

Venture Capital Financing and the Informativeness of Earnings

Daniel A. Cohen^{a*} and Nisan S. Langberg^b

^a*New York University*

^b*University of Houston*

Abstract

Are there long-term costs to obtaining venture capital financing? We explore the hypothesis that venture capital backed firms do not efficiently transform to the corporate structure of public firms and have difficulties publicly communicating with arm's length investors. Our results are three-fold. First, we find that, on average, reported accounting earnings are less informative for venture capital backed firms. Second, the informativeness of reported earnings is a decreasing function of venture capitalists' ownership of firm equity and a decreasing function of venture capitalists' board representation. Third, stock prices of venture capital backed firms reflect future earnings to a lesser extent relative to non-venture capital backed firms. Our findings support the hypothesis that venture capitalists manage the flow of public information to capital markets and preserve short-term interests arising from specific investment and ownership horizons. This evidence suggests that the benefits of receiving venture capital financing are not without costs.

JEL Classifications: M41, G14, G32

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1. Introduction

Efficient allocation of capital to high-growth startup companies is recognized as one of the most important challenges confronting capital markets, as asymmetric information between founders and investors often leads to market failure. By unifying ownership and control, venture capitalists open the flow of funds between arm's length investors (e.g. pension funds, insurance companies and other corporations) and entrepreneurs.

* Corresponding author: Email: dcohen@stern.nyu.edu. Tel: (212) 998-0267.

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The greatest impact of venture capital financing on economies around the world is undoubtedly manifested in the data on Initial Public Offerings (IPOs). Public firms, in contrast to private firms, operate under a completely different corporate structure.

In this paper we examine whether venture capital backing affects the quality of financial reporting in the post-IPO period. In particular, we seek to investigate whether new public firms efficiently make the transition from being a private company to a public one. In addition, we are interested in analyzing whether there are any long-term economic consequences associated with the choice of obtaining venture capital financing.

We address these issues by exploring newly public firms' ability to credibly communicate public financial information to diffused arm's length investors. Our main hypothesis predicts that the degrees of control and ownership by venture capitalists affect public firms' financial information credibility and thus its quality as manifested in the informativeness of reported earnings. Most research to date has focused on and documented the benefits associated with receiving venture capital financing. However, to the extent that information asymmetries exacerbate agency problems, we interpret our results as suggesting that these benefits are not without costs.

Throughout the paper, we deploy two methods widely used in the accounting literature, to measure the informativeness of reported earnings. First, we focus on the slope coefficients relating annual stock returns to levels of earnings and changes in the levels of reported earnings. In addition, we also examine investors' reaction to quarterly earnings announcements. Viewing the informativeness of earnings as a measure for the market participants' confidence in the accounting information is not new (e.g. Teoh and Wong, 1993).¹ Second, we investigate the extent to which stock prices reflect the relative dependence on current and future earnings, and adopt the approach discussed in Kothari and Sloan (1992). The underlying premise is that when firms can credibly communicate with investors (in any form, be it public financial reports or not) then stock prices reflect future earnings to a greater extent. Consistent with our prediction, we find the opposite for venture capital backed firms. Our findings throughout the study are robust to controlling for the endogenous choice of venture capital financing.

We examine venture capitalists' incentives to manage the flow of public information to capital market participants. Specifically, in the model presented in the next section, reported earnings can be manipulated by insiders (e.g. venture capitalists) and thus may not represent the true underlying economic fundamentals of the firm (Lacker and Weinberg, 1989). In equilibrium, venture capitalists' incentives to manipulate earnings are determined by the equity prices that follow earnings announcements. Anticipating this behavior, uninformed investors value firm equity while taking into account the (endogenous) informativeness of earnings (Holthausen and Verrecchia, 1988). Our model predicts the informativeness of earnings to (i) be higher for non-venture capital backed firms relative to venture capital backed firms, (ii) be higher when the equity ownership of the venture capital firm is lower, and (iii) be higher when the board representation of the venture capital firm is lower.

¹ Teoh and Wong's (1993) analysis shows a positive relation between the credibility of accounting information and informativeness, interpreted as the coefficient estimate that relates stock returns to reported earnings.

Two main forces drive the theoretical results. First, venture capitalists play an active role in the development of the firms they finance. In the process, as a consequence, probably more than any other investor, venture capitalists acquire private information regarding the firm's products, the potential product markets and the expected profits, among other things. For instance, venture capitalists often offer valuable consulting services (Gompers and Lerner, 1999; Sahlman, 1990), have board representation and substantial control rights (Kaplan and Stromberg, 2002), shape and at times replace the management team (Hellmann and Puri, 2002), and thoroughly screen and monitor the firms in the pre-funding stage.

Second, like pension funds, insurance companies, corporations and other institutional investors, venture capitalists own a substantial fraction of firm equity (Barry, Muscarella, and Vetsuypens, 1990). However, venture capital funds are unique in that they are (by law) limited in life span, and exist only for a period of ten to twelve years (Gompers and Lerner, 1999; Sahlman, 1990). Therefore, among the equity holders and other decision makers in the newly public firm, venture capitalists may be more interested in advancing short-term performance at the expense of long-term growth.² It is this specific conflict of interests arising from the limited investment and ownership horizon facing venture capital investors that we view as the potential cost associated with obtaining venture capital financing, as it might lead to inefficient decisions and reduce the overall firm value. This is particularly true when venture capitalists benefit the most from a profitable exit (e.g. when they own a substantial fraction of firm equity) and when they can more easily affect firm decisions, for instance, when they have substantial voting power or board representation.

