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ENTREPRENEURIAL FINANCE MEETS ORGANIZATIONAL REALITY: COMPARING INVESTMENT PRACTICES AND PERFORMANCE OF CORPORATE AND INDEPENDENT VENTURE CAPITALISTS

By

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ENTREPRENEURIAL FINANCE MEETS ORGANIZATIONAL REALITY: COMPARING INVESTMENT PRACTICES AND PERFORMANCE OF CORPORATE AND INDEPENDENT VENTURE CAPITALISTS

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This paper investigates the effect of compensation of corporate personnel on their investment in new technologies. We focus on a specific corporate activity, namely corporate venture capital (CVC), describing minority equity investment by established-firms in entrepreneurial ventures. The setting offers an opportunity to compare corporate investors to investment experts, the independent venture capitalists (IVCs). On average, we observe a performance gap between corporate investors and their independent counterparts. Interestingly, the performance gap is sensitive to CVCs' compensation scheme: it is the largest when CVC personnel are awarded performance pay. Not only do we study the association between incentives and performance but we also document a direct relationship between incentives and the actions managers undertake. For example, we observe disparity between the number of participants in venture capital syndicates that involve a corporate investor, and those that consist solely of IVCs. The disparity shrinks substantially, however, for a subset of CVCs that compensate their personnel using performance pay. We find a parallel pattern when analyzing the relationship between compensation and another investment practice, staging of investment. To conclude, the paper investigates the three elements of the principal-agent framework, thus providing direct evidence that compensation schemes (incentives) shape investment practices (managerial action), and ultimately investors' outcome (performance).

INTRODUCTION

Corporate personnel are often required to pursue investment in innovative yet risky projects. The reality in which corporate research and development (R&D) investment is undertaken, however, often hinders these efforts. In a seminal paper, Jensen (1993) notes that the annual R&D spending of either IBM or General Motors exceeds the aggregate annual disbursement in the venture capital industry, yet the economic successes of venture-backed firms have been profound. He ascribes this to unfavorable incentives within corporate research facilities. In doing so, Jensen underscores the need

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to understand the effects of compensation schemes on investment decisions and ensuing outcomes.

We heed the call and study the impact of corporate incentives on one such corporate activity: corporate venture capital (CVC). CVC is the practice of minority equity investment by established firms in entrepreneurial ventures, that is, innovative companies that seek capital to continue operations. CVC investment opens a window onto new markets and novel technologies, thus offering established firms an opportunity to advance their innovation efforts. Per Jensen's (1993) astute comparison, we investigate the effect of incentives awarded to corporate and independent venture capitalists (IVC): How do compensation schemes influence the investment practices venture capitalists pursue? What are the performance implications?

Research motivated by these questions can benefit from, as well as contribute to, the principal-agent literature. By linking agents' (e.g., managers) pay to performance, the theory conjectures, principals (e.g., shareholders) motivate them to invest in profitable yet risky projects that the agents may otherwise forego. Empirically, a large body of work investigates the association between firms' compensation scheme and ultimate performance. The evidence, however, is inconclusive (Core, Holthausen, and Larcker, 1999; Dalton *et al*., 2003; Murphy, 1999; Tosi *et al*., 2000; Core, Guay, and Larcker, 2003). Notably, the insight that incentives affect performance by shaping managers' behavior remains implicit to these studies. A more conclusive support for the principal-agent framework requires studying not only the indirect incentive-performance association but also the theoretical mechanism that mediates the two—namely, managerial behavior (Murphy, 1999). Unfortunately, there is scant empirical work on the latter topic. Using the market for entrepreneurial finance as an empirical setting, this paper presents a comprehensive analysis of these issues.

Specifically, CVC provides an attractive setting to study all three elements of the principal-agent framework. Theoretically, the framework analyzes how incentives shape managerial investment in profitable yet uncertain projects. It thus parallels our setting: CVC personnel invest in new ventures whose technological viability and commercial prospects are highly uncertain. Importantly, this setting affords empirical investigation that goes beyond correlating incentives and performance. We open the black box and document a direct relationship between incentives and the investment practices managers engage in. The paper therefore addresses a lacuna in the principal-agent literature. Moreover, our research setting affords intuitive interpretation of managerial action and corporate performance in the spirit of Jensen (1993) and Hamel (1999)—to the extent that IVCs are expert investors, they serve as a benchmark against which CVCs can be assessed.

To that end, the paper conducts extensive analyses of venture capital investors during the 1990s. We study the direct relationship between investors' compensation schemes and investment practices using a sample of 13,096 investment rounds by corporate and independent venture capitalist. This analysis focuses on investment practices that CVCs and IVCs commonly use to manage investment uncertainty (Gompers and Lerner, 2001): staging (i.e., targeting distinct stages of a venture's development; Gompers, 1995) and syndication (i.e., coinvesting a round by two or more investors; Lerner, 1994). For instance, analysis of investment stage indicates that CVC investors target ventures at later stages of development. That is, the investment practices of CVCs and IVCs differ. Interestingly, the magnitude of the difference is affected by the nature of corporate venture capitalists' compensation. It is large when CVC personnel receive little or no performance pay, yet shrinks significantly when they are awarded performance pay. Analysis of investment syndicates yields similar results.

We also compare investors' ultimate performance as a function of their compensation schemes. The analysis covers 2,830 corporate and independent investors who participated in the aforementioned rounds. A similar pattern emerges: CVCs experience successful portfolio exits at a rate that differs from IVCs, and the magnitude of the performance gap is sensitive to CVCs' incentives. It is large when CVC personnel are awarded performance pay, and diminishes when they receive little or no performance pay. We present mediation models that further illustrate that the compensation-performance association is mediated by managers' investment practices.

We review the principal-agent literature below. The following section develops the hypotheses. Data, methods, and results are discussed thereafter. The last section concludes.

THEORETICAL BACKGROUND

The principal-agent framework analyzes the relationship between incentives and risk-taking behavior. A key upshot is that compensation schemes may be used to guide a manager toward performance maximizing choices by affecting his or her risk preferences. This section reviews major theoretical and empirical findings and points at areas for further investigation.

Theoretically, an agency relationship is said to exist between a firm's shareholders (i.e., principal) and its managers (i.e., agents). Principal-agent models assume shareholders are risk neutral as they can hold a diversified portfolio, while managers are risk averse because their job security and income are tied to one firm. From the manager's perspective, fixed salary is an efficient risk-sharing arrangement. The risk-averse manager receives a guaranteed pay while risk-neutral shareholders take on the risk associated with uncertain future outcomes (Holmstrom, 1979; Shavell, 1979). From the shareholders' perspective, managers should maximize firm value by undertaking all positive net present value projects regardless of their riskiness (hereafter we use risk and variance interchangeably; c.f. Mansfield, 1981). Risk-averse managers, however, would opt for low variance projects and may pass up some positive but risky net present value projects that shareholders would like to pursue. Absent an ability to monitor managerial action, shareholders have to motivate managers. They can do so by offering performance pay. Having a manager bear some of the uncertainty regarding future performance will induce him or her to invest in profitable yet risky projects, which may otherwise be forgone as too risky (Holmstrom, 1979). In sum, a key characteristic of designing a compensation scheme is the need to trade off risk-sharing (managerial perspective) and motivation (principal perspective) (Levinthal, 1988; Eisenhardt, 1989). The ensuing compensation scheme shapes managerial behavior and ultimately affects firm performance.

This insight stimulated a large body of empirical work. Most studies explore the association between executive compensation and firm performance. The evidence, however, is inconclusive. Gomez-Mejia (1994: 199), for instance, states that 'it is amazing how little we know about executive pay in spite of the massive volume of empirical work... even more discouraging, when taken as a whole, results are conflicting and disappointing.' A literature overview by a leading compensation economist, Murphy (1999: 2539), also notes '...there is surprisingly little direct evidence that higher pay-performance sensitivities lead to higher stock-price performance.' Management scholars echo that observation: '*Researchers express shock when they find pay/performance sensitivities are low and the results inconsistent with their theory*.' (Tosi *et al*., 2000: 331). Recently, Dalton *et al*. (2003 : 14) conducted a meta-analysis of 229 studies in economics, finance, and management, and concluded that '*...the empirical evidence provides no consensus*.'

In an attempt to resolve the apparent inconsistencies, extant work explores alternative measures and various contingency effects (Carpenter and Wade, 2002; Core *et al*., 1999; Quinn and Rivoli, 1993; Rediker and Seth, 1995; Rajagopalan, 1996). Common to these studies is the continued focus on incentive-performance association. The literature lacks an explicit test of the theoretical insight that incentives influence behavior, which in turn, affects performance. Murphy (1999) acknowledges such difficulty in testing the principal-agent framework. He argues that case studies (e.g., Jensen and Barry, 1991; Wruck, 1994) support the theory by documenting that managers' actions are affected by incentives. Beyond anecdotal case-based studies, however, there is little evidence of an incentive-behavior relationship. The dearth of large-scale empirical work reflects measurement challenges: it is difficult to systematically observe the level of risk inherent to managerial action. Two notable exceptions are Datta, Iskandar-Datta, and Raman (2001) and Rajgopal and Shevlin (2002). The latter paper analyzes oil and gas firms, finding that projects with high cash-flow variance are undertaken by managers with significant performance pay. The former studies mergers and acquisitions (M&A) and reports that managers with large equity compensation engage in riskier takeovers.

Another empirical challenge has to do with evidence for nonexecutive managers. Extant work focuses on the relationship between the compensation scheme of the chief executive officer (CEO), or other top executives, and firms' financial (Abowd, 1990), operational (Conyon and Freeman, 2004), or innovative performance (Balkin, Markman, and Gomez-Mejia, 2000). For top executives, compensation data are readily available per Securities and Exchange Commission (SEC) regulations. Managers outside the executive suite—those heading business divisions, or directing R&D units—may have a substantial impact on the firm (Chandler, 1991; Hoskisson and Hitt, 1988). Yet, there is far less work on these managers as compensation data are hard to come by. Hoskisson, Hitt, and Hill (1993) and Holthausen, Larcker, and Sloan (1995), two notable exceptions, find that the compensation of heads of business divisions is associated with divisional performance. Recently, Lerner and Wulf (2006) report parallel findings for R&D unit heads: high-powered incentives are associated with superior patenting output.

To conclude, the principal-agent framework suggests that the sensitivity of managerial compensation to outcomes affects managers' choice of risky projects and consequently impacts a firm's performance. There is an abundance of empirical work, yet the evidence is inconclusive and mainly reports an indirect association between compensation and performance. Only a handful of studies explore the direct compensation-behavior relationship, yet that work is limited to top executives and ignores other managers who play critical roles within the corporation.

