Venture Capital and Risk Management:
Evidence from Initial Public Offerings

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Venture capital firms have been the focus of academic researchers not only for the information role that they play in capital markets (Gupta and Sapienza, 1992; Zider, 1998) but also their apparent ability to invest in successful ventures (Sandberg, 1986; Timmons, 1994; Vesper, 1990). While the average start-up has a 40% chance of failing within three years, a Wall Street Journal examination of U.S.-based start-ups funded by Venture Capital firms found that only four percent went out of business between 2006 and 2011 (Gage, 2012). Although the time of an initial public offering (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 a substantial 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

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factors currently faced by the firm going public; thus, the IPO event is an opportunity to infer the nature of the risks that successful venture capitalists are willing to endorse and manage.

Research about the specific make-up of firm-level risk relies heavily on anecdotal evidence without assessing how the decision-maker (i.e., manager) might assess risk. A call for such an assessment has long been a part of the academic literature (Baird and Thomas, 1985; Reger et al., 1992). Several researchers have examined the overarching strategic factors related to the venture capitalist’s (VC) evaluation process (Laitinen, 1992; Shepherd, 1999; Tyebjee and Bruno, 1984) while not specifically addressing the issue of firm-level risk. Firm-specific risk evaluation provides a more fine-grained look at how VCs manage risk and whether there are significant differences in the way risk is managed between ventures that are VC-backed and those that are not.

The importance of firm-specific 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 et al., 1999). These measures are general in nature, representing risk for the entire firm, and are not informative about specific sources of risk. Given the nature of the IPO event, risk can be evaluated based upon the detailed descriptions of risk factors that management disclose in the IPO prospectus. This allows the construction of risk proxies that are representative of the ex-ante risks faced by the company at the point of IPO. This study is motivated by the desire to understand the multi-dimensional nature of firm-specific risk and how the venture capitalist may manage it in a unique way.

This study contributes to a research stream that is descriptive of strategic risk-taking. Using Vesper’s (1990) approach to risk evaluation to develop proxy constructs, this study aligns with Amit et al. (1998), who examine the role of venture capitalists in their ability to reduce informational asymmetries, and in broader terms, with the framework of Baird and Thomas (1985) where strategic risk-taking incorporates a number of factors including the abilities of managerial decision-makers.

THEORETICAL DISCUSSION

VCs 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; Fried and Hisrich, 1994; Mason and Harrison, 1999; Tyebjee and 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 et al., 1998; Sandberg, 1986: Shepherd et al., 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 and Hisrich, 1994; Gladstone, 1988; Hall and Hofer, 1993).

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*The variance of returns captures all risks perceived by investors that could include management risk, information risk, industry risk, etc.*
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 risk and thereby leveling the playing field (Amit et al., 1998).

Therefore, the general proposition is that venture capitalists maximize their wealth by choosing to invest in firms with higher levels of firm-specific risk with the 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 each of the hypotheses is built around how specific sources of risk are directly associated with venture-backed IPOs.

HYPOTHESES

This study examines the association between venture capital participation and measurable sources of firm-level risk based on a taxonomy of “entrepreneurial obstacles” developed by Vesper (1990). Using a then developing stream of literature that found hurdles to new venture success, Vesper (1990) postulated three obstacles new businesses must overcome on the path to success: (1) obstacles to generate sufficient profit margin; (2) obstacles to develop an effective sales generating scheme; and (3) obstacles to obtain sufficient operational financing. Based on the idea that the success or failure of a venture involves overcoming obstacles, it is suggested that the underlying causes of these obstacles are a source of risk that must be managed.

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.

Researchers have focused their understanding of venture capitalist behavior using broad theoretical approaches including information asymmetry (Amit et al., 1998), multiple-agency theory (Arthurs et al., 2008) or more recently with institutional theory (Lu et al., 2013), while at the same time calling for a more granular approach to the elements that lie within the theories.

