

**GIVE EVERYONE A PRIZE? EMPLOYEE STOCK OPTIONS IN  
PRIVATE VENTURE-BACKED FIRMS**

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This version: October 6, 2006

**Keywords:** Employee stock options; Option grant depth; Private venture-backed firms.

I am grateful to two anonymous reviewers, J. Abarbanell, R. Bushman, G. Foster, C. Karuna, W. Landsman, T. Lys, E. Maydew, P. Oyer, P. Phan, C. Shi, E. Talmor, H. Zhang, and workshops at UNC Chapel Hill and UC Irvine for comments. B. Hughes and VentureOne generously granted me access to their proprietary compensation and valuation databases. Financial support came from the Edward O'Herron, Jr. Fund for Distinguished UNC Faculty and the UNC Center for Entrepreneurship. Key data items used in this study were obtained under a nondisclosure agreement and may not be shared without prior approval from VentureOne.

# GIVE EVERYONE A PRIZE? EMPLOYEE STOCK OPTIONS IN PRIVATE VENTURE-BACKED FIRMS

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## ABSTRACT

This study is the first to examine employee stock options in private entrepreneurial companies. I focus on private U.S. venture-backed firms because they are renowned for the intensity and organizational depth of their stock option grants. Contrary to simple stereotype, however, I show that 27% of such firms do *not* grant stock options to all employees. I seek to explain this by theorizing that even in a business environment dominated by technology assets, high levels of uncertainty, and intense information asymmetry—the archetypal economic setting for venture-backed companies—the costs of using stock options to attract, compensate, incent, monitor, and retain certain employees can exceed the benefits. I test the theory by determining whether variation in the organizational depth to which venture-backed firms grant employee stock options can be explained by proxies for both the economic costs and benefits of the stock option grant depth decision. These proxies include the fraction of employees who are in technical positions; the firm’s organizational flatness; its proximity to other venture-backed companies; the number of patents it has been granted; and the fraction of equity held by venture investors. The empirical results support the theory and imply that venture-backed firms grant employee stock options in a sophisticated manner that reflects many of the economic costs and benefits involved.

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## EXECUTIVE SUMMARY

Stock options have long been seen by firms and investors in the venture capital subsector of entrepreneurship as critical mechanisms, through which technology-intensive and highly risky startups are able to attract, compensate, incent, monitor, and retain the right employees. Indeed, the venture community uniformly argues that without employee stock options, firms such as Apple, Genentech and Google would never have been able to create the dramatic new products, drugs, services, and societal wealth that they have over the past thirty years.

Despite the importance of employee stock options to many private companies, scholarly research has focused entirely on older, more mature publicly traded firms. My study aims to be the first research to at least partially close this gap by analyzing employee stock options in pre-IPO venture-backed U.S. firms, an important subset of all private companies. While relatively few in number, venture-backed firms are an increasingly important source of employment, innovation, revenues, and equity value in economies the world over.

The particular focus of my paper is the organizational depth to which private U.S. venture-backed firms grant stock options. This is because although venture-backed firms are highly renowned for the comprehensive breadth and inclusiveness of their employee stock option grants, I show that contrary to simple stereotype, more than a quarter of them do *not* grant stock options to all their employees.

I argue that this unexpected finding can best be understood by theorizing that in a business environment dominated by technology assets, high levels of uncertainty, and intense information asymmetry—that is, the prototypical economic setting for venture-backed firms—the costs of using stock options can exceed the benefits. When the costs do exceed the benefits, sophisticated and rational top management will intentionally not give stock options to certain numbers or types of employees.

I test my hypothesis by evaluating the extent to which variation in the organizational depth to which venture-backed firms grant employee stock options can be explained by proxies

for the economic costs and benefits of the stock option grant decision. The proxies I use include the cash compensation of the firm's lowest-paid employee; the fraction of a firm's employees who are in technical positions; the firm's organizational flatness; its proximity to other venture-backed companies; the number of patents it has been granted; the fraction of equity held by venture investors; and the age of the firm. The idea behind the empirical analysis is that in a regression of the fraction of employees granted options on proxies for the economic costs and benefits involved in the grant decision, estimated proxy coefficients that are significantly in the predicted direction are supportive of (although do not definitively prove) the underlying theory.

For my tests, I use a large, detailed, and recent survey-based dataset provided by VentureOne. VentureOne's proprietary data enable me to overcome one of the most significant barriers to researching employee stock options in private companies, namely that U.S. regulators make no requirements that private firms have to disclose information about the stock options that they grant to their employees. Moreover, unlike data used for research into broad-based employee stock option plans in public companies, VentureOne's dataset reports the exact fraction of employees who receive stock options.

My empirical findings demonstrate that the majority of the estimated coefficients on the proxies for the costs and benefits of granting employees stock options are significant and in the predicted directions. This implies that venture-backed firms do not unthinkingly grant stock options to all their employees. Instead, they act as if they weigh the economic costs and benefits involved and set the organizational stock option grant depth in a quite sophisticated manner.

I interpret these results as boding well for the efficient allocation of entrepreneurial capital and labor in the highly uncertain but crucially important formative stages of technology-intensive firms' life-cycles. I also conclude that further theoretical and empirical research into the full set of compensation mechanisms used by private firms to solve common agency and human resource problems facing entrepreneurs and entrepreneurial firms—of which stock options are but one part—is both warranted and likely to be worthwhile.

## 1. INTRODUCTION

This study is the first to examine employee stock options in private entrepreneurial companies. Stock options have long been seen by firms and investors in the venture capital subsector of entrepreneurship as critical mechanisms through which technology-intensive and highly risky startups are able to attract, compensate, incent, monitor, and retain the right employees. Many argue that without stock options, firms such as Apple, Genentech, and Google either might not exist, or at best would have been severely hampered in their ability to create new technologies, products, and wealth (Heesen, 2004). To date, however, academic research into employee stock options has centered exclusively on publicly traded firms (e.g., Blasi et al., 1996; Yermack, 1995, 1997; Core and Guay, 2001; Ittner et al., 2003; Murphy, 2003; Oyer, 2004; Oyer and Schaefer, 2005; Lam and Ho, 2006; Yanadori and Marler, 2006).

My paper seeks to partially redress this imbalance by exploring how and why employee stock options are granted in private venture-backed U.S. companies (hereafter denoted as ‘venture-backed firms’). Although venture-backed firms make up only a small fraction of all privately held U.S. companies, they are an important entrepreneurial subset to study because of their disproportionate impact on U.S. employment, innovation, revenues, and equity values (Gompers and Lerner, 2001; NVCA, 2004; Stolis and Goodman, 2004). They have also been much studied by scholars in a wide range of business disciplines, including accounting (e.g., Hand, 2005), entrepreneurship (e.g., Dushnitsky and Lenox, 2005), finance (e.g., Kaplan and Strömberg, 2004) and strategy (e.g., Shepherd et al., 2000; Campbell et al., 2003).

Venture-backed firms are particularly renowned for the inclusiveness and intensity of the stock options that they grant, such that the stereotypical view of a venture-backed firm is that it ‘gives every employee a prize’ in the form of stock options, no matter their what their position in the organization. However, using a large proprietary dataset provided by a leading venture capital research firm, VentureOne, I show that this stereotypical view is incorrect. Specifically, some 27% of U.S. venture-backed firms do *not* grant stock options to all their employees, and within this group, the mean fraction of employees not granted stock options is 39%.

I argue that this finding can be understood by theorizing that in a business environment dominated by intangible technology assets, high levels of uncertainty, and intense information asymmetry—the prototypical economic setting for venture-backed firms (Gompers and Lerner,

2000)—the economic costs of using stock options can exceed the benefits. When they do, management may rationally choose not to give stock options to certain employees.