The evidence we document suggests that the reported earnings of venture capital backed firms are less informative than earnings of non-venture capital backed firms. We report the results after controlling for other determinants of earnings informativeness, such as firm size, loss observations, the book-to-market ratio and leverage. We find that investors react less to a unit of unexpected earnings for venture capital backed firms and that the reaction depends on the incentives of the venture capitalist to manipulate earnings. Consistent with the model's predictions, we find that the more equity the venture capitalist owns and the more board seats held by the venture capitalist, the less informative earnings are.

Our study contributes to two streams of research. First, we contribute to the literature that examines the role of financial intermediaries, and in particular venture capitalists, in the firms they invest in. Prior research has documented the economic consequences of venture capital financing, for example, the underpricing of IPOs (Megginson and Weiss, 1991; Lee and Wahal, 2004), product market behavior (Hellmann and Puri, 2000), corporate governance (Hochberg, 2005), and long-term returns (Brav and Gompers, 1997). We add to this literature by documenting the adverse effects venture capitalists have on the firm's informational environment subsequent to its going public. Second, we extend prior research that examines factors affecting the credibility of reported accounting earnings, as captured by the coefficient relating stock returns to earnings. Examples of such studies include Teoh and Wong (1993), Imhoff and Lobo (1992),

² The compensation of venture capitalists typically depends on the fund's proceeds upon liquidation, i.e. the short-term performance of their investments (Gompers and Lerner, 1999).

Warfield et al. (1995), Subramanyam and Wild (1996), Fan and Wong (2002), Gul and Wah (2002), Yeo et al. (2002), and Francis et al. (2005). In particular, we extend the findings of studies that focused on the relation between ownership structure and control and the informativeness of earnings (e.g. Warfield et al., 1995, Fan and Wong, 2002; and Francis et al., 2005). We show that the ownership structure of newly public firms, in particular the presence of a venture capitalist, is an important determinant of the informativeness of earnings.

The remainder of the paper is organized as follows. In section 2 we present a simple model upon which our empirical analysis builds on. Section 3 describes the data and the methodology used to estimate the informativeness of earnings, while in section 4 we discuss our findings. In section 5 we deploy a second methodology to address our research question. We conclude in section 6.

2. A Simple Model

Consider a public firm that exists for three periods, $t = 0, 1, 2$, and is endowed with a risky project. The project yields in period $t = 2$, Revenues R , where $R = U$ with probability p and $R = D$ otherwise ($U > D$). For simplicity, we assume that this project is the only asset of the firm and that revenues are net of payments to any debt holders. A venture capitalist (VC) is endowed with equity share $\alpha \in (0, 1)$ in the firm.

Three properties of venture capitalists are emphasized in this study. First, venture capitalists are not long-term investors and eventually unwind their equity positions prior to the pre-specified liquidation date of their fund. Second, venture capitalists are informed investors. And third, venture capitalists can manage the flow of public accounting information received by capital markets participants by creating opacity regarding firm prospects (as discussed and formalized below).

In the model, the venture capitalist (VC) is required to sell his ownership of firm equity at time $t = 2$, while having private information regarding the distribution of future cash flows. The VC's private information, at this point, is summarized by a signal (with perfect precision) regarding the state of the firm. In other words, the VC knows if revenues will be U or D next period. The VC can manipulate the public signal regarding the true state of the firm s^p , by creating "opacity" at level $o_i \in [0,1]$ in states of the world $i = U, D$.

$$\text{Prob}(s^p = U \mid R = U, o) = \text{Prob}(s^p = D \mid R = D, o) = 1 - o$$

Thus, if there is no opacity (in other words, full transparency), i.e. $o = 0$, then there is no private information and the public is fully informed. However, as we will show, this is not characterized as an equilibrium. Finally, let $\beta * c(o)$ denote the cost to the VC of creating the opacity level $o \in [0,1]$, where $c'(0) = 0$, $c'(o) \geq 0$, $c''(o) > 0$, and $\lim_{o \rightarrow 1} c(o) = \infty$. The coefficient β is strictly positive and represents the control of the VC. Specifically, when the VC has substantial control in the firm, the cost of manipulation is lower, i.e. β is lower.

2.1 Equilibrium

Consider first the problem of the VC at period $t = 1$. The optimal level of opacity, o , maximizes the expected price of firm equity. Therefore, it will not be optimal for the VC to create opacity when a good signal is received, i.e. $R = U$. Denote by o^* the level of opacity the VC chooses in equilibrium when a bad signal is received, i.e. $R = D$.

The publicly observed equity prices are based on public information. Thus, we can write the price of equity at time $t = 1$ as a function of public information, $P(s^p)$. Also, let $P_0 = p^*U + (1 - p)^*D$ denote the price of equity at the outset (time $t = 0$) when there is symmetric information.

The equilibrium level of opacity solves:

$$\begin{aligned} \underset{o \in (0,1)}{MAX} \quad & \alpha [P(U) \text{Pr ob}(s^p = U | R = D, o) + P(D) \text{Pr ob}(s^p = D | R = D, o)] - \beta c(o) \\ \Rightarrow \beta c'(o^*) & = \alpha (P(U) - P(D)) \end{aligned} \tag{1}$$

The equilibrium equity prices are given by:

$$\begin{aligned} P(U) &= U \text{Pr ob}(R = U | o^*, s^p = U) + D \text{Pr ob}(R = D | o^*, s^p = U) \\ &= U \left(\frac{P}{p + (1-p)o^*} \right) + D \left(1 - \frac{P}{p + (1-p)o^*} \right) \end{aligned} \tag{2}$$

$$P(D) = U \text{Pr ob}(R = U | o^*, s^p = D) + D \text{Pr ob}(R = D | o^*, s^p = D) = D$$