HYPOTHESES DEVELOPMENT

The market for entrepreneurial finance is uniquely apt for studying the effect of compensation on behavior and performance. Funding entrepreneurial ventures is tantamount to investing in risky projects due to a high level of uncertainty regarding technological feasibility, future demand, and so forth (Kaplan and Stromberg, 2004; Scherer, Harhoff, and Kukies, 2000). To the extent that IVCs are expert investors, they constitute an informed benchmark against which to contrast CVCs' behavior (Jensen, 1993; Gompers and Lerner, 2001; Kaplan and Stromberg, 2004). In other words, because corporate and independent venture capitalists invest side-by-side, the context facilitates an investigation of the effects of organizational reality in which CVC personnel operate. Below, we describe independent and corporate investors and their compensation schemes, and proceed to conjecture on the implications to investors' practices and performance.

IVC funds are limited partnerships that pool and manage money from entities such as pension funds and wealthy individuals. IVCs seek high financial returns by funding growth-oriented ventures from which they later exit via an initial public offering (IPO) or an acquisition (Gompers and Lerner, 2001). They manage all aspects of the investment from opportunity identification through due diligence processing and post investment monitoring. IVCs also offer value-added services to portfolio companies (Sapienza, 1992; Sapienza, and Manigart, 1996; Timmons, 1994).

Through their CVC programs, established firms are also important players in the venture capital market (Prowse, 1998; Timmons, 1994). Their objectives vary, though: some focus on achieving financial gain, while most CVC programs seek a window on novel technologies (Siegel, Siegel, and MacMillan, 1988; Chesbrough, 2002; Dushnitsky and Lenox, 2005a, 2005b; Benson and Ziedonis, 2008; Keil, 2002, 2004). Corporate investors assist portfolio companies by: (a) providing value-added services similar to IVC funds (Block and MacMillan, 1993); (b) leveraging corporate resources, for example, corporate laboratories, and a firm's network of suppliers (Maula and Murray, 2002; Dushnitsky and Lenox, 2005a), and (c) endorsing the venture vis-à-vis third parties (Stuart, Hoang, and Hybels, 1999).

Of particular interest is the fact the compensation schemes vary greatly across investors. IVCs have a substantial performance pay component. They receive 'carried interest'—about 20 percent of the profits the fund generates (Sahlman, 1990; Lerner, 1994; Gompers and Lerner, 1999). IVCs also collect a second pay component: a fixed annual 'management fee' of about 1.5 to 3.0 percent of the fund's assets. Note that IVC funds are run by a handful of partners (e.g., an average of eight professionals per IVC, according to VentureXpert), thus the individuals making investment decisions are those reaping carried interest and management fees.

In a corporate setting, the lack of rewards for positive performance has long been the rule rather than the exception. Established firms offer extremely flat compensation schemes to R&D personnel (Neumeyer, 1971; Zenger, 1994). The

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experience of CVC personnel echoes this organizational reality. Specifically, the most common compensation among managers in CVC programs is fixed salary (Block and Ornati, 1987; McNally, 1997). In recent years, one sees greater heterogeneity in CVC compensation schemes (Birkinshaw, Murray, and van Basten-Batenburg, 2002). A small minority of programs offers CVC personnel high-powered incentives in the form of 'carried interest.' A larger minority compensates managers through annual bonuses based on financial or strategic metrics. Overall, the majority of CVC managers receive fixed salary, and only a smaller number of programs reward managers for success.

Extant work identifies several reasons for the lack of incentive to CVC personnel. Some firms avoid a performance pay component simply because it generates administrative problems when employees transfer to and from a CVC program. Inability to establish and agree on performance metrics is another explanation. A major consideration is the inclination to maintain pay equality in order to avoid resentment by employees in other business units. Consistently, Professor Lerner observes 'The nature of incentives offered corporate venture capitalists are probably the most contentious issue associated with the design of these funds... Traditionally, corporate venture funds, worried about internal "fairness" issues, do not provide their investment group with a share of the profit' (Barry, 2001: 28).

As a result, fixed salary is the prevalent compensation scheme. In fact, managers in many leading CVC programs did not receive any performance pay:

> The head of German software-maker SAP AG's venture capital unit in Silicon Valley racked up a 6,000% return on his employer's first $25 million fund... Yet he still earned a straight salary just as SAP's 22,000 other employees did (*Daily Deal*, 2000).

> Late in December [1999], Intel Corp. hired an outside team to structure a compensation package for its venture group that would mimic those of firms outside the corporate umbrella, including a co-investment option and a carried interest reward. After corporate management rejected the plan, citing concerns over internal equity within the organization, the venture group's top officer jumped ship for a spot at a private venture firm. (*Private Equity Week*, 2000)

We proceed to explore the impact of corporate compensation schemes by way of comparison. Our approach is to exploit the fact that entrepreneurial ventures are funded by individuals operating in two different settings (i.e., within a CVC or an IVC). The settings differ on the dimension of interest—compensation scheme—yet both employ similar investment practices and feature comparable investment outcomes.

Compensation scheme and managerial investment practices

Investors employ various practices to manage the level of risk they face (Gompers and Lerner, 2001). We conjecture that investors' compensation schemes will affect the practices they undertake. Our hypotheses focus on two well-documented practices—investment stage and investment syndicate—that are universally employed by CVCs and IVCs alike.

The exposure to risk can be managed by targeting ventures at specific stages of development. The prospects of a young 'seed-stage' venture are highly uncertain. It likely still engages in R&D and has to meet technical, commercial, and managerial milestones. As the venture matures, uncertainties regarding technical feasibility, commercial viability, and managerial capabilities are resolved (Sapienza and Gupta, 1994; Gompers, 1995). A 'later-stage' venture experiences increasing sales and may be profitable; namely it has already reached most previously mentioned milestones and has only managerial goals to meet. Thus, as investors face the decision whether, and when, to provide funding, they pay close attention to ventures' developmental stage. This is reflected in the discount rates applied by investors; rates may be as high as 70 percent for 'seed-stage' investments and as low as 30 percent for 'later-stage' ventures (Sahlman, 1990).

Drawing on the principal-agent framework, we conjecture that highly uncertain investments are likely to be shunned by corporate personnel who are not exposed to performance pay. Furthermore, corporate investment practices will be aimed, on average, at diminishing investment uncertainty.

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Funding ventures at later stages of development can achieve this goal. Hence, rounds where only IVCs participate (*all-IVC*) would take place at earlier stages than those where a corporation is involved (*CVC/IVC*).

> *Hypothesis 1: Other things being equal, a round in which a corporate investor participates* (CVC/IVC) *would occur at a later stage of development than a round financed solely by IVC funds* (all-IVC).

Syndication is also instrumental in managing risk exposure. Investment syndicates are formed when two or more investors participate in the financing of a given venture (Bygrave, 1987; Lerner, 1994; Sorenson and Stuart, 2001; Brander, Amit, and Antweiler, 2002). Following Wilson (1968), syndication has been seen as a form of risk sharing. The theory of syndicates predicts that in the face of uncertain payoffs investors may choose to diversify their holdings. When investors cannot adequately diversify by investing in multiple ventures they may opt to syndicate their investment. This is likely to occur when a venture's future payoffs are characterized by high variance, or when the investment amount constitutes a substantial proportion of the investor's assets. Indeed, Brander *et al.* (2002) report syndicates are more likely to take place in ventures that have high variance payoffs.

We conjecture that CVC personnel who are not awarded performance pay will employ syndication practices that, on average, diminish investment variance. Irrespective of the venture's stage, syndicates involving only IVCs (*all-IVC*) would have fewer members than those where a CVC is a syndicate member along with the IVCs (*CVC/IVC*).

> *Hypothesis 2: Other things being equal, a syndicate in which a corporate investor participates* (CVC/IVC) *would have more members than a syndicate in which membership consists solely of IVC funds* (all-IVC).

There is a small group of CVC programs that remunerate its personnel with carried interest or similar forms of performance pay (Birkinshaw *et al.*, 2002; Hill and Birkinshaw, 2008; McNally, 1997). To the extent that compensation shapes venture capitalists' risk preferences and thus drives their investment practices, this small group of programs is likely to exhibit more aggressive practices than those of the average CVC program. Moreover, when both CVC and IVC personnel are awarded performance pay, one might expect differences in investment practices to diminish. Hence, a CVC who receives performance pay is likely to target ventures at the same stages as IVCs do, which is earlier in comparison to that of the average CVC program. Such a CVC is also likely to participate in syndicates that are closer in size to those involving only IVCs, and smaller in comparison to that of the average CVC program.

> *Hypothesis 3: Other things being equal, the use of performance pay by a corporate investor increases the likelihood that it targets earlier stage rounds.*

> *Hypothesis 4: Other things being equal, the use of performance pay by a corporate investor increases the likelihood that it participates in smaller syndicates.*

Compensation scheme and investment performance

Next, we discuss the performance implications of investors' compensation schemes. Accordingly, the discussion shifts from investment practices in each round toward investors' overall performance. The principal-agent framework guides our hypothesis once again. We conjecture that corporate venture capitalists who are not awarded performance pay will shun high-risk, high-return funding opportunities, and that this behavior will lead to inferior outcomes. In comparison to IVCs, the average corporate investor will exhibit little or no performance gains.

As noted earlier, a small number of CVCs engage in more aggressive practices. These are the CVC programs that offer performance pay to their staff. Not only do these CVCs pursue 'IVC-like' investment practices, but also they benefit from affiliation with a large corporation. We expect that a CVC awarding performance pay will experience more favorable outcomes.

Taken together, these conjectures suggest that the CVC-IVC performance differential may be sensitive to CVC compensation schemes.

Hypothesis 5: Other things being equal, the use of performance pay by a corporate investor will increase the performance gap between CVC and IVC investors.

DATA AND METHODS

Data

We construct a dataset of venture capital investments using Thomson Financial's Venture Economics database (VE). VE collects data through multiple sources including surveys of general partners and their portfolio ventures, government filings, and so forth. VE data have been used in previous studies (Gompers 1995; Dushnitsky and Lenox, 2005b; Dushnitsky, 2006; Guler and McGahan, 2008; Hochberg, Ljungqvist, and Lu, 2007). We focus on venture capital investments (i.e., excluding buyouts) in U.S. ventures operating in the high-technology industries between January 1990 and December 1999.

Venture Economics records more than 14,000 rounds in about 6,000 unique ventures that match these criteria.[1] As expected, California has the highest number of ventures, with Massachusetts and Texas being a far second and third. The highest number of ventures is in the programming and data industry and, by decreasing number, in communications, semiconductors, and computer equipment. There are approximately 1,600 investors in the sample, including hundreds of CVCs. IVCs often manage more than one fund.[2] We use VE's categories to identify CVC investors, and further confirm their identities via Lexis–Nexis (Dushnitsky and Lenox, 2005a).