I test this hypothesis by evaluating the extent to which cross-sectional variation in the organizational depth to which venture-backed firms grant employee stock options (denoted *FRACOP*) can be explained by proxies for the economic costs and benefits of the stock option grant decision. I develop a model of *FRACOP* that significantly extends the conceptual and empirical framework used by scholars that have examined the determinants of broad-based stock option plans in public companies (Core and Guay, 2001; Hillegeist and Peñalva, 2003; Oyer and Schaefer, 2005). Many of the cost and benefit proxies I use are unavailable in public companies, such as the cash compensation of the firm's lowest paid employee; the fraction of a firm's employees who are in technical positions; the firm's organizational flatness; and its geographic proximity to other venture-backed companies. The idea behind my empirical analysis is that in a regression of the fraction of employees granted options on proxies for the economic costs and benefits involved in the grant decision, estimated proxy coefficients that are significantly in the predicted direction are supportive of (although do not per se prove) the theory.

Beyond its size, scope, and recency, VentureOne's proprietary data also enable me to overcome one of the significant barriers to researching employee stock options in private companies, namely that U.S. regulators do not require private firms to disclose information about the stock options that they grant to their employees. Moreover, unlike research into broad-based employee stock option plans in public companies, VentureOne reports the exact fraction of employees who receive stock options. The empirical results demonstrate that the majority of the estimated coefficients on the proxies for the costs and benefits of granting employees stock options are significant and have the predicted signs. My findings imply that venture-backed firms do not mechanically grant stock options to all their employees. Instead, they act as if they weigh the economic costs and benefits that are involved and grant employee stock options in a sophisticated manner.

In conclusion, I interpret the results of this study as boding well for the efficient allocation of capital and labor in the highly uncertain but crucially important early stages of technology-intensive firms' life-cycles. I also conclude that further research into the full set of compensation mechanisms used by private firms to solve agency and information asymmetry problems—of which stock options are but one part—is likely warranted and worthwhile.

The remainder of the paper proceeds as follows. Section 2 motivates the paper's focus on employee stock options in venture-backed private firms. Section 3 develops the theory behind *FRACOP* and its model specification. Section 4 describes VentureOne's database and reports descriptive statistics on key firm characteristics. Section 5 explains the econometric methods employed and details the empirical test results, and Section 6 concludes.

## 2. MOTIVATION

Over the past thirty years, employee stock options have steadily grown to be the largest and most academically scrutinized component of senior management's compensation packages (e.g., Hall and Murphy, 2003; Murphy, 1999, 2003; and the references therein). More recently, attention has begun to be paid to stock options granted to middle- and low-level employees through the study of broad-based stock option plans, where they exist (Blasi et al., 1996; Core and Guay, 2001; Ittner et al., 2003; Oyer, 2004; Oyer and Schaefer, 2005).

Although much has been learned from this literature, it is limited in the sense that it is based on the theoretical and empirical analyses of *publicly traded* companies. Very little scholarship exists that focuses on understanding the causes or consequences of employee stock options in *private* firms.<sup>1</sup> I argue that rectifying this gap is important for four reasons.

First, not only does most entrepreneurship take place in private companies, but the risks and rewards of equity ownership are a key feature of entrepreneurial compensation. Whether entrepreneurship is defined as the creative destruction across markets via the conversion of new ideas into successful businesses (Schumpeter, 1950), or the taking of personal risk in the pursuit of uncertain business opportunities (Knight, 1967; Drucker, 1970), entrepreneurship manifests itself most strongly in the starting of, or working for, firms by *founders and employees alike* who are intent on creating and exploiting opportunities that could make them as part-owners wealthy. In this regard, stock options are the central means by which employees are made part-owners.

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<sup>1</sup> For example, a search of the abstracts, titles, and keywords of volumes 1-21 of the *Journal of Business Venturing* for the string "stock option" yielded one study that relates to employee stock options in private companies (Chua and Woodward, 1993). Similar searches of a wide variety of economics, entrepreneurship, finance, and management journals yielded no studies with that same focus. A search made on 6/19/06 of [www.ssrn.com](http://www.ssrn.com) for the words "stock" and "option" and either "private" or "venture" in the Abstract field yielded no papers that directly relate to stock options in private firms. Gompers and Lerner's seminal text *The Venture Capital Cycle* (2000), which summarizes and expands a large amount of research on venture-backed companies, mentions employee stock options in the context of compensation and/or the solution of agency problems between entrepreneurs and venture investors only once (p. 131). The same was true in Gompers and Lerner's text *The Money of Invention: How Venture Capital Creates New Wealth* (2001, p. 54).

Second, employee stock options have long been seen by technology entrepreneurs and venture capitalists as being vital mechanisms through which high-risk, high-return startups are able to attract, compensate, incent, monitor, and retain the right kinds of employees. Although venture-backed firms are only a small fraction of U.S. private companies (Fenn et al., 1995; Moskowitz and Vissing-Jørgensen, 2002), they are a large source of employment, innovation, revenues and new wealth (Gompers and Lerner, 2000, 2001; Grady, 2004; NVCA, 2004; Stolis and Goodman, 2004). In 2003, venture-backed firms employed over 10 million U.S. workers and generated \$1.8 trillion in sales, equal to 9.4% of U.S. private sector employment and 9.6% of company sales. One of the main reasons for the growing influence of venture-backed companies is that they consist of almost exclusively of young, technology-driven companies from which many new discoveries and patents are created (Kortum and Lerner, 2000; NVCA, 2004). As such, it is worthwhile to understand how and why they use or misuse employee stock options.

Third, although one would expect that many of the fundamental determinants and effects of stock options in venture-backed firms would be the same as those in public companies, private venture-backed firms exist in a markedly more extreme and potentially more informative setting than do public companies. As emphasized by Wright and Robbie (1998) and Gompers and Lerner (2000), technology entrepreneurs and venture investors face incentive, risk, and information problems that are typically far greater than those experienced by managers in public companies. Technology entrepreneurs and venture investors concentrate in economic sectors or industries where there is high technological and customer uncertainty, intense information asymmetry, substantial intangible assets, and rapid competitive entry and exit. As a result, both the costs arising from agency problems, and the benefits from solving them, are very high.

Finally, the distinctiveness of venture-backed firms' economic setting can lead to new questions being asked, new theories being developed, and/or new data being brought to bear—not simply the replication of findings that already exist for public companies. This is the case in my study, in that I am able to significantly extend the conceptual framework used by scholars that have examined the determinants of broad-based stock option plans in public companies; to measure the organizational depth to which employee stock options are granted more accurately than has been possible in public company studies; and to develop new and/or more precise proxies for the economic costs and benefits that theory suggests will determine the stock option grant depth.

### 3. THEORY

#### 3.1 Overview

Although there are many research-relevant dimensions of employee option plans in venture-backed firms, in this study I focus on understanding the organizational depth to which venture-backed firms grant stock options. This is because while venture-backed firms are renowned for the inclusiveness and intensity of their employee stock option grants (White, 2003; Grady, 2004), I find that, contrary to stereotype, 27% of them do *not* grant stock options to all employees, and in this group, the mean fraction of employees not granted stock options is 39%.

I argue that this somewhat unexpected result can best be understood by theorizing that management of private venture-backed firms are rational, and as such, will intentionally not give stock options to certain numbers or types of employees when the corporate costs of granting those stock options exceed the benefits. I now turn to flesh out this theory by modeling the costs and benefits that I propose are involved, given the economic setting that venture-backed firms operate in, namely a business environment dominated by technology assets, high levels of uncertainty and intense information asymmetry.

