

VENTURE CAPITAL AND RISK MANAGEMENT: EVIDENCE FROM INITIAL PUBLIC OFFERINGS

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Abstract

In this study we analyze a sample of initial public offerings (IPOs) to infer the sources of firm-specific risk associated with investment by venture capitalists. The results indicate that IPO backing by venture capitalists is associated with risk factors related to operating profit margins and ongoing sales generation, but not operational financing. The results also indicate that venture-backed IPOs are associated with greater reductions in firm-specific risk over the course of a year that includes the date of the IPO. In sum, the findings suggest venture capitalists are willing to accept higher levels of uncertainty in those instances where they have an advantage in terms of managerial skill, and are able to reduce firm-specific risk subsequent to investment in order to maximize returns when they cash out. Our study also makes use of proxies that are representative of the ex-ante nature of firm-specific risk at the time of a new issue.***

Keywords: Risk, IPO, Venture Capital, Uncertainty

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Introduction

Venture capital firms have been the focus of academic researchers not only for the information role that they play in capital markets (Gupta & Sapienza, 1992; Zider, 1998) but also their apparent ability to invest in successful ventures (Sandberg, 1986; Timmons, 1994; Vesper, 1990). In this study, we examine the association between the presence of a venture capitalist and specific sources of firm-level risk at the time of an initial public offering (IPO). Although the time of an IPO is considered a youthful stage in the life-cycle of a business entity, an IPO is typically made substantially after start-up and after the venture has experienced some degree of success. The IPO is also a time when the firm's level of public disclosure increases dramatically. An offering prospectus provides an assessment of the risk factors currently faced by the firm going public, and so the IPO event is an opportunity to infer the nature of the

risks that successful venture capitalists are willing to endorse and manage.

Using prospectuses from a large group of ventures preparing to do an IPO, we analyze the risk disclosures between IPOs that are backed by venture capitalists and those that are not. Our results indicate that venture capitalists are associated with IPOs that disclose significantly more risk factors related to operating profit margin and long run sales generation. Risk factors for operating profit margin generally include pricing pressures from competitors and cost pressures from suppliers, while risk factors for sales generation include obstacles for customers to establish a repeat pattern of ordering. Our results also indicate that venture capitalists are not associated with a higher number of risk factors related to operational financing which typically include any problem that hinders the firm's ability to produce cash flows from operations. Lastly, our results indicate that IPOs backed by a venture capitalist

improve more in terms of fiscal strength during the year of the offering than IPOs not backed by a venture capitalist.

Overall, we interpret the results to suggest that venture capitalists are willing to assume higher risks related to profit margins and sales generation because they have the managerial skills and resources to address these risks. However, well managed profit margins and sales do not guarantee positive cash flows, and so when it comes to managing risks related to operational financing, venture capitalists have a risk aversion that is similar to other non-venture capital investors. Venture capitalists, therefore, are discriminating in assuming certain types of risk and favor those risks that they are best equipped to manage and reduce before selling their shares to the public. This may help to explain why companies backed by venture capitalists can generate higher returns for themselves and their investors.

From a methodological perspective, our study develops and uses proxies that are arguably more representative of the risks faced by VCs and other investors at the time of an IPO. These new risk measures could be used in future research to examine how the individual sources of firm-specific risk affect other managerial behaviors. The next section describes the background and motivation for the study. We then present the theoretical arguments and research design, and conclude with a discussion of results and closing remarks.

Background and Motivation

An important consideration for owners and managers of all new ventures is the issue of risk management. Risk can be viewed in the context of firm failure or in the context of uncertainty or variation in expectations about future performance (Altman, 1968, 1983; Laitinen, 1992; Fama, 1976). In both views, managerial resources are consumed and wealth is lost as managers attempt to prevent failure or reduce uncertainty. Despite the costly restrictions imposed on entrepreneurs by VCs for their resources, managerial assistance from VCs is sought by many entrepreneurs each year (Venture Capital Journal, 2002). VCs' success in generating wealth is presumably due to their selection and screening criteria (Fried & Hisrich, 1994; Shepherd, Zacharakis & Baron, 1998; Vesper, 1990), their ability to mentor and guide the young firm (Barry, 1994; Timmons, 1994), their ability to reduce agency problems for owners/managers (Brophy & Shulman, 1992), and their ability to lower potential information asymmetries between the portfolio firm and investors (Brav & Gompers).¹

¹ There are some exceptions to the idea that VCs consistently increase wealth. Brau, Brown, & Osteryoung (2004) find no difference in performance between VC and non-VC backed IPOs in the small IPO segment.