We explore the impact of venture capitalists' compensation scheme (incentives) on investment practices (behavior) and outcomes (performance). The empirical analyses proceed as follows. First, the incentives-behavior relationship is studied at the round level: analyzing each round in which CVCs and/or IVCs participate (e.g., Gompers and Lerner, 1998). The sample covers 13,096 investment rounds. There are 1,197 rounds that involve a single corporate investor (i.e., a round may, or may not, include IVCs along the CVC).[3] We compare them to 11,899 rounds involving only IVCs. Second, the incentives-performance association is analyzed at the fund level; aggregating all investments by a focal investor (e.g., Hochberg *et al.*, 2007). We compare the performance of 300 CVC and 2,530 IVC investors.

To discern compensation schemes of program personnel, we utilized three independent data sources: two proprietary surveys of CVC programs and an extensive press search. First, we draw on a survey conducted by Birkinshaw *et al.* (2002) (denoted LBS survey). The survey was mailed to CVC executives identified using VE and the *Corporate Venturing Directory and Yearbook* (Barry, 2001). A response rate of 30 percent yields rich information for 95 programs. Second, we obtain an earlier survey which was conducted by a global compensation consulting firm during the peak of the 'Internet bubble' (denoted Consultant survey). The survey was mailed to programs listed in the *Corporate Venturing Directory* (Barry, 2001), and had a response rate of 17 percent. Finally, we conducted extensive searches using Factiva, Lexis-Nexis, and firm reports. This effort yielded compensation information for six percent of the CVCs in our sample.[4]

[1] At times, Venture Economics recorded investment disbursements that are part of a single round as separate investment rounds (Lerner, 1994). This can affect our analysis; for example, for a given round we may undercount the number of syndicate participants. We thus aggregate two or more consecutive rounds listed within a 90-day period as a single round. The cutoff is chosen as most term sheets specify a maximum 90-day closing window during which investors can schedule cash infusions to the portfolio company (Lerner, 1994).

[2] On average, a VC firm manages 1.95 funds. In our sample, the prestigious firm Kleiner Perkins Caufield & Byers (KPCB) lists 16 funds: KPCB I through KPCB IX, KPCB Zaibutsu Fund I, KPCB Life Sciences Zaibatsu Fund II, KPCB Information Sciences Zaibatsu Fund II, KPCB Java Fund, and KPCB VIII Founders Fund.

[3] We exclude 662 rounds in which two or more CVCs jointly participated (the results are robust to the inclusion of these rounds). The exclusion rationale is as follows. In rounds that involve one corporate investor or less, the market for financing is the main venue for investors' interaction. The act of syndication allows investors to share financial risks. However, in rounds involving two or more corporations, the investors also interact in the product market. The act of syndication may be motivated by product market reasoning that has little to do with financial risk sharing. Hence, focusing on rounds with one CVC or less constitutes a conservative test of the hypotheses.

[4] Searches included various permutations of the keywords '*bonus,*' '*carry,*' '*carried interest,*' '*compensation,*' '*incentives,*' '*salary,*' '*tax,*' and programs' or parent firms' name.

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We assess the representativeness and reliability of the compensation data. To gauge data representativeness, we compare investment rounds for CVCs with and without compensation data (Table A1).[5] Along all key features, the rounds involving CVC programs for which compensation data are available are representative of all other CVC rounds.[6] This observation holds for all three dependent variables: investment stage, syndicate size, and fund's performance. It also holds for other dimensions, such as venture's age, round valuation, and the size of CVC's parent firm. We observe some difference in industry affiliation, yet these are not of substantial magnitude and are explicitly controlled for in the multivariate analysis. A more notable difference is that CVC programs for which compensation data are available have an average investment history of 4.7 years compared to 3.0 years for all other programs. It likely reflects that programs with longer duration of investment tend to participate in industry surveys.

To evaluate data reliability, we triangulate information across all three data sources. Specifically, about 80 percent of the respondents to the consultant survey also appear in the later LBS survey. The observations are consistent across time. Data gleaned through press searches further corroborate programs' compensation information (whenever coverage overlaps survey respondents). In sum, we believe that our data accurately capture the compensation scheme CVC personnel were awarded during the 1990s.

Variables

Two sets of variables are constructed; one to investigate the incentives-behavior relationship, and another to study the incentives-performance association.

The first set centers on managerial actions aimed at managing investment uncertainty: investment stage and syndicate size. The dependent variable, *Investment stage,* denotes the venture's stage of development at the time of the investment round. Namely, it is a round-level variable. Building on VE definitions, we identify four major stages: seed, early, expansion, and later, and set the value of *Investment stage* to 1, 2, 3, and 4, respectively. Seed-stage ventures engage in R&D and usually have no established commercial operations. Early-stage ventures are at a stage where their product is in development or available commercially. Expansion-stage ventures already ship products, though profits may be negative. Finally, later-stage ventures exhibit increasing sales volume and may even be profitable. Because the level of uncertainty declines as a venture matures, higher values of *Investment stage* are associated with less risky investment.

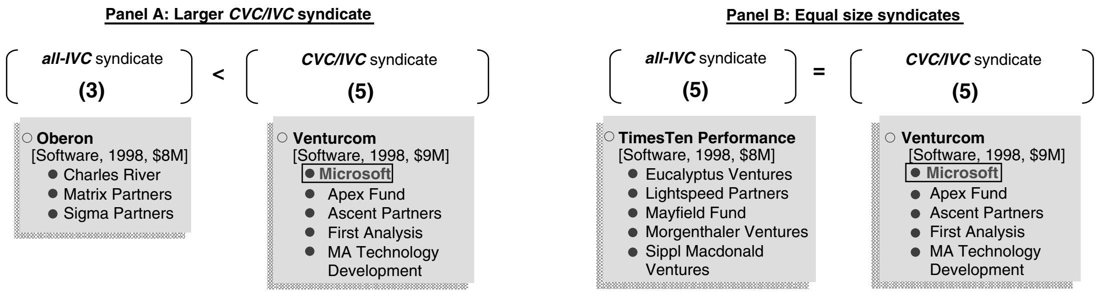
The dependent variable, *Syndicate size*, is a count of the number of syndicate members who participate in a focal investment round. It is also a round-level variable. Each unique investor is counted as one additional syndicate member, irrespective of whether it is an IVC or a CVC. For example, *Syndicate size* is equal to 4 in the following cases: (a) Vermeer Technologies received funding in December 1995 from four different IVC funds (Atlas Venture Fund II, Matrix Partners, Menlo Ventures VI, and Sigma Partners III); and (b) NetBoost received funding in August 1997 from TI Ventures (Texas Instrument CVC program) as well as three IVCs (Bay Partners, JP Morgan, and Crosspoint Venture Partners). Figure 1 presents additional examples.

The independent variable, *CVC/IVC*, is assigned a value of 1 if the focal round involves a corporate investor (e.g., a mixed CVC, IVC syndicate), and 0 if it consists solely of IVCs (e.g., an *all-IVC* syndicate). Continuing the above example, the variable

Results were coded by one of the authors and a research assistant (intercoder reliability is 93%) and pertains mainly for programs affiliated with incumbents such as Comcast, GE, and Intel. Finally, we also inspect for reorganizations that predate the surveys and might have resulted in changes to CVC's compensation—our searches yielded no evidence to that effect.

[5] As a reference, Table A1 reproduces CVC investment-rounds information reported in Gompers and Lerner (GL) (1998), Gompers (2002). In comparison to GL data, our sample tends to involve CVC rounds in younger ventures, during earlier stages, at higher valuations, and target Internet ventures. This is not surprising given GL study data from 1983–1994, while our sample centers on CVC rounds between 1990 and 1999. We find similar patterns when comparing IVC rounds in our sample to those reported in GL. The table also reproduces fund-level performance information from Hochberg *et al*. (HLL, 2007). Compared to HLL, the CVCs in our sample exhibit higher success rates. This is not surprising given that HLL aggregate CVC and IVC. Indeed, we find more consistent patterns when comparing IVC performance in our sample to that in HLL.

[6] Mann-Whitney-Wilcoxon tests could not reject the null hypothesis that CVC rounds with, and without, compensation data are drawn from populations with the same distribution of round features (see Table A1).



Figures provide examples of investment rounds. Below venture's name is a list of coinvestors in that round. The syndicate size (i.e., count of unique syndicate members) is in parentheses. Brackets delineate venture's industry, year in which round took place, and post-round valuation.

Figure 1. The variable syndicate size: a count of the number of syndicate members

is equal to 0 for Vermeer and is equal to 1 for NetBoost. As for Figure 1, *CVC/IVC* is equal to 0 for Oberon (Panel A) or Times Ten (Panel B), and is equal to 1 for Venturecom.

Next, we explain the CVC compensation measures. Ideally, they should reflect the slope of the relationship between pay and measured performance (Guay, 1999). In practice, prior work employs various measures, ranging from a simple sum of dollar value to a sophisticated discounting of stock options (Lambert, Larcker, and Weigelt, 1993; Balkin *et al*., 2000; Zenger and Marshall, 2000; Hoskisson *et al*., 2002). These studies utilize compensation data for top management teams, which are publicly available per SEC regulations. Such data are unavailable for CVC personnel. Rather, we construct two dichotomous variables that indicate whether a CVC program awards low-, or high-powered incentives. We use data from the LBS and consultant surveys as well as press reports. While the lack of detailed dollar magnitudes is a disadvantage, the documentation of 'compensation schemes' may be less prone to bias (e.g., conscious over or underreporting).

The consultant survey asked executives whether they offer carried interest to their CVC personnel. Almost a third (32%) of the programs responded positively. The press searches yield similar observations: 27 percent of the programs report carried interest as part of their compensation scheme. The LBS survey inquired about several compensation components: (a) fixed salary, (b) performance-based bonuses, and (c) long-term, outcome-based pay. Rather than yes/no answers, respondents used five-item Likert scales to report the prevalence of each component. For example, managers were asked how frequently they used carried interest to reward CVC managers. A third (33%) of the programs reported a score of 4 or 5, implying that their personnel are awarded high-powered incentives. We collapse the LBS responses into a single index, which allows us to utilize the full range of compensation components.[7] The index ranges from a low of 1 for programs that remunerate solely through fixed salary, to a high of 4.4 for programs that employ IVC-like carried interest.