#### 3.2 *A Model of the Organizational Depth to Which Venture-Backed Firms Grant Employee Stock Options (FRACOP)*

The starting point for my model is a conventional agency-theory framework in which venture investors delegate to managers the decision rights over employee compensation.<sup>2</sup> In turn, managers set the fraction of employees who receive stock options, *FRACOP*, at the level that optimally attracts, compensates, incents, monitors, and retains employees, bearing in mind the associated corporate-level costs and benefits involved.

I model *FRACOP* as a function of a variety of the economic factors that typically characterize the microeconomic business and technology landscape facing private venture-backed firms: intangible technology assets, uncertainty, risk, and growth options. Specifically, I hypothesize that cross-sectional variation in *FRACOP* is associated with the following variables in a linear manner:

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<sup>2</sup> This approach is similar to that pursued by scholars who have studied broad-based employee stock option plans in public companies. I summarize the public company literature in Appendix A.

$$\begin{aligned}
FRACOP_i = & \alpha_0 + \alpha_1 \ln(\text{Cash compensation in \$000s of the lowest-paid employee}_i) \\
& + \alpha_2 \text{Fraction of employees who are Technical}_i \\
& + \alpha_3 \ln(1 + \{\# \text{ VPs per employee}_i\}) \\
& + \alpha_4 \text{Fraction of sample firms in same tel. area code}_i \\
& + \alpha_5 \ln(1 + \# \text{ Patents granted}_i) \\
& + \alpha_6 \ln(\text{One-year-ahead forecasted employee growth}_i) \\
& + \alpha_7 \ln(\text{One-year-ahead forecasted revenue growth}_i) \\
& + \alpha_8 \text{Fraction of shares held by venture investors}_i \\
& + \alpha_9 \ln(1 + \text{Firm age in years}_i) \\
& + \beta_{10} \text{Health sector dummy}_i + \beta_{11} \text{IT sector dummy}_i + \beta_{12} \text{Retail/Service sector dummy}_i \\
& + \beta_{13} \ln(1 + \# \text{ Years since most recent funding round}_i) \\
& + \beta_{14} \text{Indicator for 2005}_i + \varepsilon_i
\end{aligned} \tag{1}$$

Several of the variables in equation (1) derive from prior work that has examined general aspects of stock options granted to and held by senior managers in public companies. Others come from more recent research into stock options granted to lower-level employees in public firms. Yet others are new to the literature due to the unique data available for venture-backed firms. For purposes of robustness, I estimate not only equation (1) per se, but also a more limited version of equation (1) in which *FRACOP* is replaced by a binary variable *FRACOP*{0,1}, and a version of equation (1) using only the subset of observations for which *FRACOP* < 1. *FRACOP*{0,1} is defined as being identical to *FRACOP* except that values of *FRACOP* less than one are recoded as zero. In subsections 3.2.1 – 3.2.9, I describe each explanatory variable and predict its sign under the assumption that firm management is economically sophisticated.

### 3.2.1 Cash compensation of the lowest-paid employee

When a young technology company receives its first injection of venture capital, venture investors take an active role in helping the founder(s) to professionalize its management by assisting in the hiring of key senior-level business, scientific, and technical personnel (Hellman, 2000; Hellman and Puri, 2002). The marginal product of such employees in creating equity value will be high. However, as venture-backed companies grow, their hiring will become more oriented toward lower-level employees, whose marginal product is far lower. This, together with high incentives facing low-level employees to free ride off the value-creation activities of more senior employees (Alchian and Demsetz, 1972; Holmstrom, 1982), leads to the prediction that as

the number of employees increases, it becomes unprofitable to incent and/or compensate employees deep in the organization using stock options.

To test this prediction, I use the total annual cash compensation of a firm's lowest-paid employee (subject to a minimum of \$10,000) rather than the number of employees for two reasons. First, it might be that it is always optimal to grant options to a fixed number of any firm's most senior executives. This would create an artificial negative correlation between *FRACOP* and the number of employees. Second, the cash compensation earned by the firm's lowest-paid employee is arguably a more direct measure of the marginal product of the class of employees for which granting stock options is profitable for marginal productivity/free riding reasons. The prediction that follows from using the cash compensation of the lowest-paid employee in equation (1) is that  $\alpha_1 > 0$ .

### 3.2.2 *Technical employees*

I hypothesize that *FRACOP* will be positively related to the fraction of employees employed in technical positions, viz.,  $\alpha_2 > 0$ . Venture-backed firms greatly rely on technology to create value.<sup>3</sup> As a result, employees working in technical areas such as engineering, IT, and R&D will have a greater ability to affect equity value than will other employees, leading them to be better incentivized and more likely to be retained through stock options (Ittner et al., 2003).

### 3.2.3 *Organizational flatness*

Rajan and Zingales (2001) propose that in the early years of a firm's life, the entrepreneur must provide incentives to her employees to develop, rather than expropriate, the firm's key assets or 'business model.' However, in order to extract the rents inherent in her business model, she has to give her employees access to the critical resources that are required for production. This increases the likelihood that those employees will steal those resources. Rajan and Zingales propose that the entrepreneur can mitigate this concern by creating a flat, rather than hierarchical, organizational structure, because then no one subordinate will have enough organizational power to overcome her. In turn, the dampening effect that such flattening has on the employees'

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<sup>3</sup> Technology is the set of methods and innovations that enable existing physical resources to be transformed into new physical resources. The reconfiguring of physical objects that technology makes possible boosts productivity, spawns new opportunities for profit, and ultimately drives economic growth (Romer, 1999).

incentives to invest in specialized human capital is overcome by spreading the expected rents from ownership widely by granting stock options broadly within the organization.

Such reasoning leads to the prediction that there will be a positive association between *FRACOP* and the extent of the firm's organizational flatness, viz.,  $\alpha_3 > 0$ . The proxy that I use for the flatness of a firm is the number of vice presidents it has per employee. The position of vice president is a common and visible boundary between lower-level employees and senior management. As in Rajan and Zingales' model, the typical VP also has a material but not a dominant amount of power and responsibility. Therefore, I propose that the higher the density of a firm's VPs, the organizationally flatter the firm.<sup>4</sup>

### 3.2.4 *Linking employees' compensation to labor market conditions*

Venture-backed firms' technology-dominated assets lead them to want to retain employees with strong business, scientific, or technical abilities, especially when the labor markets for such employees are tightest. Although stock options with multiyear vesting periods are widely viewed as a powerful way to retain such personnel, until recently it was unclear why firms would choose stock options as the retention mechanism when they could achieve the same goal using any type of compensation that would be forfeited were the employee to leave the firm.

Oyer (2004) provides a solution to this puzzle centered on the assumptions that employee turnover and pay parameter adjustments (such as the cutting of nominal pay) are costly, and firms' stock prices are positively related to the tightness of the labor market(s) they face. Oyer proposes that firms use stock options to retain employees because they index the value of employees' deferred compensation to the value of their outside opportunities. That is, stock options ensure that the value of an employee's total compensation is highest precisely when her outside opportunities are greatest and lowest when her opportunities are fewest. In Oyer's model, broad-based stock option plans are more likely the larger are the costs that firms face in replacing employees, the higher the variance of common shocks to firms in a given labor market, the greater employees' risk tolerance, and the higher the variance in local market wages.