Broad theoretical looks help focus the overall efforts of researchers, but don’t provide actionable methodologies for researchers to investigate. The typology developed by Vesper (1990) may shed insights on a more granular scale. Although Vesper’s (1990) work focuses on the managerial strategies that lead to success or failure of the venture, his work has been cited in studies that examine risk sharing (Amit et al., 1990) and risk management issues (Oviatt et al., 2004).
This study examines risk factors related to each of these obstacles at the time of the IPO, comparing VC-backed to non-VC-backed ventures, seeking to shed light on how VCs accept and manage risk. These are the primary motivations for the study.

**Risks to Profit Margin**

Vesper (1990) 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 et al., 1998) and has been cited as a primary focus of venture capitalists (Fried and Hisrich, 1995). However, VCs manage a group of young ventures, where according to one study (Gorman and 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 et al., 1992; Dean and 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). This study suggests that VCs enter markets where threats to profit margin are generally higher and/or cannot 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 may be able to 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, then the following alternative hypothesis for risks related to operating profit margins is:

\[ H1: \text{ Venture capital-backed IPOs will have more threats to operating profit} \]
\[ \text{margins disclosed in the prospectus than non-venture capital-backed IPOs.} \]

**Risks to Sales Generation**

Vesper (1990) suggested that a new venture must have the opportunity to sell to many customers and 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 and 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 and Bruno, 1984; Zacharakis and Meyer, 1998) or their confidence in the venture's team (Hall and Hofer, 1993) leads them to accept additional risks to obtain the potentially higher growth. VCs gain competitive advantage as investors by picking prospects with riskier sales generation schemes. Therefore:

**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 and Gimeno-Gascon, 1992; Duchesneau and Gartner, 1990; Eisenhardt and Schoonhoven, 1990). Castroglivanni states 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, this study suggests 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. This should lead to evidence of greater risk reduction for IPOs backed by a VC than those that are not backed by a VC. Hypothesis 4 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 et al., 1990: 448). Thus, the IPO prospectus is the ultimate source of data for this study.

Sample Selection

IPOs were identified using Investors Daily Digest (IDD) and Barron’s. There were 545 IPOs from 1991 through 1994 with complete market and financial data available on Compact Disclosure. Using IPOs from this time frame offers a number of advantages in terms of helping to control confounding market or regulatory effects in conducting the empirical analysis. Based on figures reported by Ritter (2012), the standard deviation of IPO first-day returns from 1991 to 1994 is 1.35% reflecting a fairly stable returns generating process compared to 23.92% from 1995 to 2000 (i.e., the dot.com bubble years) and 4.56% from 2001 to 2012 (i.e., the post-bubble years). Changes in IPO filing and disclosure requirements during the early 1990’s were also stable. However, starting in 1997 the Securities and Exchange Commission liberalized the rules related to private placements, making them a viable substitute to IPO financing, which again, might affect the way in which venture capitalists manage risk. Distortions are also possibly introduced by Regulation FD (Fair Disclosure) in 2000, the Sarbanes-Oxley Act in 2002, and the Dodd-Frank Act in 2010, among others. Thus, using sample observations from 1991 to 1994, given the stability of the market and
regulatory environment during this time frame, helps to avoid the potential confounding effects that changes in risk and regulations might introduce when estimating the behavior of venture capitalists.

IPOs were classified as being backed by a venture capitalist by comparing the 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 IPOs, a subset of 258 IPOs contained information on all of risk variables. These 258 IPOs constitute the observations used to examine $H_1$, $H_2$, and $H_3$ (78 of these 258 IPOs were backed by a venture capitalist). $H_4$ did not require all of the risk variables and as such the full set of 545 IPOs was utilized.

**DATA DESIGN AND ANALYSIS**

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), four other risk variables were included 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, suggesting a positive relationship 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, therefore asset size should be positively related to the venture capital indicator. Industries have their own specific risk profile, suggesting that no directional predictions are appropriate for the industry indicators. As the age of the venture increases, the risk of long-run viability decreases, suggesting that age is negatively related to the venture capital indicator.

An important consideration for venture capital investment is the potential for growth, a known determinant of VC participation. The study includes the change in sales from year-to-year to control for the effects of growth on the VC’s decision to invest.