The dichotomous compensation variables are defined as follows.[8] The variable *CVC-incentives-high* is equal to 1 if consultant survey or press searches indicate a focal CVC awards carried interest or CVC's score is above the median value of the LBS compensation index. Similarly, *CVC-incentives-low* is equal to 1 if consultant survey or press searches indicate a focal CVC does not award carried interest or CVC's score is below median value of LBS index. Finally, because compensation data are unavailable for several corporate investors, both *CVC-incentives-low* and *CVC-incentives-high* might have the value 0 for some

[7] Scholars often combine raw data items into a single composite index; for example, Stern (2004) creates a science index, Rajgopal and Shevlin (2002) capture firm's investment opportunity set, and Rodan and Galunic (2004) measure managerial action. Thus, we construct an index of CVCs' compensation. A principle component factor analysis of compensation items yielded a single factor with an eigenvalue greater than 1.

[8] Results are robust to three alternative definitions. First, we use only LBS data; thus *CVC-incentives-high* (*CVC-incentives-low)* equals 1 if focal CVC's score on the LBS compensation index is above (below) its median value. Second, rather than median value of the multidimension LBS index, we focus on a single LBS item: 'carried interest.' Namely, *CVC-incentives-high* (*CVC-incentives-low*) is equal to 1 if focal CVC's response to the LBS item is (not) 'frequently' or 'almost always.' Finally, we explore a third definition that utilizes all three sources. *CVC-incentives-high* (*CVC-incentives-low*) equals 1 if (a) CVC's response to the LBS item is (not) 'frequently' or 'almost always,' or (b) consultant survey and press searches indicate (do not indicate) it offers carried interest.

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CVC rounds. To flag these as CVC rounds, we create *CVC-other.* It is set to 1 when *CVC/IVC* equals 1 and *CVC-incentives-low* and *CVC-incentives-high* equals 0. Since these three variables are colinear with *CVC/IVC*, we drop the latter in specifications that include *CVC-incentives-low, CVC-incentives-high* and *CVC-other.*[9]

We employ several control variables. Some CVC programs pursue financial goals while others are strategically oriented. We thus control for program's objective; *Strategic CVC* is equal to 1 if a CVC's main objective is strategic (e.g., window on technology), 0 otherwise. Using Lexis-Nexis, two research assistants examined announcements of CVC formation and coded programs' primary objective (intercoder reliability is 92%). Because these announcements shape future deal flow, a firm is inclined to accurately announce its CVC objectives. Firms making announcements such as 'Dell... makes investments first and foremost to get access to important developing technology' (Dell Ventures), or 'it is not primarily profit oriented... take risks... for the sake of innovative ideas' (Novartis) are coded as strategically oriented CVC; whereas those stating 'solely for financial return' (Mitsui PE), or 'the first priority of Oracle's venture effort is financial returns' (Oracle) are labeled as financially driven (see Dushnitsky and Lenox [2006] for details). Data are available for a subset of CVCs.

The variable *Round valuation,* the post-round valuation in thousands of dollars, controls for potential heterogeneity in a venture's quality. Specifically, it is possible that CVC- and IVC-backed ventures differ in quality. This, for example, may be the result of high-quality ventures opting for CVC backing in hope of gaining access to corporate complementary assets, customers, and so forth. Because these ventures are likely to command higher valuation and thus necessitate greater syndicate membership, one may systematically observe larger *CVC/IVC* syndicates, yet not for the hypothesized reasons. *Round valuation* controls for a venture's latent quality.[10] Finally, we control for investment characteristics. *Year dummies* is a vector of dichotomous variables denoting the year of the focal round. *Venture industry dummies* is a vector of dichotomous variables denoting venture's industry. The industry affiliation is reported along a proprietary Venture Economics Industry Classification (VEIC) and represents the following industries: medical, communication, computer hardware, and computer software/Internet.

The second set of variables focuses on the performance implications of venture capitalists' compensation. Following Kaplan and Schoar (2005) and Hochberg *et al.* (2007), we analyze the incentives-performance association at the fund level. Ideally, we would measure fund performance directly using the return a fund achieved over its life span. However, such measure is unavailable due to strict data limitations. Absent data on venture capital fund returns, we follow Hochberg *et al.* (2007) and use funds' 'exit rates' as a performance measure. The dependent variable, *Fund performance,* is defined as the fraction of portfolio companies that have successfully exited via an IPO or M&A transaction by 2006. The results are robust to an alternative definition that focuses solely on the fraction of IPO exits.

The independent variables distinguish corporate from independent investors, and signify the former's compensation scheme. The variable, *CVC*, is equal to 1 for corporate investors, 0 for IVCs. The variables *CVC-incentives-low, CVC-incentives-high,* and *CVC-other* follow the earlier definitions. They denote programs that offer low-powered incentives, high-powered incentives, or for which compensation data are unavailable, respectively.

Finally, we control for other known determinants of performance such as fund characteristics and the availability of, and competition for, investment opportunities (Gompers and Lerner, 2000, Kaplan and Schoar, 2005; Hochberg *et al.*, 2007). The variable, *Fund size*, is the log of a fund's commitments as reported in VE. Following VE's fund-focus classification, *Fund early stage*, is set to 1 if a focal fund is classified as a seed- or early-stage fund, 0 else. A dichotomous variable, *First fund*, equals 1 when the focal fund is the

[9] By construction, *CVC-incentives-high, CVC-incentives-low,* and *CVC-other* are mutually exclusive and nested in *CVC/IVC*. For all-IVC rounds (*CVC/IVC* = 0), the variables equal 0. For a CVC round (*CVC/IVC* = 1), one of the following holds: (a) if compensation data are unavailable then *CVC-other* is 1, and *-low, -high* are 0; (b) if data sources suggest a CVC offers low-powered compensation, then *-low* is 1 and *CVC-other, -high* are 0; (c) if data sources suggest high-powered compensation then *-high* is 1 and *CVC-other, -low are* 0.

[10] We note that pre-money valuation is a good proxy of a venture's quality, as it reflects investors' assessment of the venture. Unfortunately, such data are unavailable due to confidentiality concerns. We use post-money valuation, which is readily available for almost all ventures in our sample.

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venture capital firm's first fund, and 0 if it is a follow-on fund. We control for the experience of a fund's VC-firm: *Fund's firm experience* is the log of the cumulative investments between the firm's creation and the fund's creation. We also control for CVC's goals: *Strategic CVC* is equal to 1 if a CVC is strategically oriented, 0 otherwise. Many funds operate within a particular time frame and/or industry, and are therefore affected by the number of investment opportunities and competition for deal flow. To proxy for the level of competition, *VC inflows*, is defined as the log of total venture capital raised in the year a focal fund was raised (i.e., its vintage year). The variable *3yr average B/M ratio* is the book/market ratio of public companies in a focal fund's industry of interest, measured over the first three years of its existence. It is used in the literature as a proxy for investment opportunities facing the fund during its most active investment phase.[11]

ANALYSIS AND RESULTS

Compensation scheme and managerial investment practices

Table 1 (Panel A) reports descriptive statistics and correlations. The mean investment stage, averaged across all rounds, is 2.50. Panel A of Table 2 presents the number and percentage of investment rounds by venture's stage and investor type. While almost 18 percent of IVCs' investments go toward ventures at the seed-stage, only 12 percent of CVCs' rounds go to ventures at that stage. In contrast, only 12 percent of IVCs' rounds are at later-stage ventures, less than the 16 percent for CVCs' rounds. Gompers (2002) notes similar patterns for the period 1983–1994.

Using the Mann-Whitney-Wilcoxon (MWW) nonparametric test, we test a null hypothesis that *all-IVC* and *CVC/IVC* rounds target ventures at similar stages of development. We opt for the MWW test because it does not require any distributional assumptions. The null is rejected, indicating that the difference is highly significant (z-stats $=$ 6.63, $p < 0.001$). In sum, corporations invest in mature and potentially less risky ventures, consistent with Hypothesis 1.

Shifting to syndicate size, we note that the mean value is 2.81 (Table 1, Panel A). Panel B of Table 2 presents univariate analysis of syndicate size. The mean is equal to 2.63 for *all-IVC* syndicates and 4.56 for *CVC/IVC* syndicates. That is, syndicates in which only IVCs participate have, on average, 2.63 unique investors. Syndicates involving a single corporate investor along with IVCs, exhibit higher participation: on average there are 4.56 different investors. The average size of *all-IVC* syndicates is in line with prior studies in Canada (Brander *et al.*, 2002), the United Kingdom (Wright and Lockett, 2003) and the United States (Guler and McGahan, 2008). The size of *CVC/IVC* syndicates is not reported elsewhere, to the best of our knowledge. The MWW test finds evidence in support of Hypothesis 2; the conjecture that *all-IVC* syndicates are of the same size as syndicates involving a corporate investor is rejected (z-stat $= 25.9$, $p < 0.001$). One might argue that the patterns simply reflect CVCs' propensity to fund mature ventures. That is, rounds in later stages usually require bigger amounts and thus more investors 'chip in.' We find that size disparity persists within each stage, and MWW tests indicate that the differences are significant (Table 2, Panel C). That is, controlling for a venture's stage, we continue to find that rounds involving a CVC have more syndicate members than similar stage rounds where all investors are IVCs.

Multivariate analysis is now presented. We conduct separate analyses of venture capitalists' investment stage, syndication, and performance. The dependent variable, *Investment stage,* is a categorical variable where higher values represent less risky investments. Thus, the ordinary least squares (OLS) assumptions of homoskedasticity and normally distributed errors are violated. We account for the ordinal nature of the variable and estimate an ordered-logit model, which is built around a latent regression in the same manner as the binomial-logit model (Greene, 2000). Because multiple observations for the same venture may create correlations between the error structure and the independent variables, we report robust standard errors clustered by ventures.

Table 3 reports results for the ordered logit model of investment stage. We control for factors

[11] Following Gompers and Lerner (2000) and Hochberg *et al.* (2007), a fund's industry of interest is the VE industry that accounts for the largest share of its portfolio. The ratios are value-weighted means measured over a fund's first three years, to control for investment opportunities during the fund's most active investment phase.