Venture capitalists are primarily interested in maximizing the return to their portfolio, and the potential for doing so can increase with the risk and rewards associated with new products, services, and competitors in growing or unknown markets. Balancing risk and reward is something that all investors must deal with, but VCs, as investors and managers at the same time, may have a competitive advantage when it comes to managing risk. VCs do not invest their funds to obtain modest returns (Sapienza, Manigart & Vermeir, 1996). VCs obtain higher than average returns (Megginson & Weiss, 1991) and it is likely that VCs systematically exploit the risk-reward relation by investing in high risk ventures with the intent of subsequently reducing the risk to make it more appealing to others when they sell their shares.

Our knowledge about the specific make-up of firm-level risk relies heavily on anecdotal evidence, and researchers have generally not concluded their assessment of what the make-up of risk is the context of the decision maker (i.e., the manager). A call for such an assessment exists in the academic literature (Baird & Thomas, 1985; Reger, Duhaime & Stimpert, 1992). Several researchers have examined the strategic factors related to the VC's evaluation process (Laitinen, 1992; Shepherd, 1999; Tyebjee & Bruno, 1984) and we supplement this thinking with consideration of the specific sources of firm-level risk. All new ventures are somewhat risky, but we propose there are fundamental differences in the way risk is managed between ventures that are VC-backed and those that are not.

The importance of risk evaluation is documented throughout the finance academic literature; however, some studies have raised concern about the effectiveness of CAPM and variance-related measures to represent firm risk (Ruefli, Collins & Lacugna, 1999). These measures are general in nature, representing risk for the entire firm, and are not informative about specific sources of risk.² In our study, we quantify risk based on the detailed descriptions of risk factors disclosed in the IPO prospectus in order to construct risk proxies that are representative of the ex-ante risks faced by the company at the point of IPO. Thus, our study is motivated by an attempt to understanding the multi-dimensional nature of firm-specific risk and how the venture capitalist manages it. A secondary motivation is to present a methodology for developing better proxies of ex-ante risk.

Theoretical Argument

VC's fund ventures at every stage of their life up to the IPO, and in most cases they play a funding and advisory role for their portfolio firm (Aragon, 2003;

² The variance of returns captures all risks perceived by investors that could include management risk, information risk, industry risk, etc.

Fried & Hisrich, 1994; Mason & Harrison, 1999; Tyebjee & Bruno, 1984). The staged financing suggests that venture capitalists provide an incentive for growth, and the advisory role suggests they are skillful at management (Amit, Brander & Zott, 1998; Sandberg, 1986; Shepherd, Zacharakis & Baron, 1998). VCs systematically examine potential investments, meet with the entrepreneurial teams, and cull from a long list of ventures a small number that appear to have sound management, strong growing markets, and clearly positioned products or services (Fried & Hisrich, 1994; Gladstone, 1988; Hall & Hofer, 1993).

All of the above suggests venture capitalists desire high returns, which in many cases, directs them to high risk businesses (Sahlman, 1990). Barry emphasizes this when he states that the term venture capital is "capital invested in highly risky ventures" (1994:4). This risk is an inherent component of the resource-based perspective of the firm which suggests that ex ante limits to competition are derived from uncertainty (Peteraf, 1993). Peteraf (1993) continues to suggest that the venture capitalist desires to invest in high growth ventures and their opportunity for growth is fundamentally founded in a market position that is not well understood. Risk may indeed be a key to understanding venture capital investing, and some have suggested that VC firms are extraordinarily capable of reducing uncertainty and thereby leveling the playing field (Amit, Brander & Zott, 1998).

Therefore, our general proposition is that venture capitalists maximize their wealth by choosing to invest in firms with higher levels of firm-specific risk with intent of reducing that risk by the time they cash out (i.e., at the IPO date). The VCs concurrent role as management specialist and investing owner provides them with a mechanism to reposition, or improve the risk profile of the investment. In the following section we develop our hypotheses on how specific sources of risk will be directly associated with venture-backed IPOs.

Specific Hypotheses

We examine the association between venture capital participation and specific sources of risk based on a taxonomy of "entrepreneurial obstacles" developed by Vesper (1990). Vesper (1990) outlines three obstacles (risks) that new businesses must overcome on the path to success as follows: 1) obstacles to generate sufficient profit margin, 2) obstacles to develop an effective sales generating scheme, and 3) obstacles to obtain sufficient operational financing.³

³ According to Vesper (1990), it is not sufficient to have a venture idea; the idea must carry an adequate profit margin. It is not sufficient to obtain initial sales orders; a scheme must be introduced that generates continuous orders and reorders. It is not sufficient to provide the seed capital needed to germinate the venture; either that capital must grow fast enough through high initial profits or it must be augmented with additional injections for longer-term survival.

By examining each of these obstacles, or risks, to ventures at the time of the IPO, and comparing VC-backed to non VC-backed ventures, we hope to shed light on how VCs accept and manager risk, and the resulting impact on the venture's level of risk. These are the primary motivations for our study.