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<sup>4</sup> As noted by Rajan and Wulf (2004), there is little research that systematically characterizes the structure of organizational hierarchies across firms. This is mainly due to a lack of publicly available data on firms' personnel positions beyond that required to be disclosed in SEC filings (i.e., compensation of the five most highly compensated executive officers). Rajan and Wulf measure organizational flatness as the number of positions between the CEO and the divisional CEO, where the division is the lowest level of profit center responsibility for a business unit. The dataset that I use does not have this information.

Based on Oyer's model, I hypothesize that *FRACOP* will be positively related to the geographic density of venture-backed firms, under the argument that the greater their geographic density, the higher will be the variance of common shocks that they face and the higher will be the variance in local market wages (Oyer, 2004, p. 1631–1632). The variable that I use to measure the geographic density of venture-backed firms is the fraction of the sample that shares a given telephone area code. In terms of equation (1), the prediction on this independent variable is therefore that  $\alpha_4 > 0$ .

### 3.2.5 *Retaining expert human capital*

As noted in Section 3.2.2, venture-backed firms hire a large number of employees with expert technical and scientific human capital because their assets and growth options are technology-intensive. I therefore predict that the importance of retaining employees using stock option grants made deeply into the organization will be increasing in the importance of both firms' technology-based assets-in-place and their technology-based longer-term growth options.

As proxies for the former, I use the one-year-ahead forecasts made by management of their firm's growth rate in employees and in revenues. This supposes that these measures are associated with the short-term benefits that are expected to be realized from current or near-term technology assets. In contrast, I use the number of patents already granted to the firm as a proxy for the firm's longer-term technology-based growth option assets. Because of its strong relationship to R&D, the number of patents has been used as a measure of the firm's long-horizon growth options in young firms such as venture-backed biotech companies (e.g., Lerner, 1994). For all three variables, the prediction in equation (1) is that there will be a positive relation between the variable and *FRACOP* (viz.,  $\alpha_5 > 0$ ,  $\alpha_6 > 0$ ,  $\alpha_7 > 0$ ).

### 3.2.6 *Efficient monitoring of managers by venture investors*

Agency theory suggests that investors may use stock options as a substitute for direct monitoring of managers because doing so helps align the unobservable portion of managers' actions toward maximizing firm value rather than consuming perquisites or free riding. If so, then venture capital investors, who usually comprise the largest set of shareholders in a venture-backed firm, will rely more on employee stock options the weaker their ability to directly monitor the firm's employees. I propose that the smaller the venture investors' interests in a

firm's equity, the more likely this situation is to occur (Ittner et al., 2003). The efficient monitoring hypothesis therefore predicts that *FRACOP* will be negatively related to the fraction of total equity held by venture capital investors, viz.,  $\alpha_8 < 0$ .

### 3.2.7 *Managerial power and rent seeking*

A very different view regarding the relation between the fraction of equity held by venture investors and *FRACOP* comes from the managerial power and rent-seeking theory of Bebchuk et al. (2002). Bebchuk et al. propose that the greater the power of management—and therefore the lower the power of venture investors—the less effective will be shareholder monitoring and the larger will be the rents that management can extract from shareholders. I hypothesize that a prime group from whom managerial rents could be extracted are lower-level employees. The mechanism by which this would occur is that management would grant themselves some or all of the options that shareholders would optimally want granted to the firm's lower-level employees, thereby lowering *FRACOP*. So in contrast to the prediction made by agency theory that  $\alpha_8 < 0$ , Bebchuk et al.'s theory predicts that  $\alpha_8 > 0$ .

### 3.2.8 *Stock options as a source of financing*

Since granting employee stock options involves no outlay of cash by the firm, the more its employees' total compensation is tilted toward stock options, the less are the cash demands put on the firm. Thus, all else held equal, stock options are a source of financing (Yermack, 1995; Core and Guay, 1999, 2001) and an important part of a comprehensive human resource management program (Blasi et al., 1996, 2003; Liccione, 2002; Lam and Ho, 2006).

I therefore predict that the more cash constrained are private venture-backed firms, the more likely they are to grant options deeply to their employees in order to conserve cash. The ideal variable to measure the degree to which a firm is cash constrained would be its current free cash flow (i.e., after-tax cash from operating activities less capital expenditures). Because this variable is not in VentureOne's dataset, I use the age of the firm as an inverse proxy for cash constraints under the plausible assumption that the younger a firm is in the VentureOne dataset, the less likely the firm is to be 'cash-flow positive' and the more likely it is to be cash constrained. In terms of equation (1), I therefore predict that  $\alpha_9 < 0$ .

### 3.2.9 *Control variables*

In addition to the variables detailed above, I include several control variables. These are three industry sector dummies; the time between the survey date and the firm's most recent round of venture capital financing; and an indicator for whether the data come from the 2004 or 2005 survey. Industry dummies are included to account for possible fixed effects due to differences in organizational culture or other organizational characteristics. The length of time between the survey date and the firm's most recent round of venture capital financing is included to mitigate selection biases that might arise from companies being more likely to respond to VentureOne's compensation survey when they will soon need to raise new capital. An indicator variable for the data's coming from the 2005 rather than the 2004 survey controls for fixed effects arising from macroeconomic or other calendar time-based factors. Due to their serving as control variables, I make no predictions about the coefficient signs on these variables.

## **4. DATA**

The data in this study come from detailed and proprietary surveys conducted by VentureOne in spring 2004 and spring 2005.<sup>5</sup> In each survey, VentureOne emailed a multi-page web-based compensation questionnaire to each of the approximately 7,000 venture-backed firms in its comprehensive financing database that it classified at the time as being private and independent. The questionnaire asked each firm to provide a broad set of compensation- and business-related information. For example, firms were asked to report the dollar values of the base salary, bonus, and other cash compensation of every employee (up to a maximum of 50 people from the most senior person down); the total shares of founder's stock and exercised and unexercised options that each held; and the total fully diluted and common shares the firm had outstanding. In terms of business information, VentureOne asked each firm to provide its actual revenues for its most recent fiscal year and expected revenues for its current fiscal year, as well as the number of employees at the end of its most recent fiscal year and the number it expected to have at the end of its current fiscal year. Of primary interest to this study, each firm was asked to indicate the number (and therefore from simple computation the fraction) of employees that receive stock options.

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<sup>5</sup> The author was generously granted access to VentureOne's data after signing a nondisclosure agreement.

The results of the compensation survey were then merged with VentureOne's financing and general support databases. VentureOne's financing database contains a record of each firm's equity financing history, where available. For each round of funding, the financing database reports the amount of money raised, when the round closed, the pre- and post-money valuations, the type of round (e.g., First, Second, Individual Investor), the firm's business status (e.g., Startup, Product Development, Shipping), and the ID code and type of each investor that participated in the round. The general support database contains general information about each firm, such as its industry, state, and telephone area code, as well as details on current and former senior management and board members, such as their title, type (e.g., outside board member, venture investor board member), and whether they are or were one of the firm's founders.

Of the approximately 7,000 venture-backed firms to which VentureOne emailed its compensation surveys in 2004 and 2005, a total of 1,296 responses were received.<sup>6</sup> Of these, 42 were eliminated because the firm had been acquired or merged, was already public or in IPO registration, or had gone out of business. This yielded 1,254 usable firm-year observations from private and independent venture-backed companies. Untabulated analysis indicates that respondents were not significantly different from nonrespondents.<sup>7</sup>

Two types of restrictions were placed on the 1,254 usable firm-year observations. First, 193 observations from the 2004 survey were excluded because the firm involved had responded to both the 2004 and 2005 surveys. Second, 209 observations were deleted because they did not have all the data needed to estimate equation (1). After applying these restrictions, there remained a sample of 852 firm-year observations for which equation (1) could be estimated.