The equilibrium is implicitly given by:

$$\beta c'(o^*) = \alpha [U - D] \left(\frac{P}{p + (1-p)o^*} \right) \tag{3}$$

We can now define the price reaction to good news, ΔU , as the change in the price of equity as a result of the release of a good signal:

$$\Delta U = p \left(\frac{1}{p + (1-p)o^*} - 1 \right) (U - D) \tag{4}$$

Proposition 1:

- (a) Manipulation takes place in equilibrium at level $o^* > 0$ defined by the equilibrium in equation (3).
- (b) The degree of manipulation increases in VC ownership and in VC control, i.e. $\frac{\partial o^*}{\partial \alpha} > 0$ and $\frac{\partial o^*}{\partial \beta} < 0$.
- (c) The price reaction ΔU is decreasing in VC ownership, i.e. $\frac{\partial \Delta U}{\partial \alpha} < 0$.

- (d) The price reaction ΔU is decreasing in VC control, i.e. $\frac{\partial \Delta U}{\partial \beta} > 0$.

Proof: Follows from the above.

3. Empirical Analysis

In this section we compare the informativeness of earnings between venture capital and non-venture capital backed firms and within the groups of venture capital backed firms. We define informativeness of earnings as the slope coefficient relating stock returns to reported accounting earnings, obtained from regressions of annual stock returns on annual earnings and changes in earnings, and from short window returns analysis of quarterly earnings announcements.

Our approach builds on Teoh and Wong's (1993) analysis, which shows a positive relation between the credibility of reported accounting information and informativeness, measured as the coefficient relating stock returns to earnings. Based on Proposition 1, we test the following hypotheses:

- H1:** *Reported earnings are equally informative for venture capital and non-venture capital backed firms.*
- H2:** *The informativeness of reported earnings does not vary with the venture capitalist's ownership of firm equity.*
- H3:** *The informativeness of reported earnings does not vary with the venture capitalist's representation on the firm's board of directors.*

In order to focus on the implications of venture capital financing for the informativeness of earnings, we address the endogeneity of ownership structure. The decision of a firm to receive venture capital funding and the decision of a venture capitalist to provide such financing are not exogenous. Firm-specific characteristics and information attributes may determine which firms are eventually venture capital backed. Therefore, the apparent endogeneity makes the issue of estimating the impact of venture capital financing on earnings informativeness challenging. To address this problem, we use a self-selection model, following other studies in the existing literature (e.g. Baker and Gompers, 2003; Morsfield and Tan, 2006). Throughout the analysis we report results using both ordinary least squares and after controlling for self-selection.

We estimate the earnings informativeness association for samples that combine both venture capital and non-venture capital backed firms, and include the following factors that have been shown by prior research both to differ between venture capital and non-venture capital backed firms and to be related to earnings informativeness.

Market-to-Book Ratio: This ratio serves as a proxy for investment opportunities. Collins and Kothari (1989) find that the book-to-market ratio is negatively associated with earnings informativeness; we include this variable in our regressions to control for the effect of investment opportunities on earnings informativeness.

Leverage: Dhaliwal et al. (1991) document that the coefficient relating earnings to stock returns is decreasing in financial leverage. Thus, we need to condition for leverage in our earnings informativeness tests.

Size: Consistent with prior research (e.g. Jiambalvo et al., 2002, among others) we control for size when testing the relation between stock returns and earnings. We expect that the coefficient estimate relating earnings to stock returns is increasing with the firm's size.

Loss: We include a dummy variable for loss observations since Hayn (1995) provides evidence that the coefficient estimates relating stock returns and earnings are smaller for loss observations.

High Tech: To address any concerns associated with the unique features of the high tech industry and their implications for earnings informativeness, we identify firms in the high tech industry by including a dummy variable.

3.1 Test of Earnings Informativeness

We start our analysis of the differential informativeness of earnings for venture capital and non-venture capital backed firms by examining the slope coefficients from regressions of annual stock returns on annual earnings. Following Easton and Harris (1991), we report tests for both the level of and change in earnings. We include control variables for the market-to-book ratio, size, leverage, and whether earnings are positive, since these variables have been shown to influence earnings informativeness. The main regression we estimate is given in equations (5a) and 5(b):³

$$R_{i,t} = \alpha_0 + \alpha_1 EARN_{i,t} + \alpha_2 EARN_{i,t} * VC_{i,t} + \sum_{k=1}^5 \beta_k EARN_{i,t} * X_{j,t}^k + \varepsilon_{j,t} \quad (5a)$$

$$R_{i,t} = \alpha_0 + \alpha_1 EARN_{i,t} + \alpha_2 \Delta EARN_{i,t} + \alpha_3 EARN_{i,t} * VC_{i,t} + \alpha_4 \Delta EARN_{i,t} * VC_{i,t} + \sum_{k=1}^5 \beta_k EARN_{i,t} * X_{j,t}^k + \sum_{k=1}^5 \gamma_k \Delta EARN_{i,t} * X_{j,t}^k + v_{j,t} \quad (5b)$$

where: $R_{i,t}$ = firm i 's 12-month cumulative abnormal return for fiscal year t . The 12-month interval starts three months after the end of the fiscal year $t - 1$ and ends three months after the end of fiscal year t ; ⁴ $EARN_{i,t}$ = firm i 's annual earnings (before extraordinary items) for fiscal year t , scaled by market value of equity at the end of fiscal year $t-1$; $\Delta EARN_{i,t}$ = change in $EARN_{i,t}$ between year $t - 1$ and year t , scaled by market value of equity at the end of fiscal year $t - 1$; $VC_{i,t}$ = venture capital backing dummy variable equal to one if the company is venture capital backed, zero otherwise; $X_{j,t}^k$ = vector of control variables, $k = 1$ to 5, defined as: $LOSS_{i,t}$ = dummy variable equal to one if $EARN_{i,t} < 0$; $HTECH_{i,t}$ = dummy variable equal to one if SIC code belongs to 2833–2836, 8731–8734, 7371–7379, 3570–3577, 3600–3674, zero otherwise; $SIZE_{i,t}$ =

³ To account for potential dependence among the observations, we calculate the standard errors after clustering observations at the firm-year level (Petersen, 2008). Thus, all our statistical tests are based on clustered standard errors.