Risks to Profit Margin

Vesper suggests that a significant threat to the success of a new venture is its ability to establish and maintain a high margin product or service. This criterion has been used in modeling potential outcomes in the venture capitalist/entrepreneur relationship (Amit, Brander and Zott, 1998) and has been cited as a primary focus of venture capitalists (Fried & Hisrich, 1995). However, VCs manage a group of young ventures, where according to one study (Gorman & Sahlman, 1989), a lead investor might be managing up to nine investments at a time while sitting on five boards of directors. The importance of achieving high growth targets is an overriding issue for venture capitalists (Sahlman, 1990), whereas the individual entrepreneurial venture, unable to spread the risk potential or less able to focus on returns, might be compelled to expend greater efforts to achieve higher margins.

Non VC-backed firms do not have the same financial resources to fall back on to cover mistakes and their efforts must be geared to reducing margin threats, not just for success, but for survival (Bruno, McQuarrie & Torgrimson, 1992; Dean & Giglierano, 1990). Non-VC-backed ventures are advised to enter markets where threats to profit margin are low or can be easily eliminated (Oster, 1999). We suggest that VCs enter markets where threats to profit margin are not low, nor can they be easily eliminated, which allows the VC to capitalize on his unique skills in reducing risks. Risks to profit margins would typically include threats to product pricing and supply costs. These are threats that a VC can probably overcome given his networks, resources, and managerial skills as an industry specialist. Therefore, if VCs are willing to accept higher levels of risk in order to maximize investment return, we propose the following alternative hypothesis for risks related to operating profit margins:

H1: Venture capital-backed IPOs will have more threats to operating profit margins disclosed in the prospectus than non venture capital-backed IPOs.

Risks to Sales Generation

Vesper suggested that a new venture must have the opportunity to sell to many customers and to obtain repeat business. The ability to develop a sales scheme that is broad enough to appeal to a wide variety of customers has been found in previous research to lead to higher sales for new ventures (McDougall, et al., 1994; Romanelli, 1989; Sandberg, 1986). This has

been extended to suggest that "increasing breadth of production, and increasing geographic coverage improve performance [in entrepreneurial firms] during both the peak and the contraction of the business cycle" (Pearce & Michael, 1997:301). Broad sales schemes imply significant differentiation of products/services that would be consistent with traditional strategic positioning advice (Porter, 1980, 1985). Several studies have found that ventures, including those at the point of IPO, enter industries characterized by high product differentiation (Robinson, 1999), and so high levels of product differentiation may be a way for new ventures to overcome problems with ongoing sales generation.

Threats to sales generation schemes would seem to be less important to venture capital-backed firms as their confidence in the industry in which they have invested (Barry, et al., 1990; Tyebjee & Bruno, 1984; Zacharakis & Meyer, 1998) or their confidence in the venture's team (Hall & Hofer, 1993) leads them to accept additional risks to obtain the potentially higher growth. We propose that VCs gain competitive advantage as investors by picking prospects with riskier sales generation schemes. Therefore, we propose the following:

H2: Venture capital-backed IPOs will have more threats to their sales generation scheme disclosed in the prospectus than non venture capital-backed IPOs.

Risks to Operational Financing

Vesper (1990) suggests that there are a number of specific threats to the new venture in financing its growth. High development costs, rapid expansion plans, high inventory needs and/or an entrepreneurial team with a low asset base. Research has shown that firms with higher initial capitalization have the opportunity to grow faster (Cooper & Gimeno-Gascon, 1992; Duchesneau & Gartner, 1990; Eisenhardt & Schoonhoven, 1990). Castrogiovanni stated that "startup capital serves three purposes: 1) to purchase the assets needed to operate a business; 2) to sustain a business during its early period when cash flows are likely to be negative; and 3) to buffer against management mistakes, environmental uncertainties, and other unforeseen difficulties." (1996:815). VCs typically structure their deals with new ventures so that they are provided money on a milestone schedule that provides an incentive for continuous cash infusion for the new venture and the opportunity to abandon ventures that are not attaining their projections (Gifford, 1997; Sahlman, 1990). The fact that VCs will provide financing in stages suggests they are associating with ventures that have significant financing risk. Therefore, consistent with the proposition that VCs invest in higher risk prospects to capitalize on the risk-return relation, we hypothesize the following about the disclosure of risk

factors related to operational financing for IPOs backed by a venture capitalist:

H3: Venture capital-backed IPOs will have more threats to their operational financing disclosed in the prospectus than non venture capital-backed IPOs.