Descriptive statistics on a variety of the characteristics of the 852 sample firms are given in Tables 2 - 5. Sample firms vary by maturity, whether defined by the Series number of their most recent round of venture funding, by firm age, or by life stage (Table 2). For example, most recent venture financings range from Seed to 9<sup>th</sup> rounds, while life stages span the full spectrum

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<sup>6</sup> The response rate of approximately 9% (= average of {795 + 501} / 7,000) is very similar to that of other compensation surveys. For example, in a nonacademic study of a combination of public and private companies with broad-based stock option plans, Weeden et al. (2001) report a response rate of 10%.

<sup>7</sup> I developed and estimated a logistic regression model to discriminate between respondents and nonrespondents. Using data available in VentureOne's aggregate financing and valuation database (which did not include compensation data), I was able to explain less than 1% of the variance. The independent variables I used were the age of the firm, the date of its most recent round of equity financing, the number of its most recent round of equity financing (e.g., 1<sup>st</sup>, 2<sup>nd</sup>, etc.), the amount raised in that round, the state in which the firm is headquartered, its life stage (e.g., Start-up, Product Development, Beta Testing, Shipping, Profitable, Clinical Trials, and Restart), and the industry sector of the firm.

from Startup to Profitable. Of the firms, 49% are Internet companies as defined by VentureOne’s internal criteria, while 51% and 29% are classified as being in the IT and Healthcare sectors, respectively (Table 3). Thirty seven percent are headquartered in California. In Table 4 I report the mean number of employees by functional area. The average number of employees in a sample firm is 54. Of these, 46% are Technical, 13% are in Sales, and 11% are Administrative staff. Lastly, mean revenue, equity financing, and valuation results (Table 5) show that, as would be expected given their relative youth, the mean current year revenue of sample firms is only \$7.2 million—but the projected one-year-ahead revenue growth rate is a rapid 68%. The average post-money equity value at firms’ last financing rounds was \$40 million, and in their last financing round (which took place an average of 1.6 years prior to the survey date) the mean amount raised was \$10.0 million at a mean dilution of 36%.

Most importantly, the leftmost column of Table 6 shows that 232 out of 852 (27%) of all sample firms do *not* grant stock options to all their employees. Within such firms, where  $FRACOP < 1$ , the mean fraction of employees not granted stock options is 39%. These results run contrary to the simple stereotype that U.S. venture-backed firms are renowned for, namely that all of their employees receive stock options. I now turn to test the theory laid out in Section 3.2 as to why this occurs, as expressed in equation (1).

## 5. ECONOMETRIC METHODS AND EMPIRICAL RESULTS

### 5.1 Univariate tests

In Table 7 I report the results of univariate tests of the directional predictions made in Sections 3.2.1–3.2.9 regarding the determinants of  $FRACOP$ , the fraction of firms’ employees granted stock options. Specifically, Table 7 shows the means of the main independent variables in equation (1) when  $FRACOP = 1$  versus when  $FRACOP < 1$ , and the  $t$ -statistic on the difference in the means.<sup>8</sup> For each independent variable listed other than the fraction of shares held by venture investors, the economic cost/benefit theory of stock option grant depth predicts that the mean of the variable will be greater when  $FRACOP = 1$  than when  $FRACOP < 1$ .<sup>9</sup>

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<sup>8</sup> Table 7 excludes the control variables in equation (1). The control variables consist of industry sector dummies;  $\ln(1 + \#Years \text{ since most recent funding round})$ ; and an indicator = 1 if the observation is from the 2005 survey.

<sup>9</sup> The difference in means for the fraction of shares held by venture investors is predicted to be negative if venture investors use employee stock options to align the unobservable portion of managers’ actions toward maximizing firm value rather than consuming perquisites or free riding (Section 3.2.6), but positive if a lower ownership holding

The univariate results reported in Table 7 strongly support the directional predictions made by the economic cost/benefit theory of why private venture-backed firms do not always grant stock options to all their employees. Seven of the nine differences in means are reliably positive as predicted (variables 1–7). One difference in means is reliably positive where competing theories predict either a positive or a negative difference (variable 8), while one difference in means is insignificantly different from zero (variable 9).

Table 8 reports the Pearson and Spearman correlations between and among *FRACOP* and the explanatory variables. There are no indications of unduly high cross-correlations: the untabulated mean Pearson cross-correlation is 0.06, while the mean Spearman cross-correlation is 0.07. This lack of multicollinearity bodes well for the potential discriminatory ability of multivariate analysis.

## 5.2 *Multivariate tests*

My primary method of estimating the multivariate relations between *FRACOP* and its hypothesized determinants as expressed in equation (1) is through an as-if-right-censored Tobit model. In the Tobit model, observations with  $FRACOP = 1$  are treated as if they were right censored.<sup>10</sup> This addresses the natural boundedness of the dependent variable by treating both the expected level of *FRACOP* conditional on having  $FRACOP < 1$ , and the probability of  $FRACOP = 1$ , as manifestations of a common underlying latent variable process.<sup>11</sup> In contrast to OLS, the estimates of the coefficients on the underlying latent explanatory variables in the Tobit model will be unbiased.<sup>12</sup> However, while OLS coefficients measure the unconditional marginal effects of the independent variables, the coefficients on the latent explanatory variables in the Tobit model measure the conditional marginal effects. As a result, the magnitudes of the coefficient estimates obtained from the Tobit model can only be correctly interpreted if they are

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by venture investors gives management more power that they then use to extract rents from lower level employees by excluding such employees from being granted options (Section 3.2.7).

<sup>10</sup> For simplicity, I do not treat observations where  $FRACOP = 0$  as if they are left-censored at that level, because there are only four such data points out of the total of 852 observations.

<sup>11</sup> The latent variable is a purely technical device, because *FRACOP* is not in actuality right-censored. Censoring occurs when a sampling or data collection process is such that the researcher cannot observe the full range of the population model. This is not the case for *FRACOP*, because stock options cannot be granted to negative numbers of employees nor to more employees than the firm has. When  $FRACOP = 1$ , this reflects an economic choice by the firm, not a deficiency in the data.

<sup>12</sup> OLS assumes that the error term is unbounded by virtue of being normally distributed. This is not so, because *FRACOP* cannot be negative or exceed one. Parameter estimates obtained using OLS will therefore typically be biased toward zero as well as inconsistent.

made unconditional. This is achieved by multiplying them by the average estimated probability that an observation will be interior, that is, the average estimated probability that  $FRACOP < 1$ .

For purposes of robustness, I also estimate the parameters in equation (1) in two other ways. I fit a binary logistic regression model in which  $FRACOP$  is replaced with  $FRACOP\{0,1\}$ .  $FRACOP\{0,1\}$  is identical to  $FRACOP$  except that all values of  $FRACOP$  that are less than one are recoded as zero. Replacing  $FRACOP$  with  $FRACOP\{0,1\}$  enables me to explore the more restricted question of which factors explain the binary decision of whether firms grant stock options to all versus less than all of their employees. I also estimate equation (1) using only the subset of observations for which  $FRACOP < 1$ .