Count Data Risk Variables

The variables of interest are counts of risk factors categorized into Vesper’s (1990) framework. To obtain these risk proxies, the authors reviewed copies of the S-1 offering registration statement on *Laser Disclosure* for each IPO.\(^4\) Each prospectus includes a section entitled “Risk Factors.” The authors categorized all risks listed into

\(^4\) 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.
one of the following categories: risks for profit margin, risks for sales generating schemes, and risks for operational financing. Risk factors that could not be grouped into one of the categories were assigned to “other.”

The content analysis was coded each time a risk factor represented a hurdle or obstacle to IPO success consistent with Vesper’s (1990) taxonomy and not the frequency of a particular word (see Smith, 1992). First, the authors identified a comparison list of concepts that would affect or fit into each of Vesper’s (1990) three risk categories. There is a “boiler-plate 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 the risk categories. A count of the number of risk factors for each dimension of risk is a proxy variable for a specific source of risk.

The benefit of developing and using the risk proxies described above is twofold. First, Vesper’s (1990) typology is consistent with the academic and practitioner literature on the obstacles new ventures must overcome to be successful. Second, the risk proxies are documented in the prospectus before the venture goes public and in this way appropriately represent the ex-ante consideration of venture capitalists. Many risk proxies used in empirical studies, such as the post-IPO variance of returns, capture the ex-post effects of risk perceived by investors and not the concerns of the VC. A limitation to the use of these proxies is that they may be a biased representation of risk if the VC is manipulating the prospectus information in order to minimize investor concerns about risk. However, there is a free ex-post verification of the credibility of the VC’s disclosures. Deceptive or manipulative disclosures could damage the VC’s reputation in bringing future portfolio companies to the public capital markets.

Beyond the authors, two independent evaluators examined the S-1 offering statements for 135 randomly drawn companies in the sample. The inter-rater reliability was calculated resulting in a coefficient alpha of 0.80, indicating a coding consistency by the original evaluators.

**Specification of the VC Logistic Regression**

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

\[
\text{VC}_j = a_0 + a_1 \text{LEVERAGE}_j + a_2 \text{InASSETS}_j + a_3 \text{AGE}_j + a_4 \cdot \text{SALES}_j + \Lambda a_5 \text{(INDUSTRY)}_j \\
+ a_7 \text{MARGIN\_RISK}_j + a_8 \text{SALES\_RISK}_j + a_9 \text{FINANCE\_RISK}_j + e_j.
\]

Examples of the 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.
These variables are defined as follows:

\[ VC = \begin{cases} 1, & \text{if VC is listed in the prospectus} \\ 0, & \text{otherwise} \end{cases} \]

\[ \text{LEVERAGE} = \text{Total liabilities scaled by total assets prior to the IPO.} \]

\[ \ln(\text{ASSETS}) = \text{The natural logarithm of total assets prior to the IPO.} \]

\[ \text{AGE} = \text{The age of the company in days from inception to the IPO date.} \]

\[ \sqrt{\text{SALES}} = \text{Pre-IPO total sales minus post-IPO total sales, scaled by pre-IPO sales.} \]

\[ \text{INDUSTRY} = \text{Dummy indicators coded for membership in the manufacturing or service industries.} \]

\[ \text{MARGIN\_RISK} = \text{A count of the risk factors in the prospectus that represent risks for profit margin.} \]

\[ \text{SALES\_RISK} = \text{A count of the risk factors in the prospectus that represent risks for sales generating schemes.} \]

\[ \text{FINANCE\_RISK} = \text{A count of the risk factors in the prospectus that represent risks for operational financing.} \]

**Variables for the Risk Reduction Analysis**

The dependent variable used to test the risk reduction hypothesis is the change in the Altman Z-score based on financial statement information from the fiscal years prior and subsequent to the IPO. By testing changes in the Z-score, it is possible to examine the relative impact that VCs have on firm risk. Technically, changes in the Z-score gauge the improvement or deterioration in the probability of bankruptcy over the year of the offering. The intent of this study is to use the bankruptcy measure as a proxy for firm-specific risk (please note that higher Z-score’s indicate a lower probability of bankruptcy). The Altman Z-score 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 Z-score is frequently recommended for evaluating financial condition (Wheelen and Hunger, 2012: 371) and is the most common measure used by investment practitioners (Falkenstein et al., 2000). The most important consideration for this study is whether the measure represents relative levels of firm-specific risk and not whether it can predict bankruptcy per se.

