Does Venture Capital Reputation Matter? Evidence from Subsequent IPOs*

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ABSTRACT: Reputation of a venture capitalist (VC) is based on experience, expertise and past performance. We investigate the relation between VC reputation measures and both the probability of future IPOs and their long-run performance. We measure long-run firm performance following three widely used approaches, namely industry-adjusted operating performance, market-to-book ratio, and long-run listing survival, plus two long-run growth measures. We find that when VC reputation is based on its market share of VC-backed IPOs, it has strong predictive power for the probability of subsequent IPOs backed by the same VC, and has strongly positive association with their post-IPO long-run performance.

Keywords: Venture capital, reputation, long run performance, Initial Public Offerings.

JEL Classification Code: G24

1. Introduction

Reputation is an important characteristic of any firm, but for specialized financial intermediaries such as venture capitalists (VCs) where there are a large number of competitors and weak industry concentration, reputation is likely to be particularly important. Given the critical nature of their advisory services and the risk capital they supply to privately held firms, a VC's reputation is likely to affect not only the types of portfolio companies they can attract, but also the returns they realize for their limited partners. Surprisingly, there is little research on how best to measure VC reputation, or its effects on venture investment outcomes or portfolio firm performance.

The primary objective of this study is to answer a simple question: Is VC reputation useful to investors in predicting future venture capital success, both in terms of the probability of future IPOs backed by the same VC and their post-IPO long-term performance? This is a particularly relevant performance metric since IPOs are generally the most profitable VC investments. However, before we can accomplish this goal, we must first determine what a good ex-ante measure of VC reputation is.

The U.S. VC industry has around 1500 firms as of 2002, with the largest 20% of these firms managing about 80% of industry capital.[1] However, despite the attention given to the role of venture capital in the issuance of public securities, especially in studies examining IPOs, most academic studies do not differentiate among VCs and instead treat them all as identical.[2] Consequently, VCs that have a large amount of capital under management and many successful IPOs, such as Kleiner Perkins Caufield & Byers, are treated indistinguishably from very small VCs. In contrast, it is standard practice in the academic literature to distinguish investment bankers by their reputations when studying their impact on the security issuance process, even though there are relatively few U.S. investment banks active in underwriting

[1] Based on data from Thomson Financial's VentureXpert, and statistics in "Gap between venture firms may grow", by Mark Boslet, *Wall Street Journal*, Feb 12, 2003.

[2] Barry, Muscarella, Peavy and Vetsuypens (1990) and Megginson and Weiss (1991) are two early studies that assess the effects of venture capital investment on the initial public offer (IPO) process with a primary focus on underpricing. More recently Bradley and Jordan (2002) and Loughran and Ritter (2004) conduct similar studies.

securities since the late 1990's, with the top 10 banks controlling around 90% of the lead-underwriter business in the IPO market (based on Thomson Financial's investment banking league tables).[3] Thus, there are a number of good reasons to want a reliable VC reputation measure, such as investor interests in determining which VCs will be associated with more frequent future IPO successes and superior post-IPO performance, and entrepreneur interests in which VCs offer more valuable advice and contacts.[4] However, currently there is no generally accepted method of measuring VC reputation. Thus, there is a serious need for a useful measure of VC reputation, which we attempt to satisfy in this paper.

We start with the premise that more reputable VCs should exhibit better private equity investment performance. Our approach to measuring superior investment performance is to focus on IPO success, which is known to be the most profitable VC investment exit. Focusing on IPO success is attractive not only because of data availability, but also because it is a clearly visible benchmark of VC success. Megginson and Weiss (1991) observe that Kleiner Perkins came to the market with 10 different IPOs in their sample period (1983-1987) giving it great visibility in the marketplace.[5] Furthermore, having a good track record of successful IPOs is likely to give these VC-backed portfolio companies better access to prestigious underwriters and greater priority in hot IPO markets, making profitable future IPOs more likely. In addition, repeated success in the IPO market gives a VC greater access to attractive future investment opportunities at lower prices as shown in Hsu (2004).[6] An increased likelihood of VC investments becoming successful IPOs and better access to investment opportunities at lower prices both enable VCs to attain higher profitability and stronger reputations.

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[3] Johnson and Miller (1988), Megginson and Weiss (1991), Carter and Manaster (1990) (updated in Carter, Dark and Singh (1998) and more recently in Loughran and Ritter (2004)) all differentiate investment bankers by reputation. No corresponding measure exists for VC reputation.

[4] Smith (1999) reports that early stage entrepreneurs choose VCs primarily based on their reputation for investing in successful companies.

[5] Since its inception in 1972, Kleiner Perkins venture investments have included America Online, Amazon, Compaq, Google, Netscape and Sun, which have all had large IPOs. See their website: http://www.kpcb.com for further details on their investment activities.

[6] Our contacts at the venture capital firm of Apax Partners in New York confirm that higher ranked VCs see a larger portion of overall deal flow.

Thus, having a strong track record of successful IPOs gives a VC greater opportunity to invest in more promising future ventures, which often lead to more successful investment outcomes. Empirically, this pattern should translate into strong serial correlation in VC performance. In other words, a VC's market share of completed venture-backed IPOs is a logical ex-ante measure of VC reputation, and should be strongly associated with future IPO success. Our objective in this study is to test this hypothesis.

We measure IPO success in terms of (1) a higher proportion of future IPOs from a VC's investment portfolio and (2) superior long-term performance of these IPO issues, where issuer performance is measured over the three year post-IPO period. Given that VCs are generally subject to a lock-up period of up to 180 days [Gompers and Lerner, 1998] and many VCs hold their stock for longer periods [see Gompers and Lerner (1998), and Field and Hanka (2001)], post-IPO performance is relevant not only to the entrepreneurs receiving VC funding, but also to the limited partners in these VC funds, who frequently receive IPO shares when VC funds exit from their IPO investments.

A few studies have suggested alternative potential measures of "VC reputation". Gompers and Lerner (1999) suggest that capital under management is a proxy for VC reputation. Lee and Wahal (2004) find that the flow of capital to a VC is positively related to its age and previous IPOs brought to the market.[7] Our primary measure of ex-ante VC reputation is a VC's market share of completed venture-backed IPOs, which we term *IPO Market Share,* and the alternative measures are: (1) VC firm age, which captures experience and long term survival in the industry; two measures of VC size, namely (2) its total capital under management, and (3) total investments made in all its portfolio companies, which capture the market's confidence in a VC's investment ability and its economic importance; and two alternative measures of a VC's recent portfolio performance, namely (4) the ratio of its venture investment in portfolio companies completing IPOs divided by its total investment in all its portfolio companies and

[7] Gompers (1996) finds that younger VCs tend to bring portfolio companies to the IPO market quicker than the older and more established VCs, to try to establish their reputations as successful VCs.

(5) the frequency of IPOs in its venture capital portfolio. We compare the predictive power of these VC reputation candidates for the probability of subsequent IPOs backed by the same VC, and their post-issue long-run performance.

We find that VCs with a larger *IPO Market Share* have a significantly greater proportion of completed IPOs in their investment portfolios than less reputable VCs. Further, this reputation measure is also consistently positively correlated with the long run performance of subsequent IPOs using well established measures of long-run firm performance. The *IPO Market Share* reputation measure dominates the alternative reputation measures in terms of its ability to predict both future successful IPOs backed by the same VC and superior post-IPO long-run performance of these subsequent IPO issuers. We show that while a simple indicator variable for VC-backing can be a useful predictor of IPO issuer long-run performance, a VC's *IPO Market Share* dominates as a predictor of IPO success. So while VC backing improves a firm's post-IPO issuer performance, a VC investor's reputation is a more important determinant of post-IPO long-run performance of a firm. Since the *IPO Market Share* reputation measure is significantly positively related to both dimensions of IPO success, it strongly suggests that more reputable VCs have higher expected returns from future IPOs. These findings are robust to a battery of sensitivity tests.

It is interesting to examine which VC firms receive the highest ranking according to our *IPO Market Share* reputation measure. Appendix B lists the top 25 VCs based on their average yearly *IPO Market Share* measures over the 1996-2002 period.[8] We find the top ranked VCs based on their *IPO Market Share* are J.P. Morgan Partners, Kleiner Perkins Caufield and Byers, New Enterprises Associates, Sequoia Capital, and Integral Capital Partners. These firms frequently have annual IPO market shares over 1% over the sample period in VC-backed deals. In total, there are 28 VC firms with average market share of VC-backed IPOs that exceed 0.5%.

[8] VC reputation as measured by *IPO Market Share* for all VCs in our sample is posted on the web site (to be added).

Do VC firms with the highest *IPO Market Shares* also find themselves in various industry lists of top ranked VC firms? We find that many of the VCs ranked in the top 100 by our IPO market share measure also appear in lists of leading VCs found in private equity publications. For instance, 34 of our top 100 Venture Capital firms appear in the top 100 Early Stage VCs and 17 appeared in the top 100 Late Stage VCs published by *Entrepreneur* magazine in 2002, and 26 were in the list of 100 top VCs published by *Forbes* magazine in 2002. Since VC rankings change over time, we also want to take a longer term perspective. Thus, we examine a VC's membership in the Private Equity Hall of Fame, which includes pre-eminent VC firms over the last 25 years, as well as buyout, mezzanine finance and other private equity firms. Top VCs according to our *IPO Market Share* reputation measure, such as JP Morgan Partners and Kleiner Perkins, as well as New Enterprise Associates, Greylock Partners, and HarbourVest Partners are all inductees in the "The Private Equity Hall of Fame" as of 2004. Thus, many of the most reputable VCs, based on our "best" VC reputation measure, are also highly ranked by several industry evaluations.

VC reputation is likely to reflect greater VC expertise, measured by its ability to select promising investments, successfully nurture growing firms, the strength of its relationships with highly ranked underwriters, and the breadth of its network of private equity contacts. These characteristics are likely to result in superior VC performance. To shed light on why some VCs are associated with better issuer post-IPO long-run performance than others, we distinguish between superior VC investment selectivity and better VC advice and support of their portfolio firms. To study VC investment selectively, we examine the characteristics of IPO firms backed by VCs of differing reputation, and then re-examine our initial results after controlling for this selection bias. We find that IPO issuers that are backed by more reputable VCs have greater growth potential, based on significantly higher ratios of R&D expenses to capital expenditures and R&D expenses plus capital expenditures to total assets, measured

three calendar years after going public. We conclude that our evidence is consistent with higher ranked VCs showing both superior investment selectivity and better nurturing of these firms.

The remainder of this paper is organized as follows. Section 2 describes the data and methodology. Section 3 analyzes the link between VC reputation measures and future successful IPOs and VC selectivity and nurturing. Section 4 analyzes the link between VC reputation measures and post-IPO issuer performance measures. Section 5 presents our sensitivity analyses. Section 6 summarizes our conclusions.

2. Data and Methodology

In this section, we describe the IPO sample, issuer long-run performance measures, VC reputation measures and our methodology for evaluating alternative VC reputation measures.

2.1 IPO Sample Construction

Our sample consists of U.S. IPOs completed in the 1993-2002 sample period. IPO issue information including offer dates, offer prices, offer proceeds, original filing high and low offer price range, VC names, and names of the managing underwriters (often referred to as lead or book managers) are taken from Thomson Financial's Securities Data Corporation (SDC) Global New Issues database. Exchange listing dates come from The Center for Research in Security Prices (CRSP) database. All IPO issuer-related data including issuer net income, total assets, book value of equity, capital expenditures, research and development expenses, and asset and sales growth rates are taken from Compustat. IPOs that list more than 3 trading days after their IPO dates, and observations where any variable needed for our analysis (listed in Appendix A) is unavailable are excluded from the final sample. Stocks not listed on the NYSE, Amex or Nasdaq exchanges or covered in the CRSP database within one month of the IPO date are excluded from the sample. IPOs by financial intermediaries, limited partnerships, foreign

corporations, and reverse LBOs, spinoffs, carve-outs, unit offerings, small offerings under $5 million in global proceeds and IPOs with offer prices under $5 per share are excluded.[9]

2.2 Methodology for Evaluating VC Reputation Measures

We analyze the explanatory power of the *IPO Market Share* VC reputation measure on both the probability of subsequent IPOs and a variety of IPO issuer long run performance measures, after controlling for major issue characteristics previously documented to influence post-issue performance. We evaluate explanatory power of the *IPO Market Share* measure against five alternative VC reputation measures. Some of our VC reputation measures like our primary *IPO Market Share* measure are based on prior performance of a VC's investments over the 3-year window ending with the calendar year prior to the IPO. Other VC reputation measures, such as total investment in all portfolio companies or capital under management are based on year-end data immediately prior to the IPO. Yet other measures like VC age are measured as of the IPO date. To avoid any obvious look-ahead bias, all our VC reputation measures must be known as of the IPO date.