In Table 9, I report the results of estimating the three multivariate models. Two key findings emerge. First, there is a reasonable consistency in both the signs and statistical significance of the coefficient estimates across the three different regression specifications (bearing in mind that the OLS regression is able to use only about a quarter of the full sample in its estimation). Second, and more importantly, parameter estimates are overall strongly consistent with the sign predictions made in Section 3.2 and the univariate results reported in Table 8. Taking the as-if-right-censored Tobit model results as the baseline, Table 9 shows that:

- In line with the expectation that the net benefits of compensating and incenting employees via stock options declines as the number of employees in the firm rises,  $FRACOP$  is reliably increasing in the cash compensation of the lowest-paid employee.
- Consistent with the hypothesis that attracting and retaining technical expertise is vital to the success of venture-backed firms,  $FRACOP$  is reliably increasing in the fraction of employees with technical human capital.
- Supporting the prediction derived from Rajan and Zingales (2001) that stock options will be granted more deeply into a firm the organizationally flatter it is, the estimated coefficient on the number of VPs per employee is reliably positive.
- Oyer's (2004) explanation for why firms grant stock options rather than other forfeitable compensation is strongly supported in that there is a reliably positive coefficient observed on the fraction of the sample that shares the firm's telephone area code.
- Consistent with the prediction that  $FRACOP$  will be larger the more important is a firm's technology-based long-term growth options, I find a reliably positive coefficient on the number of patents granted to the firm.
- A reliably positive coefficient is observed on managers' one-year-ahead forecasts of employee growth, but not on managers' one-year-ahead forecasts of revenue growth.
- The coefficient on the fraction of shares held by venture investors is reliably positive. This supports Bebchuk et al.'s (2002) hypothesis that the more control venture investors

have over the firm, the less likely it will be that senior management will redirect options that should go to lower-level employees into their own pockets.

- The coefficient on firm age, a proxy for the degree to which the firm's cash constraints make granting stock options deeply a way of obtaining financing from employees, is not significantly different from zero. This indicates that holding constant all the other independent variables in the regression, options are not granted more deeply when firms are more cash constrained.
- Lastly, neither the estimated coefficient on time since the firm's most recent funding round, nor that on the 2005 survey indicator (pure control variables) is reliably nonzero.

In total, I interpret the results reported in Tables 7–9 as supporting the theory that private venture-backed firms decide on the organizational depth to which they grant employee stock options in a sophisticated manner that trades off many of the hypothesized economic costs and benefits of attracting, compensating, incenting, monitoring, and retaining their employees.

### 5.3 *Limitations of the study*

There are several limitations of this study to acknowledge. First, the analysis takes into account the stock option grant depth but not the magnitude of the incentives provided, as in Core and Guay (1999, 2001). Thus, some results could be simply capturing biases arising from omitted correlated variables. Second, several explanatory variables are likely to be endogenous to *FRACOP* to a greater or lesser degree. These include employee growth, the number of patents, and the fraction of the company held by venture investors. Unfortunately, VentureOne's dataset does not provide a ready menu of strong candidates that can be used as instruments.

A third limitation is the survey nature of the data that I use. In general, survey data may be inaccurate, or contain strategic (i.e., untruthful) responses, or exhibit survey selection response biases relative to archival data. All these possibilities have unknown effects on the empirical results and my inferences. That said, Appendix B summarizes the results of some auxiliary tests that suggest that survey response bias likely does not dominate as a characteristic of the dataset. Finally, the unusual features of private venture-backed firms mean that the results may not generalize to other private firms or to public companies. As noted by Shane (2006), this is a common and challenging problem to overcome in entrepreneurship research.

## 6. CONCLUSIONS

Despite the importance of stock options to such companies and therefore arguably to the U.S. economy, prior academic research has concentrated exclusively on employee stock options in public companies. This study is the first to theoretically and empirically examine employee stock options in private entrepreneurial companies.

I first showed that although U.S. venture-backed firms are renowned for the inclusiveness and intensity of their employee stock option grants, contrary to simple stereotype some 27% of venture-backed firms do *not* grant stock options to all their employees. I then sought to explain this finding by theorizing that in the archetypal economic setting for venture-backed firms—viz., a business environment dominated by technology assets, high levels of uncertainty, and intense information asymmetry—the costs of using stock options to attract, compensate, incent, monitor and retain certain employees can exceed the benefits. When they do, rational managers will not grant options to certain employees. I tested the theory by determining whether variation in the organizational depth to which venture-backed firms grant employee stock options can be reliably explained by a variety of proxies for both the economic costs and benefits of the stock option grant depth decision. I found that the empirical results supported the theory, and imply that venture-backed firms grant employee stock options in a sophisticated manner that reflects many of the business tradeoffs involved.

My findings bode well for the efficient allocation of capital in private venture-backed companies. This is because they suggest that despite the intense uncertainty of the environment facing entrepreneurial companies, both managers and venture investors in such firms act in an economically astute manner when using and valuing employee stock options. From the point of view of entrepreneurship, the empirical results documented in this study imply that while entrepreneurs may be prone to behavioral distortions arising from psychological traits and base decisions in part on non-profit-maximizing factors, these do seem to not swamp or overcome the rational forces of value-maximizing pressures in their companies. The results of this study also suggest that it would be worthwhile to conduct further research into the total set of compensation mechanisms used by entrepreneurial young private firms to solve agency and information asymmetry problems and thereby create new technologies, products and wealth.

## Appendix A

### **Summary of research into the determinants of broad-based employee stock option plans in publicly traded U.S. companies**

In the first major study in the area of understanding the causes and consequences of broad-based employee stock options plans in public companies, Core and Guay (2001) analyzed the determinants of nonexecutive option holdings, option grants, and option exercises of 756 U.S. firms during 1994–1997. They find evidence that firms grant nonexecutive stock options for both incentive reasons and as a means of internal financing. Consistent with economic theory, Core and Guay observe that nonexecutives' option incentives increase with firm size, firms' growth opportunities, and the relative importance of human capital as a factor of production. Firms also appear to use more nonexecutive options as a substitute for cash compensation when they face cash flow constraints and high costs of external funds. Kedia and Mozumdar (2002) reach somewhat similar conclusions, while Jones et al. (2004) find that smaller firms and firms with higher intellectual capital indicators are more likely to use broad-based option plans, and that support for the liquidity constraints hypothesis is mixed.

Noting that broad-based stock option plans impose substantial risk on lower-level employees and suffer from free-rider problems, Oyer and Schaefer (2005) evaluate three potential explanations for why many firms issue options to all employees: a solution to moral hazard; a method of sorting on worker beliefs about the firm's prospects; and an inexpensive means by which to retain employees by adjusting their pay to market conditions (Oyer, 2004). After rejecting the incentives-based explanation, they conclude that their data appear most consistent with the sorting and retention explanations. In contrast, Bergman and Jenter (2005) find evidence consistent with the proposition that the popularity of option compensation for low-level employees is driven by boundedly rational employees who are excessively optimistic about their company's stock and who have a strict preference for options over stock.

Focusing on “new economy” firms, Ittner et al. (2003) examine the determinants and performance consequences of equity grants to all types of employees—senior-level executives, lower-level managers, and nonexempt employees. They find that the determinants of equity grants differ significantly across old economy and new economy companies, and that new-hire option grants but not subsequent grants are significantly affected by firms' employee retention

objectives. Performance tests indicate that option grants and existing option holdings that are lower than expected are associated with poorer firm performance in subsequent years.

The influence of broad-based employee stock option plans on firm performance is also the focus of Hillegeist and Peñalva (2003) and Landsman et al. (2005). Hillegeist and Peñalva find that firms with unexpectedly high levels of both executive and nonexecutive option incentives exhibit significantly higher firm performance. Landsman et al. conclude similarly, but note that the relation seems stronger for nonexecutive options than for executive options. Finally, Inderst and Müller (2006) argue that the presence of specific human capital can make it optimal to link the compensation of low-level employees to total firm value even though there are negligible incentive effects because of standard free-riding problems. Their theory predicts that broad-based incentive pay should be more prevalent in riskier firms.