Risk Reduction and Venture Capitalists

Finally, an implication in the VC's decision to assume higher levels of certain types of risk is the concept that VCs can better manage these risks in order to derive higher returns. If VCs cannot manage higher levels of risk better than the average investor, then capital market participants will punish the venture capitalist by requiring a higher rate of return when the VC subsequently tries to sell his ownership. Greater discounting at the time that the VC wants to divest their shares implies the VC will earn lower returns and for this reason their performance in terms of returns will not differ from the average investor. However, long run excess returns are possible if the VC can initially identify and purchase high risk investments, thereby paying a lower price due to higher discounting, and then reduce the risk of the venture over time by making operating improvements. Reducing the risk over time allows the VC to subsequently cash out of his investment at a lower required rate of return relative to the required rate of return on his initial outlay, and therefore, increase the chance of generating an excess return. According to this proposition we should see evidence of greater risk reduction on IPOs backed by a VC than those that are not. Our fourth hypothesis is:

H4: Over time, venture capital-backed IPOs will experience greater reductions in firm-specific risk than non venture capital-backed IPOs.

Research Design

At the time of an IPO, the offering prospectus identifies venture-capital investors, explains their investment position, and gives details of their activity within the IPO firm. IPO data, therefore, provide a unique opportunity to examine venture capitalists' activity for those firms that already have achieved a certain degree of success (Barry, Muscarella, Peavy & Vetsuypens, 1990: 448). Thus, the IPO prospectus is our ultimate source for data.

Sample Selection

We first identified IPOs in *Investors Daily Digest (IDD)* and *Barron's*. Through these two sources we were able to identify an initial set of 545 IPOs from 1991 through 1994 with the requisite market and

financial data for our regression tests available on *Compact Disclosure*.⁴

Next, we identified IPOs that were backed by a venture capitalist by comparing our sample of firms to a listing of venture-backed IPOs provided in the *Venture Capital Journal* and the *Venture Capital Yearbook*. Of the 545 IPOs identified, 217 were backed by a venture capitalist while 328 were not.

From the original set of 545 observations, we manually constructed a subset of 258 observations containing risk variables based on Vespers (1990) taxonomy mentioned above. These 258 observations will be used in a multivariate logistic regression designed to test how the various sources of firm-specific risk are associated with the probability that a VC is invested in the IPO. This multivariate analysis will be used to examine hypotheses *H1*, *H2*, and *H3*.

In testing *H4*, we are not limited to using the manually collected risk count data and so the full set of 545 observations will be used in a multivariate, ordinary least squares (OLS) regression test. This analysis is designed to test whether VC-backed IPOs are associated with greater reductions in firm-level risk over time than non VC-backed IPOs.

Regressions

Variables for the VC Logistic Analysis

The dependent variable of the VC logistic regression is an indicator variable (1/0) representing the VC's backing of the IPO or not. To control for potential confounds on the variables of interest (the count of risk factors) we included four other risk variables as follows: 1) leverage, 2) asset size, 3) industry, and 4) the age of the venture (to control for the known differences in age between VC-backed and non VC-backed ventures). As leverage increases, the risk of the venture is expected to increase, and so we expect a positive relation between leverage and the venture capital indicator. For IPOs, greater asset size implies greater liability to investors by those making the public offering under the Securities and Exchange Act of 1933, so we expect asset size to be positively related to the venture capital indicator. Industries have their own specific risk profile, and so we make no directional predictions for the industry indicators. As the age of the venture increases, the risk of long-run viability decreases, and thus we expect age to be negatively related to the venture capital indicator since younger firms tend to be riskier.

An important consideration for venture capital investment is the potential for growth, a known determinant of VC participation which is likely to be related to risk also. We include the proportionate change in sales from year-to-year to control for the

⁴ Using IPOs from this time frame avoids confounds associated with venture capital activity during the dot com boom of the late 1990's.

effects of expected growth on the VCs decision to invest.

Count Data Risk Variables

The variables of interest are counts of risk factors categorized into Vesper's framework. To obtain these risk proxies we reviewed copies of the S-1 offering registration statement on *Laser Disclosure* for each IPO.⁵ By reading the prospectus section entitled "Risk Factors", we categorize all risks listed into one of the following categories: risks for profit margin, risks for sales generating schemes, and risks for operational financing. Risk factors that cannot be grouped into one of these categories are assigned to "other".

Our content analysis coded for the existence of a concept and not the frequency of a concept or word (see Smith, 1992). First, we identified a list of concepts that would affect or fit into each of (Vesper's) three risk categories. There is a "boilerplate format" used in prospectuses to discuss risk factors with each individual risk factor clearly identified and separated from the others (numbered in many cases). Therefore, the primary challenge with the content analysis was to identify the concept in the text of a risk factor that fit into one of our risk categories.⁶ A count of the number of risk factors for each of dimensions of risk is a proxy variable for a specific source of risk.