When there is a syndicate of VC investors backing an IPO issuer, our VC reputation measures are averaged across all the VCs investing in the portfolio firm. This approach has the advantage of taking into account the past performance of all the VCs involved in an IPO deal. As part of our robustness analysis, we also measure the reputation of the "lead" or "managing" VC, defined as the VC(s) with the largest total investment in the portfolio firm at the time of the IPO. Our measures of IPO issuer long-run performance are estimated over the first 3 years after the IPO month. We avoid inducing survivorship bias in our post-IPO long run performance measures by including firm performance measured over periods less than 3 years, when issuers do not survive or remain listed for the first full 3 years after the IPO.

[9] Researchers typically exclude non-operating companies such as REITs and closed-end funds, offers priced below $5, which are subject to the antifraud provisions of Securities Enforcement and Penny Stock Reform Act of 1990, and IPOs raising less than $5 million that can be registered under Regulation A's less stringent disclosure requirements.

We examine the explanatory power of each of our VC reputation measures relative to a simple VC indicator that is commonly used in the literature. We control for underwriter reputation in our regressions to avoid falsely attributing underwriter reputation effects to VC reputation. We also run a battery of robustness checks on these results. First, we control for a VC reputation selection bias because more prestigious VCs can have better access to promising venture investment opportunities. Second, we reexamine our results after limiting our analysis to the VC-backed IPO sample. Finally, we evaluate the predictive power of alternative definitions of VC reputation measures.

2.3 Post-IPO Performance Measures

We employ three measures of long-run IPO issuer performance, which are well-established in the existing literature [for example, see Moeller, Schlingeman and Stulz (2004), Gompers, Ishii and Metrick (2003), or Field and Karpoff (2002)], namely industry-adjusted operating performance (ROA), market-to-book, and listing survivorship. We also use two forward looking proxies for future growth, specifically the ratios of R&D to capital expenditures and R&D plus capital expenditures over total assets. All the IPO performance measures are evaluated over the first 3 years following the IPO.

Rate of Return on Assets

Our first measure of IPO long-run performance is industry-adjusted return on assets, *ROA*, defined as Net Income divided by Total Assets minus the industry median ROA for the same calendar period. This accounting measure of operating performance focuses on profitability per dollar of assets, which is widely used in long-run performance studies. Each IPO firm is matched to a sample of non-issuers (firms with no public equity issues in the 3 years before or after the IPO date) based on the issuer's industry, which is measured by its 4-digit SIC code if there are at least 5 such firms, or else based on its 3-digit (or 2-digit) SIC code when there are at least 5 non-issuing firms available. We adjust for industry effects by subtracting the industry

median, rather than its mean, to minimize the influence of outliers. Net Income (item *69*) and Total Assets (item *44*) are taken from the Compustat quarterly financial statement database. Since the addition of new equity capital may take time to improve a firm's performance, we focus on a longer time period, i.e. three years. We avoid inducing any survivorship bias in this long-run performance measure by using the n-quarter matched industry-adjusted ROA figures for issuers that do not survive for 3 calendars years beyond the IPO date, where n is the maximum number of quarters less than 12 with data available in Compustat. Finally, we winsorize the *ROA* figures at the 1% and 99% levels to mitigate the effect of outliers.

Market-to-Book Ratio

Our second measure of IPO long-run performance is an issuer's market to book equity ratio, *MB*. Market to book is also used in many studies as a proxy for the growth prospects or real option value of the firm.[10] It is often used as a proxy for *Tobin's Q*, after adjusting for taxes. The book value of equity is defined as stockholders' equity plus balance sheet deferred taxes and investment tax credit, minus book value of preferred stock, which are respectively data items *60*, *52*, and *55* in Compustat's quarterly financial statement database. The market value of equity is defined as the number of shares outstanding (Compustat *Item 61*) multiplied by its stock price at the prior quarter's end (*Item 14*). The market to book ratio is measured at the end of the 12th quarter following the IPO. To avoid inducing survivorship bias in our measure of long-run performance, we use the n-quarter *MB* figures for firms that do not survive 3 calendar years beyond the IPO date, where n is the maximum number of quarters less than 12 with data available in Compustat. We winsorize the MB figures at the 1% and 99% levels to minimize the effects of outliers due to possible data problems.

[10] Examples of well know studies that use market-to-book ratio as a performance measure are Jain and Kini (1994), Gompers, Ishii and Metrick (2003), Moeller, Schlingemann and Stulz (2004).

Listing Survivorship (3-Year)

Our third measure of post-issue long-run IPO performance, *Listed*, is an indicator variable that takes a value of 1 for firms that remain listed on the NYSE, Amex or Nasdaq (i.e., remain in the CRSP database) for three years following their IPOs or are merged or acquired by listed firms, which themselves remain listed for the remainder of the three calendar years following the IPO dates, and equal 0 otherwise (firms that become bankrupt, defunct, liquidated (CRSP delisting codes 400 and above)). This is a measure of the long run viability of the firm. This issuer performance measure should be immune to pre-IPO accounting window dressing, attempting to raise investor demand for their IPOs, while capturing the adverse effects of pre-IPO cut backs in profitable investment opportunities, designed to enhance an issuer's current pre-IPO earnings at the expense of future profits. We expect more established VCs with greater reputation capital at risk to have greater incentives to discourage firms with poor long term prospects from window dressing or deferring profitable investment opportunities.

Forward-Looking Growth Measures

In addition to the above three measures of long-run IPO performance, we also compare VC backed firms based on two long term growth measures. The question we want to examine is whether firms backed by the more reputable VCs exhibit superior growth. While firm growth doesn't always translate into greater share price, in the case of high growth IPO issuers this correlation is likely to be quite high. High growth could be an indication of superior VC selectivity, superior portfolio firm support and guidance or both. The two growth measures we examine are: the ratio of research and development expenditures (R&D) to capital expenditures, and the ratio of R&D expenses and capital expenditures to total assets [see, for example, Gompers (1995)], computed using Compustat annual financial statement database. These two ratios are forward looking measures, calculated 3 years after the IPO date, and they proxy for an issuer's future growth potential. We predict that IPO issuers backed by more

reputable VCs will have significantly higher expected growth rates compared to IPO issuers backed by less reputable VCs.

2.4 VC Reputation Measures

We examine six alternative measures of VC reputation. Our objective is *not* to show the consistent strength of all these alternative VC reputation measures, but rather to examine whether a VC's *IPO Market Share* has the strongest predictive power for future IPOs and the strongest explanatory power across our measures of issuer post-IPO long–run performance. Then we want to assess whether more reputable VC firms, based on their *IPO Market Shares*, have an economically and statistically significant greater probability of investing in firms with future IPOs and that these IPO issuers will have superior long run performance.

Our first reputation measure is a VC firm's market share of VC-backed IPOs completed in the 3 calendar years prior to the IPO (a rolling window approach). Our second measure is the proportion of a VC's investments that result in completed IPOs in the 3 calendar years prior to each new IPO in our sample, scaled by VC's total investment (average over the start and end of the 3 year event window). Our third measure is the ratio of the number of IPO issuers that a VC backed in the 3 calendar years prior to each new IPO in our sample, relative to the total number of portfolio firms it backed. Our fourth measure is VC firm age at the time of the IPO. Our fifth measure is the VC's total capital under management at the year-end prior to the IPO. Our last measure is the total investment made by an individual VC in all its portfolio companies at the year-end prior to the IPO. Data used to calculate these alternative VC reputation measures are taken from the SDC's VentureXpert and Global New Issues databases. We describe these different measures of VC reputation in greater detail below. We ensure that all our VC reputation measures are based on information known prior to the IPO in question and are free of look-ahead bias.

IPO Market Share

Our first VC reputation measure is easily calculated from publicly available data: we use a VC's dollar market share of all VC-backed IPOs in the 3 calendar years immediately preceding each IPO. For instance, we aggregate the dollar size of all IPOs backed by a VC during the years 1993, 1994, and 1995 as a proportion of the total dollar size of all VC-backed IPOs in the same 3 year period to obtain the VC's 'IPO Market Share' that we use to predict the long-run performance of IPOs completed in 1996. Similarly, for IPOs made in 2000, a VC's market share of VC-backed IPOs based on years 1997-1999. Following Ritter (1984) and Megginson and Weiss (1991), we define the dollar size of an IPO as the gross proceeds from the offering, exclusive of over-allotment options. Each VC associated with an IPO is given full credit for the deal. We then calculate an equally-weighted average IPO-market share of all VCs investing in an issuer, termed the *IPO Market Share*, and use it as the IPO's composite VC reputation measure in our analysis.

Alternative IPO Market Share Measures

As a robustness check, we redefine IPO market share in two different ways. The first variant is the number of IPO firms a VC backed in the prior 3-year calendar period relative to all IPOs backed by VCs in the same three year period. This equally-weighted measure, *Share of VC-backed IPOs*, reduces the influence that a few large IPOs can have on the IPO market share calculations. A second variant is the dollar market share of IPOs that a VC backed between 1993 and the year prior to the IPO year. This measure, *Cumulative IPO Market Share*, uses all the information available from the start of our sample period and treats all the observations as equally relevant.

IPO Investments as a Proportion of a VC's Total Investments

Our second measure of VC reputation is based on the fact that IPOs are the most profitable and visible VC exit, often yielding returns in excess of 50%. To calculate the proportion of a

VC's total investment in a highly profitable exit, we divide a VC's investments in firms that completed IPOs in the 3 calendar years prior to the IPO in question, relative to the VC's total investments (averaged over the beginning and end of the 3 years). This measure tracks the relative success of a VC in selecting and nurturing its venture investments into successful IPOs. We take an equally-weighted average of these measures for all VCs investing in an IPO issuer, which we term the *IPO %*.

IPO Frequency in a VC's Venture Investment Portfolio

Our third measure of VC reputation is the frequency of highly successful exits from a VC's venture investment portfolio. We compute the VC's *IPO frequency* as the number of firms backed by the VC that completed IPOs in the 3 calendar years prior to each new IPO in our sample, relative to the number of companies in its active investment portfolio (averaged over the beginning and end of the 3 years). This measure has the advantage of not being overly influenced by a few very large IPOs.

Both the VC reputation measures -- *IPO %* and *IPO frequency* -- are defined relative to a VC's own portfolio of venture investments, while *IPO Market Share* and *Share of VC-backed IPOs* are defined relative to the total IPO activity of all VCs in the capital market. So the former two measures are not biased against VCs with a small number of total venture investments, such as boutique VCs that voluntarily limit their investment activity to specific industries or technologies or a limited number of portfolio firms, while the latter two measures give greater weight to large VCs that are more active in the VC marketplace.

VC Firm's Age

Our fourth VC reputation measure is VC firm age at the IPO date computed from the date the VC firm incorporates to the IPO date. The longer a VC is operating, the greater its experience and expertise, and the less likely it has made a serious string of mistakes. Thus, the greater is the VC's age the more likely that it is a successful competitor with a strong

reputation. We average the ages of all VCs associated with an IPO, termed *VC Age*, and use it as our fourth VC reputation measure.

Capital under Management and Total Investment

Finally, we consider two additional VC reputation measures based on a VC's fund raising and investment management ability. Specifically, we use a VC's capital under management and total investment in all its portfolio companies, both measured as of the year-end immediately prior to the IPO date. Capital under management is defined as the dollar amount invested, or available for investment, by a VC (fund raising). Total Investment is defined as the dollar amount of venture financing (disbursements) received by portfolio companies from the VC. We average the total capital under management of all VCs investing in an IPO issuer, which we term *VC Capital*, and average the total investment of all VCs investing in an IPO issuer, which we term *VC Total Investment*.

