

Executive Ownership and Control in Newly Public Firms: The Role of Venture Capitalists*

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Abstract

We study the implications of CEO equity ownership for incentives and control in a sample of 1,011 newly public firms. Before an initial public offering, equity investments by venture capitalists reduce CEO ownership by about half, from an average of 35 percent to 19 percent. Venture capitalists narrow this difference by granting options, reducing secondary sales, and lowering the dilution by primary shares, but a gap in post-IPO CEO equity ownership remains. The effect of this lower ownership on incentives depends upon the measure employed - the dollar sensitivity of CEO pay to firm value is lower in venture firms, but the elasticity is about the same. In addition, we present evidence that lower ownership, combined with concentrated outside holdings, leads to a reduction in the agency costs of managerial control. We conclude that the patterns of ownership in part represent a tradeoff by venture capitalists between the benefits of incentives and the agency costs of control.

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1. Introduction

In a closely held firm, there is little distinction between ownership and control. The owners can hire, fire, and monitor management. In a public firm with dispersed shareholders, there is a separation of ownership and control. Minority investors wield little power in hiring management, in setting compensation, and in choosing the board of directors. An initial public offering marks the beginning of the transformation of a closely held firm into the large, public firm described by Berle and Means (1932).

In the classic analysis of Jensen and Meckling (1976), managerial equity ownership helps to align the interests of the manager and minority shareholders. Here, the focus is on the cash flow rights associated with ownership. But managerial equity ownership has implications not only for incentives, but also control. The votes included with equity ownership can create entrenchment, and an entrenched management may be immune to career concerns [Fama (1980) and Holmstrom (1999)], the discipline of the product market [Hart (1983)], monitoring by large shareholders [Shleifer and Vishny (1986)], and value-enhancing takeovers [Jensen and Ruback (1983), Franks and Mayer (1990)].¹ In this situation, managers may expropriate minority shareholders and extract what Grossman and Hart (1988) call the private benefits of control. Although in principle cash flow and voting rights can be separated, in practice the vast majority of managerial incentives come from equity ownership.

Venture capitalists may be especially concerned about the tradeoff between incentives and control. Because venture capitalists are diversified, require repeated access to capital markets, and do not enjoy private benefits of control, they have a strong motivation to improve managerial

¹ Shleifer and Vishny (1997) provide a complete survey of these and other corporate governance mechanisms.

incentives and reduce inside control in order to maximize the IPO price. Gathering data from the prospectuses of 1,011 newly public firms, we study the impact of venture capital on CEO equity ownership and thereby measure the relative importance of incentives and control.

By making equity investments, venture capitalists dilute CEO ownership. Before an initial public offering (IPO), CEO ownership is 19 percent for venture capital-backed firms and 35 percent for nonventure capital-backed firms. This large difference is statistically significant and robust to controlling for CEO characteristics, firm characteristics, and using instrumental variables for venture backing. Venture capitalists reduce the gap in CEO ownership by granting options, reducing secondary sales at the time of the IPO, and lowering the dilution effect of primary share issuance, but venture capital-backed CEOs continue to own substantially less of their firms after the IPO on average. The gap in post-IPO ownership between venture capital and nonventure capital-backed CEOs is therefore almost as large as the pre-IPO ownership.

The effect of lower ownership on incentives, however, depends upon the measure employed. If incentives are measured as the dollar change in CEO pay for a dollar change in firm value, a reduction in percentage equity ownership maps directly into lower incentives. When incentives are measured as the elasticity of CEO pay to firm value, venture capital-backed CEOs have slightly higher incentives, though the difference is not significant when we control for firm size and instrument for venture backing.

In addition, we present evidence that lower ownership, combined with concentrated outside holdings by venture capitalists, leads to a reduction in the agency costs of managerial control. We use the insider Shapley value to measure control and fixed salary as a proxy for the

expropriation of minority shareholders.² Fixed salary is increasing in the level of managerial control. We find that venture capitalists both lower the level of the Shapley value and reduce the extent to which it is used to increase fixed salary.

In examining the tradeoff between incentives and control, this paper is closely related to Morck, Sheifer, and Vishny (1988). Morck, Shleifer, and Vishny show that market valuation is related to ownership in a piecewise linear way. For low ranges of inside ownership, Tobin's q is increasing in ownership, presumably because managerial incentives are increasingly aligned with shareholders. For higher ranges of ownership, market value falls as managers become entrenched and can consume private benefits at the expense of other shareholders. Our analysis of the agency costs of control is also connected to Zingales (1994), who uses the Shapley value to measure voting control and fixed salary as a proxy for managerial perquisites.

As a study of incentives, this paper is a complement to the vast large firm literature on executive ownership and compensation and provides a first examination of a different set of companies. Murphy (1985), Coughlan and Schmidt (1985), Benston (1985), Jensen and Murphy (1990), and more recently Hall and Liebman (1999) have looked at the incentive effects of CEO ownership, options, and fixed salary in the largest U.S. companies. In Jensen and Murphy, the typical CEO receives about \$3 for every \$1,000 dollar change in firm value - the equivalent of an equity position of 0.3 percent. In contrast, we find over a similar time period a pay sensitivity that is fifty times higher. Also, the use of options in our sample of IPO firms is very limited - over 80 percent of the CEOs receive no options, and options grants account for less than 3 percent of CEO pay on average. Finally, the IPO is apparently not a mechanism for immediate

² As discussed in Section 5, the Shapley value is the probability that the insiders' equity holdings are pivotal for control in random orderings of shareholders.

diversification. More than half of the sample CEOs sell no equity, and the average CEO sells less than 5 percent of pre-IPO equity in the offering.³

At the other end of the firm size and life cycle spectrum, Ang, Cole, and Lin (1999) look at ownership and agency costs in very small private firms using data from the National Survey of Small Business Finances (NSSBF). Because the authors rely on survey data, they cannot determine average managerial incentives and control. Moreover, for a large fraction of their sample, a single owner owns 100 percent of the firm. These are situations where problems associated with the separation of ownership and control, entrenchment, and the expropriation of dispersed investors are not likely to be of great concern. The firms that we analyze stand between the NSSBF firms and established public firms. In addition, unlike Ang *et al.* we also have detailed breakdown of all the major equity holders in the company rather than just a broad survey response. We can therefore do more detailed examination of the determinants of ownership.

The remainder of the paper is organized as follows. Section 2 discusses the role of venture capital in corporate governance. We describe the IPO prospectus data in Section 3. Section 4 presents the analysis of the level and cross-sectional determinants of managerial incentives and the agency costs of control. Section 5 concludes.

2. The Role of Venture Capitalists

Venture capital firms in the U.S. finance high-risk, potentially high-reward projects. Venture capitalists take an equity-linked stake in the firms they finance, sharing in both upside and downside risks. Most firms that receive venture capital financing are unlikely candidates for

³ Beatty and Zajac (1994) present similar summary statistics from 435 IPO prospectuses from 1984. They focus on the substitute or complementary nature of board structure and ownership.

alternative sources of funding - they have few tangible assets to pledge as collateral and produce operating losses for many years.

Whether the project is in a high or low technology industry, venture capitalists are active investors.⁴ They monitor the progress of firms, sit on boards of directors, structure compensation packages, mete out financing based on attainment of milestones, and help in hiring management talent. Venture capitalists retain important control rights including the ability to appoint key managers and remove members of the entrepreneurial team. They also provide entrepreneurs with access to consultants, investment bankers, lawyers, and accountants.

Venture capitalists may be concerned about the corporate governance mechanisms in the firms they finance for two reasons. Because venture capitalists are diversified, require repeated access to capital markets, and do not enjoy the private benefits of control that entrepreneurs do, they have a greater incentive to improve governance in order to maximize the public offering price. In addition, because they repeatedly bring firms public, venture capitalists have reputational concerns - if the management of a firm brought to the public market were to take advantage of investors, its venture capitalist might have difficulty convincing the public to buy its portfolio companies in the future.