Two independent evaluators also examined the S-1 offering statements for 135 randomly drawn companies in the sample. We evaluated the inter-rater reliability and computed a coefficient alpha of .80, indicating a coding consistency by the original evaluator. According to our hypotheses, we expect each of the risk proxies to be positively related to the VC's decision to participate on an IPO. In the next section we discuss the model to test our hypotheses.

⁵ The S-1 registration statement is filed under the Securities Act of 1933, and is composed of two parts. Part I is the prospectus of an offering, and typically includes textual descriptive information, including a detailed discussion of the risk factors faced by the IPO. Part II of the registration contains information not required in the prospectus and typically includes expenses of issuance, information on directors and officers, exhibits and financial statements.

⁶ Examples of our coding follow: Competitive threats that might require a price cut were coded as a risk to margin; disruption of raw material supplies or a cause that could increase manufacturing costs were coded as a risk to margin; marketing issues that hindered sales to repeat customers, inability to develop sales schemes, or inability to identify potential customers were coded as a risk to sales generation; expansion plans that could not be covered by operating cash flows were coded as a risk to operational financing.

Specification of the VC Logistic Regression

$$\begin{aligned}
 & (+) \quad (+) \quad (-) \quad (+) \quad (+/-) \\
 VC_j = & a_0 + a_1 LEVERAGE_j + a_2 \ln ASSETS_j + a_3 AGE_j + a_4 \Delta SALES_j + \sum a_{ij} (INDUSTRY_i) \\
 & (+) \quad (+) \quad (+) \\
 & + a_7 MARGIN_RISK_j + a_8 SALES_RISK_j + a_9 FINANCE_RISK_j + e_j.
 \end{aligned}$$

These variables are defined as follows:
 VC = (1,0) dummy variable indicating the backing of a VC or not, with a value of 1 if a VC is listed in the prospectus as backing the IPO.

LEVERAGE = Total liabilities scaled by total assets as of the balance sheet just prior to the IPO.

LnASSETS = the natural logarithm of total assets as of the balance sheet just prior to the IPO (the log is used to remove the nonlinearity usually found in a cross-section of firm assets).

AGE = the age of the company in days from inception to the IPO date.

ΔSALES = Pre-IPO total sales minus post-IPO total sales, scaled by pre-IPO sales. Thus, this is the proportionate change in sales during the year of the IPO.

INDUSTRY = Dummy indicators coded for membership in the manufacturing or service industries based on 2 digit SIC code.

MARGIN_RISK = a count of the risk factors in the prospectus that represent risks for profit margin.

SALES_RISK = a count of the risk factors in the prospectus that represent risks for sales generating schemes.

FINANCE_RISK = a count of the risk factors in the prospectus that represent risks for operational financing.

Variables for the Risk Reduction Analysis

The dependent variable to test our risk reduction hypothesis is the change in the Altman Zscore based on financial statement information from the fiscal years prior and subsequent to the IPO. By testing changes in the Zscore, we can examine the relative impact that VCs have on firm risk. Technically, changes in the Zscore gauge the improvement or deterioration in the probability of bankruptcy over the year of the offering. Our intent, however, is to use the bankruptcy measure as a proxy for firm-specific risk

$$\begin{aligned}
 & (+/-) \quad (+/-) \quad (+/-) \\
 \Delta ZSCORE_j = & b_0 + b_1 \ln PROCEEDS_j + \sum b_{ij} (INDUSTRY_j) + \sum b_{ij} (YEAR_i) + \\
 & (+) \\
 & + b_9 VC_j + e_j.
 \end{aligned}$$

These variables are defined as follows:
 ΔZSCORE = Pre-IPO Altman Zscore index minus post-IPO Altman Zscore index, scaled by the pre-IPO Altman Zscore index. Thus, this is the

The specification of the logistic regression is as follows. Predicted signs for the coefficients are shown in parentheses.

(please note that higher Zscore's indicate a lower probability of bankruptcy). The Altman Zscore is an index computed on the basis of the firm's working capital, earnings, equity, and sales, which are factors that are arguably correlated with fiscal strength and risk. Altman's Zscore is frequently recommended for evaluating financial condition (Wheeler and Hunger 1998:326) and is the most common measure used by investment practitioners (Falkenstein, Boral, and Carty 2000). For our purpose, the important consideration is whether the measure represents relative levels of firm-specific risk, and not whether it can predict bankruptcy per se.

For this regression we include controls that potentially affect the Zscore but are not related to changes in management risk. The IPO event itself is a significant change for the firm and the size of the offering as it relates to changes in ownership and capital structure may introduce transient uncertainty not related to operations. Accordingly, we include a control variable for the amount of offering proceeds to account for this uncertainty. Macroeconomic trends and changes have been linked to the relative incidence of bankruptcies and so we control for these effects by including variables for industry membership and year. We make no prediction for the sign on the coefficients of offering proceeds, industry, and year variables.