2.5 Control Variables

Since we are interested in the marginal effect of VC reputation on future firm performance, we control for the effects of other issue characteristics on an issuer's long run performance as described below. One of the most common issue characteristics in earlier IPO studies is the natural logarithm of IPO gross proceeds (*LnSize*). It is typically argued that larger offers are generally made by more established and geographically diversified firms, which are more apt to be less risky [see Carter, Dark and Singh (1998)]. This data is taken from the SDC New Issues database. Likewise issuer age is suggested to proxy for lower issuer risk [for example, Ritter (1984)]. It is argued that because older firms have more tangible assets or collateral, a more developed management team and longer standing customer relationships, they are better able to withstand adverse economic shocks, making them less risky. Issuer age at the IPO is measured relative to the firm's first incorporation date. This data is taken from Jay Ritter's web site. We measure VC age as the natural logarithm of one plus issuer age (*LnAge*).

The recent IPO literature has examined technology intensive firms separately because of the high level of technological risk and high level of expected growth [for example, see Loughran and Ritter (2004)]. We include a *Tech* indicator (defined in Appendix A) as a control variable to capture technology intensive industry characteristics. As a robustness check, we control for the 8 industry groupings of Gompers, Kovner, Lerner, and Scharfstein (2006) that capture VC expertise. As newer entrants in the VC industry, commercial banks are likely to be less experienced and also more willing to take greater risk. To account for this possibility, we include a *Bank-VC* indicator variable, which takes a value of one if any of the VC investors backing an IPO is a commercial bank, and is otherwise zero. This variable is based on data taken from SDC. We include year fixed effects in our panel regressions to control for differences across years. For instance, Ljungqvist and Wilhelm (2003) reports that IPOs completed in the 1999-2000 "bubble" period have unusual issue characteristics. We control for the cash and marketable securities balances scaled by total assets as a proxy to control for the empire-building incentives, or alternatively funding constraints, that can affect the post-issue performance of the IPO issuer firm.

Previous studies find that lead underwriter reputation significantly affects initial and long run IPO returns [see, for example, Carter and Manaster (1990) and Carter, Dark and Singh (1998)]. We measure the underwriter's reputation by its Carter-Manaster ranking, *Underwriter Reputation*, as updated on Jay Ritter's web site: *http://bear.cba.ufl.edu/ritter/rank.xls.* Finally, since several studies beginning with Megginson and Weiss (1991) find that VC-backed firms have subsequent strong performance, which differs from that of non VC-backed firms, we include an indicator variable that is equal to one for VC-backing and is zero otherwise. By including a VC-backing indicator, we require our VC reputation measures to capture more than the effect of VC investors being present. These control variables are fully described in Appendix A.

2.6 Sample Descriptive Statistics

Over the ten year 1993-2002 sample period, we have 1200 IPOs backed by 1519 separate VCs and 1302 IPOs without VC backing.[11] Of the sample of VC-backed IPOs, 17% were backed by a single VC, 13% by a syndicate of 2 VCs, 13% by 3 VCs, 10% by 4 VCs, 9% by 5 VCs, 25% by a syndicate of 6 to 10 VCs and the remaining 13% of the IPOs by a syndicate of more than 10 VCs. We have 378 VC-backed IPOs in the 1993-1995 sample period, which we use to calculate the initial VC reputation measures. We analyze the effect of VC reputation on the long-run performance of 2019 IPOs issued in the 1996-2002 period, of which 822 are VC-backed IPOs. Panel A of Table 1 shows the yearly frequencies of non-VC-backed and VC-backed IPOs. While we have the CRSP-based data for the *Listed* performance measure for our entire IPO sample, we have the Compustat-based *ROA* and *MB* variables for only 787 VC-backed IPOs and 1154 non-VC-backed IPOs. We have the R&D expense and the capital expenditure figures needed to compute our ex-ante growth measures for 560 VC-backed IPOs and 837 non-VC-backed IPOs.

Panel B compares the characteristics of non-VC-backed IPOs with those of the VC-backed IPOs completed in the 1996-2002 sample period. Consistent with Gompers and Lerner (2000) and Lee and Wahal (2004), VC-backed IPO issuers tend to be younger and include a higher frequency of issuers in technology intensive industries than non-VC-backed issuers. Also, consistent with Lee and Wahal (2004), IPOs with venture backing are typically underwritten by more prestigious investment banks than non-VC-backed IPOs.

Panel C reports the descriptive statistics for long-run performance measures of non-VC-backed and VC-backed IPOs. All three of our long-run performance measures, namely *ROA*, *MB,* and *Listed,* as well as our two forward looking growth measures, the ratio of research and development expenditures (R&D) to capital expenditures, and the ratio of R&D expenses and capital expenditures to total assets, show that long run performance is significantly higher for

[11] The data downloaded from the SDC database comprised 1541 VC-backed IPOs. As comparisons, Loughran and Ritter (2004) had 1391 VC-backed IPOs in their sample from 1990 through 1998, and 487 VC-backed IPOs in 1999 and 2000, and Ljungqvist (1999) had 513 VC-backed IPOs in the 1996-1998 period.

VC-backed IPOs than for non VC-backed IPOs. This is consistent with a number of earlier studies of VC-backing [see Brav and Gompers (1997), for example].

Panel A of Table 2 presents descriptive statistics for our alternative VC reputation measures, while Panel B reports their pair-wise correlations as well as their correlations with *Underwriter Reputation*. The means and medians for each of these VC reputation measures are close to each other, except for *VC Capital* and *VC Total Investment*, suggesting that outliers are not a serious concern for our first four reputation measures. The two VC size measures, *VC Capital* and *VC Total Investment*, show strong skewness across the IPO sample, which is to be expected given the sample includes a small number of relatively large VCs, along with many small and medium size VCs. We examine the correlations among VC reputation measures after grouping them into closely related categories to create 2 groups of reputation measures. The composition of the two groups of reputation measures are as follows - Group 1: *IPO %* and *IPO frequency*, and Group 2: *VC Capital* and *VC Total Investment*. The within group correlations are statistically significant, which is to be expected given the grouping objective. In addition, the correlation between *IPO Market Share* and *VC Total Investment* is positive and highly significant, which is also not surprising considering that the larger is a VC's aggregate investment in portfolio companies, the more likely it is to have a large IPO market share. Interestingly, the inter-group correlations of these VC reputation measures are distinctly different from each other, with correlations below 0.40. The correlations of VC reputation measures with lead underwriter reputation, *Underwriter Reputation*, are also very low. This provides some comfort that the explanatory power of VC reputation measures in the long run IPO issue performance regressions are not the result of them acting as a close proxies for lead underwriter reputation.

3. Predicting Subsequent IPOs and their Relation to VC Selectivity and Nurturing

3.1 VC Reputation and Probability of Future IPOs

Do more reputable VCs, on average, invest in portfolio companies that have a higher probability of going public in the near future? We match each of our six VC reputation

measures for each VC each year to the number of completed IPOs that are backed by the same VC in the subsequent three years. For example, a VC's *IPO Market Share* in year 2002 is matched with the number of subsequent IPOs by firms in its portfolio during the period 2003-2005.

Since the number of successful IPOs that are backed by a VC in the near future is likely to be dependent on the number of active portfolio companies they have, we need to deflate the number of IPOs that a VC brings to market by the average number of portfolio companies the VC is currently funding. For this purpose, *Future IPO Frequency* is defined as the number of completed IPOs backed by a VC in the following 3 years, scaled by the average number of active portfolio companies being funded by the same VC at the beginning of the each of those 3 years. Given that our focus is on the frequency of IPOs from VC portfolio investments, our estimation is based on VC backed IPOs only.

We regress *Future IPO Frequency* on each of our six measures of *VC Reputation*, controlling for year fixed effects. Year fixed effects control for time varying economic conditions, unrelated to VC reputation such as IPO market conditions, which can affect the likelihood of completed IPOs. In the following panel regressions, note that both the explanatory variables and residuals are likely to exhibit dependence by VC firm and by year, in part because of serial dependence in both the dependant and independent variables. In these situations, year and VC firm clustered standard errors (that are also robust to heteroskedasticity) are unbiased and produced more accurate confidence intervals [see Petersen (2006)]. Table 3 presents coefficient estimates and associated *t*-statistics based on standard errors which are robust to heteroskedasticity as well as to year and VC firm clustering (*t*-statistics are in parentheses).

The table shows that a VC's *IPO Market Share* reputation measure is positively associated with successful IPOs in the following 3 years at the 1 percent significance level. Related reputation measures that are also based on a VC's IPO track record, i.e., *IPO %* and *IPO frequency*, are also positively and significantly associated with future IPO success, but not as strongly as *IPO Market Share*. We find that VCs having a *IPO Market Share* equal to or greater

than 0.50% are associated with an average of 10.36 completed IPOs over the next 3 years, which is significantly higher (at the 1% level) than the average of 1.15 completed IPOs associated with VCs having a *IPO Market Share* less than 0.50%. We chose 0.50% *IPO Market Share* as the cut-off point because the top 25 VCs all have average yearly *IPO Market Shares* greater than 0.50% (see Appendix B). The other VC reputation measures, namely *VC Age*, *VC Capital* and *VC Total Investment*, are all insignificantly associated with the frequency of completed IPOs in the following 3 years. In summary, IPO success in the recent past, reflected in the *IPO Market Share*, *IPO %* and *IPO frequency* reputation measures, appears to carry over into the near future as well.

Before we investigate the relation between VC reputation and post-IPO long-run performance of issuers, it is important to recognize that superior post-IPO performance of a VC's portfolio companies can be the result of either superior VC portfolio firm selectivity, and/or superior nurturing. We begin by examining the firm selectivity issue.

3.2 VC Reputation and Firm Selectivity

To learn more about the VC selection process, we examine the cross sectional differences in the characteristics of IPO firms backed by VCs of different reputations. Table 4 presents the coefficient estimates and associated *t*-statistics that are based on heteroskedasticity-consistent standard errors for each of our six measures of *VC Reputation* regressed against our control variables, as shown below:

$$(1)\quad VC\ Reputation\ Measure = \beta_0 + \beta_1\ Underwriter\ Reputation + \beta_2\ LnAsset + \beta_3\ LnSize + \beta_4\ LnAge + \beta_5\ Tech + \varepsilon,$$

where β_0 is a vector of year fixed effects, and *LnAsset*, represents the natural log of the issuer's total assets at the end of the quarter immediately prior to the IPO date. Table 4 shows that IPO issuers backed by higher ranked VCs tend to be smaller (as measured by asset size), and are more frequently in *Tech* industries than IPO issuers backed by lower ranked VCs or having no

VC backing. There is also strong evidence that IPOs backed by higher ranked VC-backed are also backed by higher ranked lead underwriters than IPOs backed by lower ranked VCs or having no VC backing. This evidence highlights the importance of controlling for issuer characteristics in our analysis of post-IPO performance.

3.3 VC Reputation and Firm Nurturing

What is the relation between VC reputation and the post-IPO growth potential of the firms that they back? Are higher ranked VCs more likely to bring public firms with larger unexercised real investment options, which are likely to have higher future growth potential? To address this question, we examine issuer expected growth rates measured by (1) the ratios of research and development (R&D) expenses to capital expenditures and (2) R&D expenses plus capital expenditure to total assets ratio, measured over 3 years following the IPO month. Table 5 reports regression estimates when each one of these two IPO issuer growth measures is regressed against one of our alternate measures of *VC* reputation, controlling for year fixed effects.

The results in Table 5 show that all six VC reputation measures have significant positive associations with both measures of issuer expected growth. So firms backed by more reputable VCs continue to have significantly higher growth potential post-IPO, compared to firms backed by less reputable VC firms. This evidence suggests that more reputable VCs have better nurturing abilities. An important related question is whether higher growth IPO issuers exhibit superior long-run post-issue performance compared with lower growth IPO issuers. That is, do IPO issuers backed by more reputable VCs exhibit superior post-issue performance compared to IPO issuers backed by less reputable VCs? We examine this important question in next section.