⁴ We obtain similar results (not tabulated) if we cumulate stock returns over the 15-month period starting at the end of year $t - 1$.

the log of firm's market value of equity in year t ; $MB_{i,t}$ = Market-to-Book ratio, the ratio of firm i 's market value of equity to their book value of equity at the end of year t ; $LEV_{i,t}$ = firm's leverage, defined as the ratio of firm i 's long-term debt to total book value of assets at the end of year $t - 1$.

For equation (5a), our test of relative earnings informativeness for venture capital backed firms focuses on the sign of α_2 . Under the null hypothesis H1, $\alpha_2 = 0$, whereas $\alpha_2 < 0$ implies less earnings informativeness, while $\alpha_2 > 0$ suggests greater earnings informativeness. For equation (5b), under the null hypothesis H1, $\alpha_3 + \alpha_4 = 0$, whereas less earnings informativeness implies $\alpha_3 + \alpha_4 < 0$ and greater earnings informativeness implies $\alpha_3 + \alpha_4 > 0$.

Our second test of H1 examines the market reaction of venture capital backed firms versus non-venture capital backed firms to the earnings news conveyed in quarterly earnings announcements. Using Compustat quarterly earnings announcement dates and CRSP stock returns data, we calculate the three-day cumulative abnormal return for all quarterly earnings announcements during 2001–2006 made by our sample firms. We use a seasonal random walk model to measure unexpected earnings. We test the differential sensitivity of returns to unexpected earnings for venture capital backed firms and non-venture capital backed firms by estimating equation (6), where the null hypothesis predicts that $\lambda_2 = 0$:

$$CAR_{i,q,t} = \lambda_0 + \lambda_1 UE_{i,q,t} + \lambda_2 UE_{i,q,t} * VC + v_{i,q,t} \quad (6)$$

Where: $CAR_{i,q,t}$ = cumulative abnormal return over the three days $(-1, 1)$ centered on firm i 's announcement of quarter q earnings for year t ; $UE_{i,q,t}$ = unexpected earnings of quarter q earnings for year t , measured as the difference between reported earnings for quarter q of year t and reported earnings for quarter q of year $t - 1$, scaled by the share price at the end of the prior fiscal quarter.

As previously noted, we acknowledge that venture capital financing is not exogenous but rather endogenously determined. To control for this problem we estimate a two-stage model. In the first stage we model the probability of obtaining venture capital financing and repeat all of our tests by controlling for self-selection. The challenge we face is that the firm characteristics that determine venture capital backing at the time of the initial financing are not publicly observable. Using publicly available data following the IPO event reflects both the selection of venture capital financing as well as the influence of the venture capital on firm characteristics. To address this concern, studies in the literature use location and industry indicators in estimating the venture capital backing selection model since these variables are not influenced by venture capital intervention in the firm's operations (see, for example, Morsfield and Tan, 2006). In addition to the state in which the firm is based we also control for the firm's age and include an indicator variable whether the CEO is also the founder of the firm.⁵ We include the headquarters state to control for the geographic concentration of venture capital firms, as it has been shown that venture capital firms are concentrated in several states, such as California, Massachusetts, Texas and Washington. We use firm age to measure the firm's

⁵ We obtain data of firm age from Jay Ritter's website, <http://bear.cba.ufl.edu/ritter/ipodata.htm>.

existence prior to the IPO, predicting that more mature firms rely to a less extent on venture capital compared to younger firms. We include the CEO-founder indicator since founder firms are less likely to attract venture capital backing since these firms are less willing to provide significant ownership to venture capital firms. Finally, we control for the industry in which the firm operates.

3.2 Conditional Tests of Earnings Informativeness

In this subsection we test how venture capital ownership and board of directors' characteristics affect the informativeness of earnings for a reduced sample of venture capital backed firms. We estimate the following two regressions:

$$R_{i,t} = \alpha_0 + \alpha_1 EARN_{i,t} + \alpha_2 EARN_{i,t} * OWN_{i,t} + \alpha_3 EARN_{i,t} * SEAT_{i,t} + \sum_{k=1}^5 \beta_k EARN_{i,t} * X_{j,t}^k + \eta_{i,t} \quad (7a)$$

$$R_{i,t} = \alpha_0 + \alpha_1 EARN_{i,t} + \alpha_2 \Delta EARN_{i,t} + \alpha_3 EARN_{i,t} * OWN_{i,t} + \alpha_4 \Delta EARN_{i,t} * OWN_{i,t} + \alpha_5 EARN_{i,t} * SEAT_{i,t} + \alpha_6 \Delta EARN_{i,t} * SEAT_{i,t} + \sum_{k=1}^5 \beta_k EARN_{i,t} * X_{j,t}^k + \sum_{k=1}^5 \gamma_k \Delta EARN_{i,t} * X_{j,t}^k + \eta_{i,t} \quad (7b)$$

$$CAR_{i,q,t} = \lambda_0 + \lambda_1 UE_{i,q,t} + \lambda_2 UE_{i,q,t} * OWN_{i,t} + \lambda_3 UE_{i,q,t} * SEAT_{i,t} + v_{i,t} \quad (8)$$

where: $OWN_{i,t}$ = percentage of equity owned by venture capital firms at date of IPO; $SEAT_{i,t}$ = percentage of seats on board of directors occupied by venture capital firms.