A large theoretical literature has explored the mechanisms that venture capitalists use to reduce agency, information, and verifiability problems. The mechanisms include active

⁴ In addition, there is considerable evidence that venture financing is prevalent in industries where potential agency costs are large. Venture capitalists provide finance mainly to early stage and high technology companies [Gompers (1995)]. They specialize in screening and monitoring these firms where adverse selection and agency problems are the most severe. Lerner (1994) shows that venture capitalists tend to join the board of directors around times when CEOs are fired. Barry *et al.* (1990) show that venture capitalists maintain a concentrated equity position beyond the IPO and serve on the board of directors.

monitoring and advice [Cornelli and Yosha (1997); Marx (1994); Hellmann (1998)], screening [Chan (1983)], incentives to exit [Berglöf (1994)], syndication [Admati and Pfleiderer (1994)], and staging of the investment [Bergemann and Hege (1998)]. In most cases, the critical role of venture capitalists is in gathering information and monitoring.

Recent empirical evidence has documented how venture capitalists screen and monitor entrepreneurial firms. These papers have examined venture investment staging [Gompers (1995)], syndication of investment [Lerner (1995)], monitoring [Gorman and Sahlman (1989)], board structure [Baker and Gompers (1999)], and CEO turnover and board composition [Lerner (1994)]. This paper studies the influence of venture capitalists on incentives and control in the firms they take public.

3. Data

Our initial sample consists of 1,553 firms that went public between 1978 and 1987. The sample of 1,120 nonventure capital-backed firms and 433 venture capital-backed firms combines the Ritter (1991) IPO data and the Barry *et al.* (1990) venture capital data. The data on CEO compensation were collected from IPO prospectuses. We were able to locate prospectuses for 1,306 firms. From this smaller sample, we eliminated 30 limited partnerships, 12 real estate investment trusts (REITs), 71 spin-offs, and 38 financial firms. In addition, we eliminated 79 firms with more than one class of common stock. Of the 1,076 firms left, we were unable to gather data on ownership for 65 firms.

The summary statistics for the remaining 1,011 firms are presented in Table 1. The variables are divided into four categories. In the first panel, we present the CEO ownership data. The equity stake, primary shares, options, and secondary shares sold in the offering are shown both as

a fraction of the equity market value and in constant 1987 dollars.⁵ The options are valued using Black-Scholes formula with the industry median standard deviation, the Treasury bill rate, the CRSP share price at the close of the first day of trading, and the option terms as presented in the IPO prospectus. We also gather data on fixed salary from the IPO prospectus.

On average, CEOs own 30 percent of the firm's equity prior to the initial public offering. This equity has a value, calculated with the first day closing price, of \$17.6 million. The average proceeds of an IPO are \$15.2 million. Contrary to conventional wisdom, use of options is quite small in this sample at an average of 0.3 percent of firm value and a small fraction of CEO equity holdings. Also surprising is the low level of CEO sales at the IPO, at an average of less than two percent of firm value and a small fraction of pre-IPO ownership. In fact, more than half of the sample sell nothing at the IPO. This conflicts with the notion that a public offering allows the CEO to diversify immediately. Average and median salaries are also low, at \$181,000 and \$132,000 respectively.

The second, third, and fourth panels describe the cross sectional determinants of ownership that we consider: CEO age and tenure, firm size and risk, and firm characteristics. In addition to age, we gather tenure and founder information from the IPO prospectus. For firm size, we use the market value of equity from CRSP as of the first day of trading and COMPUSTAT data on the book value of long-term debt. In the last panel, we show firm characteristics: venture capital backing, fixed assets intensity, research and development intensity, cash flow to sales, and firm age. These data are from COMPUSTAT and the IPO prospectus.

⁵ The dollar values are calculated using prices from the Center for Research on Security Prices (CRSP) at the close of the first trading day adjusted to 1987 using the consumer price index from Stocks, Bills, Bonds and Inflation (SBBI).

The average CEO in our sample is about 47 years old and has been CEO for seven years. Just over half of the sample CEOs are founders of their firms. Not surprisingly, we also find that typical firm in our sample is small and has little long-term debt. Average equity values are around \$82 million, and average asset values are \$88 million. We also find that the sample tends to be heavily weighted in high technology demonstrated by a small fraction of tangible capital, high levels of research and development, and low levels of cash flow. The average firm is nine and a half years old.

In Table 2, we recalculate the summary statistics separately for 363 venture and 648 nonventure capital-backed firms. This reveals large differences in CEO ownership. Prior to the IPO, CEOs of venture capital-backed firms have significantly lower equity stakes, at an average of 19 percent, than their counterparts at nonventure capital-backed firms, who have 35 percent ownership on average. Because venture capital-backed firms are almost twice the size, \$115 million versus \$63 million on average, the dollar value of CEO stakes is roughly the same across the two groups. In addition, venture capital-backed firms issue less new stock at the IPO, grant more options, allow fewer equity sales, and pay lower salaries. These simple comparisons are all significant at the one percent level, which suggests that venture capitalists explicitly reduce the gap in pre-IPO ownership and incentives. However, we have not yet controlled for firm characteristics or the potential endogeneity of the venture capital financing decision.

The last three panels of Table 2 also show that venture capital-backed CEOs are younger by three years on average and have three years less tenure. A similar fraction, around 55 percent, of both samples is founders. In addition, venture capital-backed firms are larger, measured by equity and assets, and riskier, measured by the industry median standard deviation of stock returns in the year prior to the IPO. While we do find a difference in tangible assets, there is no

significant difference in R&D spending. Only 467 firms, however, report this line item in COMPUSTAT. If we assume that the remaining 544 firms had no R&D spending, the difference becomes significant at the one percent level. We use this convention in our analysis in the next section. At six years old, the average venture capital-backed firm is over four years younger than the average nonventure capital-backed.

4. Empirical Results on Incentives and Control

In this section, we explore the influence of venture capital on CEO incentives and control. In the first subsection, we consider the endogeneity problem in measuring the impact of venture capital on ownership, the issuance of primary shares, options, secondary sales at the IPO, and salary. The second subsection examines CEO ownership around the IPO. After documenting that venture capitalists dilute pre-IPO ownership by almost half, we investigate whether options grants, primary shares, and secondary sales reduce this gap. In the third subsection, we evaluate the implications of this ownership difference for incentives. And the last subsection attempts to quantify the concomitant agency costs of control.

A. Estimation Issues

The decision by a firm to raise venture capital and the decision of a venture capitalist to provide finance are not exogenous. Firm and CEO characteristics may determine which firms are venture capital-backed. These same characteristics may influence the optimal level of ownership and the balance between incentives and control. This endogeneity makes the problem of estimating the impact of venture capital financing on ownership challenging.

The omission of unidentified firm and CEO characteristics may cause us to falsely impute a significant impact of venture capital. To address this problem, we employ an instrumental variables approach. The ideal instrument is a variable that increases the probability of venture capital-backing, but otherwise is unrelated to the desired level of CEO ownership. We use two instruments for venture backing.

The first is the state where the firm's headquarters are located. We gather this information from the prospectus and COMPUSTAT. Lerner (1995) argues that the cost of monitoring is increasing in the distance between the firm and its venture capitalist. Furthermore, the venture capital industry is concentrated in several states, including Massachusetts, California, and Texas. For this reason, the probability of venture backing is related to location of the firm. A set of state categorical variables explains about 14 percent of the variation in venture backing. While location may itself be endogenous, we believe that after controlling for other firm characteristics such as R&D intensity, the location decision likely depends on exogenous factors such as where the firm founder resides.

The second instrument is a categorical variable, equal to one if the firm was founded after 1979. Gompers and Lerner (1998) find that amendment to the Employee Retirement Income Security Act in 1979, which allowed pension funds to invest in venture capital partnerships, had a dramatic impact on money flowing into venture capital funds. Venture capital commitments rose seven-fold between 1978 and 1983. As a result, the probability of venture backing is considerably larger for firms founded after 1979, increasing from 31 percent to 41 percent. Kortum and Lerner (1999) use this instrument to measure the influence of venture capital on patenting activity. In the subsequent analysis, we report both ordinary least squares and instrumental variables regressions using these two variables.

B. Determinants of CEO Equity Ownership

The simple univariate comparison in Table 2 revealed that venture capitalists dilute pre-IPO CEO equity ownership by about half, from an average of 35 percent to 19 percent. In Table 3, we consider additional determinants of pre-IPO CEO equity ownership. Even after controlling for CEO and firm characteristics and the endogeneity of the financing decision, venture capital reduces CEO ownership by at least 14 percent.