4. Evidence on Long-run IPO Issuer Performance

Using a multivariate equation framework described below, we assess the power of alternative VC reputation measures to explain post-IPO long-run performance. Our objective is not to show the consistent strength of *all* our alternative VC reputation measures, but rather to determine if there is a single measure of VC reputation that dominates the other reputation measures in terms of its association with superior post-IPO long-run issuer performance. For this analysis, we employ several fundamentally different measures of long-run performance including the IPO issuer's (1) industry-adjusted rate of return on assets, which measures accounting profitability over the first 3 years after the IPO, (2) the market-to-book ratio, which measures the issuer's long-run growth potential three years after becoming a publicly listed firm, and (3) the stock's exchange listing rate of survival, which measures the probability of financial distress in the first three years after the IPO.

4.1. VC Reputation and Post-IPO Long-run Industry Match-Adjusted ROA

We predict that post-IPO earnings performance will be higher when an issuer is backed by a more reputable VC. To test our prediction, we use the following regression specification for industry-adjusted ROA:

$$(2) \qquad ROA = \beta_0 + \beta_1 \, VC\ Reputation + \varepsilon.$$

We sequentially estimate equation (2) using each one of our six VC reputation measures as the sole regressor: namely, *IPO Market Share, IPO %*, *IPO frequency*, *VC Age, VC Capital*, and *VC Total Investment*. We find that all six VC reputation measures have significant positive effects on industry-adjusted ROA of the IPO issuers that they backed. In addition, the explanatory power of *IPO Market Share* is noticeably higher than that of the other VC reputation measures.

While issuers backed by more reputable VCs have superior post-IPO earnings performance, this may be due to other issue characteristics. To address this concern, we control for the

following issue characteristics in our regression analysis: *LnSize* and *LnAge* represent the natural logarithms of the IPO's dollar issue size and issuer age respectively, and *Tech*, *Bank-VC* and *VC-backed* represent indicator variables for issuers in tech industries, commercial bank VCs and VC-backed issuers respectively. The pair-wise correlations among the control variables -- *LnSize, LnAge,* and *Tech* – are generally very low, all being less than 10%. We also include year fixed effects in the panel regressions to control for the differences in economic conditions across time. The expanded regression specification is:

$$(3) \quad ROA = \beta_0 + \beta_1\, VC\ Reputation + \beta_2\, VC\text{-}backed + \beta_3\, Underwriter\ Reputation + \beta_4\, Bank\text{-}VC + \beta_5\, LnSize + \beta_6\, LnAge + \beta_7\, Tech + \varepsilon,$$

where β_0 is a vector of year fixed effects.

To assess the relative explanatory power of our alternative VC reputation measures, the *ROA* regression results reported in Table 6 differ only in terms of the VC reputation measure used as a regressor. The regression equation (3) also includes a VC-backing indicator, which is the standard VC control variable used in most of the extant IPO literature. This allows us to estimate the incremental explanatory power of our VC reputation measures over and above the existence of VC backing. The regression model also includes the lead underwriter's reputation measure, *Underwriter Reputation*, to distinguish its effect on issuer performance from that of VC reputation.

Table 6 presents coefficient estimates and associated *t*-statistics based on standard errors which are robust to heteroskedasticity and industry clustering (*t*-statistics are in parentheses).[12] The table shows that IPO issuers backed by more reputable VCs have better long-run operating performance. All of the alternative VC reputation measures have significant positive effects on issuers' long-run *ROA*, although the explanatory power of *VC Age* is noticeably lower than that for the other VC reputation measures. At the same time, the VC indicator variable is statistically

[12] In regressions of post-IPO issuer performance on VC reputation, the explanatory variables and residuals need not be independent within industries. Then industry-clustered standard errors (that are also robust to heteroskedasticity) are well-specified.

insignificant in the presence of any of the VC reputation measures, which indicates that controlling for VC reputation is more informative than simply controlling for the existence of one or more VC investors, as most of the extant literature does. This evidence indicates that our VC reputation measures have significant explanatory power for the long-run operating performance of IPO issuers.

The amount of cash available to the firm can influence its operating performance, and especially its *ROA*. If the firm has large cash holdings, it may be tempted to invest in less profitable projects to accommodate CEO empire-building incentives. On the other hand, if a firm is financially constrained, its wasteful expenditures are also curtailed, but it may also not be able to undertake all its profitable investment opportunities. Either way, *ROA* could be affected by the cash balances the firm has on hand. If VC reputation is correlated with the issuer cash balances, then our earlier results may be due to a missing variable bias. To test this alternative hypothesis, we follow Opler, Pinkowitz, Stulz, and Williamson (1999) and Almeida, Campello, Weisbach (2004) by defining *Cash Ratio* as the average of the yearly ratio of cash and marketable securities to total assets. We then add this as an additional control variable into equation (3) and find that our results qualitatively unchanged. That is to say, all of our VC reputation measures continue to have significant positive effects on issuers' long-run *ROA*. The regression coefficient on *Cash Ratio* is insignificant. Replacing *Cash Ratio* with a broader measure, *Liquid Assets Ratio*, defined as the average of the yearly ratio of current assets minus current liabilities deflated by total assets, also does not qualitatively change our results.[13] These results are untabulated to conserve space, but available upon request.

Thus, proxies for financial constraints are not statistically significant. In our mind, this is not surprising given that VC backed IPO issuers are young, high growth firms that generally need significant amounts of external capital to thrive or, indeed, to survive. While there may be

[13] While financial constraints can have an important influence on a firm's operating performance, the fact that we do not find a significant cross-section relationship is consistent with our sample of IPO firms generally being young, high growth firms in serious need of external capital to thrive or, indeed, to survive.

differences in the degrees to which individual firms need infusions of new capital, it is also likely that essentially all of these firms are experiencing serious financial constraints relative to the population of listed firms. Thus, while our sample firms are experiencing financial constraints, it does not help explain the superior post-issue operating performance of IPO issuers backed by more reputable VCs.

Turning to the other control variables, we see that older, more established issuers and more reputable underwriters are associated with firms having superior industry-adjusted ROA, while commercial bank VCs are associated with poorer long-run operating performance, consistent with banks, as new entrants in the VC market, being willing to take greater risk to capture market share.

4.2. VC Reputation and Post-IPO Long-run Market-to-Book Ratio

Table 7 shows the coefficient estimates and associated *t*-statistics (which are robust to heteroskedasticity and industry clustering) for market-to-book regressions that include one of our alternative VC reputation measures, along with a *VC-backing* indicator and a set of control variables representing the issue characteristics used in Table 6.

Two VC reputation measures - *IPO Market Share* and *IPO frequency* - have significant positive relationships with the issuer's long-run market to book ratio. Weak results pertaining to other VC reputation measures suggest that only one or two of our alternative VC reputation measures are significant on a consistent basis in regressions explaining future post-IPO long-run performance. The VC-backing indicator is also significantly positively associated with superior post-issue long-run IPO firm performance, in terms of market-to-book ratio. This result may reflect from the fact that four of our six VC reputation measures have no power to predict post-IPO market-to-book ratios, though VC-backed firms tend to have higher

performance than non VC-backed firms.[14] Turning to the control variables, larger IPOs are associated with significantly smaller long-run market-to-book ratios.

4.3. VC Reputation and Post-IPO Long-run Listing Survival

Our third measure of IPO long-run performance is issuer listing survival 36 months after the IPO month. We use an indicator variable, *Listed*, that takes a value of 1 for firms that survive at least 3 years after the IPO month, and 0 for firms that liquidate, declare bankruptcy, become defunct or are otherwise dropped from the CRSP database due to financial distress within 36 months of the IPO month. Since the dependent variable is a qualitative binary variable, we analyze this relationship using a logit model. Table 8 presents the coefficient estimates and associated *z*-statistics (corrected for heteroskedasticity and industry clustering) for logit regressions that include one of our alternative VC reputation measures, along with a *VC-backing* indicator and the issue characteristics used in Tables 6 and 7 as control variables.

Three VC reputation measures -- *IPO Market Share*, *IPO %* and *VC Age* -- have significant positive associations with long-run listing survival. Estimates of the control variables in Table 8 also show that older issuers and issues underwritten by more reputable investment bankers are more likely to remain listed 3 years after going public, while IPOs backed by commercial bank-VCs are less likely to be listed 3 years later. In untabulated results, we find that when we estimate a logit model using only an intercept and one of our six VC reputation measures, all of the reputation measures have a significant positive effect on listing survival, except *VC Capital*.

From the results of tables 6-8, *IPO Market Share* is the only VC reputation measure that is strongly and consistently related to future post-IPO issuer performance and that this measure dominates the other measures previously used in the VC literature, such as VC firm *Age*.

[14] As with ROA, we estimate a simple regression with one of the six alternative VC reputation measures on long-run MB. All the reputation measures have significant positive effects on issuer long-run MB ratios. We find that the explanatory power of *IPO Market Share* and *IPO frequency* are noticeably higher than other VC reputation measures.

4.4. Summary of Findings

To summarize, the evidence in Table 3 shows that the *IPO Market Share* VC reputation measure is strongly and positively associated with future successful IPOs backed by the same VC firm. The evidence in Tables 6-8 shows that *IPO Market Share* has significant explanatory power in all the regressions across the three IPO long-run performance measures, while the other VC reputation measures are sometimes significant. Weaker results obtained with the alternative VC reputation measures highlights the strength of *IPO Market Share* as a VC reputation measure. To measure the economic significance of *IPO Market Share,* we take a one standard deviation change in a VC's *IPO Market Share* and find that it is associated with a 31% change in *ROA* and a 15% change in *MB,* controlling for the other issue characteristics. A one standard deviation increase in a VC's *IPO Market Share* also raises the odds of listing survival by a factor of 1.45, after controlling for other issue characteristics. Thus, *IPO Market Share's* association with post-IPO issuer performance has clear economic significance.

It is important to recognize that together, Tables 6-8 examine different elements of firm long-run performance: average profitability, future growth potential, and the propensity for exchange delisting due to financial distress. Thus, the significance of different control variables across these tables should not be surprising. It is however, reassuring that when control variables are statistically significant, they have consistent signs. For example, underwriter reputation is significantly and positively associated with long-run *ROA* and *Listed*, while *Bank-VC* variable is significantly and negatively associated with the same two long-run performance measures. These signs make sense, as discussed above. The exception is issuer age, which is significantly and positively associated with *ROA* and *Listed*, but negatively associated with *MB*. Again this makes sense: older firms presumably have more stable operations, which are associated with higher profitability. Older firms are also likely to remain listed on a major stock exchange for a longer period than younger firms for the same reason: they have more

established operations. However, older firms are likely to have lower growth potential, which is captured by a smaller market to book ratio (which is more forward looking than *ROA*).

We considered a number of other control variables in the regression specifications examined in Tables 6-8 including *LnAsset*, indicator variables for Nasdaq listing, the 1999-2000 "bubble period" (in place of year fixed effects), and when a VC investor is also a lead underwriter in the IPO issuer. The results remain qualitatively the same with the inclusion of any of these added control variables. Recall that we controlled for survivorship bias in our *ROA* and *MB* measures of post-IPO long run performance by including observations that occur less than 3 years after the IPO month due to early delisting. If we alternatively only analyze issuers that remain listed for the first 3 calendar years following the IPO month, we find that *IPO Market Share* continues to be positively related and statistically significant (at the 1% level) for the *ROA* and *MB* long term performance measures.

Finally, we examined the relations between our VC reputation measures and post-IPO 3-year cumulative abnormal stock return using Fama-French calendar time regressions. We find that *IPO Market Share* has a significantly positive association with issuer long-run abnormal stock returns. This conclusion is robust to adding a liquidity factor to the statistical model and the use of factors purged of recent equity issuers [see Loughran and Ritter (2000)]. We interpret it as further evidence that more reputable VCs invest in higher growth firms.

5. Robustness Analysis

The *IPO Market Share* VC reputation measure is consistently positively associated with all our IPO issuer long run performance measures. The explanatory power of this VC reputation measure is also significantly higher than that of a simple VC-backing indicator variable, which is often used in the security offering literature as a control variable for VC involvement. To assess the strength of this finding, we subject it to extensive sensitivity analysis.

5.1. Correcting for Selection Bias

The coefficient estimates in previous tables could be subject to a selection bias if higher ranked VCs have better access to more promising business ventures as argued in Lee and Wahal (2004). Thus, a VC's superior performance may be due to the quality of the ventures in which it is able to invest, rather than its reputation as an able VC. To address this question, we use a variation on Heckman's (1979) correction method.