3.3 Data and Sample

The empirical analysis is based on data obtained from the following data sources: the 2006 Compustat annual and quarterly industrial and research files, the 2006 CRSP files, the Securities Data Corporation (SDC) database for 2001–2006 and the Corporate Library database available through WRDS. Since the detailed directorship and ownership data is available in the Corporate Library database beginning with 2001, we limit our sample to the period 2001–2006. We also hand-collect venture capital backed related information since Ljungqvist and Wilhelm (2003) suggest that there are some errors in the SDC database with regards to the definition of venture capital backing. When specific data on venture capital board representation was not available we read the IPO prospectus and firms' proxy statements. Unit offerings and IPOs with an offer price of less than \$5.00 are not included in our sample. In addition, we eliminated IPOs for which we could not identify valid CUSIP numbers. To be included in the final sample, IPOs must have financial data available on Compustat both in the year of and the year prior to the offering as well as stock return data. These criteria result in a main sample of 509 IPOs for which we have all the data needed to construct our variables of interest. This sample consists of 228 venture capital backed IPOs versus 281 non-venture capital backed IPOs.

3.4 Descriptive Statistics

Across all industries (based on two-digit SIC codes), we find that venture capital backed IPOs represent 44.79% of all IPOs. This figure is very close to the 43.50% venture capital backed sample used in a recent study by Morsfield and Tan (2006). There is a significant variation across industries, from 27% in the transportation industry (SIC codes 37, 39, 40, 42, 44, 45) to a high of 68% in the scientific instruments industry (SIC code 38). In a finer analysis we find a large concentration of venture capital backed IPOs in SIC code 7372 – software firms (15%), and in the biotechnology industry (SIC code 8731, among others – 8%). With regards to the geographical distribution of venture capital backed IPOs, we find that the most venture capital backed IPOs are concentrated in California, Massachusetts and Texas. These three states represent more than 50% of the overall venture capital backed IPOs. This concentration is not surprising given that prior research has documented that venture capital backed firms are located closer to areas where private equity markets are more developed. Usually, the interpretation for such a finding is that venture capital firms want to closely monitor their investments, thus increasing the concentration of venture capital backed firms in those specific geographical areas. In untabulated statistics we find that venture capital backed firms have higher market values, smaller assets and lower book values, less sales revenues, and are less leveraged. In addition, venture capital backed firms are more likely to report negative earnings compared to non-venture capital backed firms.

4. Results

The results of estimating equation (5a) and (5b) are reported in Table 1. Although we include all the control variables discussed above, we report only the main variable of interest. Consistent with prior research, the annual regression relating stock returns to the level and change in earnings provides positive coefficient estimates (both significant at the 0.001 significance level). In line with the results documented in Collins and Kothari (1989), we find that the coefficient estimate for the interaction between earnings and the market-to-book ratio is positive. We also find that earnings informativeness is decreasing in leverage. This finding is consistent with firms having greater incentives to manage earnings in the presence of covenant restrictions associated with leverage, which makes earnings quality, and thus earnings response coefficients, lower for firms that are more leveraged. Finally, we find that the coefficient estimates are smaller for loss observations, consistent with the evidence in Hayn (1995).

With respect to our main variables of interest, $EARN*VC$ and $\Delta EARN*VC$, the estimate of $\hat{\alpha}_3$ in equation (5a), column (1) is -0.465 and $\hat{\alpha}_3 + \hat{\alpha}_4$ in column (2) is -0.530, both significant at the 0.01 level. These results support our hypothesis that the earnings of venture capital backed firms are less credible and thus provide a lower level of informativeness. In terms of the magnitude and economic significance of these effects, the ratio of $\hat{\alpha}_2$ to $\hat{\alpha}_1$ in equation (5a) or the ratio of $\hat{\alpha}_3 + \hat{\alpha}_4$ to $\hat{\alpha}_1 + \hat{\alpha}_2$ in equation (5b), suggests that venture capital backed firms' earnings are about 35%–48% less informative (-0.465/0.967, column1 and -0.530/1.53, column 2).

Columns 3 and 4 in Table 1 report the results when we control for the self-selection model. The findings in columns 3 and 4 are consistent with the previous results documented in the left two columns of Table 4. With regards to the magnitude and significance of the effects, columns 3 and 4 suggest that venture capital backed firms' earnings are about 39%–40% less informative ($-0.392/0.974$, column 3 and $-0.574/1.48$, column 4) even after controlling for the endogenous features inherent in venture capital backing.

Table 1
Tests of Earnings Informativeness of Venture Capital Backed Firms versus Non-Venture Capital Backed Firms

Variable	VC DUMMY		Controlling for self-selection	
<i>INTERCEPT</i>	-0.008 (-2.67)	-0.174 (-3.68)	-0.002 (-2.94)	-0.157 (-3.76)
<i>EARN</i>	0.967 (14.37)	0.824 (16.27)	0.974 (13.68)	0.841 (17.37)
<i>EARN*VC</i>	-0.465 (-10.68)	-0.341 (-11.42)	-0.392 (-11.73)	-0.335 (-12.74)
$\Delta EARN$		0.706 (14.38)		0.638 (15.37)
$\Delta EARN*VC$		-0.189 (-12.37)		-0.239 (-11.39)
Inverse Mills Ratio			0.487 (4.99)	0.562 (5.07)
Adj. R^2	0.142	0.234	0.157	0.264
$VC*EARN + VC*\Delta EARN$		-0.530		-0.574

Variables definitions: The dependent variable is $R_{i,t}$ = firm i 's 12-month cumulative abnormal return for fiscal year t . The 12-month interval starts three months following the end of the fiscal year $t-1$ and ends three months after the end of fiscal year t . VC = a dummy variable that equals one for venture capital backed firms and zero otherwise. $EARN_{i,t}$ = firm i 's annual earnings (before extraordinary items) for fiscal year t , scaled by market value of equity at the end of fiscal year $t-1$. $\Delta EARN_{i,t}$ = change in $EARN_{i,t}$ between year $t-1$ and year t , scaled by market value of equity at the end of fiscal year $t-1$. $VC_{i,t}$ = venture capital backing dummy variable equal to 1 if the company is venture capital backed, zero otherwise.