The first two columns of Table 3 present ordinary least squares regressions. Ownership is increasing in CEO tenure and is about 15 percent higher for firm founders. In addition, ownership is decreasing in research and development intensity and increasing in cash flow to assets. Perhaps these variables reflect the ability of the firm to finance investment with internal funds and debt. Without access to either, the firm must raise outside equity, diluting CEO ownership. The last two columns of Table 2 show that the effect of venture finance on CEO ownership is not a result of omitted variables. When we instrument for venture capital-backing with state location and a categorical variable equal to one for firms founded after 1979, the results are qualitatively similar.

While it may seem tautological that venture capital-backing would lower CEO equity ownership, it need not be. It is tautological that venture capital finance substitutes for either inside or outside ownership. However, nonventure capital-backed companies in most cases also raise significant amounts of outside equity, especially in high technology industries. Nonetheless, Table 3 illustrates that on average venture capital investment displaces CEO rather than other outside ownership.

Given the impact of venture capital-backing on pre-IPO ownership, we next consider how venture capitalists create or maintain incentives by granting options, reducing secondary sales by the CEO, and reducing primary shares. For founders and managers with long tenure and large shareholdings, secondary sales of shares at the IPO provide an opportunity to diversify and decrease ownership. Venture capitalists may have a strong interest in requiring CEOs to maintain their equity stake, despite the possibility that they could sell some at the time of the offering. Venture capitalists may also have an interest in lowering the ownership dilution of primary share issues. If the firm issues a large number of primary shares, the fraction of the company that the CEO owns will decline markedly even if she does not sell any equity at the time of the IPO. As such, the venture capitalist may wish to issue fewer primary shares. On the other hand, option grants are typically used to increase incentives. Faced with CEO wealth constraints, the firm can align executive and shareholder incentives at lower cost with grants of options rather than shares, because the elasticity of options to firm value is greater than one.

Table 4 examines the motives for CEO secondary equity sales at the IPO, the primary share offer size, and options grants. In the first column, the dependent variable is the percentage of the firm issued as primary shares at the time of the IPO. In the second columns, the dependent variable is options grants scaled by firm equity value. We also examine two measures of CEO equity sales. The first is equity sales by the CEO as a fraction of total firm equity. The second measure is CEO equity sales as a fraction of the CEOs pre-IPO equity ownership. In addition, all the regressions include firm size, firm risk, and CEO age, tenure, and founder status as independent variables. We also add firm-level controls and report both ordinary least squares (in the first four columns) and instrumental variables regression specifications (in the second four columns).

The results are broadly consistent with the hypothesis that venture capitalists use options and limit CEO sales to maintain the level of ownership after the offering. However, the impact of venture capital is economically small. Options grants as a percent of shares outstanding are higher by about 0.2 percent, and sales are lower by less than one percent.⁶ These differences although small are statistically significant. Primary shares sold are actually higher, albeit insignificantly, in venture capital-backed firms once we control for firm size. The magnitudes and statistical significance are generally lower in the instrumental variables analysis. In other words, once we factor in the endogeneity of the venture financing decision, there is no significant difference between the two groups. In sum, there is little evidence that other actions by venture capitalists substantially offset the dilution of pre-IPO ownership. The gap in post-IPO ownership is almost as large.

Two other relationships are worth noting. Shares sold increase with CEO tenure, even controlling for ownership. Longer-term executives are more likely to start to cash out at the offering. Also, options grants are increasing in firm risk, where options are likely to be most valuable.

It is possible that venture capitalists are only concerned with having a minimum level of ownership. In this spirit, we examine the pre-IPO and post-IPO ownership of four groups of CEOs. We divide the venture capital and nonventure capital-backed samples according to those CEOs with and without options grants and with and without secondary sales of equity at the IPO. In Table 5 we calculate summary statistics for these groups in the first four columns.

⁶ The options data are censored at zero: 849 of 1,011 CEOs received no options. We also run (but do not report) Tobit regressions. The results are qualitatively identical.

The patterns of Tables 3 and 4 are apparent. In all categories, venture capital-backed CEOs own significantly less of the firm prior to the IPO. CEOs with options grants and no sales have much lower pre-IPO ownership, with an average of 9.4 percent for venture capital-backed and 14.7 percent for nonventure capital-backed CEOs. This sample has a smaller proportion of founders and the CEOs have shorter tenure. CEOs without options who sell equity have much higher pre-IPO ownership, with an average of 26.3 percent (venture capital-backed) and 45.1 percent (nonventure capital-backed). In this group, 75 percent of the venture capital-backed CEOs and 60 percent of the nonventure capital-backed CEOs are founders and the average tenure is almost 10 years.

In all the categories, venture capital-backed firms have lower offering dilution, i.e., the impact of primary shares issued on percentage ownership is smaller. Similarly, across all the categories, CEOs of venture-backed firms sell less and have more options, thus maintaining higher ownership for CEOs in venture capital-backed companies. Perhaps more importantly, the difference in ownership between venture capital-backed and nonventure capital-backed firms is smallest for CEOs who have options and no secondary sales. These are the firms, with a low fraction of founders and short tenure, where creating or maintaining the incentives of ownership is most important. In this category, the average venture firm CEO ownership is lower by only 2 percent. This evidence suggests that a threshold ownership level rather than higher ownership *per se* may be the critical factor for venture capitalists.

C. The Level of CEO Incentives

This section focuses on the level and cross sectional determinants of CEO incentives in recently public firms. We use two measures of incentives: the level of post-IPO CEO equity

ownership and the elasticity of CEO pay to shareholder wealth (\mathbf{h}) defined as the percentage change in CEO pay for a percentage change in firm value. It is important to look at both measures because low equity ownership in percentage terms does not necessarily mean low incentives. For example, a CEO who receives no salary and has no outside wealth, but who owns 5% of a firm's equity may have strong incentives to maximize firm value.

CEO incentives are typically defined as the sensitivity of changes in CEO pay to changes in shareholder wealth. With our data, we can identify four sources of CEO pay: equity holdings after the IPO, options, salary, and shares sold. Our first measure of incentives is post-IPO CEO equity ownership. Because CEOs sell very little equity, post-IPO ownership looks much like pre-IPO ownership. As a measure of incentives, CEO equity ownership measures how a marginal dollar increase or decrease in firm value affects the marginal dollar value of CEO pay.

Our second measure of CEO incentives is the elasticity of pay to firm value. Each source of CEO pay, i.e., equity holdings, options, salary, and shares sold, has an elasticity with respect to changes in shareholder wealth. The elasticity of equity holdings (\mathbf{h}_e) is 1.0: a one percent change in the equity capitalization of the firm also increases the CEO's equity value by one percent. Black-Scholes formula provides the elasticity of option holdings to equity. A dollar increase in share price increases the value of the option by $N(d_1)$, also called Black-Scholes delta (Δ).⁷

⁷ Delta (Δ) is the derivative of the Black-Scholes formula with respect to the stock price. We assume no dividends are paid during the life of the option. $N(\cdot)$ is the cumulative normal distribution function, and d_1 is defined as a function of the standard deviation of the stock returns (\mathbf{s}), the stock price (P), the exercise price (X), the risk-free rate (r_f), and the time to maturity (T):

$$d_1 = \frac{1}{s\sqrt{T}} \left[\ln\left(\frac{P}{X}\right) + \left(r_f + \frac{s^2}{2}\right)T \right]$$

Converting these dollar changes to percentage changes yields the elasticity of the option as a function of delta (Δ), the stock price (P), and the Black-Scholes value of the call option (c).

$$\mathbf{h}_o = \Delta \frac{P}{c} \quad (1)$$

Because our data represent a snapshot at the time of the IPO, we cannot measure the elasticity of salary to shareholder wealth (\mathbf{h}_s). Instead, we rely on the average elasticity reported in past studies of large firms. This is approximately 0.1. Finally, CEO pay from sales of shares has no sensitivity ($\mathbf{h}_{sales} = 0$) to shareholder wealth.