Heckman proposed a two-stage estimation procedure using the inverse Mills' ratio to take account of selection bias. In the first step, the likelihood of a positive outcome for the dependent variable is modeled using a logit regression. Then the estimated parameters from this model are used to calculate the inverse Mills' ratio for the VC reputation variable, which is then included as an additional explanatory variable in the second step regression model along with the VC reputation measure itself. This removes the portion of the error term correlated with the VC reputation measure. The inverse Mills' ratio captures the probability of higher ranked VCs selecting better quality startup firms. Thus, including the inverse Mills' ratio eliminates the selection bias associated with using VC reputation as an explanatory variable.

Turning back to Table 4, we see that smaller and younger issuers and a higher proportion of technology intensive firms are associated with higher ranked VCs. Taking these results into account, we include both these issue characteristics as instruments in our first stage logit model of VC selection:

$$(4) \qquad VC\ Rank_i^* = \alpha_{i0} + \alpha_{i1}\, LnAsset + \alpha_{i2}\, LnSize + \alpha_{i3}\, LnAge + \alpha_{i43}\, Tech + \varepsilon_i$$

$$VC\ Rank_i = \begin{cases} VC\ Rank_i^* & \text{for venture- backed IPOs} \\ 0 & \text{for non VC-backed IPOs,} \end{cases}$$

where *VC Rank** is a latent variable observed only for VC-backed IPOs and *VC Rank* is an indicator variable that takes a value of one for higher ranked VCs, defined as VCs with *IPO Market Share* greater than the median market share and is zero otherwise. *LnAsset* is used as the instrumental variable in the first stage VC selection equation, but not in the second stage issuer

long term performance regressions. Given the above model, we estimate the following logit regression in the first stage of the two-step Heckman procedure:

$$VC\ Rank = \alpha_0 + \alpha_1 LnAsset + \alpha_2 LnSize + \alpha_3 LnAge + \alpha_4 Tech + \varepsilon,$$

The inverse Mills' ratio is calculated from the above logit regression estimates and then used in the following second stage regression:

$$(5) \quad P = \beta_0 + \beta_1 IPO\ Market\ Share + \beta_2 VC\text{-}backed + \beta_3 Underwriter\ Reputation + \beta_4 Bank\text{-}VC + \beta_5 LnSize + \beta_6 LnAge + \beta_7 Tech + \beta_8 Inverse\ Mills + \nu,$$

where β_0 is the vector of year fixed effects and issuer performance, *P*, alternatively represents *ROA*, *MB*, or *Listed*. The *t*-statistics (or *z*-statistics in the case of the *Listed* logit regressions) are based on standard errors that are robust to heteroskedasticity and VC firm clustering.

The results in Table 9 show that the first stage prediction model has reasonable explanatory power and that *LnAsset* is a valid instrument.[15] In the second stage estimation, we did find evidence that VC selectivity is important since the inverse Mills' ratio is statistically significant for all the three performance measures. However, after controlling for selectivity and major issue characteristics, *IPO Market Share* remains significant and is positively related to all three IPO long-run performance measures. Thus, the more reputable VCs are associated with superior long-run performance in the future IPOs they back, after taking into account their selectivity in making venture investments.

5.2. VC-backed IPO Sample

Thus far, we have examined the full sample of VC-backed and non-VC-backed IPOs to evaluate our alternative VC reputation measures. However, as Table 1 highlights, the VC-backed IPO sample has different characteristics from the non-VC-backed sample. Thus, it may be prudent to restrict our analysis to the IPO sample with VC backing and then re-evaluate

[15] *LnAsset* is not significant in the second-stage regressions.

whether our alternative VC reputation measures, and especially *IPO Market Share*, continue to have significant explanatory power in regressions of IPO issuer long-run performance. This could be especially useful if the control variables affect the non VC-backed sample differently from the VC-backed sample.

Table 10 reports the estimates when our strongest VC reputation measure, *IPO Market Share,* along with the prior control variables for issue characteristics are regressed on each of the three primary measures of post-IPO performance, namely *ROA, MB,* and *Listed*:

$$(6) \qquad P = \beta_0 + \beta_1 \, IPO\ Market\ Share + \beta_2 \, Underwriter\ Reputation + \beta_3 \, Bank\text{-}VC + \beta_4 \, LnSize + \beta_5 \, LnAge + \beta_6 \, Tech + \varepsilon.$$

Table 10 shows that *IPO Market Share* continues to have significant explanatory power in all the regressions using alternative measures of issuer long-run performance, where we restrict ourselves to the VC-backed IPO sample. When we repeat this analysis in untabulated results for the other five competing VC reputation measures, we find that none of these competing reputation measures are consistently significant across all the measures of post-IPO performance. In fact, we find that only *IPO %*, *VC Capital*, and *VC Total Investment* are significant for more than one of these long-run performance measures.

5.3. Controlling for Hot and Cold IPO Markets

Helwege and Liang (2004) examine industry clustering and differences in operating performance between firms that went public in "hot" and "cold" IPO periods. They identify hot and cold IPO periods based on aggregate monthly issue volume, following the work of Bayless and Chaplinsky (1996) and Lowry and Schwert (2002). They use 3-month centered moving averages of the number of IPOs in each month to make this classification. Using a moving average avoids classifying seasonally low months as cold when they are in the middle of a "neutral" period. Periods with three consecutive months where the moving average exceeds 33 IPOs (which represent the top quartile of the monthly moving averages) are defined

as hot IPO issue months. Periods with 10 or fewer IPOs (which represent the bottom third of the monthly moving averages) for three consecutive months are defined as cold IPO issue months.[16] They observe that the years 2001-2002 are among the coldest IPO periods since 1960, averaging only 6 IPOs per month.

Next we replace the year fixed effects with *Hot* and *Cold* IPO market indicators using the Helwege and Liang classification, and re-run our regression analysis. We find that *IPO Market Share* continues to have significant explanatory power for all three long-run performance measures, *ROA*, *MB*, and *Listed*. The fact that *IPO Market Share* continues to have significant explanatory power, after controlling for hot and cold IPO markets, shows that the explanatory power of this VC reputation measure is robust to various IPO market conditions.

5.4. Controlling for Different Industries

Post-IPO long-run performance could be affected by the industry group to which the issuer belongs. Thus far, we have controlled for *Tech* firms in our analyses. VCs invest in firms of other industries as well; indeed some VCs specialize in making investments in a particular industry (that need not be a technology intensive industry, as defined above). In this section, we use a vector of 8 indicator variables for industries that have similarities in technology and management expertise, which would make VC specialization in such industries valuable. Following Gompers, Kovner, Lerner, and Scharfstein (2006), the industry groupings are defined as (a) Internet and Computers, (b) Communications and Electronics, (c) Business and Industrial, (d) Consumer Products, (e) Energy, (f) Biotech and Healthcare, (g) Financial Services, and (h) Business Services. We find that *IPO Market Share* continues to have significant explanatory power for all three long-run performance measures, *ROA*, *MB*, and *Listed*. Thus, the explanatory power of this VC reputation measure is robust to controlling for industry characteristics that could affect long-run performance.

[16] They designate the bottom third of the sample as cold months because the bottom quartile includes a number of months with zero offerings and results in an excessively small sample.

5.5. Examining Sample Sub-periods

We next segregate the IPO sample into two segments: IPOs issued in 1996-1999 and those issued in 2000-2002, and examine whether the *IPO Market Share* VC reputation measure continues to have significant explanatory power over all three long-run performance measures for both time periods. The first period ends with the tech bubble. The second period captures the recession that follows the bubble period. While the *IPO Market Share* continues to have significant explanatory power for all three long-run performance measures in both sub-intervals, it is has a stronger association with the post-issue long-run performance measures *ROA*, and *MB* in the later period, and with *Listed* in the first period.

5.6. Examining IPO Market Shares for Lead VCs

Thus far in our analysis, we calculate the *average* reputation measure of all VC syndicate members backing an issuer and use it as the IPO's composite VC reputation measure. However, lead syndicate members may be more influential and bear greater responsibility for nurturing the portfolio firm and are clearly more important in selecting venture investments. Moreover, analysis of the effects of underwriting reputation in the corporate finance literature usually focuses on the average reputation of only lead underwriters. Thus, it could be particularly illuminating to restrict our examination of VC reputation to that of the "lead" VC backing an IPO issuer, and evaluate the explanatory power of the "*Lead IPO Market Share*", in regressions of issuer long-run performance measures.

Table 11 reports model estimates when we measure *IPO Market Share* for only the lead VC, defined as the firm or firms with the largest dollar investment in the IPO issuer as of the year end immediately prior to the IPO, which we term the *Lead IPO Market Share*. We then repeat the regression analysis in Tables 6-8 substituting the lead VC's reputation measure, and again include a VC-backing indicator and the other issue characteristics specified in equation (7)

below. Estimates are presented for all three primary measures of post-IPO issuer long-run performance, where *P* sequentially represents *ROA, MB,* and *Listed*:

(7) $P = \beta_0 + \beta_1$ *Lead IPO Market Share* $+ \beta_2$ *VC-backed* $+ \beta_3$ *Underwriter Reputation* $+ \beta_4$ *Bank-VC* $+ \beta_5$ *LnSize* $+ \beta_6$ *LnAge* $+ \beta_7$ *Tech* $+ \varepsilon$,

The estimates in Table 11 show that *Lead IPO Market Share* is strongly significant (at the 1% level) in all the regressions for the three primary long-run performance measures. In comparing these results with those for *IPO Market Share* in Tables 6-8, we find that the statistical significance tends to be larger when we restrict the analysis to the reputation of the lead VC. This result suggests that *IPO Market Share* has a stronger association with the long-term performance measures of future IPO issuers, when we restrict our analysis to the reputation of the lead VC, rather than the *average* or composite reputation measure of the VC syndicate. Therefore, as a further check of the usefulness of our composite VC reputation measures, we add an interaction term between our composite VC reputation measure and an indicator for VC syndicates with less than 4 members. If our composite VC reputation measure is more reliable for smaller VC syndicates, then we should expect the coefficient of the interaction term to be positive and statistically significant. However, the coefficient of interaction term is statistically insignificant, which supports the reliability of our composite VC reputation measure in predicting the long-term success of portfolio firms that go public.

5.7. Correcting for Selection Bias with Lead IPO Market Share

As before, we run our first stage logit model for VC selection, given by equation (4) where *VC Rank* is an indicator variable that takes a value of one for IPOs backed by a lead VC with an *IPO Market Share* greater than the median IPO market share of all VCs and is zero otherwise. The inverse Mills' ratio is estimated from this logit regression and then used in the second stage regression specification given by equation (5).

The results in Table 12 show that, after controlling for major issue characteristics, *Lead IPO Market Share* remains strongly significant (at the 1% significance level) in all the regressions for the three alternative long-run performance measures. Comparing these results to the earlier *IPO Market Share* results in Table 9, we find that the statistical significance tends to be larger when we use the reputation of the lead VC. Nevertheless, *IPO Market Share* has a positive and statistically significant association with long-run performance of future IPO issuers using either variant of the *IPO Market Share* measure.

5.8. Examining Alternative Definitions of IPO Market Share

Thus far, we find that *IPO Market Share* is the only VC reputation measure to consistently have significant positive coefficients in regressions of post-issue long run performance. As a robustness check, we recalculate *IPO Market Share* as the market share of a VC based on the frequency of IPO deals that the VC backed relative to all VC-backed IPOs in the same period, rather than the relative dollar value of deals the VC backed. This alternative definition is termed *Share of VC-backed IPOs*. This approach limits the influence of particularly large IPOs in estimating VC reputation. The resulting estimates are reported in Table 13.

We also explore a second variant of IPO-market-share, which uses all the information available from the start of our sample period and treats all the observations as equally relevant. We define this variant of the *IPO Market Share* as the dollar market share of IPOs that the VC backed between 1993 and the year prior to the IPO year. For example, for IPOs completed in 2000, the IPO market share is calculated over the years 1993-1999. This measure, termed the *Cumulative IPO Market Share*, estimates a VC's reputation by using the entire history of VC activity up to the IPO year. These estimates are also reported in Table 13.