Our next test of Hypothesis H1 investigates the capital market's reaction to the earnings news conveyed in quarterly earnings announcements of venture capital backed firms and non-venture capital backed firms. The results estimating equation (6) are reported in Table 2. Consistent with prior research, we find a positive and significant value of unexpected earnings (UE). The coefficient estimate $\hat{\lambda}_2$, which is significantly negative, suggests that investors respond less to a unit of unexpected earnings for venture capital backed firms than for non-venture capital backed firms (-0.066 , t -statistic -5.98). Comparing the estimates $\hat{\lambda}_1$ and $\hat{\lambda}_2$ suggests that quarterly earnings announcements are about half as informative for venture capital backed firms relative to non-venture capital backed firms. Repeating the analysis controlling for self-selection of venture capital provides the same results.

Table 2
Market Reaction to Quarterly Earnings Announcements of Venture Capital Backed Firms versus Non-Venture Capital Backed Firms

Variable	VC DUMMY	Controlling for self-selection
<i>Intercept</i>	0.004 (7.98)	0.003 (8.06)
<i>UE</i>	0.129 (15.47)	0.134 (14.96)
<i>UE*VC</i>	-0.066 (-5.98)	-0.069 (-4.96)
Inverse Mills Ratio		0.462 (3.87)
Adj. R^2	0.021	0.028

Variables definitions: The dependent variable is cumulative abnormal return over the three days (-1,1) centered on firm i 's announcement of quarter q earnings for year t .

$UE_{i,t}$ = the unexpected earnings in firm i 's quarter q , year t earnings announcement, measured as reported earnings for quarter q , year t minus reported earnings for quarter q , year $t-1$, divided by market value of equity 30 days prior to the announcement. VC = a dummy variable that equals one for venture capital backed firms and zero otherwise.

Overall, the results in Tables 1 and 2 suggest that venture capital backing decreases the valuation weight investors place on reported earnings of such firms. The results we document are robust to controlling for self-selection and to the inclusion of control variables identified by prior research to be related to the returns-earnings relation.

4.1 Venture Capital Ownership and Earnings Informativeness

We test Hypotheses H2 and H3 and report the results in Table 3, Panels A and B. The evidence in Table 3, Panel A suggests that while $EARN$ and $\Delta EARN$ are still positive and significant (as in the previous analysis), venture capital ownership (OWN) decreases the informativeness of earnings. In addition, we find that the larger the influence and control of venture capital firms on the boards of directors, as evidenced in the percentage of the seats they have on the board ($SEAT$), the lower the informativeness of earnings. Overall, we find that both variables significantly decrease the informativeness of earnings, after controlling for factors known to influence the returns-earnings relation.

Table 3, Panel B presents the results of testing how board characteristics and venture capital ownership affects the market's reaction to quarterly earnings announcements. In line with the results we report in Table 3, Panel A, we find that the higher the ownership stake of venture capital funds and the more influence these funds have on the board of directors, the less the market reacts to the earnings news signal as conveyed in the quarterly earnings announcement. As in Panel A, both $SEAT$ and OWN once interacted with UE (unexpected earnings) have a statistically significant negative coefficient.

Table 3

The Effect of Venture Capital Ownership and Board of Directors Characteristics on Earnings Informativeness for Venture Capital Backed Firms**Panel A: Annual Returns-Earnings Regressions**

Variable	VC DUMMY		Controlling for self-selection	
<i>INTERCEPT</i>	-0.005 (-2.73)	-0.179 (-3.54)	-0.001 (-2.74)	-0.143 (-3.25)
<i>EARN</i>	0.978 (13.04)	0.835 (15.09)	0.986 (12.78)	0.854 (16.34)
$\Delta EARN$		0.684 (13.43)		0.652 (13.41)
<i>EARN*SEAT</i>	-0.254 (-3.68)	-0.246 (-3.79)	-0.248 (-3.71)	-0.239 (-3.92)
$\Delta EARN*SEAT$		-0.187 (-2.94)		-0.183 (-2.85)
<i>EARN*OWN</i>	-0.182 (-4.69)	-0.196 (-4.83)	-0.189 (-4.52)	-0.187 (-4.51)
$\Delta EARN*OWN$		-0.171 (-5.06)		-0.149 (-5.12)
Inverse Mills Ratio			0.479 (4.84)	0.559 (5.12)
Adj. R^2	0.167	0.259	0.173	0.291

Panel B: Market Reaction to Earnings Announcements Conditional on Board and Venture Capital Ownership

Variable	VC DUMMY	Controlling for self-selection	
<i>Intercept</i>	0.003 (6.51)		0.002 (5.74)
<i>UE</i>	0.124 (14.36)		0.131 (13.64)
<i>UE*OWN</i>	-0.041 (-2.98)		-0.039 (-2.89)
<i>UE*SEAT</i>	-0.037 (-4.67)		-0.043 (-4.61)
Inverse Mills Ratio			0.075 (4.37)
Adj. R^2	0.027		0.031

Variables definitions for Panel A: The dependent variable is $R_{i,t}$ = firm i 's 12-month cumulative abnormal return for fiscal year t . The 12-month interval starts three months following the end of the fiscal year $t-1$ and ends three months after the end of fiscal year t . VC = a dummy variable that equals one for venture capital backed firms and zero otherwise. $EARN_{i,t}$ = firm i 's annual earnings (before extraordinary items) for fiscal year t , scaled by market value of equity at the end of fiscal year $t-1$. $\Delta EARN_{i,t}$ = change in $EARN_{i,t}$ between year $t-1$ and year t , scaled by market value of equity at the end of fiscal year $t-1$. OWN = percentage of equity owned by venture capital firms at date of IPO. $SEAT$ = percentage of seats on board of directors occupied by venture capital firms.