For this regression, controls are included that potentially affect the Z-score 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 risk not related to operations. Accordingly, an additional control variable is included for the amount of offering proceeds to account for this risk. Macroeconomic trends and changes have been linked to the relative incidence of bankruptcies; therefore, the regression includes variables for industry membership and year.
The variable of interest is a VC indicator (1/0 dummy variable indicating VC backing or not). Hypothesis H4 proposes that the sign on the VC dummy variable will be positive consistent with the idea that VC-backed IPOs are associated with greater reductions in risk (indicated by higher Z-score) than IPOs that are not backed by a VC.

Specification of the Risk Reduction Regression

This study uses OLS to estimate the Risk Reduction Regression as follows (predicted signs included):

\[
\Delta \text{ZSCORE}_j = b_0 + b_1 \ln \text{PROCEEDS}_j + \Delta b_1(\text{INDUSTRY}_j) + \Delta b_2(\text{YEAR}_j) + b_3 \text{VC}_j + e_j.
\]

These variables are defined as follows:

- \(\Delta \text{ZSCORE}\) = Pre-IPO Altman Z-score index minus post-IPO Altman Z-score index, scaled by the pre-IPO Altman Z-score index. Thus, this is the proportionate change in the Altman Z-score index during the year of the IPO.
- \(\ln \text{PROCEEDS}\) = 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).
- \(\text{INDUSTRY}\) = Dummy indicators for membership in the manufacturing, service, or transportation industries based on two-digit SIC code.
- \(\text{YEAR}\) = Dummy indicators for prospectus dates belonging to years 1991, 1992, 1993, and 1994.
- \(\text{VC}\) = (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 \(\Delta \text{SALES}\) and \(\text{FINANCE}_R\). 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 two industries are different), and less common in the transportation industry. The mean comparisons for leverage and assets are not consistent with the general hypothesis that VCs choose to participate in riskier IPOs. The expectation was that VC-backed IPOs would be more highly leveraged and larger in size, assuming leverage and size are correlated with risk.
| Variable              | (1) Full Sample | (2) VC-Backed | (3) Non VC-Backed | (4) Diff     |
|-----------------------|-----------------|---------------|-------------------|--------------|
|                       | Mean (Stdev), t-stat (μ=0), No. of Obs. | Mean (Stdev), t-stat (μ=0), No. of Obs. | Mean (Stdev), t-stat (μ=0), No. of Obs. | t-stat for diff. |
| LEVERAGE (Ratio)      | 0.734 (9.640) 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*** |
| LiZSCORE (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*** |
| LiSALES (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 | -4185.00 -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 the hypotheses in three of four cases: risk factors for operating profit margins, sales generation, and the improvement in Z-score, 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-backed 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 ($\pi = -0.467$, p-value < 0.01) and AGE with SALES_RISK ($\pi = -0.390$, 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 the results (Covin et al., 1994; Neter et al., 1990).6

VC Logistic Regression Results

Table 2 presents the estimation results of the VC logistic regression. To test the overall significance of the logistic model, a likelihood ratio was computed 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-backed and non-VC-backed ventures. The maximum rescaled $R^2$, 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).

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 < 0.01), 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.

