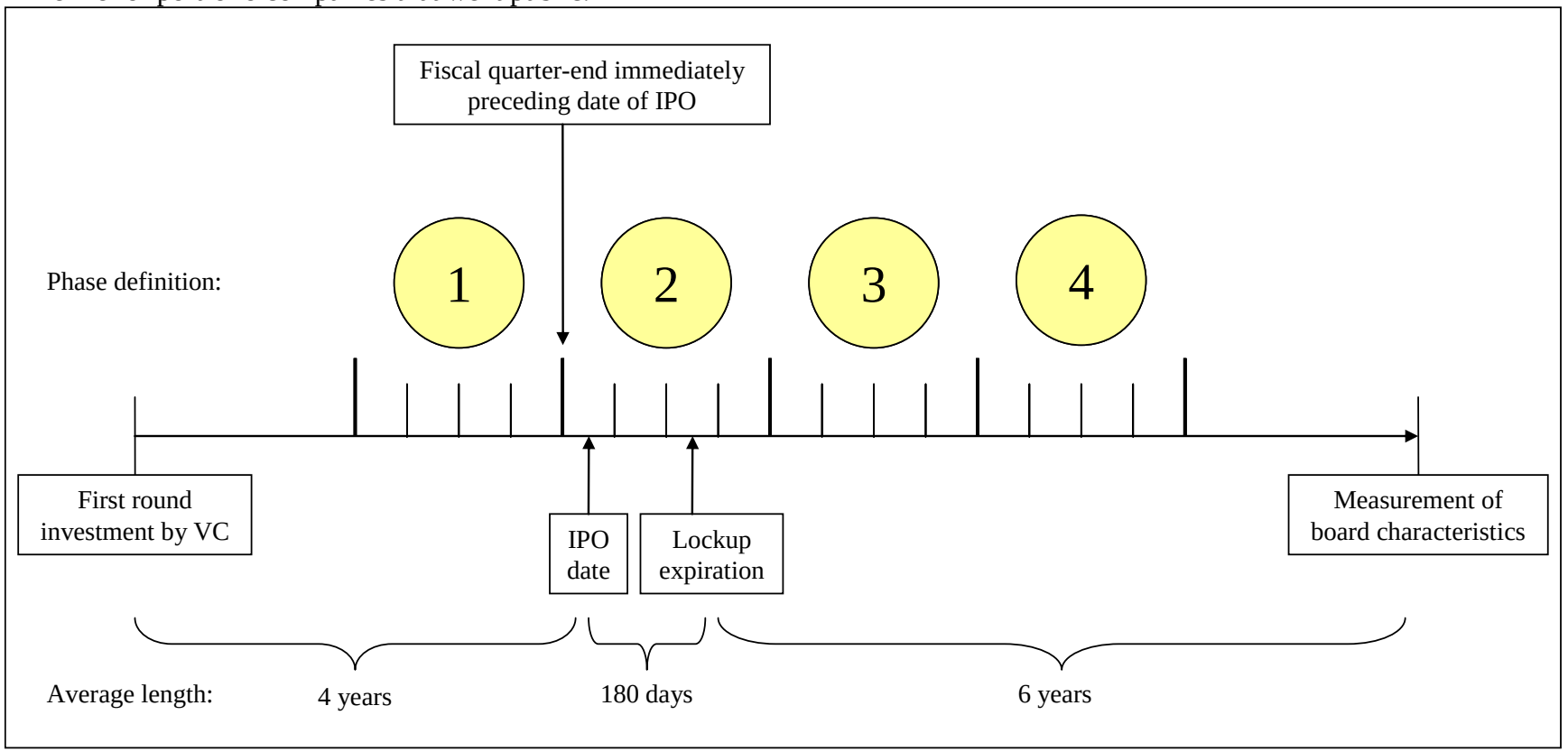
Figure 1

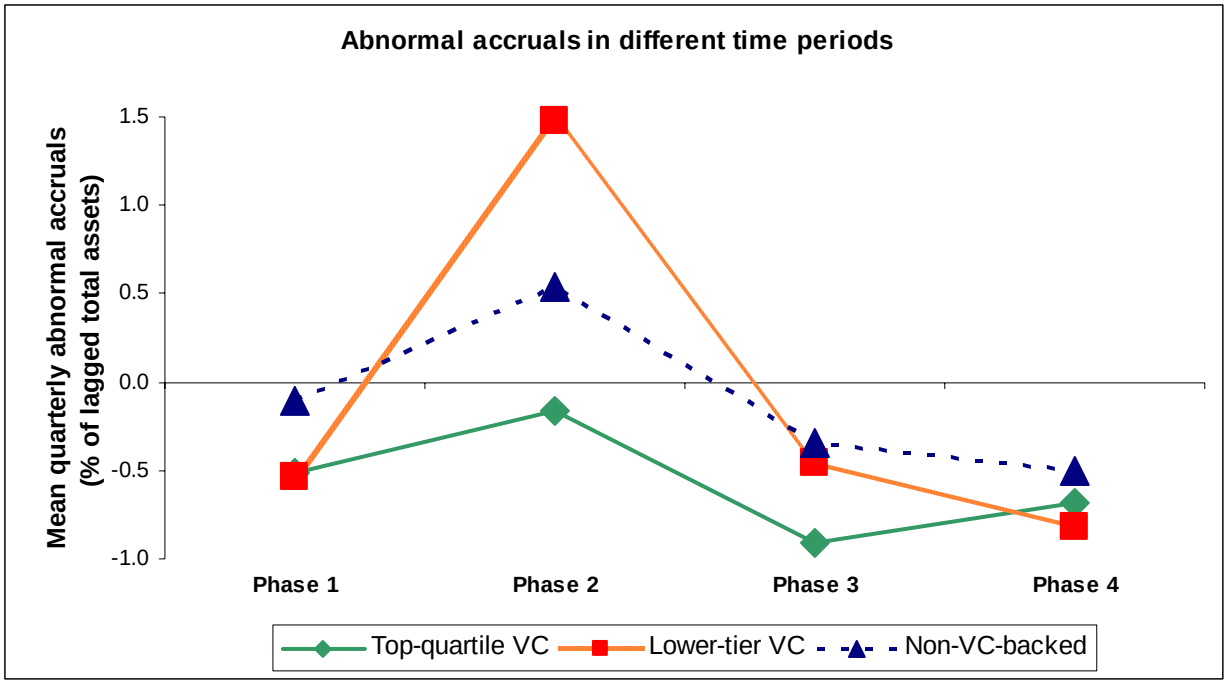
Timeline for portfolio companies that went public:



The figure illustrates how four distinct time periods are identified for each IPO company. (1) denotes the pre-IPO phase, (2) is the period containing the IPO and lockup expiration dates, (3) and (4) are two subsequent periods of four quarters each. Each phase consists of four fiscal quarters.

Figure 2

Mean abnormal accruals in each phase, showing separately: IPO companies backed by top-quartile VCs, backed by lower-tier VCs, and non-VC-backed:



The figure shows mean abnormal accruals for three groups of IPO companies in four different time periods. Abnormal accruals are estimated using a modified cross-sectional version of the Jones (1991) technique of decomposing total accruals into normal and abnormal components. The accrual model is:

$$\text{Total accruals} = \alpha + \beta_1(\Delta\text{Sales} - \Delta\text{Receivables}) + \beta_2\text{PPE} + \varepsilon$$

Total accruals are calculated as the change in non-cash current assets (Compustat data item 40 minus item 36) minus the change in current liabilities (item 49) excluding the current portion of long-term debt (item 45), minus depreciation and amortization (item 5). ΔSales is the change in sales (item 2), ΔReceivables is the change in accounts receivable (item 37), and PPE is net property, plant and equipment (item 42). All variables are scaled by lagged total assets (item 44). The residuals from the quarterly cross-sectional (by 2-digit SIC group) regression model above represent the abnormal accruals, which are reported as percentages of lagged total assets. All variables are winsorized at the 1st and 99th percentiles.

Table 1. Descriptive statistics of portfolio companies

The sample consists of 8,600 portfolio companies that received first-round funding from 1,386 VCs between 1990 and 2004, identified using the Venture Economics database. Panel A shows the status, as of September 2006, of the sample companies by cohort year of first-round investment by the VCs. Panel B reports the distribution of companies by industry and status. Panel C provides descriptive statistics for board characteristics of 6,991 portfolio companies for which the data are available. Panel D shows mean board characteristics for the 6,991 companies grouped according to their status as of September 2006.