Table 1. Descriptive statistics and correlations

	Variable	Mean	Min	Max											
A.	***Investment practices***				(1)	(2)	(3)	(4)	(5)	(6)	(7)				
(1)	***Investment stage***	2.5	1	4											
(2)	***Syndicate size***	2.9	1	32	0.17										
(3)	***CVC/IVC***	0.09	0	1	0.06	0.25									
(4)	***CVC-inc-low***	0.02	0	1	0.04	0.11	0.41								
(5)	***CVC-inc-high***	0.01	0	1	0.01	0.05	0.28	−0.01							
(6)	***CVC-other***	0.07	0	1	0.04	0.21	0.84	−0.03	−0.02						
(7)	***Round valuation***	7.7	0.3	13	0.12	0.32	0.15	0.06	0.05	0.16					
(8)	***Strategic-CVC***	0.02	0	1	0.05	0.12	0.46	0.56	0.28	0.15	0.09				
B.	***Investment performance***				(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)
(a)	***Fund performance***	0.3	0	1											
(b)	***CVC***	0.1	0	1	0.06										
(c)	***CVC-inc-low***	0.01	0	1	0.01	0.24									
(d)	***CVC-inc-high***	0.01	0	1	0.05	0.28	−0.01								
(e)	***CVC-other***	0.09	0	1	0.05	0.91	−0.03	−0.03							
(f)	***Fund size***	2.5	0.7	5.7	0.01	−0.17	0.06	0.02	−0.20						
(g)	***First fund***	0.4	0	1	−0.02	0.22	0.03	0.04	0.21	−0.19					
(h)	***Fund stage***	0.3	0	1	−0.07	−0.13	−0.05	−0.02	−0.13	0.04	−0.08				
(i)	***VC inflow***	10.4	5.9	11.8	−0.13	0.12	0.03	0.02	0.12	−0.26	−0.08	0.07			
(j)	***3yr B/M average***	1.0	0.4	4.4	0.07	−0.11	−0.02	−0.03	−0.10	0.18	0.07	−0.05	−0.80		
(k)	***Fund's firm experience***	3.3	0	7.0	0.07	−0.27	0.01	−0.02	−0.29	0.66	−0.62	0.12	−0.11	0.07	
(l)	***Strategic-CVC***	0.01	0	1	0.01	0.32	0.27	0.23	0.19	0.06	0.05	−0.04	0.07	−0.06	0.00

Table 2. Univariate analysis of investment stage and syndicate size

	all-IVC	*CVC/IVC*	Mann-Whitney *z*- statistics
A. ***Investment stage (number of rounds/[%])***			
Seed rounds	2,117	142	
	[17.8%]	[11.9%]	
Early rounds	3,429	311	
	[28.8%]	[26.0%]	
Expansion rounds	4,921	549	
	[41.4%]	[45.9%]	
Later rounds	1,432	195	
	[12.0%]	[16.3%]	
ALL rounds	11,899	1,197	
	[100%]	[100%]	
B. ***Syndicate size (mean size)***			
ALL rounds	2.63	4.56	25.9***
C. ***Syndicate size by stage (mean size)***			
Seed rounds	2.27	3.32	7.0***
Early rounds	2.41	3.55	10.3***
Expansion rounds	2.73	4.97	18.9***
Later rounds	3.31	5.98	11.7***

Panel A reports the number of *all-IVC* and *CVC/IVC* investment rounds by venture's stage at investment. Numbers in square brackets represent stage percentage of total investments. Panels B and C report mean syndicate size for *all-IVC* and *CVC/IVC* rounds. Mann-Whitney-Wilcoxon tests significant at the level of * $z<0.05$, ** $z<0.01$, *** $z<0.001$.

that may affect stage of investment by including a vector of dichotomous variables denoting year of investment and a vector of dichotomous variables denoting venture's industry affiliation. For parsimony, we do not report coefficients on each dichotomous variable. We also include a proxy of venture's quality, *Round valuation*, and an indicator of program's objective, *Strategic CVC*.

Model 3-1 finds a positive and significant coefficient on *CVC/IVC*. As with any nonlinear regression model, coefficient estimates do not necessarily represent marginal effects. We use the estimates to calculate the probability of investment in a seed-stage venture. If a round consists of IVCs (*CVC/IVC* = 0) the probability is 18 percent, but drops to 13 percent if a corporate investor is involved (*CVC/IVC* = 1). The pattern flips for rounds in more mature ventures: early-stage (29% for *all-IVC* rounds vs. 25% for *CVC/IVC* rounds), expansion-stage (41% vs. 45%), and later-stage (12% vs. 17%), respectively. It is consistent with Hypothesis 1: in comparison to IVCs' practices, CVCs invest in ventures at later stages of development. Prior work reports similar patterns (Gompers and Lerner, 1998; Gompers, 2002).

Model 3-2 directly tests the effect of CVC's compensation. By construction, compensation variables are colinear with *CVC/IVC*. We thus replace *CVC/IVC* with *CVC-incentives-low, CVC-incentives-high,* and *CVC-other*. The coefficient for *CVC-incentives-low* is positive and highly significant, whereas *CVC-incentives-high* is insignificantly different from 0. The difference between the coefficients is statistically significant (= 1.98**). Again, we calculate the probability of funding a seed-stage venture. It is 18 percent for an *all-IVC* round, 11 percent if corporate venture capitalists with little or no performance pay are involved (*CVC-incentives-low* = 1), and 14 percent if CVCs are awarded high-powered incentives (*CVC-incentives-high* = 1). The likelihood of funding a later-stage venture is 12, 20, and 16 percent, respectively. The results support Hypothesis 3. In the presence of performance pay, CVC personnel engage in practices that only slightly differ from that of their independent counterparts. In contrast, the difference between *all-IVC* and *CVC/IVC* is evident when we focus on programs that award low-powered incentives. Note, the impact of compensation schemes persists while controlling for numerous factors including ventures' industry and CVC objectives.

We reestimate the models using different subsamples. Model 3-3 replicates Model 3-2 while excluding investments by a single investor, irrespective of investor type. That is, we analyze only syndicated rounds. The control *Strategic CVC* is

Table 3. Analysis of investment stage

	(3-1)	(3-2)	(3-3)	(3-4)	(3-5)	(3-6)
	Full	Full	Syndicated rounds	Holding IVC fund	Holding IVC firm	Treatment-effects (second stage)
CVC/IVC	0.221*** [0.07]	—	—	—	—	—
CVC-other	—	0.215*** [0.08]	0.266*** [0.08]	0.213*** [0.08]	0.237*** [0.08]	—
CVC-incentives-low	—	0.368** [0.17]	0.502*** [0.17]	0.382** [0.17]	0.398** [0.17]	—
CVC-incentives-high	—	0.109 [0.19]	0.248 [0.21]	0.114 [0.19]	0.131 [0.19]	—0.444** [0.24]
Year dummies	*Incl.*	*Incl.*	*Incl.*	*Incl.*	*Incl.*	*Incl.*
Venture industry dummies	*Incl.*	*Incl.*	*Incl.*	*Incl.*	*Incl.*	*Incl.*
Round valuation	0.000*** [0.00]	0.000*** [0.00]	0.000*** [0.00]	0.000*** [0.00]	0.000*** [0.00]	0.000 [0.00]
Strategic CVC	0.324*** [0.12]	0.274** [0.15]	0.173 [0.16]	0.264* [0.15]	0.252* [0.15]	—
Mills ratio	—	—	—	—	—	*0.265* [0.20]*
N	13,096	13,096	8,520	5,896	8,241	334
Log-likelihood	−16553***	−16552***	−10843***	−7417***	−10439***	−429***

Ordered-logit regression results. The dependent variable is a categorical measure denoting whether the venture receiving the investment round is at a seed (1), early (2), expansion (3), or later stage (3). The main independent variable, *CVC/IVC*, gets the value 0 if the focal investment round is all-IVC syndicate, or 1 if it is a mixed CVC, IVC syndicate. *CVC-incentives-low* (*CVC-incentives-high*) gets the value 1 when a program award is low- (high-) powered incentives, and the value 0 if information about CVC's compensation is unavailable. *Year dummies* is a vector of dichotomous variables denoting the year of the focal round (1990–1999). *Venture industry dummies* is a vector of dichotomous variables denoting the three-digit VEIC code of the venture. *Round valuation is* post-round valuation in thousands of dollars. *Strategic CVC* gets the value 1 if CVC stated strategic orientation, 0 else. The table reports parameter coefficient estimates; robust standard errors clustered by funded venture are in brackets ($^{*}z < 0.05$, $^{**}z < 0.01$, $^{***}z < 0.001$). For vectors of dichotomous variables, the table reports inclusion of a vector. As a robustness test, the analysis is replicated in various subsamples: only syndicated rounds (Model 3-3), rounds where IVC funds previously syndicated with a CVC investor (Model 3-4), and rounds where IVC firm previously syndicated with a CVC (Model 3-5). Model 3-6 reports the results of the second stage of a treatment effects model of investment stage.

not significantly different from 0. Importantly, the independent variables retain their sign and significance, consistent with Hypotheses 1 and 3.

Model 3–4 repeats the analysis for a subsample of IVC funds that ever syndicated with CVC investors. Model 3–5 does the same while holding IVC firms constant (a firm can manage several funds). These models tackle concerns regarding IVC heterogeneity. Specifically, one might argue that it is sorting on the part of IVCs that leads to the stage disparity. Each IVC makes two choices: (a) what its preferred stage of investment is, and (b) whether or not to coinvest with a corporate investor. Due to unobserved IVCs' attributes (e.g., inherent capabilities, risk preferences), some IVCs may seek CVC participation as well as more mature ventures, while other IVCs may pursue younger ventures and no corporate involvement. By holding the IVC constant, we control for its unobserved attributes. Hence, we focus on those IVCs that previously syndicated with a CVC investor, comparing ventures' stage in rounds where they invest along with other IVCs to those in which they coinvest with a corporation. Irrespective of whether we hold the IVC fund (Model 3–4), or IVC firm (Model 3–5) constant, the coefficients are similar in sign and statistical significance to those of Model 3-2.

Endogeneity concerns are addressed next. One might argue that performance pay does not shape the stage a CVC targets. Rather, both are an artifact of program goals. That is, compensation and behavior are endogenously derived from a CVC's objectives. To alleviate these concerns, we use a dedicated econometric strategy: a treatment-effects model (Heckman, 1979; Maddala, 1983).

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The model accounts for the fact that an unobserved factor (i.e., CVC objective) may be correlated with both (a) compensation scheme and (b) investment practices. Accordingly, we estimate a two-stage treatment model. The first-stage regression estimates a CVC's compensation scheme choice, and the second- stage estimates the stage of a CVC's investment. The model dictates the use of a subsample of investment rounds for which CVC compensation data are available.[12]

To achieve identification and generate credible estimates, the exclusion restriction has to be satisfied (Hamilton and Nickerson, 2003; Singh and Mitchell, 2005). That is, the first stage should include a variable that affects compensation choice but does not directly impact investment practices (i.e., does not enter the second stage). Fortunately, such a variable exists in our setting: the geographical distance between a CVC program and its corporate headquarters likely affects the nature of program's compensation schemes (Nickerson and Zenger, 2008),[13] yet does not directly impact the investment stage a program targets. Additional variables include *Strategic CVC*, an indicator of program's objectives (Gompers and Lerner, 1998), and a set of firm and industry factors that stimulate strategic CVC investment (Dushnitsky and Lenox, 2005b).[14] In sum, the first-stage probit regression estimates for each corporate investor the probability that CVC personnel are awarded high-powered incentives (Model A2-1 in Table A2).