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6 Variance inflation factors (VIFs) computed in the multivariate regression analysis also indicate that collinearity is not a problem. VIFs greater than five suggest that collinearity is possibly harming the estimation and the highest VIF in this analysis is 1.56.
Table 2
VC Logistic Regression

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.

| Variable            | Prediction | Estimate | Standard Error | Asymptotic t-statistic | p-value | Odds Ratio |
|---------------------|------------|----------|----------------|------------------------|---------|------------|
| **Controls:**       |            |          |                |                        |         |            |
| Intercept           | +/-        | -12.422  | 3.008          | 4.12                   | <0.001  | -          |
| LEVERAGE            | +          | -0.719   | 0.413          | 1.74                   | 0.041   | 0.487      |
| LnASSETS            | +          | 0.597    | 0.158          | 3.78                   | <0.001  | 1.818      |
| AGE                 | -          | -0.0002  | 0.00006        | 3.14                   | 0.001   | 1.000      |
| logSALES            | +          | 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      |
| **Risk Variables**  |            |          |                |                        |         |            |
| MARGIN_RISK         | +          | 0.299    | 0.143          | 2.09                   | 0.018   | 1.349      |
| SALES_RISK          | +          | 0.459    | 0.106          | 4.30                   | <0.001  | 1.584      |
| FINANCE_RISK        | +          | -0.133   | 0.120          | 1.10                   | 0.134   | 0.875      |

| Likelihood Ratio $\chi^2$ (H$_0$: $\alpha = 0$) | 92.760 |
| Prob $> \chi^2$ | <0.001 |
| Max-Rescaled $R^2$ | 0.419 |
| No. observations | 258 |

The estimated coefficients of 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. Essentially, the odds ratio allows for the assessment of the relative impact that 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.

A potential explanation for these results is that the risk proxies may simply be capturing the amount of information available about the IPO and not risk. Based on approaches used in previous studies by Bamber (1987) and Atiase (1985), this study compares the “information environment” for VC-backed versus non-VC-backed IPOs by performing an analysis of variance for the “market value of equity” and “analyst following.” The “market value of equity” has been shown to be an effective proxy for the size of a company’s information environment (Bamber, 1987) and “analyst following” has been shown to proxy for information production about a given company (Atiase, 1985). Both tests indicated there is no significant difference in the information available for VC- versus non-VC-backed IPOs (results not presented). Including these proxies as control variables in the VC logistic regression did not change the results. Thus, the robustness test suggests that SALES_RISK, MARGIN_RISK, and FINANCE_RISK may be capturing sources of risk and not simply the amount of information available.

**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-squared 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 (INPROCEEDS), and some industry and year dummies (MANUFACT, SERVICE, and YR94).

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7 An odds ratio of one means that there is a 50/50 chance the event will occur with a one unit change in the independent variable. Therefore, an odds ratio greater than one suggests that the event is more likely to occur, while an odds ratio less than one suggests that the event is less likely to occur.
Table 3
Risk Reduction Regression
OLS Estimation of the factors that explain reductions in IPO risk. The dependent variable is the change in the Altman Z-score (bankruptcy index) from the pre- to post-IPO financial statements.

| Variable       | Prediction | Estimate | Standard Error | t-value | p-value |
|----------------|------------|----------|----------------|---------|---------|
| Controls:      |            |          |                |         |         |
| 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   |
| Experimental Variable: | | | | | |
| VC             | +          | 0.970    | 0.334          | 2.90    | 0.002   |

R² 0.049
F-Value 3.14
Prob > F 0.001

Hypothesis 4 predicts that VCs will be associated with greater improvement in firmspecific 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 Z-score (higher Z-scores indicate a lower probability of bankruptcy). This suggests that VCs have a greater impact on risk reduction than the average IPO investor or manager.
DISCUSSION

Why are VC firms willing to invest in riskier businesses than the ordinary investor? Why are they seemingly better at managing those risks? In order to dissect these fascinating questions into a researchable agenda, it is necessary to take a more fine-grained look at risk. In that vein, this study had three goals: (1) to examine the association between elements of firm-specific risk and VC investment at the time of the IPO in order to infer the types of risk that VCs assume and manage; (2) to examine changes in firm-specific risk to test whether or not VCs have a greater ability to reduce risk; and (3) to operationalize new risk proxies that might be useful for practitioners and researchers alike.