## Appendix B

### Potential selection biases in the VentureOne survey data

The survey nature of VentureOne’s data may introduce response bias. In particular, it might be that firms that grant employee stock options more deeply into their organizational structure are more likely to respond to VentureOne’s survey. Such a response bias could lead to biases in the inferences I draw from the statistical tests undertaken in the paper.

To shed light on the severity of this type of inferential threat, three additional analyses were carried out. First, I hypothesized that if the average fraction of a firm’s employees who are granted stock options, *FRACOP*, is the same every time VentureOne undertakes a survey, then it is less likely that VentureOne’s surveys contain a self-selection bias based on *FRACOP*. I report evidence consistent with this hypothesis in Exhibit B.1, using *FRACOP* data obtained from VentureOne for six surveys that VentureOne did between 2002.H2 and 2006.H1 over and above the two surveys I use in the main body of the paper. (“H1” [“H2”] refers to the first [second] half of the calendar year.) For each survey, I calculated the average *FRACOP* and the average of a dummy variable *ALLGETAPRIZE*. The variable *ALLGETAPRIZE* is set to one if *FRACOP* = 1 and zero if *FRACOP* < 1. Exhibit B.1 reports the average *FRACOP* and average *ALLGETAPRIZE* by survey.

Exhibit B.1			
VentureOne survey	Raw # of observations	Average <i>FRACOP</i>	Average <i>ALLGETAPRIZE</i>
2002.H1	561	0.92	0.81
2003.H1	556	0.89	0.74
2003.H2	381	0.88	0.72
2004.H1	795	0.88	0.73
2004.H2	849	0.88	0.74
2005.H1	501	0.89	0.76
2005.H2	775	0.89	0.75
2006.H1	697	0.88	0.72
TOTAL	5,115	0.89	0.75

As can be seen from Exhibit B.1, the average values of *FRACOP* and *ALLGETAPRIZE* are very similar across all eight VentureOne surveys. This is consistent with my hypothesis.

Second, the results in Exhibit B.1 might still be consistent with there being a selection bias if the same set of firms always responds to VentureOne’s surveys—namely, those with high

values of *FRACOP*. To shed light on this possibility, I determined that 2,363 different firms comprise the 5,115 firm-year observations reported in Exhibit B.1. Based on conversations with VentureOne, I also estimate that over the period 2002–2006, VentureOne sent their survey to approximately 9,000 different firms. Thus, of the 9,000 different firms that could have responded to VentureOne’s surveys over 2002–2006, some 26% did (2,363/9,000). This figure of 26% compares favorably with 9%, the percentage represented by 849/9,000 that would apply if the 849 firms that responded to the survey in 2004.H2 constituted the full set of firms from which all VentureOne’s survey respondents were drawn.

Finally, I asked my contact at VentureOne whether based on their significant experience, they perceived that certain kinds of firms were more likely to respond to their survey than others. After some thought, my contact said that it was his sense that the only bias in respondents that might be present was that firms were more likely to respond to the survey if they were getting ready to seek their next round of venture funding. This is because if the firm was successful in getting more venture funding, it could then be in a position to adjust the salaries and/or other aspects of total compensation of its existing employees to market averages, and to offer market-based compensation to employees it was seeking to hire. However, since the typical venture-backed firm receives a new injection of equity from venture funds every 14 or so months, this selection bias would not seem to be likely to be correlated with *FRACOP*.

In total, I interpret the points discussed above as indicating that if there is a selection bias toward firms with larger *FRACOP* being more likely to respond to the survey, the size of the selection bias is arguably not likely to be large.

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**Table 1****Selection criteria applied to private venture-backed U.S. firms in VentureOne's databases**


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Firms invited to participate in VentureOne's Spring 2004 and Spring 2005 compensation surveys	≈ 7,000
Firms that responded to the 2004 survey	795
Firms that responded to the 2005 survey	<u>501</u>
	1,296
<i>Less:</i> Firms that:	
Had been acquired or merged	20
Were in IPO registration	10
Were out of business	8
Were publicly traded	<u>4</u>
	42
= Private venture-backed firms that responded to VentureOne's 2004 or 2005 surveys	1,254
<i>Less:</i> Firms that were in both 2004 and 2005 surveys (to keep the sample to one observation per firm, the firm's 2005 survey information was not used)	193
<i>Less:</i> Firms with insufficient data to compute:	
% equity held by venture capital investors	90
% employees in technical positions	50
# VPs per employee or % employees granted stock options	21
Forecasted one-year growth rate in revenues or employees	22
Firm age	11
Other miscellaneous	<u>15</u>
	209
= Firms with sufficient data for analysis of the fraction of their employees that are granted stock options	852
<i>Of which:</i>	
2004 data	610
2005 data	<u>242</u>
	852

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**Table 2****Distribution of private venture-backed U.S. firms by financing round, age, and life stage**

Last round	# obs.	Firm age (in years)	Startup	Product in devt.	Product in Beta test	Clinical trials	Shipping product	Profitable
Seed	20	2.9	25%	65%	0%	0%	10%	0%
1 <sup>st</sup>	236	4.1	6	41	2	2	44	5
2 <sup>nd</sup>	221	5.7	0	24	9	4	55	8
3 <sup>rd</sup>	146	6.3	0	7	3	10	70	9
4 <sup>th</sup>	73	6.8	0	7	3	12	71	7
≥5th	26	8.6	0	8	0	12	58	23
Other	130	8.5	0	15	2	5	65	13

“Other” financing rounds are those not specifically labeled as Seed through 9<sup>th</sup>. Percentages sum to 100% by row.

**Table 3****Distribution of private venture-backed U.S. firms by key sectors and states (*n* = 852)**

Internet	IT	Healthcare	Retail/Svc.	Other	California HQ
49%	51%	29%	18%	2%	37%

**Table 4****Mean employees in private venture-backed U.S. firms, by functional area (*n* = 852)**

	All employees	Business						
		Admin.	Developmt.	Finance	Marketing	Sales	Technical	Other
Number	54	4.3	1.0	2.3	2.2	7.8	19	17
Percent	100%	11%	3%	5%	5%	13%	46%	17%

Employees are as of the most recent fiscal year-end prior to the survey date.

**Table 5****Mean revenues, equity values, and financing for private venture-backed U.S. firms**

	Revenues (\$ mil.)		Projected revenue growth (% p.a.)	Post-money equity value at last round (\$ mil.)	Equity raised in last round (\$ mil.)	Dilution in last round (%)	Time since last round (years)
	Prior year	Current year					
	\$7.2	\$12.1	68%	\$40	\$10.0	36%	1.6
# obs.	852	852	--	435	852	433	852

Mean projected revenue growth is calculated as the mean current-year revenues divided by mean prior-year revenues. The post-money equity value (dilution) at the last financing round is unknown for 417 (419) firms.

**Table 6****Employee stock options and overall equity holdings for private venture-backed U.S. firms**

Overall equity holdings are defined by VentureOne as the sum of all preferred stock, common stock, stock options granted (whether or not vested), and stock options available for future grants. *FRACOP* is the fraction of a firm's employees that are granted stock options.  $N = 852$ .