Variable definitions for Panel B: The dependent variable is cumulative abnormal return over the three days (-1,1) centered on firm i 's announcement of quarter q earnings for year t . $UE_{i,t}$ = the unexpected earnings in firm i 's quarter q , year t earnings announcement, measured as reported earnings for quarter q , year t minus reported earnings for quarter q , year $t-1$, divided by market value of equity 30 days prior to the announcement.

Overall, the results in Table 3 suggest that as the ownership and influence of venture capitalists increases, capital markets investors decrease the valuation weight on reported earnings. While some of the control variables account for the variation in earnings informativeness, a significant portion is still unexplained by these variables. We conclude that the unexplained portion in earnings informativeness is attributed to investors' perceptions that venture capitalists influence the public financial reporting process in ways that reduce the credibility of earnings and thus its informativeness.

The empirical evidence to date is mixed regarding the association between ownership structure and earnings informativeness. On one hand, Warfield et al. (1995) find a positive relation between managerial ownership and earnings informativeness, whereas Fan and Wong (2002) find a negative relation between ownership and earnings informativeness for their sample of East Asian firms with concentrated ownership.⁶

Taken as a whole, the results we document so far indicate that there is a long-term adverse effect associated with being backed by venture capital financing. In particular, one implication of these results is that venture capital backed firms have information-related problems that might affect their ability to raise capital in the future. The specific test of this assertion is left for future research.

5. An Alternative Test of Communication Efficiency

As in Jiambalvo et al. (2002), who examine the influence of institutional investors on the informativeness of earnings, we assess the extent to which stock prices lead accounting earnings conditional on venture capital backing. Specifically, we examine whether the stock prices of venture capital backed firms impound more or less information about current earnings relative to future earnings. If venture capitalists are characterized as transient investors (short-horizon) who are more concerned with current short-term profitability, they will lack any incentives to become informed regarding the future prospects of the firm they invest in. Stated differently, venture capitalists will focus only on current earnings as a measure of profitability. If venture capitalists are over-focusing and emphasize short-term profitability as reflected in current reported earnings instead of future profitability, we might expect that stock prices of venture capital backed firms will reflect more information contained in current reported earnings relative to the information contained in future earnings. The main motivation for investigating these empirical predictions is due to the limited investment and ownership horizon faced by venture capitalists. As we stated earlier, venture capitalists are required by law to liquidate their equity holdings and exit the newly public firms they have invested in during a specific time frame.

⁶ In particular, Fan and Wong (2002) find that concentrated ownership, created by cross-holdings and pyramid structures that separate cash flow rights from voting rights, decreases the informativeness of earnings.

In order to examine the extent to which stock prices reflect the relative dependence on current and future earnings, we adopt the approach discussed in Kothari and Sloan (1992). It is well known that stock prices lead earnings, since not all the economic actions undertaken by the firm are reflected in current earnings but such actions are available and known to investors. These economic actions, although known to investors and not reflected in current reported earnings, will be reflected in future earnings. Under this scenario, if investors impound value relevant information that is not reflected in current earnings, current stock prices will reflect the information regarding future earnings, after controlling for current earnings.

Kothari and Sloan (1992) use the premise that stock prices lead accounting earnings and suggest the following association:

$$R_{it,t-\tau} = \theta_0 + \theta_{1(\tau)} \frac{E_{it}}{P_{it-\tau}} + v_{it-\tau} \quad (9)$$

where: $R_{it,t-\tau}$ = the buy-and-hold return for firm i over the period $t - \tau$ to t ; E_{it} = income before extraordinary items for the accounting period ended at time t ; $P_{it-\tau}$ = the stock price at the end of period $t - \tau$. The capital market's response during the period $t - \tau$ to accounting earnings information for the period ended at time t is represented by $\theta_{1(\tau)}$.

The discussion in Kothari and Sloan (1992) suggests that as the interval τ increases, more information contained in reported earnings at time t would be reflected in the return cumulated over the period $t - \tau$ to t . This is the case since the capital market's expectation about future profitability will be reflected earlier in stock prices but only later in reported accounting earnings. If the information contained in current reported earnings has already been reflected in stock prices in the previous period, the coefficient $\theta_{1(\tau)}$ will get smaller (larger) as the interval τ gets smaller (larger). This implies that $\theta_{1(\tau)}$ when $\tau = 2$ is larger than for $\tau = 1$. The ratio of $\theta_{1(\tau)}$ obtained for a longer time interval to the one obtained for a shorter interval (i.e. $\frac{\theta_{1(\tau=2)}}{\theta_{1(\tau=1)}}$) will provide a measure of the firm's information environment. The higher the ratio, the more information in current reported earnings has already been reflected in previous stock returns.