Panel A: Status of portfolio companies by investment cohort year, as of September 2006

Year of initial VC investment	Overall sample	Went Public	Trade sale	Liquidated/ inactive	Still active
1990	220	51	82	32	46
1991	179	56	56	15	46
1992	267	61	103	34	58
1993	227	69	66	29	59
1994	267	72	103	33	54
1995	437	111	147	65	103
1996	533	109	201	60	158
1997	600	73	232	70	218
1998	696	65	236	112	263
1999	1,254	36	398	302	487
2000	1,811	28	466	431	851
2001	638	12	139	73	401
2002	483	11	81	19	368
2003	454	4	49	4	392
2004	534	4	21	3	499
1990-2004	8,600	762	2,380	1,282	4,003
		8.9%	*27.7%*	*14.9%*	*46.5%*

Panel B: Industry composition (%)

	Overall sample	Went Public	Trade sale	Liquidated/ inactive	Still active
Biotechnology	5.9	13.4	4.3	2.3	6.4
Communications and Media	11.4	11.7	12.3	12.2	10.6
Computer Hardware	3.8	4.6	4.4	4.8	3.0
Computer Software and Services	23.6	17.9	29.1	18.5	23.2
Consumer Related	4.1	5.3	2.8	4.5	4.6
Industrial/Energy	2.9	3.5	2.4	2.0	3.5
Internet Specific	24.0	18.4	23.8	40.6	19.9
Medical/Health	11.1	16.4	9.3	5.3	12.9
Other Products	6.2	4.5	5.2	4.8	7.4
Semiconductors/Other Electronics	7.1	4.5	6.5	5.2	8.6
	100	100	100	100	100

Table 1 (cont.). Descriptive statistics of portfolio companies

Panel C: Board characteristics

	Mean	Standard deviation	Median	Minimum	Maximum
Board size	4.40	2.37	4	1	11
Number of independent directors on board	3.32	2.26	3	0	9
Fraction of independent directors on board	0.65	0.30	0.75	0	1
VC sits on board (Yes=1; No=0)	0.69	0.46	1	0	1
Number of VCs on board	1.89	0.92	2	1	4
CEO is founder (Yes/No)	0.06	0.24	0	0	1
CEO is chairman of the board (Yes/No)	0.15	0.35	0	0	1

Panel D: Mean and median board characteristics by status of portfolio company

	Overall		Went public		Trade sale		Still active	
Number of companies with available data	6,991		701		1,912		3,348	
	Mean	Median	Mean	Median	Mean	Median	Mean	Median
Board size	4.40	4	6.24	7	4.09	4	4.38	4
Number of independent directors on board	3.32	3	5.05	5	3.06	3	3.27	3
Fraction of independent directors on board	0.65	0.75	0.77	0.83	0.63	0.75	0.65	0.75
VC sits on board (Yes/No)	0.69	1	0.70	1	0.67	1	0.74	1
Number of VCs on board	1.89	2	1.70	1	1.79	2	2.05	2
CEO is founder (Yes/No)	0.06	0	0.02	0	0.04	0	0.10	0
CEO is chairman of the board (Yes/No)	0.15	0	0.30	0	0.13	0	0.13	0

Table 2. VC characteristics

Table 2 shows descriptive statistics of the 1,386 VCs that provided first-round financing to 8,600 startups between 1990 and 2004, identified using the Venture Economics database.

	N	Mean	Standard deviation	Median	Minimum	Maximum
Number of first-round investments made during 1990-2004	1,386	9.2	17.6	3	1	192
Number of first-round investments that resulted in:						
IPO	1,386	0.9	2.8	0	0	40
Private sale	1,386	2.6	5.8	1	0	60
Liquidation	1,386	1.3	2.8	0	0	29
Still active	1,386	4.2	7.2	2	0	73
Fraction of first-round investments that resulted in:						
IPO	1,386	0.07	0.17	0	0	1
Private sale	1,386	0.24	0.29	0.17	0	1
Liquidation	1,386	0.14	0.23	0.00	0	1
Still active	1,386	0.53	0.36	0.50	0	1
Total first-round amounts invested in all porfolio companies during 1990-2004 ($m)	1,352	54.8	148.3	11.0	0.07	1,839
Dollar amount invested in first rounds that resulted in:						
IPO	1,352	6.5	24.0	0	0	330
Private sale	1,352	15.1	46.9	1	0	547
Liquidation	1,352	6.9	20.8	0	0	252
Still active	1,352	25.1	64.8	5	0	839
Fraction of dollar amount invested in first rounds that resulted in:						
IPO	1,352	0.08	0.20	0.00	0	1
Private sale	1,352	0.23	0.30	0.10	0	1
Liquidation	1,352	0.13	0.24	0.00	0	1
Still active	1,352	0.54	0.38	0.55	0	1
Geographic headquarters of VC firm:						
Northeast (includes New York and Boston)	1,384	0.35				
West (includes California)	1,384	0.34				
South (includes Texas and North Carolina)	1,384	0.20				
Midwest (includes Chicago)	1,384	0.11				