The two panels of Table 13 present estimates for the primary regression models in Tables 6-8, when we use our two alternative IPO market share definitions. The panels show that both variants of IPO market share have significant positive relationships with all three measures of long-run performance for later IPOs backed by the same VC. Comparing the explanatory

power of these two alternative market share measures for issuer long-run performance measures, we find that neither of these two variants of *IPO Market Share* has as much explanatory power across all long-run performance measures as our original *IPO Market Share*. Nevertheless, these results yield further evidence supporting the robustness of our earlier conclusions that *IPO Market Share* is the best measure of VC reputation based on our evidence.

6. Conclusion

The roles VCs play in the private equity market is currently a topic of considerable academic interest, particularly in the context of initial public offerings. However, these studies generally pool all VCs into a single category and then examine the association between an important IPO characteristic and an indicator of VC-backing. In contrast, it is common practice in this same literature to distinguish investment banks by their underwriting reputation, where higher ranked underwriters are found to have a significantly greater impact on the IPO underwriting process. While the investment banking industry is highly concentrated, the VC industry is far less concentrated and is characterized by a large number of competing firms. Thus, there is a serious need to differentiate among the various VCs, and one promising approach is to develop a reliable measure of VC reputation. We are the first to investigate the usefulness of distinguishing VCs by reputation and examining its relationship to the probability of future IPOs as well as to long-run performance of these IPO issuers.

IPO success is a clearly visible benchmark of VC success. Having a strong track record of successful IPOs gives a VC greater opportunity to invest in more promising future ventures, which often lead to more successful investment outcomes. Thus, a VC's market share of completed venture-backed IPOs should be strongly associated with future IPOs and post-IPO issuer performance of future IPOs backed by the same VC. Indeed, we find that *IPO Market Share* is significantly positively associated with the probability of future IPOs and in these subsequent IPOs, it has a significant positive relation with all the post-issue long-run performance measures we examine.

Our investigation is based on several well-known measures of long-run performance including issuer industry-adjusted rate of return on assets, market-to-book ratio, and listing survival on a major stock exchange. We examine a broad array of alternative VC reputation measures including a VC firm's age, the fraction of its portfolio companies going public, its capital under management, and its total investment in portfolio companies. We find that *IPO Market Share* has the greatest explanatory power of the alternative VC reputation measures, and has consistently significant explanatory power for the long-run performance of subsequent IPOs backed by the same VC. We conclude that VC reputation has an economically and statistically significant association with a VC's subsequent investment success in terms of IPOs.

Our findings are robust to controlling for selection bias, hot and cold IPO markets, and industry characteristics. *IPO Market Share* also has a strong relationship with future IPO issuer long-term performance measures, when it is based on the reputation of the lead VC syndicate member (defined as the VC with the most investment in the issuer at the time of the IPO). *IPO Market Share* also has a significant positive association with IPO issuer growth prospects measured by the ratio of R&D expenses to capital expenditures and the ratio of R&D expenses plus capital expenditure to total assets. Reassuringly, the most reputable VCs based on *IPO Market Share,* are often the most reputable VCs based on trade publications and popular press rankings and discussions with industry contacts.

In summary, we show that, by ignoring a VC's reputation, valuable information about VC quality is lost. This information is useful to VC limited partners, entrepreneurs and IPO investors, since VC reputation has a significant effect of the probability of future IPOs and the long-run performance of these IPO issuers. We also shed light on why some VCs are associated with better issuer long-run performance than others by investigating whether this positive relationship with these long-run performance measures is due to superior investment selectivity or better support and development of the VC's portfolio firms. We conclude that the evidence is consistent with both sources of VC expertise being important.

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Appendix A
Definitions of Variables

IPO Performance Measures	*Description*
Future IPO Frequency	The number of successfully completed IPOs backed by a VC in the 3 years in the future scaled by the average of the number of the portfolio companies at the beginning of the each of those 3 years that are being currently funded by the same VC.
ROA	The match-adjusted return on assets (ROA), computed as net income divided by total assets, as at the end of the 3rd year (12th quarter after the quarter of the offer date) for the IPO firm minus the industry median ROA on the same date, where the industries are based on 4 digit SIC codes if there is a minimum of 5 non-issuing firms, else 3 digit SICs codes, or 2 digit SIC codes until there are at least 5 non-issuing firms. We use the nth quarter measure, where n <12 for firms that do not survive for 3 years post issue.
MB	The market to book ratio is measured at the end of the 12th quarter after the IPO quarter. We use the nth quarter measure, where n <12 for firms that do not survive for 3 years post issue.
Listed	An indicator variable that takes a value of 1 for firms that remain listed on the NYSE, Amex or Nasdaq (i.e., remain in the CRSP database), or are merged or acquired by a listed firm, which remains listed at least through the end of the 12th quarter after the IPO, and equals 0 otherwise (firms that become bankrupt, defunct or liquidated (CRSP delisting codes 400 and above)).
R&D expenditure/ Capital Expenditure	The ratio of research and development expenditures (R&D) to capital expenditures as at the end of the third year after the IPO, computed using Compustat annual financial statement database.
(R&D + Capital Expenditure) / Total Assets	The ratio of research and development expenditures (R&D) plus capital expenditures to total assets as at the end of the third year after the IPO, computed using Compustat annual financial statement database.
VC Reputation Measures	*Description*
IPO Market Share	The market share of a VC is based on the dollar value of IPO deals that the VC backed in the 3 calendar years immediately preceding each IPO, as a proportion of the dollar value of all VC-backed IPOs in the same period. Each VC associated with an IPO is given full credit for the issue size of the IPO. That is, for IPOs made in 2000, it is the dollar market share of the IPO market for a VC in the years 1997-1999. The measure is averaged over all VCs associated with an IPO to obtain a composite VC reputation measure for an individual IPO.
Share of VC-backed IPOs	The share of VC-backed IPOs is defined as the number of IPO deals that the VC backed in the 3 calendar years immediately preceding each IPO, as a proportion of all VC-backed IPOs in the same period. The measure is averaged over all VCs associated with an IPO to obtain a composite VC reputation measure of an individual IPO.

IPO %	A VC's dollar investments in firms that had IPOs completed in the 3 calendar years immediately prior to each new IPO, scaled by the average of the VC's total investments as of beginning of year 1 and the end of year 3 of the event window. This measure is then averaged across all VCs backing the IPO firm.
IPO frequency	The number of IPOs made in the 3 calendar years immediately prior to each IPO from a VC's investment portfolio, scaled by the average number of the VC's active portfolio firms as of the beginning of year 1 and the end of year 3 of the event window. This measure is then averaged across all VCs backing the IPO firm.
VC Age	The age of the VC computed from the date of its incorporation to the IPO date, averaged over all VCs associated with an IPO.
VC Capital	The dollar amount (in millions) invested or available for investment by a VC, as of the year-end immediately prior to each IPO, averaged over all VCs investing an IPO issuer.
VC Total Investment	The dollar amount of venture capital financing (disbursements) a VC made in its portfolio companies as of the year-end immediately prior to each IPO, averaged over all VCs investing in an IPO issuer.

Control Variables	*Description*
LnSize	The natural log of the size of the IPO: gross proceeds from the offering, exclusive of overallotment options.
LnAge	The natural log of the age (in years) of the issuer at the time of the offering, as computed from the date of incorporation to the date of the offering.
LnAsset	The natural log of the IPO issuer's total assets at the end of the quarter immediately prior to the IPO date.
Bank-VC	Dummy variable that takes the value of 1 if any VC backing an IPO is a commercial bank, and 0 otherwise.
Underwriter Reputation	The lead underwriter reputation score measured by the Carter-Manaster score, as modified by Ritter and made available on his web site: *http://bear.cba.ufl.edu/ritter/rank.xls*
Tech	Indicator Variable that is 1 for IPOs made by Tech firms, and 0 otherwise. Tech firms are defined as those with issuer SIC codes 3571, 3572, 3575, 3577, 3578 (computer hardware), 3661, 3663, 3669 (communications equipment), 3674 (electronics), 3812 (navigation equipment), 3823, 3825, 3826, 3827, 3829 (measuring and controlling devices), 3841, 3845 (medical instruments), 4812, 4813 (telephone equipment), and 4899 (communication services).
VC-backed	Dummy variable that takes the value of 1 for VC-backed IPOs and 0 otherwise.

Appendix B
Top 25 VCs

This Appendix lists the top 25 VCs based on averaging their annual *IPO Market Shares* over 1996-2002.

Rank	*VC*	Average of annual *IPO Market Share (in %)*
1	J.P. Morgan Partners	2.13
2	Kleiner Perkins Caufield & Byers	1.39
3	New Enterprise Associates	1.17
4	Sequoia Capital	1.00
5	Integral Capital Partners	0.94
6	Alta Partners	0.92
7	Warburg Pincus	0.87
8	Accel Partners	0.86
9	Sprout Group	0.85
10	TA Associates	0.82
11	Summit Partners	0.78
12	DLJ Merchant Banking Partners	0.77
13	Norwest Venture Partners	0.75
14	Lightspeed Venture Partners	0.73
15	Oak Investment Partners	0.71
16	Pilgrim Baxter & Associates	0.70
17	Institutional Venture Partners	0.70
18	Greylock	0.68
19	Mayfield Fund	0.66
20	Goldman, Sachs & Co.	0.65
21	Centennial Ventures	0.64
22	HarbourVest Partners	0.58
23	Bessemer Venture Partners	0.58
24	Technology Crossover Ventures	0.57
25	U.S. Venture Partners	0.57

Table 1
Descriptive Statistics of IPO Sample

Panel A reports the number of non-VC-backed and VC-backed IPOs by year in our sample for IPOs filed in the 1996-2002 period, during which we evaluate IPO performance. Panel B reports means and medians for the *ROA*, *MB*, and *Listed* long-term performance measures and the number of observations for non-VC-backed and VC-backed IPOs. Panel C shows the mean *Size* of the issue, *Age* of the issuer, *Underwriter Reputation*, and proportions of the IPOs that are from *Tech* industries for our non-VC-backed and VC-backed IPO samples. The variables are defined in Appendix A.

Panel A

Year	***Non VC-backed IPOs***	***VC-backed IPOs***
1996	343	209
1997	262	112
1998	182	60
1999	229	201
2000	112	204
2001	39	17
2002	30	19
Total	1197	822

Panel B

	Non VC-backed IPOs (N = 1197)	***VC-backed IPOs (N = 822)***
Variable	Mean	Mean
Size ($m)	57.54	58.11
Age (years)	11.49	7.68**
Tech (%)	11.95	22.90***
Underwriter Reputation	6.57	8.14*

Panel C

	Non VC-backed IPOs		***VC-backed IPOs***	
Variable	N	Mean	N	Mean
ROA	1154	0.29	787	0.56***
MB	1154	2.95	787	4.43***
Listed (in %)	1197	84.46	822	88.08*
R&D Expenditure/Capital Expenditure	837	4.64	560	17.66***
(R&D + Capital Expenditure) / Total Assets	837	0.14	560	0.24**

*, **, and *** denote significant difference in the means of the two groups at the 10%, 5% and 1% levels respectively.

Table 2
Descriptive Statistics of VC Reputation Measures

Panel A presents descriptive statistics for our alternative measures of VC reputation. IPOs in the sample must be completed in the 1996-2002 period. All variables are defined in Appendix A. Panel B shows the pair-wise Pearson's correlations, as well as the Pearson's correlations with lead underwriter reputation scores, *Underwriter Reputation*.