Last round	Percent of firms <b>not</b> granting options to all employees ( $FRACOP < 1$ )	Mean percent of employees not granted options when $FRACOP$ is:		Percent of options granted to CEO or Pres.	Mean vesting period (years)	Percent of equity held by:		
		$< 1$	$\in [0, 1]$			CEO	Founder or Pres.	VCS
Seed	30%	48%	14%	46%	3.5	9.3%	8.0%	40%
1 <sup>st</sup>	28	44	12	46	3.8	7.3	10.1	55
2 <sup>nd</sup>	28	37	10	47	3.8	6.0	7.8	65
3 <sup>rd</sup>	19	26	5	48	3.9	4.6	6.9	70
4 <sup>th</sup>	23	23	5	48	3.8	5.4	6.5	71
$\geq 5$ th	19	55	11	54	4.0	6.1	7.1	76
Other	37	46	17	46	3.7	7.1	8.1	57
All	27%	39%	11%	47%	3.8 yr.	6.3%	8.3%	62%

**Table 7****Means of the hypothesized determinants of the fraction of employees granted stock options ( $FRACOP$ ) in private venture-backed U.S. firms, for  $FRACOP = 1$  versus  $FRACOP < 1$** 

Hypothesized determinant of $FRACOP$	Mean when $FRACOP = 1$ ( $n = 621$ )	Mean when $FRACOP < 1$ ( $n = 231$ )	$t$ -stat. diff.
1. Ln(Cash comp. of lowest-paid employee, in \$000s)	4.38	4.23	3.2 <sup>###</sup>
2. Fraction of employees who are Technical	0.49	0.39	5.0 <sup>###</sup>
3. Ln(1 + {# VPs per employee})	-2.28	-2.64	4.5 <sup>###</sup>
4. Fraction of sample firms in same tel. area code	0.035	0.019	7.9 <sup>###</sup>
5. Ln(1 + # Patents granted)	0.39	0.29	2.0 <sup>##</sup>
6. Ln(One-year-ahead forecasted employee growth)	0.34	0.27	2.0 <sup>##</sup>
7. Ln(One-year-ahead forecasted revenue growth)	0.86	0.68	2.8 <sup>###</sup>
8. Fraction of shares held by venture investors	0.64	0.57	3.3 <sup>***</sup>
9. Ln(1 + Firm age in years)	1.78	1.90	-3.4 <sup>###</sup>

$T$ -statistics on difference in means assume unequal variances across observations where  $FRACOP = 1$  versus observations where  $FRACOP < 1$ . Inferences are very similar if equal variances are assumed. Single, double, and triple hash marks (asterisks) denote coefficient estimates that are reliably of the predicted sign at the 5%, 2.5%, and 1% significance levels, respectively, under a one-tailed (two-tailed) test. The control variables present in equation (1) are not included above because theory makes no clear sign prediction for them.

**Table 8**

**Correlation matrix of the variables used to estimate the relations between the fraction of employees granted stock options in private venture-backed U.S. firms (*FRACOP*) and proxies for the economic costs and benefits of attracting, incenting, monitoring, and retaining those employees**

The sample is the set of 852 private venture-backed U.S. firms in VentureOne's Spring 2004 and Spring 2005 compensation survey databases that satisfied the data requirements described in Table 1. Pearson (Spearman) correlations are above (below) the diagonal. Correlations greater than 0.065 in absolute magnitude are reliably significant at the 5% level under a two-tailed test. The predicted sign between *FRACOP* and each independent variable is shown in parentheses above the independent variable.

Variable	(+) [1]	(+) [2]	(+) [3]	(+) [4]	(+) [5]	(+) [6]	(+) [7]	(+) [8]	(+, -) [9]	(-) [10]
[1] <i>FRACOP</i>		0.02	0.25	0.27	0.20	0.11	0.08	0.09	0.17	-0.13
[2] Ln(Cash comp. of lowest-paid employee, in \$000s)	0.09		0.03	-0.23	0.13	-0.03	0.01	0.03	0.01	-0.01
[3] Fraction of employees who are Technical	0.19	0.03		0.20	0.17	-0.00	0.05	0.06	0.03	-0.23
[4] Ln(1 + {# VPs per employee})	0.15	-0.21	0.15		0.07	-0.02	0.01	0.08	0.00	-0.29
[5] Fraction of sample firms in same tel. area code	0.24	0.11	0.16	0.07		0.11	-0.00	-0.02	0.12	-0.11
[6] Ln(1 + # Patents granted)	0.08	-0.03	0.01	-0.03	0.07		-0.12	-0.11	0.07	0.26
[7] Ln(1 + One-year-ahead forecasted employee growth)	0.07	0.04	0.02	-0.03	-0.02	-0.15		0.16	-0.01	-0.10
[8] Ln(1 + One-year-ahead forecasted revenue growth)	0.08	0.04	0.03	0.04	-0.01	-0.14	0.17		0.04	-0.19
[9] Fraction of shares held by venture investors	0.11	0.01	-0.00	-0.04	0.10	0.08	-0.05	0.02		-0.04
[10] Ln(1 + Firm age in years)	-0.11	-0.02	-0.22	-0.30	-0.09	0.30	-0.12	-0.19	0.01	

**Table 9**

**Regressions of the fraction of employees granted stock options in private venture-backed U.S. firms (*FRACOP*) on proxies for the economic costs and benefits of attracting, incenting, monitoring, and retaining those employees**

The sample is the set of 852 private venture-backed U.S. firms in VentureOne’s Spring 2004 and 2005 surveys satisfying data limitations per Table 1. Standard errors are in square brackets. Single, double, and triple hash marks (asterisks) denote coefficient estimates that are reliably of the predicted sign at the 5%, 2.5% and 1% significance levels, respectively, under a one-tailed (two-tailed) test. Numbers in italics are the unconditional marginal effects implied by the Tobit model, viz., the nonitalicized latent parameter estimates multiplied by the average estimated probability that an observation will not be right-censored.

Independent variables:	Predicted coef. sign	Dependent variable:		
		<i>FRACOP</i>	<i>FRACOP</i> {0,1}	<i>FRACOP</i> <1
		Estimation approach:		
		As-if-right- censored Tobit	Logistic regression	OLS
Ln(Cash comp. of lowest-paid employee, in \$000s)	+	0.11, <i>0.03</i> [0.04]###	0.48 [0.14]###	-0.05 [0.03]
Fraction of employees who are Technical	+	0.40, <i>0.11</i> [0.10]###	1.03 [0.36]###	0.28 [0.08]###
Ln(1 + {# VPs per employee})	+	0.16, <i>0.04</i> [0.03]###	0.44 [0.10]###	0.06 [0.02]###
Fraction of sample firms in same tel. area code	+	5.02, <i>1.36</i> [0.99]###	17.17 [3.6]###	1.07 [0.88]
Ln(1 + # Patents granted)	+	0.11, <i>0.03</i> [0.04]###	0.26 [0.13]##	0.10 [0.03]###
Ln(One-year-ahead forecasted employee growth)	+	0.11, <i>0.03</i> [0.05]##	0.37 [0.19]##	0.04 [0.04]
Ln(One-year-ahead forecasted revenue growth)	+	0.04, <i>0.01</i> [0.03]	0.13 [0.10]	-0.00 [0.02]
Fraction of shares held by venture investors	+, -	0.31, <i>0.08</i> [0.09]###	0.84 [0.32]###	0.17 [0.06]###
Ln(1 + Firm age in years)	-	0.02, <i>0.01</i> [0.06]	-0.07 [0.19]	-0.03 [0.04]
Ln(1 + # Years since most recent funding round)	?	-0.09, <i>-0.02</i> [0.05]	-0.19 [0.18]	-0.07 [0.04]
Indicator = 1 if observation is from 2005 survey	?	-0.05, <i>-0.01</i> [0.05]	-0.21 [0.18]	-0.01 [0.04]
Industry dummies included?		Yes	Yes	Yes
Assumed error distribution		Normal	n.applic.	Normal
# right-corner (i.e., as-if-censored) values		619	n.applic.	0
% concordant		n.applic.	73%	n.applic.
OLS adj. $R^2$		0.18	0.11	0.23
# observations		852	852	232