Table 3. VC quality score

The sample consists of 1,386 VCs that provided first-round financing to 8,600 startups between 1990 and 2004, identified using the Venture Economics database.

Panel A shows descriptive statistics for characteristics of VCs that are commonly associated with VC quality or reputation. Panel B shows pairwise correlation coefficients among these variables. All variables are measured as of 2006. Panel C reports the results of a principal-components factor analysis of the variables. The table only reports factors with eigenvalues greater than one, together with the factor loadings (following promax rotation) of each variable. Panel D shows mean VC quality scores calculated each year between 1990 and 2004.

Panel E presents regression results of VC performance on dummy variables for quality score quartiles, with the lowest quartile 4 being the omitted category. Robust standard errors allowing for data clustering by portfolio company (for column 1) or by VC (for columns 2 and 3) are shown on the line immediately below the coefficient estimates. Panel F presents regression results of VC performance on a dummy variable equal to one for VCs in the top quality score quartile and zero otherwise, together with control variables for: the natural logarithm of the amount that each VC invested in a portfolio company, a dummy variable that is equal to one if the VC and portfolio company are located in the same geographical region of the United States and zero otherwise, and industry fixed effects. Robust standard errors allowing for data clustering by portfolio company (for columns 1, 2 and 3) or by VC (for columns 4 and 5) are shown immediately below the coefficient estimates. The regression samples consist of a maximum of 12,721 first-round investments made by 1,386 VCs in 8,600 portfolio companies between 1990 and 2004. Average IRR achieved by a VC is calculated as a simple average over all funds managed by the VC for which data are available. Excess IRR is the internal rate of return minus the median IRR of all early-stage funds in the same vintage year. Industry fixed effects and intercepts are not reported. ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Panel A: VC characteristics

	N	Mean	Standard deviation	Median	Minimum	Maximum
Year in which VC started business	1,373	1993	9.1	1996	1911	2004
VC age	1,373	13	9.1	10	2	95
Capital under management ($m)	1,104	554	1,950	100	0.1	39,000
Number of portfolio companies in which VC invested, all rounds	1,386	41.7	97.8	11	1	1,355
Number of portfolio companies in which VC invested, first rounds only	1,386	13.4	27.3	4	1	311
Average syndicate size for deals in which VC participated, all rounds	1,386	2.9	1.2	2.9	1	9
Average syndicate size for deals in which VC participated, first rounds only	1,386	2.2	0.9	2.0	1	8

Table 3 (cont.). VC quality score

Panel B: Pairwise correlations

	(1)	(2)	(3)	(4)	(5)
(1) VC age	1				
(2) Capital under management ($m)	0.22 ***	1			
(3) Number of portfolio companies in which VC invested, all rounds	0.42 ***	0.39 ***	1		
(4) Number of portfolio companies in which VC invested, first rounds only	0.44 ***	0.41 ***	0.97 ***	1	
(5) Average syndicate size for deals in which VC participated, all rounds	0.17 ***	0.08 **	0.18 ***	0.13 ***	1
(6) Average syndicate size for deals in which VC participated, first rounds only	0.08 ***	0.02	0.10 ***	0.07 **	0.75 ***

Panel C: Principal-components factor analysis

	Factor1	Factor2
Eigenvalue	2.64	1.64
Variable:		
VC age	0.63	0.04
Capital under management ($m)	0.60	-0.07
Number of portfolio companies in which VC invested, all rounds	0.93	0.04
Number of portfolio companies in which VC invested, first rounds only	0.95	-0.02
Average syndicate size for deals in which VC participated, all rounds	0.06	0.92
Average syndicate size for deals in which VC participated, first rounds only	-0.04	0.94