The variable of interest is a VC indicator (1:0 dummy variable indicating VC backing or not). According to hypothesis H4, we expect the sign on the VC dummy variable to be positive consistent with the idea that VC-backed IPOs are associated with greater reductions in risk (indicated by higher Zscore) than IPOs that are not backed by a VC.

Specification of the Risk Reduction Regression

We use OLS to estimate the Risk Reduction Regression as follows (predicted signs included):

proportionate change in the Altman Zscore index during the year of the IPO.

lnPROCEEDS = the natural logarithm of the total IPO proceeds as reported in the prospectus (as with assets, the natural log is used to remove the

nonlinearity found in cross-sectional data of this type).

INDUSTRY = Dummy indicators coded for membership in the manufacturing, service, or transportation industries based on 2 digit SIC code.

YEAR = Dummy indicators for prospectus dates belonging to years 1991, 1992, 1993, and 1994.

VC = (1,0) dummy variable indicating the backing of a VC or not.

Results

Descriptive Statistics

Descriptive statistics and mean comparisons of all variables between VC-backed and non VC-backed IPOs are presented in Table 1. All mean comparisons

of the variables between VC-backed and non VC-backed IPOs are statistically different except Δ SALES and FINANCE_RISK. The descriptive statistics for the control variables suggest that VC-backed IPOs have less leverage, smaller assets, lower offering proceeds, are more common in the manufacturing and service industries (although the participation rates across these industries are different), and less common in the transportation industry. The mean comparisons for leverage and assets are not consistent with our general hypothesis that VCs choose to participate on riskier IPOs. We would expect VC backed IPOs to be more highly leveraged and larger in size, assuming leverage and size are correlated with risk.

Table 1. Descriptive Statistics

Variable	(1) Full Sample. Mean (Stdev), t-stat ($\mu=0$), No. of Obs.	(2) VC Backed Mean (Stdev), t-stat($\mu=0$), No. of Obs.	(3) NonVC Backed. Mean (Stdev), t-stat ($\mu=0$), No. of Obs.	(4) Diff t-stat for diff.
LEVERAGE (Ratio)	0.734 (0.640) 26.76*** 545	0.677 (0.918) 10.86*** 217	0.772 (0.349) 40.03*** 328	-0.095 -1.71*
ASSETS (Million \$)	83.87 (226.94) 8.63*** 545	36.687 (60.05) 9.00*** 217	115.09 (284.32) 7.33*** 328	-78.403 -4.00***
Δ ZSCORE (Index)	1.126 (15.378) 1.71* 545	2.423 (18.107) 1.97* 217	0.268 (13.228) 0.37 327	2.155 1.64*
PROCEEDS (Million \$)	41.092 (56.227) 17.06*** 545	31.117 (21.122) 21.74*** 217	47.651 (69.687) 12.38*** 328	-16.534 3.38***
Δ SALES (Ratio)	0.530 (1.453) 8.51*** 545	0.625 (0.742) 12.40*** 217	0.467 (1.772) 4.77*** 328	0.158 1.24
AGE (Days)	6503 (6912) 5.11*** 258	3534 (1932) 15.84*** 75	7720 (7799) 13.39*** 183	-4185 -4.59***
MANUFACT (1:0 dummy)	0.453 (0.498) 14.60*** 258	0.600 (0.493) 10.54*** 75	0.393 (0.489) 10.86*** 183	0.207 3.07***
SERVICE (1:0 dummy)	0.224 (0.418) 8.63*** 258	0.333 (0.474) 6.08*** 75	0.180 (0.385) 6.33*** 183	0.153 2.70***
TRANSPORT (1:0 dummy)	0.061 (0.239) 6.01*** 545	0.031 (0.174) 2.62*** 217	0.080 (0.273) 5.41*** 328	-0.049 2.42***
MARGIN_RISK (Count)	2.507 (1.210) 33.28*** 258	2.866 (1.358) 18.27*** 75	2.360 (1.114) 28.65*** 183	0.506 3.10***
SALES_RISK (Count)	2.670 (2.012) 21.31*** 258	4.080 (1.843) 19.17*** 75	2.092 (1.784) 15.87*** 183	1.988 8.04***
FINANCE_RISK (Count)	3.267 (1.406) 37.31*** 258	3.213 (1.081) 25.73*** 75	3.289 (1.522) 29.24*** 183	-0.076 0.39

***, **, and * indicate significance at 0.01, 0.05, and 0.10, respectively (one-tail).

The mean comparisons for the experimental risk proxies are consistent with our hypotheses in three of four cases: risk factors for operating profit margins, sales generation, and the improvement in Zscore, are statistically higher for VC backed IPOs than non-VC backed IPOs. The count of risk factors for operational financing is not statistically different between VC and non-VC backed IPOs. Mean comparisons, whether they are consistent or not with the hypotheses, should be interpreted cautiously since they do not control for the correlated effects of other important factors.