The elasticity of CEO pay to shareholder wealth (\mathbf{h}) is derived in Table 6 for venture and nonventure capital-backed CEOs. What we want is the ratio of the percentage change in all identifiable CEO wealth to the percentage change in firm value. This is precisely a weighted average of the separate elasticities. This is simply the weighted average of the four elasticities: equity, options, salary, and shares sold. The weights are the fraction of CEO pay that each source represents. The elasticity can be decomposed into its four parts, the incentives from equity (E^{CEO}), options (O^{CEO}), salary (S^{CEO}), and shares sold, which have an elasticity of zero and drop out of the equation.

$$\mathbf{h} = \frac{E^{CEO}}{W^{CEO}} \mathbf{h}_e + \frac{O^{CEO}}{W^{CEO}} \mathbf{h}_o + \frac{S^{CEO}}{W^{CEO}} \mathbf{h}_s \quad (2)$$

Table 6 presents this decomposition for both venture capital and nonventure capital-backed CEOs. The vast majority, about 90 percent, of incentives by this measure come from equity ownership. Options, which on average represent only 3.0 percent (venture capital-backed) and

1.4 percent (nonventure capital-backed) of CEO pay and have an elasticity slightly larger than one, make a small contribution to overall incentives.

In order to calculate CEO pay from salary (S^{CEO}), we discount salary at a real rate of 3 percent assuming that the level remains constant in real terms until retirement age. For retirement age, we use the larger of 65 or three years older than the CEO's current age. The average CEO in our sample is 47 years old and has 18 years to retirement. Because the sample CEOs are younger and work at smaller firms, the present value of current and future salary is 6 percent of equity market value, a much larger fraction than in Jensen and Murphy.

The overall average elasticity of CEO pay to shareholder wealth is 0.73 for venture capital-backed CEOs and 0.70 for nonventure capital-backed CEOs. Because the present value of salary is relatively insensitive to the market value of the firm by assumption and also represents a substantial portion of total CEO pay (almost 30 percent), CEO pay in total has an elasticity of less than one.

Are these measures too high or too low? The first measure, equity ownership, is substantially larger for small firms than large firms. There are two reasons, however, to expect this finding. The CEO's contribution to the firm is a much larger fraction of firm value – these firms have fewer employees and divisions and the CEO value added is likely to be a large portion of overall value. In addition, as Baker and Hall (1998) argue, the impact of private benefits of control and pet projects (for example, the purchase of corporate jet) may have close to the same dollar impact on a small firm as a large firm. For this reason, high equity ownership may be required to prevent the CEO from destroying firm value.

Past studies have focused on various cross sectional determinants of CEO incentives: firm size, firm risk, and CEO age. In this section, we look at the impact of venture capital-backing,

controlling for these factors. We also address the interactions between size, firm risk, CEO age, and firm characteristics. The dependent variables in Table 7 are our two measures of incentives. In addition to proxies for size, risk, and CEO reputation and tenure effects, we include firm-level controls for fixed assets intensity, research and development intensity, cash flow to sales, and firm age as independent variables.⁸ Although the sample level of incentives, measured by CEO equity ownership and elasticity, is quite different from previous large-firm studies, the cross-sectional relationships are largely the same.

Table 7 makes it clear that measuring the impact of venture capital-backing on incentives depends upon the choice of variable examined. In the case of post-IPO equity ownership, venture capital-backing is associated with significantly lower CEO incentives. This is not surprising. Tables 2 and 3 demonstrated that pre-IPO ownership was lower for venture capital-backed CEOs. We also show that CEOs sell very little equity at the time of the offering, so it is not surprising the post-IPO CEO equity ownership is also substantially lower. The coefficient on venture capital-backing in Table 7 is, however, substantially lower than it is in Table 3 which examines pre-IPO ownership. This is not surprising given the results of Table 4 show venture capitalists taking action to reduce the ownership gap.

When we examine the elasticity of CEO pay to firm value, however, venture capital-backed CEOs actually have slightly more sensitive pay, although the differences are not significant. If we believe that the elasticity is a better measure of incentives, then venture capital-backed CEOs actually have better, not worse incentives. The active decisions of the venture capitalist perhaps

⁸ We also ran but do not report regressions with industry fixed effects at the 2-digit level. Results are qualitatively similar.

compensate for the lower pre-IPO equity ownership. These results highlight the importance of examining incentives in a variety of ways.

Baker and Hall (1998) look at firm size and incentives. They argue that CEO decisions that have a similar dollar impact in small and large firms require a higher dollar sensitivity, equity ownership, in small firms, while decisions that have a similar percentage impact in small and large firms require a lower elasticity (h) in small firms.

Figure 1 shows how our two measures of incentives vary across firm size quintiles. In Panel A venture capital-backed CEO ownership declines with firm size, i.e., venture-backed CEOs own less of larger firms. Equity ownership by nonventure-backed CEOs is relatively flat. When we examine the elasticity measure of incentives in Panel B of Figure 1, we see that h rises for both venture capital and nonventure capital-backed CEOs as firm size increases. This largely stems from the increase in the value of the CEO's equity stake. Even if the CEO of a large company owns relatively less of the firm in percentage terms, that stake is larger in absolute dollars and as a fraction of their wealth. Hence, CEO equity ownership can decline as a fraction of the firm, but incentives as measured by elasticity may rise.

Firm risk has mixed predictions concerning ownership and incentives. Demsetz and Lehn (1985) argue that ownership concentration should be increasing in stock price volatility which proxies for control potential. On the other hand, Aggarwal and Samwick (1998), find that incentives are decreasing in firm risk. This is a direct implication of the static principal-agent model, which characterizes the optimal contract between shareholders and the CEO as a tradeoff between risk sharing and incentives. Holding required incentives constant, increases in risk should reduce the sensitivity of CEO pay to performance.

We find mixed evidence of a link between risk and incentives in Table 7. We measure risk using the median and mean industry standard deviation of monthly stock returns for twelve months prior to the IPO. Post-IPO equity ownership is (insignificantly) decreasing while h is increasing in firm risk. It does not seem as if the results from Aggarwal and Samwick hold in our sample.

Gibbons and Murphy (1992) study CEO age and CEO incentives. They argue that the optimal compensation contract uses both explicit and implicit incentives. For young CEOs, for whom reputation is a valuable asset and can be converted into future earning potential, fewer explicit incentives are required. They work hard to develop a reputation. Older CEOs who are close to retirement and have fewer reputational concerns need explicit incentive pay to elicit the appropriate effort. Measured by the elasticity of CEO pay to shareholder wealth, incentives are increasing in CEO age, but equity ownership is unrelated to CEO age.

The reputation effect could also be mixed with a tenure effect. If equity is accumulated over time (e.g., because of wealth constraints), founders and long-standing CEOs will own more of the firm. We do indeed find that tenure is positively related to equity ownership.

In addition, we look at the impact of firm characteristics on the incentive effect of equity ownership. The elasticity (h) increases with firm size, CEO age, and founder status. The firm specific control variables also demonstrate that pay sensitivity is increasing in asset intensity and liquidity, but not affected by R&D intensity. These variables potentially proxy for wealth constraints. Firms with tangible assets can raise debt to avoid raising outside equity.⁹ In addition, higher liquidity could proxy for the ability to finance investments without outside equity. Wealth

⁹ In Hart and Moore (1994), debt capacity is a function of the liquidation value of the project's assets.

constraints may reduce incentives. Firms with little debt capacity and internal sources of funds are forced to raise outside equity in order to finance investment – this reduces incentives.

D. Venture Capitalists and Control

In addition to their effect on incentives, we explore another potential influence of venture capitalists: Venture capitalists may reduce the agency costs of equity ownership. Holding a large fraction of the firm's equity, the entrepreneur may be able to consume pecuniary and non-pecuniary benefits of control that are costly to outside shareholders.

As a large outside shareholder, the venture capitalist can limit the control of the CEO. We characterize the control of the CEO by calculating an insider Shapley value. The Shapley value is the probability that the equity block of insiders is pivotal in a simple majority voting game. Shapiro and Shapley (1977) derive the formula for voting power in a game where votes are distributed among a few significant players and a very large number of small players. Rydqvist (1987) and Zingales (1995) have used the Shapley value to measure the value of voting rights in firms with more than one class of shares. Furthermore, in addition to the direct effect on control, a venture capitalist can use covenants and additional restrictions to limit the actions of the CEO. As such, our Shapley values should be seen as an upper bound for the control of the CEO in venture capital-backed firms.