Panel D: Trend in VC quality score

		Mean taken over all VCs		
Year	Number of active VCs	Number of prior first-round investments made	Average syndicate size	VC quality score
1990	293	16.7	2.8	47.7
1991	304	17.0	2.8	47.8
1992	318	17.4	2.7	48.2
1993	336	17.5	2.7	48.1
1994	369	17.1	2.7	46.1
1995	442	15.7	2.6	41.5
1996	512	15.0	2.5	38.9
1997	601	14.2	2.4	36.0
1998	675	14.1	2.3	35.1
1999	856	13.3	2.2	32.2
2000	1,138	12.3	2.2	29.5
2001	1,217	12.3	2.2	29.1
2002	1,285	12.2	2.2	29.0
2003	1,339	12.3	2.2	29.1
2004	1,386	12.5	2.2	29.6

Table 3 (cont.). VC quality score

Panel E: Exit outcome regressions on quartiles of VC quality

Dependent variable	Either IPO or trade sale	Average IRR achieved by VC	Average excess IRR achieved by VC
Dummy variables for quartiles of VC quality. Lowest quartile 4 is omitted category.			
Quartile 1	0.039 **	18.68 ***	13.75 ***
	0.017	4.52	3.92
Quartile 2	-0.015	0.13	0.31
	0.019	2.96	2.89
Quartile 3	-0.020	-1.02	-0.51
	0.020	3.27	2.96
Intercept	0.358 ***	-3.37	2.63
	0.016	2.12	1.76
N	14,622	5,427	5,427
R-squared	0.002	0.048	0.037
Number of companies in sample	8,600	5,300	5,300
Number of VCs in sample	1,386	207	207

Panel F: Exit outcome regressions on quartiles of top-quartile dummy for VC quality and control variables

Dependent variable	IPO exit	Trade sale exit	Either IPO or trade sale exit	Average IRR achieved by VC	Average excess IRR achieved by VC
Dummy for VC quality being in top quartile	0.022 ***	0.025 ***	0.047 ***	18.75 ***	12.77 ***
	0.006	0.009	0.010	4.12	3.58
Log of amount VC invested in portfolio company ($m)	0.015 ***	0.002	0.018 ***	-1.44	0.01
	0.004	0.006	0.007	1.30	1.04
VC and portfolio company located in same region	-0.032 ***	0.019 **	-0.014	2.62	3.53 *
	0.007	0.009	0.010	2.31	1.90
Industry fixed effects	Yes	Yes	Yes	Yes	Yes
N	12,480	12,480	12,480	5,367	5,367
R-squared	0.026	0.009	0.007	0.061	0.055
Number of companies in sample	8,404	8,404	8,404	4,327	4,327
Number of VCs in sample	1,352	1,352	1,352	205	205

Table 4. Analysis of board characteristics

The base sample consists of a maximum of 10,603 first-round investments made between 1990 and 2004 by 1,292 VCs in 6,991 portfolio companies, where data on board characteristics are available from Venture Economics. The augmented sample consists of the base sample, an additional 8,956 later-round investments made in 1,967 portfolio companies by 990 VCs, and 981 companies that did not receive VC funding. Panels A and B show univariate comparisons (two-tailed t-tests) of board characteristics. The comparison in Panel A is between companies backed by lower-tier and top-quartile VCs. The comparison in Panel B is between companies backed by lower-tier VCs and companies that did not receive VC funding.

Panel C reports regression results of board characteristics (listed at the top of each column of results) on: dummy variables for categories of portfolio companies (received VC funding in the first round, received VC funding in later round, and did not receive VC funding at all – the omitted category), a dummy variable equal to one if the company received VC funding from a top-quartile VC and zero otherwise, interaction terms, and control variables. The regression sample consists of the augmented sample for which data are available for all variables used in the regressions. The final regression sample consists of 16,996 investments made in 8,689 portfolio companies between 1990 and 2004. The investments include 9,503 first-round and 6,729 later-round investments made by 1,382 VCs, and 764 investments in companies that did not involve VCs. Panel D reports regression results similar to Panel C, where the dummy for top-quartile VCs is instrumented using average fund excess IRR and exit success rate, measured as the fraction of each VC's portfolio that was exited via either IPOs or trade sales. Panel D regressions are run using only companies that received first-round VC funding. Robust standard errors allowing for data clustering by portfolio company are shown immediately below the coefficient estimates. Year and industry fixed effects and intercepts are not reported. ***, **, * denote statistical significance at the 1%, 5%, and 10% level, respectively.