Independent variables that potentially exhibit collinearity are LnASSETS with SALES_RISK ($\rho = -0.467$, p-value < 0.01) and AGE with SALES_RISK ($\rho = -0.390$, p-value < 0.01) (other correlation results are not presented). However, these correlations appear to be relatively low and should impart no substantive effect upon our results (Covin, Slevin & Schultz, 1994; Neter, Wasserman & Kutner, 1990) (Variance inflation factors (VIFs) computed in the multivariate regression analysis also indicates that collinearity is not a problem. VIFs greater than 5

suggest that collinearity is possibly harming the estimation and the highest VIF in our analysis is 1.56).

VC Logistic Regression Results

Table 2 presents the estimation results of the VC logistic regression. To test the overall significance of the logistic model, we compute a likelihood ratio test for the joint significance of the explanatory variables. The chi-square for this test statistic is 92.76 (p-value < 0.001), indicating the combined independent variables are important in explaining the differences between VC and non VC-backed ventures. The maximum-rescaled R², a measure of goodness-of-fit, is 41.9%, indicating that the independent variables explain a significant portion of the VC’s decision to participate on the IPO. The significant explanatory power of the logistic estimation is also evident in the fact that nine out of ten independent variables are significant at conventional levels (one-tail p-value < 0.10).

Table 2. VC Logistic Regression.

Variable	Prediction	Estimate	Standard Error	Asymptotic t-statistic	p-value	Odds Ratio
<i>Controls:</i>						
Intercept	+/-	-12.422	3.008	4.12	<.001	-
LEVERAGE	+	-0.719	0.413	1.74	0.041	0.487
LnASSETS	+	0.597	0.158	3.78	<.001	1.818
AGE	-	-0.0002	0.00006	3.14	0.001	1.000
ΔSALES	+	0.492	0.270	1.82	0.034	1.637
MANUFACT	+/-	1.335	0.470	2.84	0.002	3.801
SERVICE	+/-	1.292	0.513	2.51	0.006	3.641
<i>Risk Variables (Experimental):</i>						
MARGIN_RISK	+	0.299	0.143	2.09	0.018	1.349
SALES_RISK	+	0.459	0.106	4.30	<.001	1.584
FINANCE_RISK	+	-0.133	0.120	1.10	0.134	0.875
Likelihood Ratio χ^2 ($H_0: \alpha = 0$)		92.760				
Prob > χ^2		<0.001				
Max-Rescaled R ²		0.419				
No. observations		258				

Logistic estimation of risk factors that explain whether the IPO is backed by a venture capitalist. The dependent variable is a dichotomous variable (1:0) indicating VC participation or not.

Hypotheses 1 and 2 suggest that VC-backed firms will have more risks related to their profit margins and their ability to generate sales than non VC-backed firms. The parameter estimates for MARGIN_RISK and SALES_RISK are both positive and significant (p<.01), supporting these hypotheses. Hypothesis 3 suggests that VC-backed firms will have more risks related to operational financing than non VC-backed firms. The parameter estimate is not significant at conventional levels (p = 0.269) indicating that the number of operational financing

risks does not affect the VC’s decision to participate on an IPO.

The estimated coefficients on the control variables are generally consistent with expectations except for the estimate on LEVERAGE. This coefficient is negative and significant (p=0.081). An alternative explanation for this result might be found in the bondholder wealth expropriation hypothesis (Copeland and Weston 1992). Equity holders, as residual claimants on net income, have an incentive to increase the risk of the firm so as to maximize their claim relative to debt holders. Venture capitalists tend

to be active, large-block equity holders, and their presence may signal higher levels of risk to lenders who generally prefer to avoid risk. These lenders would then avoid investments that are endorsed by venture capitalists, causing the observed negative association between leverage and the presence of a venture capital investor.

The slope coefficients from logistic estimation are interpreted as the rate of change in the “log odds” as the independent variables change, which is not very intuitive. An interpretation which is more intuitive is the effect of the independent variable on the “odds ratio,” which indicates the relative increase or decrease in the probability of the event given a one unit change in the independent variable (An odds ratio of 1 means that there is a 50/50 chance the event will occur with a one unit change in the independent variable. A negative coefficient means the event is less likely to occur, and so the odds ratio will be less than one; a positive coefficient means the event is more likely to occur, and so the odds ratio is will be greater than one.). Essentially, the odds ratio lets us assess the relative impact each independent variable has on the probability of the event, which in this case is the participation of a VC on the IPO. The largest

impacts on VC participation in the logistic model are from the industry control variables (3.801 for MANUFACT and 3.641 for SERVICE). This is not unexpected since VCs develop expertise along industry lines and focus their investments accordingly. The odds ratios of the two significant experimental variables, SALES_RISK and MARGIN_RISK, are not statistically different from each other (chi-square = 0.834, p =0.360) suggesting that neither of these sources of risk dominates the other in terms of the association with participation by a venture capitalist.