Model 3–6 reports the second stage of an ordered-logit treatment-effects model where the dependent variable is *Investment stage*. In contrast to prior models that compare CVCs with IVCs, the current analysis is focused solely on CVCs. We compare investment practices of programs that offer performance pay to those that do not. The coefficient for *CVC-incentives-high* is negative and significant. The findings indicate that, consistent with Hypothesis 3, CVCs that offer performance pay target investments at earlier stages. Next, we calculate the net economic effect of high-powered performance pay: it accounts for an average 'net' decrease of 0.17 in the targeted stage of investment.[15]

We now turn to *Syndicate size*. Given the nature of the variable, we employ the negative binomial regression approach (Hausman, Hall, and Griliches, 1984), and specify the following regression: $Syndicate\ \ size_{it} = exp(X_{it}\beta_1 + C_{it}\beta_2)$, where $Syndicate\ size_{it}$ is the number of syndicate members that participate in a focal round in venture i in year t, X_{it} is a vector of independent variables denoting the presence of a CVC and its compensation scheme, C_{it} is a vector of control variables (it also controls for venture's stage using a vector of dichotomous variables based on *Investment stage)*, and β_1, β_2 are the corresponding vectors of coefficient estimates. Again, we report robust standard errors clustered by ventures.

In Model 4-1, the coefficient for *CVC/IVC* is positive and significant. Calculating the marginal

[12] The first-stage estimates the likelihood that a CVC employs high incentives. Thus, we use a subsample of CVC rounds for which compensation data are available. Put differently, most of the rounds in the full sample (e.g., IVC rounds, CVC without compensation info) are irrelevant for our analysis. Within that subsample, univariate analysis does not find a statistically significant relationship between program objectives and compensation schemes: chi2 test (*chi2* = 0.056; *Pr* = 0.813), and Fisher exact test (*Pr* = 0.59).

[13] Nickerson and Zenger (2008: 1431) 'assert that individual employees invidiously compare their rewards with others they deem to be within their referent group (for example, see Adams 1963, Festinger 1954). If perceived inequity arises, the resulting negative feeling—what we refer to as envious emotion—drives individuals to... reduced effort, influence activities, departure, noncooperativeness, or even outright sabotage.' The authors single out the role of distance (page 1434 onward): 'The general conclusion in the literature is that spatial proximity... [is a] primary determinant[s] of the choice of salient referents ...' [page 1434] 'increasing the physical distance among workers... restrict the scope of interaction and information sharing, thereby reducing the salience of these workers as referents' (1437). Others report similar tensions within corporations (Argyres and Liebeskind, 1998; Capron, and Mitchell, 2008). Landier, Nair, and Wulf (2007) present evidence of the effect distance has within organizations. Building on these insights, performance pay is more likely in units that are distant from headquarters. What are the implications for CVC compensation scheme? Note that many CVC programs are located around Silicon Valley. It follows that performance pay for CVC personnel is more likely for the Atlanta-headquartered UPS than the California-headquartered Chevron.

[14] We include factors that are associated with an increase in CVC's marginal innovative output: *Industry tech opportunities* (for each industry, the natural logarithm of the average number of citation-weighted patents applied for by firms in a given year), *Industry IPP* (for each industry, the mean percentage of innovations for which patenting is an effective mechanism for protecting intellectual property), *Industry complementary assets* (for each industry, the importance of distribution and sales capabilities), as well as *Firm R&D* (firm's annual R&D expenses divided by total assets), and *Firm cash-flow* (income before extraordinary items plus depreciation and amortization). Advantageously, data for these factors are available for all CVCs during the year they invest.

[15] The differences in targeted stage across two programs that are equally likely to award high-incentives, where one does and the other does not (Greene, 2000: 933): $E[Stage|likely, high\text{-}incentives] - E[Stage|likely, low\text{-}incentives]$.

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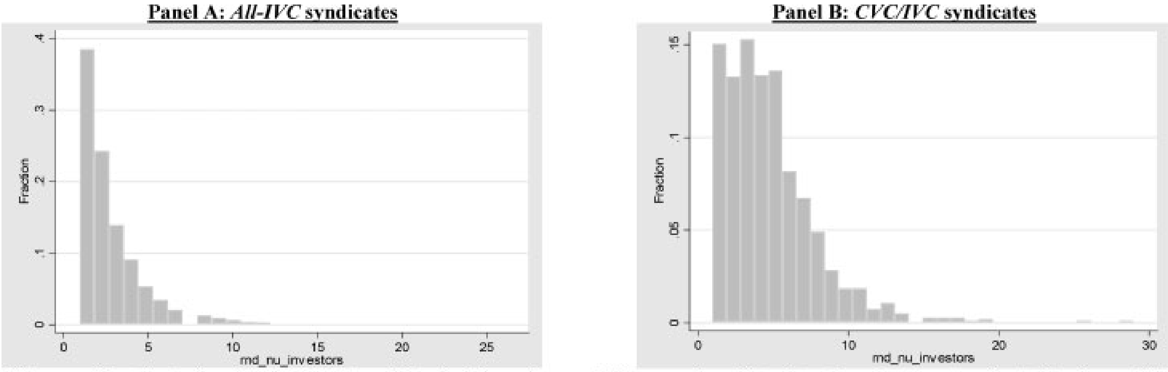
Panel A: *All-IVC* syndicates | **Panel B: *CVC/IVC* syndicates**



Histogram of syndicate size where investment syndicate includes only independent venture capital funds (note Y-axis max at 40%).

Histogram of syndicate size where investment syndicate includes one CVC investor along with IVC funds (note Y-axis max at 15%).

Figure 2. Distribution of syndicate sizes by syndicate type

effects, we find that rounds involving a CVC investor are associated with a syndicate size that is 56 percent larger than rounds where syndicate members are all IVCs. Hence, the results are consistent with Hypothesis 2.

In Model 4-2, we test the effect of compensation schemes. The variable *CVC/IVC* is replaced with the three dichotomous compensation variables. *CVC-other* is positive and significant. The coefficient on *CVC-incentives-low* is positive, significant, and larger in magnitude than that for *CVC-incentives-high*. The difference between the two is highly significant (= 3.25***). Marginal effects indicate that in comparison to *all-IVC* rounds, syndicate size is 61 percent larger for a round involving a CVC with little or no performance pay. Syndicates are only 37 percent larger for a round involving a CVC with high-powered incentives. The findings support Hypothesis 4: syndicate size disparity shrinks in the presence of performance pay, as corporate personnel engage in practices that are closer to those of IVCs.

We reproduce Model 4-2 in various subsamples. As Figure 2 shows, an investment by a single investor is more common among IVCs (37% of rounds) than it is for CVCs (15% of rounds). Arithmetically, it drives downward the average *all-IVC* syndicate size. To account for this fact, Model 4-3 excludes investments by a single investor irrespective of investor type. The results are consistent with Model 4-2 and Hypothesis 4. To address concerns regarding IVC heterogeneity, Models 4-4 (4–5) repeat the analysis for a subsample of IVC funds (firms) that have syndicated with CVCs. Again, the results are qualitatively similar to Model 4-2.

Model 4–6 is a treatment-effects model accounting for endogeneity concerns. That is, the concern that performance pay does not shape syndicate size, rather both are an artifact of program goals. Similar to Model 3–6, the first-stage probit regression estimates CVC's compensation scheme decision. The second-stage negative-binomial model estimates CVC's syndicate size. Recall that we use a subsample of investment rounds for which CVC compensation data are available. The coefficient for *CVC-incentives-high* is negative and significant. That is, CVC programs that award performance pay pursue investments in smaller syndicates, consistent with Hypothesis 4. The economic effect of performance pay is substantial. By comparing the size of syndicates involving (a) CVCs with high-powered incentives, and (b) CVCs that were likely to receive high-powered incentives but did not, we find that the former programs partake in syndicates that are, on average, 51 percent smaller (Greene, 2000).

Finally, we stress that the findings are distinctly consistent with syndication as a risk-sharing practice. Extant work identifies other syndication rationales: selection, referral, and value added.[16]

[16] We briefly describe three other syndications rationales. The first refers to an approval process involving multiple members that reduces the likelihood of accepting a bad project (Sah and Stiglitz, 1986). That is, syndicates can improve the ability to select attractive targets since syndicate members serve as a source of a 'second opinion' (Bygrave, 1987). Accordingly, Lerner (1994) finds that experienced venture capitalists syndicate early stage investments with other experienced venture capitalists, who can provide expert opinion. The second denotes that syndication may be instrumental in building a quality future deal flow. Investor X includes investor Y in a lucrative investment in anticipation that Y, when recognizing another quality venture in

Irrespective of the rationale, syndication is a voluntary structure that emerges if and only if all members agree to do so. We note that risk sharing is the only syndication rationale that is consistent with our larger syndicates finding. Other rationales would predict that *CVC/IVC* syndicates should be smaller—not larger—than *all-IVC* syndicates. Consider, for example, the 'selection' rationale. In a syndicate that already includes a few IVCs, the marginal contribution of adding a CVC would surpass that of an additional IVC. The latter's skill set is redundant with existing syndicate members whereas the CVC has access to unique due diligence skills (e.g., corporate R&D personnel). Hence, a syndicate consisting of a CVC and two IVCs likely has better selection capabilities than a larger syndicate involving four IVCs. The 'referral' and 'value- added' rationales yield similar predictions.

Compensation scheme and investment performance

We shift from analyzing investment practices at the investment-round level to studying funds' performance at the fund level. Table 1 (Panel B) reports descriptive statistics and correlations for the fund level sample. The mean value of funds' exit rates, averaged across IVCs and CVCs, is about 30 percent. Similar rates are reported by Hochberg *et al.* (2007).

A multivariate analysis of venture capitalists' performance is presented. The dependent variable, *Fund performance,* is a continuous measure. Following Hochberg *et al.* (2007), we use OLS to estimate the following regression specification:[17] $Fund\ performance_i = X_i\beta_1 + C_i\beta_2 + Y_i\beta_3 + \varepsilon$, where $Fund\ performance_i$ is a measure of fund i exit rates, X_i is vector of independent variables denoting corporate investors (*CVC*) and their compensation schemes (*CVC-incentives-low, CVC-incentives-high,* and *CVC-other*), C_i is a vector of controls, Y_i is a vector of fund vintage-year dummies, and β_1, β_2, β_3 are the corresponding coefficient estimates.