The presence of a venture capitalist alters the ownership structure of the firms in our sample. Table 8 shows the post-IPO ownership structure of venture and nonventure capital-backed firms. The first panel lists inside owners and the second panel lists outside owners. Nonventure capital-backed firms have approximately twice the inside ownership (41 percent vs. 22 percent) and one-third of the concentrated outside ownership (5.9 percent vs. 17.5 percent) of venture capital-

backed firms. The power of the CEO is increased both with more votes and less non-insider ownership concentration. We combine these two pieces in the Shapley value. This value is based on a game with five players: the inside owners collectively, and the next four largest shareholders.¹⁰ We assume that the rest of the ownership is completely dispersed. The Shapley value presented in Panel C of Table 8 is the probability, given random orderings of the players, that the insiders are pivotal. This probability is 61 percent for nonventure capital-backed firms, almost 35 percent higher than venture capital-backed firms.

The first two columns of Table 9 confirm that this effect of venture capital on Shapley values is not a consequence of the endogeneity of venture capital-backing. We present both ordinary least squares and instrumental variables regression results. Here, the dependent variable is the Shapley value as calculated in Table 8. The independent variables are whether the firms is venture capital-financed, firm size, firm risk, and CEO age and tenure as well as firm-level control variables. Venture capital-backing consistently lowers the control of the CEO. Controlling for the endogeneity of venture-backing with instrumental variables estimation actually increases the magnitude of the coefficient. The insider Shapley value is lower by 33 to 43 percent for venture capital-backed firms. In addition, we find that the Shapley value is decreasing in CEO age, but increasing in CEO tenure and for founders. This is consistent with Hermalin and Weisbach (1998), who argue that CEO power is likely to increase with tenure at the firm. Founders also potentially wield significant power.

In the second two columns of Table 9, we consider how the CEO might exercise this control at the expense of minority shareholders. It is impossible to measure nonpecuniary private

¹⁰ We only gather data on ownership by board members.

benefits or CEO work effort. Instead, we use the payment of fixed salary as a dependent variable to proxy for pecuniary and non-pecuniary benefits of control.¹¹ This seems reasonable because CEOs with greater control can increase their salary to draw greater economic value from the firm. In addition, we include the indicator variable for venture capital backing and as well as an interaction term between venture capital-backing and the Shapley value.

The results show that controlling for other determinants of salary, such as firm size, CEO tenure, and founder status, fixed salary is increasing in the insider Shapley value. This effect is statistically significant at the 1 percent level. The venture capital interaction term is negative - it is significant at the 5 percent level without firm and CEO controls and significant at the 10 percent level in the fourth columns where we control for these other characteristics. Thus, the venture capitalist reduces salary in two ways. First, the Shapley value is lower by an average of 34 percent in venture capital-financed firms. Using the positive coefficient on Shapley value in the third column, this reduces salary by 13 percent. Second, the coefficient on the Shapley value is lower for venture backed firms, reducing salary by a further 8 percent. For any level of insider control, the presence of a venture capitalist reduces the ability of the CEO to use this control to increase salary.

5. Conclusions

In this paper we explore the role of venture capitalists in financing young, closely held firms. In particular, we examine the effect of venture capital on CEO equity ownership. Because

¹¹ Zingales (1995) also uses abnormal salary as a measure of agency costs. Abnormal salary is the residual from a regression of salary on log sales and a time trend. In the regressions we control for firm, industry, and CEO attributes as well.

venture capitalist cannot consume private benefits of control, they are motivated to maximize the incentive effects of equity ownership while reducing its agency costs. In our sample of 1,011 newly public companies, venture capitalists lower pre-IPO CEO equity ownership. The lower pre-IPO equity ownership is not the result of the endogeneity of the venture capital-backing of the firm. In addition, we explore the active decisions of the venture capitalist to increase the post-IPO ownership and incentives of the CEO. Venture capitalists lower ownership offering dilution due to primary share issuance, increase the use of CEO options, and decrease CEO equity sales at the time of the IPO. All of these measures reduce the difference in post-IPO CEO ownership between venture and nonventure capital-backed firms.

Our examination of the incentive effects of post-IPO equity ownership depends upon the measure of incentives examined. Venture capital-backed CEOs have lower incentives when measured by percentage equity ownership, but when elasticity of CEO pay to firm value is examined, incentives show no difference. Finally, we present evidence that venture capitalists, as large outside shareholders, reduce the power of the CEO to control the firm and extract private benefits. The results support the notion that venture capitalists try to improve the incentive effects of CEO equity ownership while at the same time reducing the negative, control aspects.

This paper stands in sharp contrast to previous studies that have examined CEO ownership primarily in large, established corporations. In firms where management decisions matter a lot and reputation is likely to be less important, ownership is concentrated. More detailed panel analysis would be helpful in examining the path that firms take from their early stages, which we examine in this paper, to later stages of development studied in previous work.

This paper is one of the first to examine corporate governance and equity ownership in young, entrepreneurial firms on a large scale. The relationship between CEO equity ownership

and compensation with other corporate governance mechanisms is critical to our understanding of the optimality of the mechanisms employed. For example, examination of the structure and function of boards of directors in these firms would be extremely important. Similarly, analyzing the market for corporate control or product market competition would aid in understanding the relative importance of explicit, contract-based corporate governance and more market-based competitive forces.

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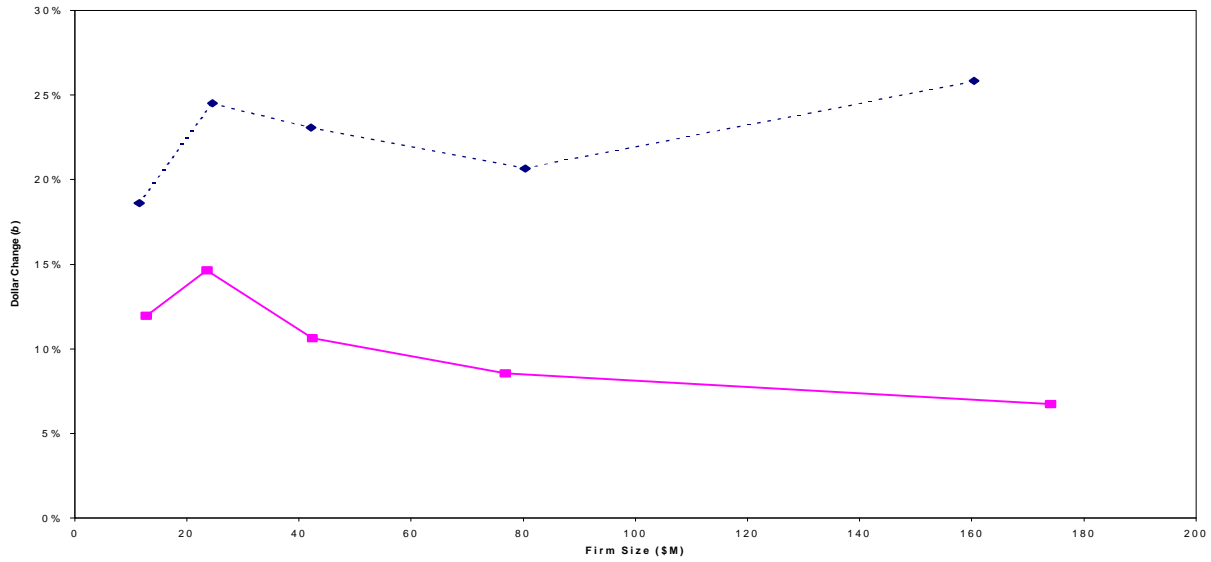
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Figure 1

Median CEO Incentives by Firm Size for Venture and Nonventure-Backed Firms. Comparison of incentives by quintile of firm size for 1,011 IPOs between 1978 and 1987. The calculation is performed separately for venture-backed firms (solid line) and nonventure-backed firms (dashed line). The two measures of incentives are CEO ownership as a percentage post-IPO shares outstanding (Figure 1A) and the elasticity of CEO pay to shareholder wealth (Figure 1B). Firm size is defined as the CRSP market value of equity at the end of the first day of trading deflated to 1987 dollars using the CPI from SBBI.