Risk Reduction Regression Results

Table 3 presents the results of an OLS estimation of the Risk Reduction Regression. The overall regression is significant at conventional levels (F-statistic for zero slopes = 3.14, p-value = 0.001), however, the R-square is low indicating the independent variables have low explanatory power. Six out of ten independent variables are significant, including controls for the amount of offering proceeds (LnPROCEEDS), and some industry and year dummies (MANUFACT, SERVICE, and YR94).

Table 3. Risk Reduction Regression

Variable	Prediction	Estimate	Standard Error	t-value	p-value
<i>Controls:</i>					
Intercept	+/-	-5.569	3.099	-1.80	0.036
LnPROCEEDS	+	0.326	0.178	1.83	0.033
MANUFACT	+/-	0.712	0.414	1.72	0.043
SERVICE	+/-	1.133	0.502	2.25	0.024
TRANSPORT	+/-	-0.168	0.722	-0.23	0.407
YR91	+/-	0.016	0.751	0.02	0.491
YR92	+/-	0.659	0.706	0.46	0.175
YR93	+/-	0.356	0.696	0.51	0.304
YR94	+/-	1.180	0.704	1.68	0.094
<i>Experimental Variable:</i>					
VC	+	0.970	0.334	2.90	0.002
R ²		0.049			
F-Value (H ₀ : β = 0)		3.14			
Prob > F		0.001			

OLS Estimation of the factors that explain reductions in IPO risk. The dependent variable is the change in the Altman Zscore (bankruptcy index) from the pre- to post-IPO financial statements.

Hypothesis 4 predicts that VCs will be associated with greater improvement in firm-specific risk compared to cases where a VC is not on the IPO. The results are consistent with this hypothesis. The coefficient on the experimental variable, the VC dummy indicator, is positive and significantly (p-value = 0.002) related to larger increases in the Altman Zscore (higher Zscores indicate a lower probability of bankruptcy). We interpret this to suggest that VCs have a greater impact on risk reduction than the average IPO investor or manager.

Conclusion

We began this study with three goals in mind: 1) to examine the association between sources of firm-specific risk and VC investment at the time of the IPO in order to infer the types of risk that VCs successfully assume and manage, 2) to examine changes in firm-specific risk to test whether or not VCs have a greater impact on risk reduction, and 3) to operationalize new risk proxies that might be useful for practitioners and researchers alike. The

study of the explicit sources of an inherently multi-dimensional construct is lacking in the academic literature. The typical study utilizes a single ex-post measure to represent firm-specific risk (Barney, Busenitz, Fiet, & Moesel, 1989; Ramanujam, 2003) or uses a combination of market-based fluctuations from the CAPM model (Lubatkin & Chatterjee, 1991; Miller, Wiseman & Gomez-Mejia, 2002). While it is generally recognized that there is a risk/reward tradeoff in business, without an explicit accounting of the risk portfolio, assumptions and conclusions regarding firm performance or behavior would seem to be somewhat lacking. This is never more so than with new/young ventures that have little history, few structures, processes or other inertial forces that would force them down a particular path.

Our results show that VCs are associated with higher levels of risk related to operating margins and ongoing sales generation at the time of the IPO. These associations are based on information provided in the prospectus of IPOs, which is a point of success in the life cycle of new ventures. Observing the risk factors at this time is suggestive of the types of risks that VCs are willing to assume and manage before cashing out of their investment. If we think of operating margins and ongoing sales generation in terms of their underlying inputs such as pricing, supply costs, and marketing strategy, the results imply that VCs are better at managing these issues, respectively. The results also show that VCs are not associated with higher levels of risk related to operational financing. VCs may have an advantage at managing certain types of risk, but like most investors, ultimately have an overriding concern with cash flows.

We also document that VCs have a greater impact in reducing risk than other investors and managers. This is consistent with our suggestion that VCs manage risk after making an investment to subsequently decrease the discount factor, and therefore, improve investment returns.

Finally, categorizing the risk factors disclosed in the prospectus into Vesper's taxonomy provides significant explanatory power in estimating the probability that a VC is a current investor on the IPO. These risk factors, detailed in the prospectus, are disclosed well in advance of the IPO date and arguably represent the ex ante nature of risks perceived by the issuer. The analysis of the risk factors as a vector construct provides a multidimensional view of the different types of risks faced by IPO owners and answers a call to utilize measures that are not limited to industry or market representations. Firm level risks may be categorized and quantifiable to provide a more complete analysis of the threats faced by owners and managers.

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