Panel A: Univariate comparisons of mean board characteristics – VC-backed, lower-tier versus top-quartile VCs

	Lower-tier VC	Top-quartile VC	t-stat: Equal means
Board size	4.18	4.70	-10.52 ***
Number of independent directors on board	3.14	3.60	-10.01 ***
Fraction of independent directors on board	0.62	0.67	-9.52 ***
VC sits on board (Yes/No)	0.64	0.73	-10.50 ***
Number of VCs on board	1.85	2.02	-7.04 ***
CEO is founder (Yes/No)	0.06	0.07	-1.10
CEO is chairman of the board (Yes/No)	0.15	0.14	1.29

Panel B: Univariate comparisons of mean board characteristics – lower-tier VC-backed versus non-VC-backed

	Lower-tier VC	Non-VC-backed	t-stat: Equal means
Board size	4.18	2.96	14.08 ***
Number of independent directors on board	3.14	1.93	14.50 ***
Fraction of independent directors on board	0.62	0.45	13.96 ***
CEO is founder (Yes/No)	0.06	0.08	-2.03 **
CEO is chairman of the board (Yes/No)	0.15	0.15	0.25

Table 4 (cont.). Analysis of board characteristics

Panel C: Board characteristics regressions

Dependent variable	Board size	Number of independent directors on board	Fraction of independent directors on board	VC sits on board (Yes/No)	Number of VCs on board	CEO is founder (Yes/No)	CEO is chairman (Yes/No)
Dummy variables for timing of VC funding. Non-VC-backed is the omitted category.							
Received VC funding in first round	1.07 ***	1.06 ***	0.14 ***	0.64 ***	1.18 ***	-0.032 ***	0.016
	0.10	0.10	0.02	0.01	0.04	0.012	0.016
Received VC funding in later round	1.56 ***	1.50 ***	0.18 ***	0.65 ***	1.26 ***	-0.041 ***	0.021
	0.13	0.13	0.02	0.02	0.05	0.013	0.020
Received VC funding in first round × top quartile VC	0.36 ***	0.32 ***	0.04 ***	0.08 ***	0.25 ***	0.009 *	-0.017 **
	0.05	0.05	0.01	0.01	0.03	0.006	0.008
Received VC funding in later round × top quartile VC	0.16 *	0.15 *	0.01	0.03 *	0.09 **	0.011	-0.006
	0.09	0.08	0.01	0.02	0.04	0.007	0.014
Dummy for IPO exit	1.51 ***	1.44 ***	0.12 ***	0.00	-0.16 **	-0.035 **	0.137 ***
	0.12	0.12	0.01	0.02	0.07	0.014	0.025
Dummy for trade sale exit	-0.08	-0.05	0.01	-0.01	-0.12 ***	-0.061 ***	-0.016
	0.09	0.09	0.01	0.01	0.05	0.008	0.014
Dummy for VC and portfolio company located in same geographic region	-0.01	-0.01	0.01	0.03 ***	0.06 **	0.006	-0.018 **
	0.05	0.05	0.01	0.01	0.03	0.005	0.009
Age of portfolio company	0.18 *	0.13	-0.01	-0.04 ***	-0.13 ***	-0.020 ***	0.064 ***
	0.09	0.09	0.01	0.02	0.04	0.007	0.016
Total amount invested by VC in portfolio company	0.026 ***	0.024 ***	0.002 ***	0.003 ***	0.013 ***	0.0002	0.001 **
	0.004	0.004	0.000	0.001	0.002	0.0002	0.000
Year of investment fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	16,996	16,996	16,996	16,996	16,996	16,996	16,996
R-squared	0.154	0.151	0.101	0.182	0.189	0.038	0.033

Table 4 (cont.). Analysis of board characteristics

Panel D: Board characteristics regressions – instrumental variables specification