Panel A: Descriptive Statistics

	Mean	Median	Std Dev	Max	Min
IPO Market Share (in %)	0.42	0.36	0.30	1.72	0.01
IPO % (in %)	21.85	21.29	6.58	69.30	8.09
IPO frequency (in %)	22.79	21.30	10.39	68.10	2.36
VC Age (in years)	13.97	13.74	7.12	50.80	0.10
VC Capital (in $b)	3.60	1.74	4.95	25.00	4.00
VC Total Investment (in $b)	2.16	1.51	2.12	10.69	3.72

Panel B: Correlations

	IPO %	*IPO frequency*	*VC Age*	*VC Capital*	*VC Total Investment*	*Underwriter Reputation*
IPO Market Share	0.399	0.350	0.142	0.470	0.579	0.083
IPO %		0.756	0.049	0.106	0.167	0.007
IPO frequency			0.073	0.037	0.088	0.018
VC Age				0.064	0.019	0.042
VC Capital					0.922	0.108
VC Total Investment						0.146

Table 3
VC Reputation Measures and Future IPO Success

This table presents coefficient estimates for regressions of VC reputation on each VC's number of completed IPOs over the next 3 years, scaled by the average of the number of the portfolio companies the VC has invested as of the beginning of each of those 3 years. For example, each VC's *Future IPO Frequency*, is regressed on its *IPO Market Share*, and the vector of year fixed effects. The regressions are estimated for VC-backed IPOs over 10633 VC-years in the 1996-2002 period (comprising 1519 VCs each year). The definitions of all the variables are found in Appendix A. In parenthesis, *t*-statistics are reported, which are based on heteroskedasticity consistent standard errors adjusted for VC firm and year clustering.

Independent Variable: VC Reputation Measure	*Dependent Variable*
	Future IPO Frequency
IPO Market Share	0.923***
	(2.89)
IPO %	0.102*
	(1.77)
IPO frequency	0.088*
	(1.69)
VC Age	-0.053
	(-1.04)
VC Capital	-0.002
	(-1.03)
VC Total Investment	-0.001
	(-0.76)

*, **, and *** denote coefficient estimates significantly different from zero at the 10%, 5% and 1% levels respectively.

Table 4
VC Reputation Measures and IPO Issuer Characteristics

This table presents coefficient estimates and in parentheses, the associated *t*-statistics based on heteroskedasticity consistent standard errors adjusted for industry clustering where one of the alternative VC reputation measures, *VC Reputation*, is regressed on issue variables as specified below:

$$VC\ Reputation\ Measure = \beta_0 + \beta_1\ Underwriter\ Reputation + \beta_2\ LnAsset + \beta_3\ LnSize + \beta_4\ LnAge + \beta_5 Tech + \varepsilon,$$

where β_0 is a vector of year fixed effects. IPOs in the sample must be completed in the 1996-2002 period. All variables are defined in Appendix A.

VC Reputation Measure	*Underwriter Reputation*	LnAsset	LnSize	LnAge	Tech	*Adjusted R^2*
IPO Market Share	0.04***	-0.03***	-0.02	-0.01*	0.06***	17.76%
	(2.80)	(-4.24)	(-1.55)	(-1.64)	(3.50)	
IPO %	0.02***	-0.02***	-0.01*	-0.00*	0.02***	26.98%
	(2.89)	(-5.49)	(-1.86)	(-1.77)	(3.10)	
IPO frequency	0.02***	-0.02***	-0.01**	-0.00*	0.02***	23.30%
	(2.89)	(-4.66)	(-2.10)	(-1.68)	(3.19)	
VC Age	1.29***	-0.96***	-0.64*	-0.00	2.01***	21.71%
	(2.64)	(-4.72)	(-1.71)	(-0.04)	(4.34)	
VC Capital	0.03***	-0.02***	-0.00	-0.00	0.00	10.66%
	(2.66)	(-2.68)	(-0.48)	(-0.86)	(0.22)	
VC Total Investment	0.02***	-0.01***	-0.00	-0.00	0.00	14.71%
	(2.74)	(-3.23)	(-0.64)	(-1.00)	(0.11)	

*, **, and *** denote coefficient estimates significantly different from zero at the 10%, 5% and 1% levels respectively.

Table 5
VC Reputation Measures and IPO Issuer Growth Characteristics

This table presents *VC Reputation* coefficient estimates and in parentheses the associated *t*-statistics based on heteroskedasticity consistent standard errors adjusted for industry clustering when either (a) the ratio of research and development expenses to capital expenditures at the end of 3 years after the IPO year, or (b) the ratio of research and development expenses plus capital expenditure to total assets at the end of 3 years after the IPO year, is regressed on one of the alternate measures of *VC Reputation*, and the vector of year fixed effects. The regressions are estimated for 1397 IPOs completed in the period 1996-2002 where all the necessary data is available. The definitions of all the variables are found in Appendix A.

Independent Variable	*Dependent Variable*	
	R&D expenditure/ Capital Expenditure	(R&D + Capital Expenditure) / Total Assets
IPO Market Share	11.56***	0.133***
	(2.94)	(5.13)
IPO %	0.42***	0.007***
	(3.42)	(5.34)
IPO frequency	0.36***	0.001***
	(3.35)	(5.16)
VC Age	0.61***	0.005***
	(3.30)	(5.81)
VC Capital	0.70**	0.001***
	(2.43)	(3.73)
VC Total Investment	0.17***	0.001***
	(2.69)	(3.99)

*, **, and *** denote coefficient estimates significantly different from zero at the 10%, 5% and 1% levels respectively.

Table 6
Cross-sectional Regressions Explaining Long-run Match-adjusted *ROA*

This table presents coefficient estimates and in parentheses associated *t*-statistics based on standard errors which are robust to heteroskedasticity and industry clustering. The post-IPO long-run match-adjusted *ROA*, purged of any survivorship bias, is regressed on one of the alternative VC reputation measures, *VC Reputation*, using the following specification:

$$ROA = \beta_0 + \beta_1 \, VC\ Reputation + \beta_2 \, VC\text{-}backed + \beta_3 \, Underwriter\ Reputation + \beta_4 \, Bank\text{-}VC + \beta_5 \, LnSize + \beta_6 \, LnAge + \beta_7 \, Tech + \varepsilon,$$

where β_0 is a vector of year fixed effects. All other variables are defined in Appendix A. The regressions are estimated for 1941 IPOs completed in the period 1996-2002, where data for all the above variables is available.

VC Reputation Measure	*VC Reputation Measure*	*VC-backed*	*Underwriter Reputation*	*Bank-VC*	LnSize	LnAge	Tech	*Adjusted R^2*
IPO Market Share	0.57***	-0.11	0.03**	-0.21**	-0.01	0.04***	-0.14	5.40%
	(2.83)	(-0.59)	(2.47)	(-2.15)	(-0.17)	(3.79)	(-1.00)	
IPO %	0.02***	-0.26	0.03***	-0.21**	-0.01	0.04***	-0.14	5.15%
	(5.78)	(-1.54)	(2.84)	(-2.50)	(-0.18)	(5.24)	(-1.01)	
IPO frequency	0.01***	-0.17	0.03**	-0.24***	-0.01	0.04***	-0.14	5.27%
	(6.85)	(-0.99)	(2.41)	(-2.83)	(-0.13)	(4.54)	(-0.99)	
VC Age	0.01*	0.07	0.03***	-0.27***	-0.01	0.04***	-0.14	4.97%
	(1.78)	(0.34)	(2.85)	(-3.54)	(-0.22)	(3.78)	(-0.96)	
VC Capital	0.35***	0.01	0.03***	-0.26***	-0.01	0.04***	-0.12	5.44%
	(7.76)	(0.09)	(3.04)	(-3.22)	(-0.27)	(4.24)	(-0.94)	
VC Total Investment	0.92***	-0.07	0.03***	-0.24***	-0.01	0.04***	-0.11	5.56%
	(13.14)	(-0.47)	(2.93)	(-3.19)	(-0.33)	(3.97)	(-0.92)	

*, **, and *** denote coefficient estimates significantly different from zero at the 10%, 5% and 1% levels respectively.

Table 7
Cross-sectional Regressions Explaining Long-run Market-to-Book Ratio

This table presents coefficient estimates and in parentheses associated *t*-statistics based on standard errors which are robust to heteroskedasticity and industry clustering. The post-IPO long-run market-to-book ratio, *MB*, purged of any survivorship bias, is regressed on one of the alternative VC reputation measures, *VC Reputation*, using the following specification:

$$MB = \beta_0 + \beta_1 \, VC\ Reputation + \beta_2 \, VC\text{-}backed + \beta_3 \, Underwriter\ Reputation + \beta_4 \, Bank\text{-}VC + \beta_5 \, LnSize + \beta_6 \, LnAge + \beta_7 \, Tech + \varepsilon,$$

where β_0 is a vector of year fixed effects. All other variables are defined in Appendix A. The regressions are estimated for 1941 IPOs completed in the period 1996-2002, where data for all the above variables is available.

VC Reputation Measure	*VC Reputation*	*VC-backed*	*Underwriter Reputation*	*Bank-VC*	LnSize	LnAge	Tech	*Adjusted R^2*
IPO Market Share	1.34***	1.17**	0.08	-0.28	-0.42**	-0.21	0.37	4.23%
	(2.57)	(1.98)	(1.01)	(-0.46)	(-2.09)	(-1.57)	(1.18)	
IPO %	0.02	1.31**	0.09	-0.30	-0.42**	-0.21*	0.39	4.01%
	(0.72)	(1.96)	(1.11)	(-0.49)	(-2.12)	(-1.66)	(1.24)	
IPO frequency	0.03*	1.00**	0.08	-0.33	-0.41**	-0.21*	0.39	4.17%
	(1.89)	(2.02)	(1.06)	(-0.54)	(-2.08)	(-1.68)	(1.23)	
VC Age	0.10	1.89***	0.10	-0.29	-0.43**	-0.18	0.34	3.84%
	(0.54)	(4.15)	(1.23)	(-0.48)	(-2.23)	(-1.46)	(1.09)	
VC Capital	0.00	1.74***	0.10	-0.34	-0.42**	-0.20	0.36	3.90%
	(0.10)	(5.55)	(1.24)	(-0.55)	(-2.13)	(-1.53)	(1.13)	
VC Total Investment	0.00	1.74***	0.10	-0.34	-0.42**	-0.20	0.35	3.90%
	(0.05)	(5.11)	(1.24)	(-0.55)	(-2.13)	(-1.53)	(1.13)	

*, **, and *** denote coefficient estimates significantly different from zero at the 10%, 5% and 1% levels respectively.

Table 8
Cross-sectional Regressions Explaining Long-run Listing Survival

This table presents logit regression coefficients and in parentheses the associated *z*-statistics that are based on standard errors robust to heteroskedasticity and VC firm clustering. An indicator variable for firms that remain listed in the CRSP database for 36 months following their IPOs, *Listed*, is regressed on one of the alternative VC reputation measures, *VC Reputation*, using the following specification:

$$Listed = \beta_0 + \beta_1\, VC\ Reputation + \beta_2\, VC\text{-}backed + \beta_3\, Underwriter\ Reputation + \beta_4\, Bank\text{-}VC + \beta_5\, LnSize + \beta_6\, LnAge + \beta_7\, Tech + \varepsilon,$$

where β_0 is a vector of year fixed effects. All other variables are defined in Appendix A. There were 186 delisted non-VC-backed issuers, and 98 delisted VC-backed issuers. The regressions are estimated for 2019 IPOs completed in the period 1996-2002, where data for all the above variables is available.

VC Reputation Measure	*VC Reputation*	*VC-backed*	*Underwriter Reputation*	*Bank-VC*	LnSize	LnAge	Tech	*Adjusted R^2*
IPO Market Share	0.96**	-0.01	0.20***	-0.57*	0.19	0.38***	0.14	10.64%
	(2.32)	(-0.05)	(4.68)	(-1.73)	(0.93)	(5.15)	(0.68)	
IPO %	0.03*	-0.35	0.21***	-0.53*	0.18	0.38***	0.15	10.53%
	(1.82)	(-0.84)	(4.79)	(-1.64)	(1.51)	(5.10)	(0.76)	
IPO frequency	0.01	0.11	0.21***	-0.60*	0.18	0.38***	0.15	10.40%
	(0.91)	(0.37)	(4.83)	(-1.83)	(1.50)	(5.13)	(0.75)	
VC Age	0.03*	-0.10	0.22***	-0.64*	0.16	0.39***	0.14	10.91%
	(1.86)	(-0.38)	(5.18)	(-1.94)	(1.33)	(5.32)	(0.72)	
VC Capital	0.03	0.23	0.21***	-0.62*	0.18	0.38***	0.20	10.54%
	(1.05)	(1.18)	(4.91)	(-1.89)	(1.50)	(5.09)	(0.96)	
VC Total Investment	0.06	0.20	0.21***	-0.62*	0.18	0.37***	0.20	10.52%
	(0.99)	(0.95)	(4.91)	(-1.87)	(1.49)	(5.09)	(0.98)	

*, **, and *** denote coefficient estimates significantly different from zero at the 10%, 5% and 1% levels respectively.