The results suggest that VC-backed ventures are riskier at the time of the IPO. Observing the risk factors at IPO is suggestive of the types of risks that VCs are willing to assume and manage before cashing out of their investment. Examining 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 believe that they are better at managing these factors. While the results show that VCs are not associated with higher levels of risk related to operational financing, this may be that they (like all investors) have few means at their disposal to improve daily cash flows. VCs seem to have an advantage at managing certain types of risk, but not all types. Another consideration may be that VCs, by their nature, are typically well-financed and therefore managing threats to operational financing of one business in a portfolio of businesses could simply be a lower priority, and again, more difficult to detect with this proxy.

This study goes further than simply discerning the types and levels of risk that VCs are willing to manage. The results outlined earlier suggest that VCs have a greater ability to reduce risk than other investors and managers. This is consistent with the suggestion that VCs actively manage risk after making an investment to subsequently decrease the discount factor and therefore improve investment returns.

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 et al., 1989; Ramanujam, 2003) or uses a combination of market-based fluctuations from the CAPM model (Lubatkin and Chatterjee, 1991; Miller et al., 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 are somewhat lacking. It is difficult for researchers to tease out the nuances of business practice without refinement in the methods that are used. This is never more so than with new or young ventures that have little history, few structures, processes or other inertial forces that would force them down a particular path.

Categorizing the risk factors disclosed in the prospectus into Vesper’s (1990) taxonomy provides a significantly more fine-grained approach that can now be used by future researchers. These risk factors, detailed in the prospectus, are disclosed well in advance of the IPO date and arguably represent the ex-ante view of business risks as 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 more fine-grained measures that are not limited to industry or market representations. Firm level risks may be categorized and quantified to provide a more complete analysis of the threats faced by owners and managers.

CONCLUSION

Using prospectuses from a large group of ventures preparing to do an IPO, this paper analyzed the risk disclosures between IPOs that are backed by venture capitalists and those that are not. The 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. The 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, the results indicate that IPOs backed by a venture capitalist improve more in terms of fiscal strength during the year after the offering than IPOs not backed by a venture capitalist.

Overall, the results seem 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, this study utilized proxies that are more fine-grained representatives of the risks faced by new ventures. These new risk measures could be used in future research to examine how the individual sources of firm-specific risk affect other managerial behaviors.

LIMITATIONS AND FUTURE RESEARCH

As with most empirical analyses, there are limitations to this study. First is the possibility of correlated omitted variables. For example, it could be that the original entrepreneur or management team is primarily managing the risks identified in the analysis and not the VC. Therefore, the entrepreneur or management teams’ input, as correlated omitted variables with the VC proxy, could be driving the results. The regression analyses of the study assume that the input from the entrepreneur and/or the management team is not systematically different between the experimental group (VC-backed IPOs) and the control group (non-VC-backed IPOs). A practical issue related to controlling the omitted variable bias is the difficulty in measuring entrepreneurial or management team input in managing risk.
Assuming the entrepreneur or the management team does have significant input on managing risks, the timing of this input raises the issue of endogeneity. In other words, the VC and the entrepreneur (or management team) could be (and probably are) managing risks simultaneously. The analysis in this study assumes that the VC’s influence is primary and predetermined before the IPO process begins. This appears to be a fair assumption given the screening performed by VCs before making an investment in a portfolio firm and the extensive influence VCs have on managing the firm as documented in the literature (Sahlman, 1990).

Some recommendations for further research on this topic relate to the limitations described above. For example, future research could examine risk management by VCs and the management team while controlling for potential endogenous effects. A framework using simultaneous equations or self-selection models could be employed assuming an argument for the existence of endogeneity is developed. Correlated omitted variables could be included in an analysis assuming construct validity for entrepreneurial or management team input is appropriately established. Another idea is to examine VC-related managerial issues during the years well past the IPO date. VCs do not cash out entirely at the time of the IPO and, on average, stay with their portfolio company for another nine years (Sahlman, 1990). Examining risk and VC incentives during this period seems relatively unexplored in the literature.

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