Dependent variable	Board size	Number of independent directors on board	Fraction of independent directors on board	VC sits on board (Yes/No)	Number of VCs on board	CEO is founder (Yes/No)	CEO is chairman (Yes/No)
Dummy for top-quartile VC	0.787 **	0.698 *	0.103 **	0.222 ***	0.365 *	0.042	-0.143 **
	0.400	0.380	0.045	0.074	0.210	0.049	0.067
Dummy for IPO exit	1.788 ***	1.681 ***	0.142 ***	0.061 **	-0.093	-0.033 **	0.169 ***
	0.144	0.140	0.015	0.028	0.075	0.015	0.028
Dummy for trade sale exit	-0.117	-0.044	0.021 *	0.007	-0.109 *	-0.049 ***	-0.003
	0.111	0.106	0.012	0.019	0.057	0.011	0.018
Dummy for VC and portfolio company located in same geographic region	0.032	0.009	0.007	0.032 **	0.084 **	0.001	-0.017
	0.077	0.074	0.008	0.014	0.038	0.008	0.013
Age of portfolio company	0.021	-0.015	-0.005	-0.038 *	-0.180 ***	0.002	0.032
	0.121	0.117	0.015	0.023	0.060	0.012	0.019
Total amount invested by VC in portfolio company	0.025 ***	0.022 ***	0.001 **	0.003 ***	0.012 ***	0.0001	0.001 *
	0.005	0.006	0.001	0.001	0.004	0.0003	0.001
Year of investment fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Hansen-Sargan J-statistic (overidentification test)	0.827	0.944	1.673	2.081	1.034	1.89	0.244
P-value for J-statistic	0.36	0.33	0.20	0.15	0.31	0.17	0.62
N	4,241	4,241	4,241	4,241	4,241	4,241	4,241
R-squared	0.165	0.159	0.092	0.077	0.171	0.040	0.027

Table 5. IPO companies – descriptive statistics

This table presents descriptive statistics for 762 portfolio companies that received first-round VC funding between 1990 and 2004 and went public.

	Mean	Standard deviation	Median	Minimum	Maximum
IPO proceeds ($m)	59	75	45	3	1,666
Offer price ($)	13.2	5.7	13	3.5	85
Lockup provisions (Yes/No)	0.78	0.41	1	0	1
Number of days between IPO date and lockup expiration date	185	48	180	90	720
Percentage of shares outstanding subject to lockup agreement	67	20	73	0.1	100
Number of days to next equity issue	589	614	332	79	3,595
Conduct SEO within one year after IPO (Yes/No)	0.14	0.34	0	0	1
Conduct SEO within two years after IPO (Yes/No)	0.19	0.39	0	0	1
Size of VC syndicate in first-round investment	1.7	1.0	1	1	6

Table 6. IPO companies – abnormal accruals analysis

The sample consists of 613 portfolio companies that received first-round VC funding between 1990 and 2004 and went public, together with 613 non-VC-backed IPO companies, matched by: year of IPO, industry, and return on assets in the year of IPO. Quarterly financial statement data for each company are obtained from Compustat. Abnormal accruals are estimated using a modified cross-sectional version of the Jones (1991) technique of decomposing total accruals into normal and abnormal components. The accrual model is:

$$\text{Total accruals} = \alpha + \beta_1(\Delta\text{Sales} - \Delta\text{Receivables}) + \beta_2\text{PPE} + \varepsilon$$

Total accruals are calculated as the change in non-cash current assets (Compustat data item 40 minus item 36) minus the change in current liabilities (item 49) excluding the current portion of long-term debt (item 45), minus depreciation and amortization (item 5). ΔSales is the change in sales (item 2), $\Delta\text{Receivables}$ is the change in accounts receivable (item 37), and PPE is net property, plant and equipment (item 42). All variables are scaled by lagged total assets (item 44). The residuals from the quarterly cross-sectional (by 2-digit SIC group) regression model above represent the abnormal accruals, which are reported as percentages of lagged total assets. All variables are winsorized at the 1^{st} and 99^{th} percentiles.

Panel A shows univariate comparisons (two-tailed t-tests) of mean abnormal accruals for IPO companies that received funding from lower-tier and top-quartile VCs. Panel B shows univariate comparisons of mean abnormal accruals for IPO companies that received first-round VC funding from lower-tier VCs and matching non-VC-backed IPO companies. Panel C reports regression results of abnormal accruals on: dummy variables for the phases in each IPO company's life cycle (the omitted category is phase 4), a dummy variable equal to one if the backing VC was a top-quartile VC and zero otherwise, interaction terms, and control variables. Robust standard errors allowing for data clustering by portfolio company are shown immediately below the coefficient estimates. Year and industry fixed effects and intercepts are not reported. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