Table 9
VC Market Share Reputation Measure and its Relation to Long-run IPO Firm Performance
After Controlling for Selection Bias

This table presents two-stage-Heckman regression coefficients and in parentheses associated *t*-statistics. In a first step, a logit regression is estimated for the likelihood of observing the use of a highly ranked VC, based on having an IPO market share in VC-backed deal above the median. The estimated parameters are used to calculate the inverse Mills' ratio, which is used as an additional explanatory variable in the OLS estimation removing the part of the error term correlated with the explanatory variable and avoiding the bias. The associated *t*-statistics (or *z*-statistics in the case of logit regression) are based on standard errors robust to heteroskedasticity and VC firm clustering. The first stage regression equation is:

$$VC\ Rank = \alpha_0 + \alpha_1 Ln\ Asset + \alpha_2 LnSize + \alpha_3 LnAge + \alpha_4 Tech + \varepsilon,$$

where VC Rank is 1 if *IPO Market Share* > median IPO Market Share and 0 otherwise. The inverse Mills' ratio is estimated from the above regression and used in the following second stage regression:

$$P = \beta_0 + \beta_1 IPO\ Market\ Share + \beta_2 VC\text{-}backed + \beta_3 Underwriter\ Reputation + \beta_4 Bank\text{-}VC + \beta_5 LnSize + \beta_6 LnAge + \beta_7 Tech + \beta_8 Inverse\ Mills + \nu,$$

where as before β_0 is the vector of year fixed effects and *P* represents one of the issuer performance measures: *ROA*, *MB*, or *Listed*. All the variables are defined in Appendix A.

Stage 1 Estimates

	LnAsset	LnSize	LnAge	Tech	*Intercept*	*Adjusted* R^2
VC Rank	-0.19***	0.37***	-0.11*	0.55***	-1.44***	6.47%
	(-2.78)	(3.33)	(-1.91)	(3.61)	(-2.91)	

Stage 2 Estimates

	IPO Market Share	*VC-backed*	*Underwriter Reputation*	*Bank-VC*	LnSize	LnAge	Tech	Inverse Mills' Ratio	*Adjusted* R^2
ROA	0.56***	-0.14	0.03***	-0.21**	-0.12*	0.08***	-0.31***	-0.64***	5.69%
	(2.62)	(-0.72)	(2.94)	(-2.09)	(-1.85)	(4.07)	(-2.76)	(-3.34)	
MB	1.64***	0.86**	0.12	-0.10	-1.37***	-0.05	-1.02**	-5.53***	5.69%
	(2.59)	(2.12)	(1.56)	(-0.15)	(-2.89)	(-0.37)	(-2.43)	(-5.09)	
Listed	0.94**	0.14	0.15***	-0.60*	0.60***	0.27***	0.70	1.75**	10.94%
	(2.12)	(0.59)	(3.17)	(-1.67)	(3.02)	(3.00)	(1.60)	(2.53)	

*, **, and *** denote coefficient estimates significantly different from zero at the 10%, 5% and 1% levels respectively.

Table 10
VC Market Share Reputation Measure and Explaining Long-run IPO firm Performance
Using Only VC-backed IPOs

This table presents regression coefficients and in parentheses the associated *t*-statistics (*z*-statistics) based on standard errors robust to heteroskedasticity and VC firm clustering. The post-IPO long-run performance measures, *ROA*, *MB*, or *Listed*, are regressed on *IPO Market Share* VC reputation measure and control variables, using the following specification:

$$P = \beta_0 + \beta_1 \textit{IPO Market Share} + \beta_2 \textit{Underwriter Reputation} + \beta_3 \textit{Bank-VC} + \beta_4 \textit{LnSize} + \beta_5 \textit{LnAge} + \beta_6 \textit{Tech} + \varepsilon,$$

where P is *ROA*, *MB*, or *Listed*, and β_0 is a vector of year fixed effects. All other variables are defined in Appendix A.

	IPO Market Share	*Underwriter Reputation*	*Bank-VC*	LnSize	LnAge	Tech	*Adjusted* R^2
R0A	0.53***	0.01	-0.25	-0.07	0.02	-0.20	4.82%
	(2.56)	(0.14)	(-1.26)	(-0.58)	(0.17)	(-1.44)	
MB	0.90***	0.16	-0.24	-0.86*	-0.84**	0.32	4.49%
	(2.97)	(1.39)	(-1.19)	(-1.79)	(-2.36)	(0.48)	
Listed	1.24**	0.15	-0.72**	0.21	0.23	0.06	5.10%
	(2.48)	(1.55)	(-2.16)	(0.95)	(1.21)	(0.21)	

*, **, and *** denote coefficient estimates significantly different from zero at the 10%, 5% and 1% levels respectively.

Table 11
Lead VC Market Share Reputation Measure and Explaining Long-run IPO firm Performance

This table presents regression coefficients and in parentheses the associated *t*-statistics (*z*-statistics) based on standard errors robust to heteroskedasticity and VC firm clustering. The post-IPO long-run performance measures, *ROA*, *MB*, or *Listed*, are regressed on *IPO Market Share* VC reputation measure and control variables, using the following specification:

$$P = \beta_0 + \beta_1 \textit{Lead IPO Market Share} + \beta_2 \textit{VC-backed} + \beta_3 \textit{Underwriter Reputation} + \beta_4 \textit{Bank-VC} + \beta_5 \textit{LnSize} + \beta_6 \textit{LnAge} + \beta_7 \textit{Tech} + \varepsilon,$$

where *Lead IPO Market Share* is the IPO market share of the VC that had the maximum investment in the IPO firm at the time of the IPO, *P* is *ROA*, *MB*, or *Listed*, and β_0 is a vector of year fixed effects. All other variables are defined in Appendix A.

	Lead IPO Market Share	*VC-backed*	*Underwriter Reputation*	*Bank-VC*	LnSize	LnAge	Tech	*Adjusted* R^2
R0A	0.30***	-0.10	0.03**	-0.23**	-0.00	0.04***	-0.13	5.35%
	(3.72)	(-0.58)	(2.06)	(-2.36)	(-0.06)	(4.18)	(-0.98)	
MB	1.01***	1.17	0.07	-0.42***	-0.27	-0.21	0.49	4.17%
	(3.66)	(1.42)	(0.64)	(-2.57)	(-0.82)	(-1.12)	(1.39)	
Listed	0.46***	-0.03	0.21***	-0.59*	0.20	0.38***	0.14	10.55%
	(4.57)	(-0.38)	(4.77)	(-1.79)	(1.63)	(4.78)	(0.74)	

*, **, and *** denote coefficient estimates significantly different from zero at the 10%, 5% and 1% levels respectively.

Table 12
Lead VC Market Share Reputation Measure and its Relation to Long-run IPO Firm Performance
After Controlling for Selection Bias

This table presents two-stage-Heckman regression coefficients and in parentheses associated *t*-statistics. In a first step, a logit regression is estimated for the likelihood of observing the use of a highly ranked Lead VC, based on having a lead IPO market share in VC-backed deal above the median. The estimated parameters are used to calculate the inverse Mills' ratio, which is used as an additional explanatory variable in the OLS estimation removing the part of the error term correlated with the explanatory variable and avoiding the bias. The associated *t*-statistics (or *z*-statistics in the case of logit regression) are based on standard errors robust to heteroskedasticity and VC firm clustering. The first stage regression equation is:

$$Lead\ VC\ Rank = \alpha_0 + \alpha_1 Ln\ Asset + \alpha_2 LnSize + \alpha_3 LnAge + \alpha_4 Tech + \varepsilon,$$

where VC Rank is 1 if *IPO Market Share* > median IPO Market Share and 0 otherwise. The inverse Mills'ratio is estimated from the above regression and used in the following second stage regression:

$$P = \beta_0 + \beta_1 Lead\ IPO\ Market\ Share + \beta_2 VC\text{-}backed + \beta_3 Underwriter\ Reputation + \beta_4 Bank\text{-}VC + \beta_5 LnSize + \beta_6 LnAge + \beta_7 Tech + \beta_8 Inverse\ Mills + \nu,$$

where β_0 is the vector of year fixed effects and *P* represents one of the issuer performance measures: *ROA*, *MB*, or *Listed*. All the variables are defined in Appendix A.

Stage 1 Estimates

	LnAsset	LnSize	LnAge	Tech	*Intercept*	*Adjusted* R^2
Lead VC Rank	-0.26***	0.47***	-0.02	0.64***	-2.16***	6.89%
	(-4.44)	(4.94)	(-0.32)	(5.30)	(-4.49)	

Stage 2 Estimates

	Lead IPO Market Share	*VC-backed*	*Underwriter Reputation*	*Bank-VC*	LnSize	LnAge	Tech	Inverse Mills' Ratio	*Adjusted* R^2
ROA	0.29***	-0.13	0.03**	-0.23**	-0.05	0.05***	-0.34***	-0.44***	5.64%
	(3.08)	(-0.69)	(2.49)	(-2.27)	(-0.94)	(3.71)	(-3.22)	(-6.57)	
MB	1.27***	0.56	0.12	-0.15	-0.84***	-0.21	-1.34***	-3.72***	6.04%
	(3.71)	(1.38)	(1.43)	(-0.22)	(-3.76)	(-1.61)	(-2.91)	(-5.09)	
Listed	0.46***	0.11	0.16***	-0.52*	0.40***	0.39***	0.77	1.38**	11.28%
	(2.56)	(0.41)	(4.20)	(-0.79)	(5.74)	(5.78)	(0.74)	(4.08)	

*, **, and *** denote coefficient estimates significantly different from zero at the 10%, 5% and 1% levels respectively.

Table 13
Analysis of Alternative IPO Market Share VC Reputation Measures
for Explaining Long-run IPO firm Performance

This table presents regression coefficients and the associated *t*-statistics (*z*-statistics) in parentheses are based on standard errors robust to heteroskedasticity and industry clustering. The post-IPO long-run performance measures, *ROA*, *MB*, and *Listed*, are regressed on 2 alternative IPO market share measures, *Share of VC-backed IPOs*, or *Cumulative IPO Market Share* and on the control variables. In the top panel, we use *Share of VC-backed IPOs*, and in bottom panel the *Cumulative IPO Market Share* as the VC reputation measure. All the variable definitions are found in Appendix A.

	Share of VC-backed IPOs	*VC-backed*	*Underwriter Reputation*	*Bank-VC*	LnSize	LnAge	Tech	*Adjusted R^2*
R0A	0.48**	-0.11	0.03	-0.21	-0.02	0.03	-0.15	5.36%
	(2.44)	(-0.84)	(1.41)	(-1.09)	(-0.33)	(0.91)	(-1.52)	
MB	1.22*	1.27**	0.17	-0.45	-0.39**	-0.22*	0.40	4.35%
	(1.90)	(2.05)	(0.95)	(-0.72)	(-1.97)	(-1.74)	(1.22)	
Listed	1.25***	-0.19	0.19***	-0.41	0.22	0.39***	0.13	10.92%
	(2.56)	(-0.74)	(4.52)	(-1.22)	(0.82)	(4.83)	(0.64)	

	Cumulative IPO Market Share	*VC-backed*	*Underwriter Reputation*	*Bank-VC*	LnSize	LnAge	Tech	*Adjusted R^2*
R0A	0.65***	-0.16	0.03	-0.20	-0.02	0.04	-0.15	5.54%
	(3.07)	(-1.29)	(1.38)	(-1.03)	(-0.37)	(0.90)	(-1.52)	
MB	1.35**	1.22**	0.07	-0.37	-0.43**	-0.22*	0.42	4.41%
	(1.99)	(1.94)	(0.99)	(-0.59)	(-2.14)	(-1.76)	(1.31)	
Listed	1.34**	-0.17	0.20***	-0.49	0.22	0.40***	0.12	10.95%
	(2.48)	(-0.70)	(4.50)	(-1.42)	(0.86)	(4.88)	(0.57)	

*, **, and *** denote coefficient estimates significantly different from zero at the 10%, 5% and 1% levels respectively.