Table 5 reports OLS regression results of investors' performance. Model 5-1 shows a positive and significant coefficient on *CVC*. That is, corporate investors exhibit significantly better performance as measured by the rate of successful portfolio exits.[18] The economic magnitude of this effect is meaningful: CVCs experience a 10 percent excess in their exit rates. That is, the average exit rate of corporate investors is about one third higher than that of independent VC funds. As for the control variables, the sign and significance of all the coefficients is consistent with Kaplan and Schoar (2005) and Hochberg *et al.* (2007), with the exception of *Fund size* having flipped sign and *VC inflow* being insignificant.

Model 5-2 directly tests for the effect of CVC's compensation scheme. To that end, we substitute *CVC* with *CVC-incentives-low, CVC-incentives-high,* and *CVC-other*. All three variables have positive and significant coefficient estimates. The controls retain the same sign and significance as in Model 5-1. More importantly, the coefficient on *CVC-incentives-high* is significantly larger than that on *CVC-incentives-low* (= 1.97**). The average exit rates for CVCs with little or no performance pay (i.e., *CVC-incentives-low = 1*) is 9.7 percent higher than that of IVCs. The CVC-IVC performance differential doubles to 20 percent when CVCs are awarded high-powered performance pay (*CVC-incentives-high = 1*).

Therefore, consistent with Hypothesis 5, we find that the performance of a corporate investor (weakly) dominates that of independent VC funds, if the CVC does (does not) award performance pay. The results support our hypothesis. Moreover, they address an alternative explanation that CVCs exhibit greater exit rates simply because they fund later-stages ventures.[19] The results refute this explanation: CVCs with performance pay invest in earlier-stage deals (as per Hypothesis 3) and still outperform IVCs (per Hypothesis 5).

Model 5-3 reports a treatment-effects model at the fund level. The approach follows the one in Models 3–6 and 4–6, and similarly the sample

the future, will syndicate it with X. Thus, syndication is motivated by anticipation of reciprocity (Sorenson and Stuart, 2001). This referral rationale views syndication as a vehicle to enhance deal flow (i.e., broaden the pool of investment targets), whereas the selection explanation assumes that for a given deal flow (i.e., a given pool of targets) syndication can increase the likelihood of selecting high-quality ventures. Finally, syndication can be an important strategy to enhance a venture's prospects. The argument is based on the fact that each investor provides substantial value-added services in addition to capital infusion (Sapienza, 1992; Sapienza and Manigart, 1996; Brander *et al.*, 2002).

[17] The results are robust to Tobit estimation. Results are available from the authors upon request.

[18] Footnote 21 reviews the unique advantages CVC investors afford to their portfolio companies.

[19] We thank an anonymous referee for this observation.

Table 4. Analysis of syndicate size

	(4-1)	(4-2)	(4-3)	(4-4)	(4-5)	(4-6)
	Full	Full	Syndicated rounds	Holding IVC fund	Holding IVC firm	Treatment-effects (second stage)
CVC/IVC	0.449*** [0.03]	—	—	—	—	—
CVC-other	—	0.456 *** [0.03]	0.319 *** [0.02]	0.748 *** [0.03]	0.589 *** [0.03]	—
CVC-incentives-low	—	0.464 *** [0.05]	0.260 *** [0.05]	0.762 *** [0.05]	0.603 *** [0.06]	—
CVC-incentives-high	—	0.307 *** [0.08]	0.208 *** [0.07]	0.600 *** [0.08]	0.440 *** [0.08]	− 0.248*** [0.09]
Year dummies	*Incl.*	*Incl.*	*Incl.*	*Incl.*	*Incl.*	*Incl.*
Venture stage dummies	*Incl.*	*Incl.*	*Incl.*	*Incl.*	*Incl.*	*Incl.*
Venture industry dummies	*Incl.*	*Incl.*	*Incl.*	*Incl.*	*Incl.*	*Incl.*
Round valuation	0.000*** [0.00]	0.000*** [0.00]	0.000*** [0.00]	0.000*** [0.00]	0.000*** [0.00]	0.000 [0.00]
Strategic CVC	0.026 [0.05]	0.042 [0.06]	0.053 [0.05]	0.024 [0.06]	0.024 [0.06]	—
Mills ratio	—	—	—	—	—	*0.157*** [0.05]*
Constant	1.845*** [0.08]	1.883*** [0.05]	1.965*** [0.07]	1.278*** [0.10]	1.334*** [0.09]	1.257*** [0.29]
N	13,096	13,096	8,520	5,896	8,241	334
Log-likelihood	−25532***	−25530***	−17336***	−10179***	−14972***	−767***

Negative binomial regression results. The dependent variable is a count of the number of syndicate members (IVC or CVC investors) that participate in a focal investment round. The main independent variable, *CVC/IVC*, gets the value 0 if the focal investment round is all-IVC syndicate, or 1 if it is a mixed CVC, IVC syndicate. *CVC-incentives-low* (*CVC-incentives-high*) gets the value 1 when a program award is low- (high-) powered incentives. *Year dummies* is a vector of dichotomous variables denoting the year of the focal round (1990–1999). *Venture stage dummies* is a vector of dichotomous variables denoting whether the focal round is seed, early, expansion, or later. *Venture industry dummies* is a vector of dichotomous variables denoting the three-digit VEIC code of the venture. *Round valuation* is post-round valuation in thousands of dollars. *Strategic CVC* gets the value 1 if CVC stated strategic orientation, 0 else. The table reports parameter coefficient estimates; robust standard errors clustered by funded venture are in brackets ($^{*}z < 0.05$, $^{**}z < 0.01$, $^{***}z < 0.001$). For vectors of dichotomous variables, the table reports inclusion of a vector. As a robustness test, the analysis is replicated in various subsamples: only syndicated rounds (Model 4-3), rounds where IVC funds previously syndicated with a CVC investor (Model 4-4), and rounds where an IVC firm previously syndicated with a CVC (Model 4-5). Model 4-6 reports the results of the second stage of a treatment-effects model of syndicate size.

includes only corporate investors for which compensation data are available. The first-stage regression estimates CVC's compensation scheme decision (Model A2-2 in Table A2), and Model 5-3 presents second-stage estimates of CVC's performance. The coefficient for *CVC-incentives-high* is positive and significant. Comparing the performance of (a) CVCs with high-powered incentive, and (b) CVCs that were likely to receive such incentive but did not, we find that the latter exhibit 2.3 percent higher exit rates. We find that among all corporate investors, those that award performance pay also experience the highest performance. This observation is in line with Hypothesis 5. As for the controls, they maintain their sign though some exhibit lower significance levels due to smaller sample size.

As a final test, we explore whether the incentive-performance association is mediated by the investment practices CVC personnel undertake. Recall, the theory predicts that incentives affect performance by shaping managerial action. The mediation test involves three steps (Baron and Kenny, 1986; Shaver, 2005), two of which are reported above: (a) test the association between incentives and performance (see Table 5), and (b) test if incentives shape behavior (see Tables 3 and 4).

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Table 5. Analysis of fund's performance

	(5-1)	(5-2)	(5-3)
	Full	Full	Treatment-effects (second stage)
CVC	0.102***	—	—
	[0.02]		
CVC-other	—	0.094***	—
		[0.03]	
CVC-incentives-low	—	0.097**	—
		[0.06]	
CVC-incentives-high	—	0.200***	0.328*
		[0.05]	[0.19]
Fund size	−0.076**	−0.077**	−0.110
	[0.03]	[0.03]	[0.18]
Fund size ^ 2	0.008	0.009	0.011
	[0.00]	[0.00]	[0.03]
First fund	0.028	0.028	−0.026
	[0.02]	[0.02]	[0.12]
Fund early stage	−0.035***	−0.035***	−0.283*
	[0.01]	[0.01]	[0.12]
VC inflow	−0.023	−0.023	−0.088
	[0.02]	[0.02]	[0.06]
3 yr average B/M ratio	−0.070*	−0.069*	−0.144
	[0.03]	[0.03]	[0.17]
Fund's firm experience	0.035***	0.035***	0.042
	[0.01]	[0.01]	[0.07]
Strategic CVC	−0.037	−0.051	—
	[0.05]	[0.05]	
Vintage year dummies/Mills ratio	*Incl.*	*Incl.*	*−0.173*
			[0.12]
N	2,830	2,830	45
Adj. R2	0.062	0.063	—
All coef.=0 (F-test)	6.05***	5.58***	14.48***

OLS regression results. The dependent variable is the fraction of fund's portfolio companies that are successfully exited. The independent variable, *CVC*, gets the value 1 if the focal fund is a corporate investor, 0 if it is an IVC fund. *CVC-incentives-low* (*CVC-incentives-high*) gets the value 1 when a program award is low- (high-) powered incentives. *Fund size* is the log of fund's commitments as reported in the VE database. *First fund* equals 1 when the focal fund is VC-firm's first fund, and 0 if it is a follow-on fund. *Fund early stage* is set to 1 if a focal fund is classified as a seed or early-stage fund, 0 else. To proxy for the level of competition, *VC inflows* is defined as the log of total venture capital raised the year a focal fund was raised (i.e., its vintage year). We further proxy for the level of investment opportunities with *3yr average B/M ratio*, the book/market ratio of public companies in a focal fund's industry of interest, measured over the first three years of fund's existence. *Fund's firm experience* is the log of the cumulative investments between the firm's creation and the fund's creation. *Strategic CVC* gets the value 1 if CVC stated strategic orientation, 0 else. *Vintage year dummies* is a vector of dichotomous variables denoting fund's vintage year. The table reports parameter coefficient estimates; robust standard errors clustered by fund's firm are in brackets ($^{*}z < 0.05$, $^{**}z < 0.01$, $^{***}z < 0.001$). For vectors of dichotomous variables, the table reports inclusion of a vector. As robustness test, Model 6-3 reports the results of the second stage of a treatment-effects model of fund's performance.

The third step calls for the inclusion of managerial practices in a specification similar to that of the first step. To that end, we use the values of *Investment stage* and *Syndicate size* averaged across a fund's investment rounds. Because the error term in this regression may be correlated with that in the second step (Shaver, 2005), we use two-stage least squares (2SLS) estimation. Due to space limitation, Table 6 reports results of the third regression.