1A: CEO Equity Ownership – Venture-backed (solid) and nonventure-backed (dashed) firms



1B: Elasticity of CEO pay to shareholder wealth – Venture-backed (solid) and nonventure-backed (dashed) firms

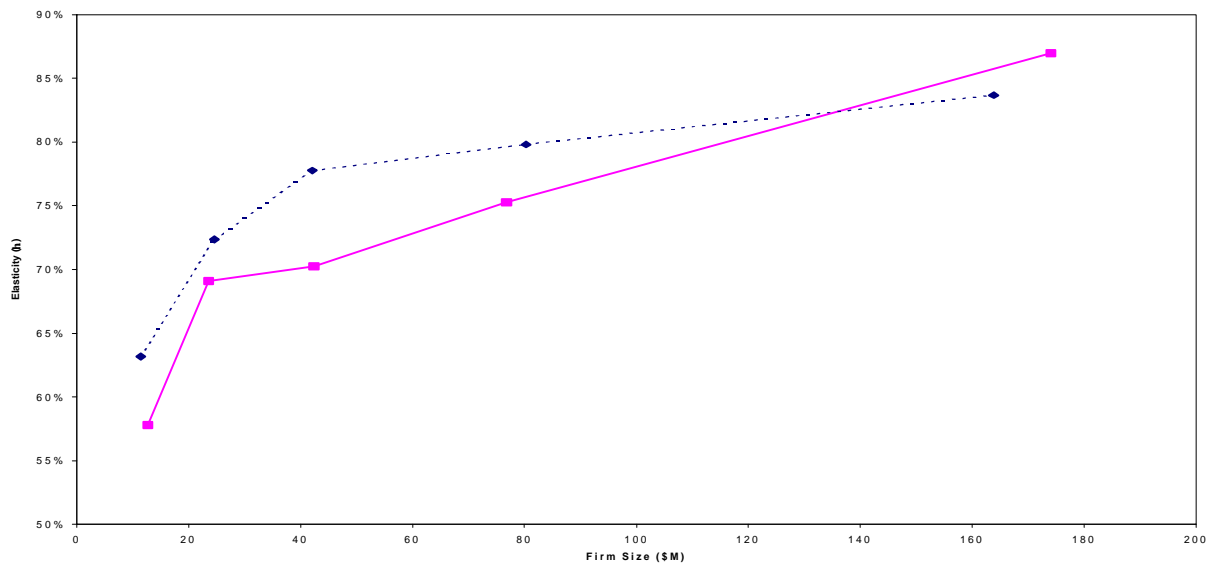


Table 1

Summary Statistics. Description of CEO compensation, CEO age and tenure, firm size and risk, and other firm characteristics for 1,011 initial public offerings (IPOs) between 1978 and 1987. The sample excludes dual-class stock, non-operating, and financial firms. In Panel A, CEO compensation data are pre-IPO equity ownership in percentage and dollars, primary shares as a percentage of shares outstanding and in dollars, options as a percentage of post-IPO shares outstanding and in dollars, shares sold as a percentage of post-IPO shares outstanding and in dollars, and total salary in dollars. The values are from the IPO prospectus and CRSP. Panel B shows the CEO age, tenure, and founder status from the IPO prospectus. Panel C shows the equity value, price times shares outstanding using CRSP data, asset value, price times shares outstanding plus long-term debt from COMPUSTAT, and industry median standard deviation, calculated with monthly stock returns from CRSP for the year prior to IPO. Panel D shows venture backing status from Gompers (1996). The other firm characteristics are the ratio of plant, property and equipment to total assets, the ratio of research and development expense to total assets, and the ratio of cash flow to sales, with all data from COMPUSTAT. Firm age is from the prospectus. All dollar figures are converted into 1987 levels using the CPI from SBBI.

	N	Median	Mean	SD	Min	Max
Panel A: CEO Compensation Data						
Pre-IPO Equity (%)	1,011	22.61	29.56	25.35	0.00	100.00
Pre-IPO Equity (\$000)	1,011	6,126.57	17,621.29	41,567.29	0.00	737,851.30
Primary Shares (%)	1,011	22.76	24.65	12.33	0.00	90.65
Primary Shares (\$000)	1,011	9,267.93	15,181.24	23,033.45	0.00	486,140.60
Options (%)	1,011	0.00	0.25	0.92	0.00	11.35
Options (\$000)	1,011	0.00	129.43	613.09	0.00	10,755.35
Shares Sold (%)	1,011	0.00	1.45	2.97	-3.14	34.60
Shares Sold (\$000)	1,011	0.00	1,143.82	3,512.30	-688.64	55,135.63
Salary (\$000)	1,011	131.99	181.49	194.00	0.00	3,675.16
Panel B: CEO Age and Tenure						
Age	1,009	46.00	46.91	8.62	24.00	78.00
Tenure (Years)	999	5.00	7.07	7.05	0.00	45.00
CEO is a Founder	997	1.00	0.56	0.50	0.00	1.00
Panel C: Firm Size and Risk						
Equity Value (\$M)	1,011	42.29	81.63	130.15	1.86	2,125.28
Asset Value (\$M)	944	49.13	87.55	129.07	1.87	2,127.84
Industry Equity SD (%)	1,011	50.27	50.47	12.57	9.15	113.55
Panel D: Other Firm Characteristics						
IPO is VC Backed	1,011	0.00	0.36	0.48	0.00	1.00
PPE Intensity (%)	744	18.99	25.31	20.57	0.00	90.62
R&D Intensity (%)	467	5.77	9.24	16.63	0.00	244.57
Cash Flow to Sales (%)	735	2.70	-4.60	33.98	-248.20	66.62
Firm Age (Years)	996	5.67	9.53	12.25	0.08	166.00

Table 2

Summary Statistics for Venture and Nonventure-backed Firms. Comparison of average CEO compensation, CEO age and tenure, firm size and risk, and other firm characteristics for 1,011 venture and nonventure-backed IPOs between 1978 and 1987. As a measure of incentives, we report the elasticity of CEO pay to shareholder wealth (h). The other variables are described in detail in Table 1. All dollar figures are converted into 1987 levels using the consumer price index from SBBI. The p-value tests the hypothesis of no difference in the venture and nonventure-backed firms.

	N	Venture Backed	Not Venture Backed	Difference	p-value
Panel A: CEO Compensation Data					
Pre-IPO Equity (%)	1,011	19.06	35.44	-16.38	<0.01
Pre-IPO Equity (\$000)	1,011	16,889.41	18,031.28	-1,141.87	0.70
Primary Shares (%)	1,011	22.98	25.59	-2.62	<0.01
Primary Shares (\$000)	1,011	20,094.74	12,428.77	7,665.97	<0.01
Options (%)	1,011	0.37	0.18	0.19	<0.01
Options (\$000)	1,011	228.04	74.20	153.84	<0.01
Shares Sold (%)	1,011	0.72	1.86	-1.14	<0.01
Shares Sold (\$000)	1,011	689.20	1,398.49	-709.29	<0.01
Salary (\$000)	1,011	142.92	203.10	-60.18	<0.01
Panel B: CEO Age and Tenure					
Age	1,009	44.78	48.10	-3.31	<0.01
Tenure (Years)	999	5.01	8.23	-3.21	<0.01
CEO is a Founder	997	0.57	0.55	0.03	0.39
Panel C: Firm Size and Risk					
Equity Value (\$M)	1,011	114.87	63.01	51.87	<0.01
Asset Value (\$M)	944	114.00	72.46	41.54	<0.01
Industry Equity SD (%)	1,011	53.64	48.69	4.95	<0.01
Panel D: Other Firm Characteristics					
PPE Intensity (%)	744	20.25	28.11	-7.86	<0.01
R&D Intensity (%)	467	10.53	8.11	2.42	0.12
Cash Flow to Sales (%)	735	-2.77	-5.61	2.83	0.25
Firm Age (Years)	996	6.82	11.08	-4.25	<0.01

Table 3

Determinants of Pre-IPO CEO Ownership. Ordinary least squares and instrumental variables regressions of ownership on venture capital backing, firm size, firm risk, and CEO characteristics for 1,011 IPOs between 1978 and 1987. The dependent variable is the percent of the firm's equity owned by the CEO prior to the initial public offering. For firm size, we use the market value of equity at the end of the first day of trading. For firm risk, we use the industry median standard deviation of monthly stock returns from CRSP for the year prior to IPO. The other independent variables are described in detail in Table 1. Instruments for venture capital backing are state of operation dummies and a categorical variable that equals one if the firm was founder after 1979. Heteroskedasticity robust t-statistics are shown in braces.