If venture capitalists can be classified as transient investors who myopically focus on short-term reported accounting earnings given their limited investment and ownership horizon, one would expect the ratio $\frac{\theta_{1(\tau=2)}}{\theta_{1(\tau=1)}}$ to be smaller for venture capital backed firms than for non-venture capital backed firms. In other words, stock prices of venture capital backed firms would be more sensitive to current reported earnings relative to future earnings than stock prices of non-venture capital backed firms. To investigate this prediction, we estimate the coefficient $\theta_{1(\tau)}$ separately for venture capital backed firms and non-venture capital backed firms for $\tau = 1$ and for $\tau = 2$. Next, we calculate the ratio $\frac{\theta_{1(\tau=2)}}{\theta_{1(\tau=1)}}$ for each group and test whether the ratio is lower for the venture capital backed firms. A smaller ratio for venture capital backed firms compared to the non-venture capital backed firms is consistent with the assertion that venture capital investors can be classified as transient investors with a short-term investing horizon.

The results of estimating equation (9) for venture capital backed versus non-venture capital backed firms and for the two time periods ($\tau = 1$ and $\tau = 2$) are reported in Table 4.

Table 4
Regression Analysis of Stock Returns on Current Earnings with Different Time Intervals, Venture Capital Backed Firms and Non-Venture Capital Backed Firms

$$R_{it,t-\tau} = \theta_0 + \theta_{1(\tau)} \frac{E_{it}}{P_{it-\tau}} + v_{it-\tau}$$

	(1)	(2)	(3)	(4)	(5)	(6)
	$\theta_{1(\tau=1)}$	$\theta_{1(\tau=2)}$	$\frac{\theta_{1(\tau=2)}}{\theta_{1(\tau=1)}}$	$\theta_{1(\tau=1)}$	$\theta_{1(\tau=2)}$	$\frac{\theta_{1(\tau=2)}}{\theta_{1(\tau=1)}}$
Venture Capital Backed Firms	1.076	1.543	1.434	1.094	1.764	1.612
Non-Venture Capital backed Firms	1.309	2.341	1.788	1.186	2.204	1.858

The robust *t*-statistics (Petersen, 2008) are based on standard errors that are clustered by both firm and year (Panel A) and quarter (Panel B) and are shown in parentheses.

$R_{it,t-\tau}$ is the buy-and-hold return for firm *i* over the period $t - \tau$ to *t*, E_{it} is income before extraordinary items for the accounting period ended at time *t*, $P_{it-\tau}$ is the stock price at the end of period $t - \tau$. $\theta_{1(\tau)}$ is the capital market’s response to reported earnings. Columns (1) to (3) report the results of estimating equation (9) for venture capital backed firms and non-venture capital backed firms. Columns (4) to (6) report the results after controlling for different factors affecting the earnings-returns relationship: *LOSS*, *HTECH*, *SIZE*, *MB*, and *LEV*.

Columns (1) to (3) report the results of a univariate estimation while the multivariate analysis after controlling for the interaction of reported earnings with other determinants of the earnings-returns relationship (*SIZE*, *LEV*, *MB*, *LOSS* and *HTECH*) is reported in columns (4) to (6). Consistent with the findings in Kothari and Sloan (1992), the estimated coefficients $\theta_{1(\tau)}$ for both the venture capital backed and non-venture capital backed firms increase with the time interval over which stock returns are computed. This finding is consistent with the claim that stock prices lead accounting earnings. Our main focus is on the ratio $\frac{\theta_{1(\tau=2)}}{\theta_{1(\tau=1)}}$ that captures the extent to which stock prices lead earnings across venture capital and non-venture capital backed firms. The results suggest that the ratio $\frac{\theta_{1(\tau=2)}}{\theta_{1(\tau=1)}}$ is significantly lower for the venture capital backed firms (1.434 for venture capital backed firms versus 1.788 for non-venture capital backed firms, and 1.612 versus 1.858 once the control variables are included (columns 3 and 6)). This finding is consistent with the view that venture capital investors can be characterized as transient owners who are myopically focused on short-term earnings.

6. Summary and Conclusions

The extant literature has documented by far the benefits of venture capital financing for the newly public firm. These benefits range from the valuable strategic advice, business plans and industry connections provided by venture capitalists to newly public firms, high quality of underwriters, and the low underpricing of IPOs enjoyed by venture capital backed firms. We hypothesize that these benefits do not come without costs. For

example, some offsetting effects of obtaining venture capital financing might be due to the different investment time horizon and specific objectives venture capital firms face. We seek to investigate whether the unique ownership structure of the newly public firm, specifically, the degree of control and ownership by venture capitalists, affects its financial information credibility and thus its quality as manifested in the informativeness of reported earnings. For a sample of 509 IPOs which consist of 228 venture capital backed firms we examine what the long-term economic consequences of venture capital financing are, as evidenced in the informativeness of reported earnings of newly public firms.

Controlling for other known factors to affect earnings informativeness, we find that the informativeness of earnings depends on whether the newly public firm was venture capital backed or not. In particular, the results suggest that venture capital backed firms have earnings that are less informative compared to a group of non-venture capital backed firms. These findings are robust to attempts to control for firms' decision to obtain venture capital in the first place. For a sub-sample of venture capital backed firms we also document that earnings are less informative if venture capitalists retain more ownership and control of the board.

Taken as a whole the evidence we present suggests that there is a cost associated with being backed by a venture capitalist. Our theory suggests that the conflict of interest between long-term equity investors and venture capitalists who seek to promote short-term performance leads to less informative earnings as one of its attributes. This by itself might introduce information asymmetry problems affecting the firm's ability to raise future capital, which might increase its cost of capital and reduce firm value. However, the underlying conflict of interest we emphasize may bring about the inefficiency of other firm decisions. The specific test of this assertion is left for future research.

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