Table 6 (cont.). IPO companies – abnormal accruals analysis

Panel A: Univariate comparisons of mean abnormal accruals – VC-backed, lower-tier vs. top-quartile VCs

	Lower-tier VC	Top-quartile VC	t-stat: Equal means
Overall	0.048	-0.567	2.05 **
Phase 1	-0.531	-0.517	-0.01
Phase 2	1.472	-0.166	2.84 ***
Phase 3	-0.462	-0.912	1.02
Phase 4	-0.815	-0.683	-0.25

Panel B: Univariate comparisons of mean abnormal accruals – lower-tier VC-backed vs. non-VC-backed

	Lower-tier VC	Non-VC-backed	t-stat: Equal means
Overall	0.048	-0.073	0.38
Phase 1	-0.531	-0.104	-0.26
Phase 2	1.472	0.536	1.48
Phase 3	-0.462	-0.339	-0.26
Phase 4	-0.815	-0.498	-0.64

Table 6 (cont.). IPO companies – abnormal accruals analysis

Panel C: Regressions of abnormal accruals on VC quality, time period, and controls

Dependent variable: Modified Jones abnormal accruals	(1)	(2)	(3)
Dummy variables for time period. Final steady state (phase 4) is the omitted category.			
Phase 1	0.284	0.294	0.692
	1.454	1.494	3.070
Phase 2	2.287 ***	2.110 ***	1.966 ***
	0.679	0.702	0.745
Phase 3	0.353	0.176	0.182
	0.728	0.758	0.760
Dummy variables for VC quality. Lower-tier VC is the omitted category.			
Top-quartile VC	0.131	0.191	0.033
	0.495	0.527	0.527
Non-VC-backed	0.317	0.350	0.006
	0.484	0.513	0.513
Interaction terms:			
Phase 1 × top-quartile VC	-0.117	-0.356	2.381
	1.603	1.632	3.725
Phase 1 × non-VC-backed	0.111	-0.138	8.738
	1.596	1.622	5.644
Phase 2 × top-quartile VC	-1.769 **	-1.745 **	-1.645 **
	0.731	0.755	0.795
Phase 2 × non-VC-backed	-1.252 *	-1.215	-1.078
	0.730	0.750	0.784
Phase 3 × top-quartile VC	-0.581	-0.458	-0.372
	0.774	0.793	0.793
Phase 3 × non-VC-backed	-0.194	-0.072	-0.010
	0.757	0.778	0.777
Return on assets			5.630 ***
			1.613
Book to market			0.001
			0.000
Leverage			-0.152
			0.653
Sales growth			0.026
			0.021
Firm size			-0.121
			0.082
Dummy for SEO within 2 years			0.467 **
			0.225
Year fixed effects	No	Yes	Yes
Industry fixed effects	No	Yes	Yes
N	10,968	10,968	9,776
R-squared	0.004	0.022	0.055

Table 7. IPO companies – financial restatements

The sample consists of 182 portfolio companies that received first-round VC funding and have conducted an IPO after 1999, together with 182 non-VC-backed IPO companies, matched by: year of IPO, industry, and return on assets in the year of IPO. Panel A compares IPO companies backed by lower-tier and top-quartile VCs, and reports univariate comparisons (two-tailed t-tests) of the mean probability of an IPO company making a financial restatement at any time since its IPO, the probability of the financial restatement affecting the first two fiscal years following the IPO, and the number of quarters affected by financial restatements. Panel B compares companies backed by lower-tier VCs to non-VC-backed IPO companies. *** and ** denote statistical significance at the 1% and 5% level, respectively.

Panel A: Univariate comparisons of means – VC-backed companies, lower-tier vs. top-quartile VCs

	Lower-tier VC	Top-quartile VC	t-stat: Equal means
Restatement affected any fiscal quarter post-IPO	0.086	0.055	3.30 ***
Restatement affected first eight fiscal quarters post-IPO	0.088	0.059	1.99 **
Number of quarters affected by restatement	5.908	4.135	5.76 ***

Panel B: Univariate comparisons of means – lower-tier VCs vs. non-VC-backed

	Lower-tier VC	Non-VC backed	t-stat: Equal means
Restatement affected any fiscal quarter post-IPO	0.086	0.086	0.06
Restatement affected first eight fiscal quarters post-IPO	0.088	0.087	0.05
Number of quarters affected by restatement	5.908	7.063	-2.68 ***