	<i>CEO Equity Ownership (%)</i>			
	Ordinary Least Squares		Instrumental Variables	
	(1)	(2)	(3)	(4)
Venture Capital Financed	-14.55 [-9.65]	-13.89 [-8.76]	-21.49 [-4.04]	-20.47 [-3.56]
log (Firm Size)		-0.76 [-0.96]		0.02 [0.02]
Firm Risk (%)		-0.09 [-1.25]		-0.06 [-0.89]
CEO Age (Years)	-0.05 [-0.49]	-0.06 [-0.63]	-0.09 [-0.86]	-0.09 [-0.90]
CEO Tenure (Years)	0.62 [3.69]	0.62 [3.68]	0.55 [3.08]	0.55 [3.08]
CEO is a Founder	14.74 [8.70]	14.71 [8.68]	14.88 [8.62]	14.89 [8.64]
Firm Controls:				
PPE Intensity (%)	0.01 [0.31]	0.01 [0.27]	0.00 [-0.03]	0.00 [-0.07]
R&D Intensity (%)	-0.14 [-2.22]	-0.13 [-2.11]	-0.10 [-1.53]	-0.10 [-1.60]
Cash Flow to Assets (%)	0.03 [1.17]	0.04 [1.28]	0.04 [1.48]	0.04 [1.39]
Firm Age (Years)	-0.10 [-1.03]	-0.11 [-1.08]	-0.12 [-1.15]	-0.12 [-1.18]
Intercept	26.27 [5.35]	33.98 [5.20]	31.34 [5.09]	34.31 [5.20]
R ²	0.22	0.22	0.21	0.21
N	901	901	891	891

Table 4

CEO Ownership of Options, CEO Shares Sold, and Primary Shares Issues. Ordinary least squares and instrumental variables regressions on venture capital backing, firm size, firm risk, and CEO characteristics for 1,011 IPOs between 1978 and 1987. The dependent variables are the level of the CEO's option ownership as a percentage of firm's pre-IPO outstanding equity, shares sold by the CEO as a percentage of pre-IPO outstanding shares and as a percentage of CEO equity holdings, and primary shares outstanding as a percentage of post-IPO shares outstanding. Instruments for venture capital are state of operation dummies and a categorical variable that equals one if the firm was founder after 1979. Heteroskedasticity robust t-statistics are shown in braces.

	<i>Ordinary Least Squares</i>				<i>Instrumental Variables</i>			
	Primary Shares (%)	Options (%)	Shares Sold (%Firm)	Shares Sold (%CEO)	Primary Shares (%)	Options (%)	Shares Sold (%Firm)	Shares Sold (%CEO)
Venture Capital Financed	0.97 [1.39]	0.21 [2.36]	-0.64 [-4.09]	-2.23 [-3.84]	-0.70 [-0.33]	0.43 [1.91]	-0.12 [-0.21]	-0.20 [-0.09]
CEO Equity Ownership (%)			4.99 [7.03]	-1.80 [-1.07]			6.11 [3.41]	1.00 [0.18]
log (Firm Size)	-5.97 [-15.35]	-0.10 [-2.37]	0.18 [2.34]	0.80 [3.29]	-5.77 [-12.23]	-0.13 [-2.39]	0.11 [1.11]	0.52 [1.41]
Firm Risk (%)	-0.08 [-2.34]	0.01 [2.27]	0.00 [0.40]	-0.03 [-1.35]	-0.06 [-1.88]	0.01 [1.96]	0.00 [0.37]	-0.03 [-1.39]
CEO Age (Years)	0.03 [0.62]	0.00 [-1.39]	-0.01 [-1.17]	-0.07 [-1.51]	0.02 [0.50]	0.00 [-0.91]	-0.01 [-0.95]	-0.06 [-1.26]
CEO Tenure (Years)	-0.33 [-4.46]	0.00 [-0.99]	0.11 [5.72]	0.41 [4.44]	-0.34 [-4.33]	0.00 [-0.36]	0.11 [5.25]	0.42 [4.06]
CEO is a Founder	-1.19 [-1.71]	-0.19 [-2.89]	-0.10 [-0.49]	-0.21 [-0.37]	-1.28 [-1.82]	-0.20 [-2.92]	-0.21 [-0.85]	-0.46 [-0.61]
PPE Intensity (%)	-0.04 [-1.84]	0.00 [1.01]	-0.01 [-2.62]	-0.04 [-2.72]	-0.04 [-1.80]	0.00 [1.38]	-0.01 [-2.57]	-0.04 [-2.65]
R&D Intensity (%)	-0.11 [-2.80]	0.00 [0.47]	0.00 [-0.70]	-0.01 [-0.51]	-0.10 [-2.57]	0.00 [0.20]	-0.01 [-0.81]	-0.01 [-0.69]
Cash Flow to Assets (%)	-0.07 [-4.00]	0.00 [-0.78]	0.01 [3.00]	0.04 [3.72]	-0.07 [-3.77]	0.00 [-0.81]	0.01 [2.68]	0.03 [3.55]
Firm Age (Years)	0.06 [0.63]	0.00 [-0.65]	-0.01 [-1.92]	-0.06 [-1.05]	0.05 [0.58]	0.00 [-0.41]	-0.01 [-1.95]	-0.06 [-1.12]
Intercept	53.43 [16.98]	0.49 [2.13]	0.08 [0.08]	7.05 [2.74]	52.87 [16.92]	0.47 [2.04]	-0.09 [-0.08]	6.51 [2.34]
R ²	0.37	0.05	0.24	0.14	0.37	0.04	0.24	0.13
N	901	901	901	878	891	891	891	868

Table 5

Changing Ownership at IPO. The impact of shares sold, options, and primary shares on CEO ownership. The CEOs are divided into four groups, those with and without options and those selling and not selling shares.

	CEOs Options No Sales (1)	CEOs Options Sales (3)	CEOs No Options No Sales (2)	CEOs No Options Sales (4)	All CEOs (5)
Panel A: Venture Capital-backed Firms					
Number of Firms	66	20	151	126	363
CEO is Founder	0.38	0.50	0.53	0.75	0.57
Age	45.21	44.15	45.21	44.14	44.78
Tenure	4.03	5.10	4.39	6.26	5.01
Pre-IPO ownership without options (%)	9.39	12.13	18.19	26.26	19.06
Primary Shares Effect (%)	2.69	2.46	4.75	4.98	4.33
Options Effect (%)	1.63	1.34	0.00	0.00	0.37
Sales Effect (%)	0.00	0.86	0.00	1.95	0.72
Post-IPO ownership with options (%)	8.33	10.15	13.44	19.33	14.38
Panel B: Non-Venture Capital-backed Firms					
Number of Firms	76	22	303	247	648
CEO is Founder	0.38	0.55	0.54	0.60	0.55
Age	46.09	44.09	48.61	48.45	48.10
Tenure	5.57	8.41	6.30	11.40	8.23
Pre-IPO ownership without options (%)	14.73	36.04	32.76	45.05	35.44
Primary Shares Effect (%)	5.39	8.99	9.55	8.80	8.76
Options Effect (%)	1.19	1.12	0.00	0.00	0.18
Sales Effect (%)	-0.09	2.44	0.00	4.69	1.86
Post-IPO ownership with options (%)	10.62	25.73	23.20	31.57	25.00

Table 6

CEO Incentives. Average pay elasticity for 1,011 IPOs between 1978 and 1987. Incentives are measured by h , the elasticity of CEO pay to shareholder wealth.

$$h = \frac{dW^{CEO}/W^{CEO}}{dE/E} = \frac{E^{CEO}}{W^{CEO}} * 1 + \frac{O^{CEO}}{W^{CEO}} * \left(\Delta \frac{P}{c} \right) + \frac{S^{CEO}}{W^{CEO}} * 0.1$$

CEO equity (E^{CEO}) is equal to the CEO ownership percentage times total equity. CEO options (O^{CEO}) are calculated using the Black-Scholes formula. The present value of CEO salary is salary until retirement discounted at a real rate of 3%. Years-to-retirement is the larger of 65 minus CEO age and three. The elasticity of the CEO options to shareholder wealth is equal to Black-Scholes delta (Δ) times the first-day closing price (P) divided by the Black-Scholes option value (c). The elasticity of CEO salary to shareholder wealth is assumed to be 0.1, a level reported in previous large-firm studies. CEO pay is equal to the sum of CEO equity, options, shares sold, and salary.

	Percentage of CEO Pay	Elasticity	Contribution to h	Percentage of Mean h
Panel A: Elasticity of CEO Pay to Shareholder Wealth (h) * 100 for Venture Capital-backed Companies				
CEO Equity (E^{CEO})	66.40	1.00	66.40	91.59
CEO Options (O^{CEO})	2.97	1.13	3.34	4.61
CEO Salary	27.58	0.10	2.76	3.80
CEO Shares Sold	3.05	0.00	0.00	0.00
Average h			72.50	100.00
Standard Deviation			18.05	24.90
Minimum			10.00	13.79
Maximum			99.68	137.49
Median h			76.19	105.09
Panel B: Elasticity of CEO Pay to Shareholder Wealth (h) * 100 for Non-Venture Capital-backed Companies				
CEO Equity (E^{CEO})	65.65	1.00	65.65	90.55
CEO Options (O^{CEO})	1.38	1.18	1.63	2.25
CEO Salary	28.55	0.10	2.86	3.94
CEO Shares Sold	4.41	0.00	0.00	0.00
Average h			70.13	96.74
Standard Deviation			21.38	29.49
Minimum			10.00	13.79
Maximum			100.00	137.94
Median h			75.31	103.88

Table 7

Determinants of CEO Incentives. Ordinary least squares and instrumental variables regressions of incentives on venture capital backing, firm size, firm risk, and CEO characteristics for 1,011 IPOs between 1978 and 1987. The dependent variable is the elasticity of CEO pay to shareholder wealth (h). For firm size, we use the market value of equity at the end of the first day of trading. For firm risk, we use the industry median standard deviation of monthly stock returns from CRSP for the year prior to IPO. The other independent variables are described in detail in Table 1. Instruments for venture capital backing are state of operation dummies and a categorical variable that equals one if the firm was founder after 1979. Heteroskedasticity robust t-statistics are shown in braces.

	<i>Post-IPO CEO Ownership (%)</i>				<i>Elasticity of CEO Wealth (h) * 100</i>			
	Ordinary Least Squares		Instrumental Variables		Ordinary Least Squares		Instrumental Variables	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Venture Capital Financed	-9.33 [-8.30]	-9.91 [-8.28]	-14.99 [-3.83]	-15.35 [-3.61]	3.85 [2.95]	0.04 [0.03]	4.92 [1.17]	-0.79 [-0.18]
log (Firm Size)		1.18 [1.95]		1.82 [2.33]		6.29 [8.94]		6.35 [7.03]
Firm Risk (%)		-0.04 [-0.74]		-0.02 [-0.45]		0.08 [1.47]		0.08 [1.45]
CEO Age (Years)	-0.02 [-0.25]	-0.02 [-0.25]	-0.05 [-0.67]	-0.04 [-0.57]	0.48 [6.33]	0.52 [7.09]	0.49 [6.10]	0.52 [6.80]
CEO Tenure (Years)	0.48 [3.75]	0.46 [3.60]	0.41 [3.07]	0.40 [2.93]	0.14 [1.10]	0.09 [0.64]	0.14 [1.04]	0.07 [0.49]
CEO is a Founder	10.93 [8.82]	11.06 [8.88]	11.10 [8.77]	11.25 [8.87]	12.86 [9.35]	13.42 [10.25]	12.95 [9.38]	13.47 [10.24]
PPE Intensity (%)	0.04 [1.17]	0.03 [0.95]	0.02 [0.73]	0.02 [0.49]	0.10 [2.69]	0.08 [2.29]	0.11 [2.86]	0.08 [2.29]
R&D Intensity (%)	-0.06 [-1.45]	-0.06 [-1.57]	-0.02 [-0.57]	-0.04 [-0.93]	0.03 [0.37]	-0.02 [-0.36]	0.02 [0.28]	-0.02 [-0.27]
Cash Flow to Assets (%)	0.05 [2.39]	0.03 [1.75]	0.06 [2.60]	0.04 [1.83]	0.07 [2.51]	0.02 [0.61]	0.07 [2.38]	0.02 [0.69]
Firm Age (Years)	-0.07 [-0.87]	-0.07 [-0.92]	-0.07 [-0.97]	-0.08 [-0.99]	-0.23 [-2.58]	-0.24 [-2.46]	-0.23 [-2.60]	-0.24 [-2.50]
Intercept	16.06 [4.36]	13.86 [2.95]	20.28 [4.32]	14.50 [3.04]	38.29 [9.84]	10.67 [2.24]	37.29 [7.59]	10.77 [2.25]
R ²	0.21	0.22	0.20	0.20	0.17	0.27	0.18	0.27
N	901	901	891	891	901	901	891	891

Table 8

Ownership Structure. Inside and outside ownership for venture and nonventure-backed firms. Ownership data is limited to the CEO and members of the board of directors listed in the IPO prospectus and is calculated as a percentage of post-IPO shares outstanding. In Panel A, insiders are current and former employees and their relatives. Panel B shows the five largest outsider owners on the board of directors. Panel C shows the Shapley Value, which is the probability that the insiders collectively are pivotal in random orderings of shareholders.

	N	Venture Backed	Not Venture Backed	Difference
Panel A: Insider Ownership Percentage				
CEO	1,011	14.01	24.82	-10.82
Other Insiders		7.83	16.10	-8.27
Total Insiders		21.83	40.92	-19.08
Panel B: Outsider Ownership Percentage				
Largest Outside Owner	1,011	9.91	4.03	5.88
2 nd Outside Owner		4.61	1.21	3.39
3 rd Outside Owner		1.99	0.46	1.53
4 th Outside Owner		0.72	0.14	0.58
5 th Outside Owner		0.25	0.05	0.20
Total Outsiders		17.48	5.90	11.58
Panel C: Insider Shapley Value * 100				
Shapley Value	1,011	26.43	60.89	-34.47

Table 9

Venture Capitalists and Control. Ordinary least squares and instrumental variables regressions of the insider Shapley Value and CEO salary on venture backing and firm and CEO characteristics. The Shapley Value is the probability that the insiders collectively are pivotal in random orderings of shareholders. For firm size, we use the market value of equity at the end of the first day of trading. For firm risk, we use the industry median standard deviation of monthly stock returns from CRSP for the year prior to IPO. The other independent variables are described in detail in Table 1. Instruments for venture capital backing are state of operation dummies and a categorical variable that equals one if the firm was founder after 1979. Heteroskedasticity robust t-statistics are shown in braces.

	<i>Shapley Value * 100</i>		<i>Log Salary (\$87)</i>	
	OLS	IV	OLS	OLS
	(1)	(2)	(3)	(4)
Venture-Backed	-32.82	-43.50	0.0373	-0.0371
	[-13.64]	[-5.01]	[0.68]	[-0.70]
Shapley Value			0.3893	0.3311
			[5.63]	[5.79]
Venture-Backed * Shapley Value			-0.2956	-0.1791
			[-2.51]	[-1.68]
log (Firm Size)	-0.31	0.91		0.2452
	[-0.27]	[0.59]		[12.99]
Firm Risk (%)	-0.11	-0.08		-0.0020
	[-1.12]	[-0.83]		[-1.34]
CEO Age (Years)	-0.24	-0.30		0.0038
	[-1.59]	[-1.91]		[1.75]
CEO Tenure (Years)	0.78	0.64		0.0149
	[3.51]	[2.61]		[4.60]
CEO is a Founder	14.86	15.35		-0.1395
	[6.07]	[6.16]		[-3.90]
Firm Controls:				
PPE Intensity (%)	0.04	0.02		0.0006
	[0.61]	[0.30]		[0.63]
R&D Intensity (%)	-0.14	-0.10		-0.0001
	[-1.35]	[-0.91]		[-0.06]
Cash Flow to Sales (%)	0.08	0.09		0.0034
	[1.77]	[1.91]		[3.69]
Firm Age (Years)	-0.16	-0.16		0.0039
	[-1.16]	[-1.17]		[2.21]
Intercept	66.19	68.13	4.7926	3.7511
	[6.71]	[6.81]	[104.41]	[24.09]
R ²	0.26	0.25	0.05	0.37
N	901	891	1006	898