Model 6-1 replicates the specification of Model 5-1 and introduces *Investment stage*. The coefficient on the new variable is statistically significant as is the coefficient on *CVC*. This finding suggests that staging practices partially mediate the association between incentives and performance.[20]

[20] Compared to Model 5-1, the magnitude of *CVC* in Model 6-1 is significantly different (1.62*). The same holds for Models 6-3 (4.24***) and 6-5 (3.2**). As for CVC compensation

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Table 6. Analysis of investment practices mediation of fund's performance

Mediator(s):	Investment stage		Syndicate size		Investment stage and syndicate size	
	(6-1)	(6-2)	(6-3)	(6-4)	(6-5)	(6-6)
CVC	0.088***	—	0.070*	—	0.067**	—
	[0.03]		[0.03]		[0.03]	
CVC-other	—	0.079**	—	0.059	—	0.059*
		[0.03]		[0.03]		[0.03]
CVC-incentives-low	—	0.034	—	0.044	—	0.020
		[0.08]		[0.08]		[0.09]
CVC-incentives-high	—	0.188**	—	0.197*	—	0.188*
		[0.07]		[0.07]		[0.08]
Investment stage	0.389**	0.405**	—	—	0.412**	0.410**
	[0.14]	[0.13]			[0.16]	[0.16]
Syndicate size	—	—	−0.059***	−0.059***	−0.025*	−0.025*
			[0.02]	[0.02]	[0.01]	[0.01]
Fund size	−0.036	−0.038	−0.038	−0.041	−0.079**	−0.080**
	[0.03]	[0.03]	[0.03]	[0.03]	[0.03]	[0.03]
Fund size ^ 2	0.004	0.005	0.005	0.006	0.008	0.008
	[0.01]	[0.01]	[0.00]	[0.00]	[0.00]	[0.00]
First fund	0.032	0.033	0.008	0.008	0.031	0.031
	[0.02]	[0.02]	[0.02]	[0.02]	[0.02]	[0.02]
Fund early stage	0.066	0.069*	−0.021*	−0.021*	−0.045	−0.045
	[0.04]	[0.04]	[0.01]	[0.01]	[0.04]	[0.04]
VC inflow	−0.035	−0.035	−0.031	−0.030	−0.057	−0.056
	[0.02]	[0.02]	[0.02]	[0.02]	[0.04]	[0.04]
3 yr average B/M ratio	−0.097**	−0.098**	−0.087**	−0.086**	−0.080**	−0.080**
	[0.03]	[0.03]	[0.03]	[0.03]	[0.02]	[0.02]
Fund's firm experience	0.022*	0.021*	0.011	0.010	0.035***	0.035***
	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]
Strategic CVC	−0.135*	−0.150**	−0.035	−0.052	−0.117	−0.128
	[0.06]	[0.06]	[0.05]	[0.05]	[0.08]	[0.08]
Vintage year dummies	*Incl.*	*Incl.*	*Incl.*	*Incl.*	*Incl.*	*Incl.*
N	2,830	2,830	2,830	2,830	2,830	2,830
Adj. R2	0.075**	0.076**	0.073**	0.074**	0.079**	0.080**

The table reports the mediation regression. See Table 5 for variables definitions. Estimation is based on 2SLS (Models 6-1 through 6-4) or 3SLS (Models 6-5 and 6-6). The table reports parameter coefficient estimates; robust standard errors clustered by fund's firm are in brackets (* $z < 0.05$, ** $z < 0.01$, *** $z < 0.001$).

Model 6-2 replicates Model 5-2 and further supports our interpretation: *Investment stage* is significant and the coefficients for CVCs' compensation are insignificant or of lower magnitude. The next two models (Models 6-3 and 6-4) repeat the analyses while focusing on syndication. The results are qualitatively similar and indicate that syndication practices also partially mediate the effect of incentives. Finally, Models 6-5 and 6-6 test for the joint mediation of staging and syndication. Both *Investment stage* and *Syndicate size* are statistically significant. The results further point to the mediating role of investment practices.

schemes, the coefficients in Models 6-2, 6-4, and 6-6 are jointly different from that in Model 5-2: 2.1*, 5.17***, and 3.04**, respectively.

DISCUSSION AND CONCLUSION

The history of corporate R&D and innovation management is a history of experimentation to find the set of incentives that stimulate an entrepreneurial spirit within the organization (Coff, 2003; Merges, 1999; Zenger, 1994; Ziedonis, 2004). Recently, there have been calls to bring 'Silicon Valley'—where compensation schemes follow theoretical prescription—inside the firm (e.g., Hamel, 1999). This study investigates the frictions that arise when the logic of entrepreneurial finance meets

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organizational reality. In doing so, we present detailed empirical evidence that offers a unique test of the principal-agent framework.

The venture capital market constitutes an advantageous setting for our investigation. A comparison of corporate and independent venture capitalists, noted Jensen (1993), could offer valuable insights on the effect of compensation on a firm's investment in novel technologies. Gompers and Lerner (1998) similarly acknowledge the importance of research on corporate experimentation in venture financing. Yet, more than a decade later, rigorous analysis remains lacking, largely due to data and measurement challenges. This paper is the first study, to the best of our knowledge, to pursue the research agenda set by these scholars.

Our results underscore the impact of firm's compensation schemes. First, we find that compensation drives investment practices. Based on an analysis of 13,096 investment rounds in technology-based ventures during the 1990s, we find that CVCs target ventures at later stages of development compared to IVCs, yet the gap shrinks when CVC personnel are awarded performance pay. Investment syndicates exhibit a similar pattern. Syndicates where a corporate investor is a member are persistently larger in size (i.e., more participants) than those involving only IVCs. The size disparity shrinks for CVC programs awarding performance pay. Second, analysis of the 2,830 investors who disbursed these investments indicates that performance pay not only shapes investors' behavior, but also affects their ultimate performance. Corporate investors perform at least as well as their independent counterparts, and the performance differential is higher for CVC programs that award performance pay.

The paper makes several contributions. First, it informs entrepreneurship scholars. Since the early observations of Block and Ornati (1987) through the recent insights of Professor Lerner (in Barry, 2001), the literature long alluded to the critical role incentives play within CVC programs. We present large-scale evidence on the consequences of CVC compensation schemes.

More broadly, the paper offers distinctive support to the principal-agent framework. We study a unique empirical setting that allows us to construct measures for all three underlying elements of the theory: incentives, behavior, and performance. Extant work tests the association between high-powered incentives and subsequent performance, and reports inconclusive results. The dearth of supportive evidence, scholars conjectured, may indicate that incentives do not shape behavior as the theory predicts. Alternatively, the theoretical predications may be valid and the reason for the inconsistencies in the reported incentive-performance association could be due to unrelated factors (e.g., industry characteristics) that vary across studies. Absent systematic data on managerial behavior, prior work could not decisively conclude between the two explanations. In this paper, we find a positive incentive-performance association consistent with the theory. Most importantly, our study is among the few large sample analyses to document a direct relationship between incentives and managerial behavior. Demonstrating the role of managers' actions in mediating the incentive-performance association offers strong support to the theory.

Relatedly, this study investigates strategically important, yet often ignored, corporate personnel. Most empirical work to date focuses on 'C-suite' executives (e.g., CEO and his/her top management team [TMT]). This is partially due to the importance of TMT's decisions, and partially due to data availability per SEC regulations. A smaller body of work suggests that incentives awarded to nonexecutive managers can also affect innovative and financial outcomes (e.g., Hoskisson *et al.*, 1993; Lerner and Wulf, 2006). Although outside the executive suite, corporate venture capitalists can have a strategic impact on firm's innovation efforts. Our work underscores the implication of their compensation schemes.

Limitations and future work

Future work could advance this study in several ways. One can explore the role of CVC compensation schemes. The principal-agent framework conjectures that incentives shape managerial actions. There is an alternative explanation: programs that award performance pay may attract managers who are intrinsically less risk averse and have superior capabilities to make risky investments. Both explanations predict a positive relationship between incentives, investment practices, and performance. Future research could explore these explanations further. For instance, anecdotal evidence suggests that managers alternate positions between corporate and independent VC funds. Future work could collect systematic data on venture capitalists' career patterns. To the extent that CVCs and IVCs draw on the same pool (different pools) of people, the data are consistent with the former (latter) explanation.

There is also an opportunity to explore alternative facets of investors' performance. In line with extant work (e.g., Gompers and Lerner, 1998; Hochberg *et al*., 2007), we measure the frequency of liquidity events (e.g., IPO, M&A) within an investor's portfolio. The measure reflects the fact that CVC-backed ventures are at least as likely to experience a favorable event, a pattern attributed to ventures' ability to leverage corporate resources (e.g., Maula and Murray, 2002; Dushnitsky, 2006; Maula, 2007) and endorsement (e.g., Stuart *et al*., 1999) toward reducing costs, speeding time to market, or streamlining strategy.[21] Analysis of alternative performance measures could open at least two avenues for future work.

First, one could test whether the performance of CVCs is superior to that of IVCs. The latter are investment professionals (Sahlman, 1990; Gompers and Lerner, 2001; Kaplan and Stromberg, 2004), yet we observe that an average CVC portfolio exhibits liquidity events at a rate similar to or greater than an IVC portfolio. Our findings may reflect the fact that CVC-backed ventures derive tangible benefits from their corporate investors. Namely, it is possible that the advantages of corporate affiliation compensate for any CVC shortcomings. Future work could study whether the performance differential is robust to alternative performance measures.

Second, subsequent work should explore whether the 'compensation effect' persists under different measures. Namely, one could replicate our analyses using alternative performance measures, such as investors' internal rate of return (IRR).[22] Support to the principal-agent framework necessitates only that the CVC-IVC performance gap is sensitive to CVC compensation scheme, irrespective of whether the gap is positive or negative. In other words, the 'compensation effect' may manifest itself in the form of increasing a positive performance differential—as we find—or as reducing a negative gap.

Another interesting venue for future work is the impact of a CVC on its parent firm. Our discussion centers on the association between a program's compensation scheme and the fund-level implications (e.g., CVC program's rate of successful exits). Going forward, scholars may explore whether the positive relationship between high-powered compensation and CVC performance automatically results in contribution to parent's performance.

Extant work reports that parent firm performance is sensitive to CVC activity. There is a positive association between CVC and the quality and exploratory nature of a firm's innovation output (Dushnitsky and Lenox, 2005a; Schildt, Maula, Keil, 2005). Corporate venture capital also affects a firm's alliance activity (Dushnitsky and Lavie, 2010). It has a notable financial effect as well: (a) a firm's cumulative abnormal return varies significantly if it acquires a portfolio company (Benson and Ziedonis, 2008), and (b) a firm's Tobin's q levels differ depending on whether its CVC program is strategically oriented (Dushnitsky and Lenox, 2006).

Although high-powered incentives are associated with enhanced performance at the level of the CVC program, it remains an open question

[21] Although corporate investors often offer little incentives to their investment personnel, CVCs afford several advantages to the ventures they fund. First, corporate investors provide value-added services similar to those provided by quality IVCs (Block and MacMillan, 1993; Dushnitsky, 2006). Second, CVCs can leverage corporate resources. For example, investing firms may offer access to complementary assets such as corporate laboratories, beta test sites, supplier networks, and distribution channels (Maula and Murray, 2002; Dushnitsky, 2006). Thus, CVC-backed ventures can produce initial product batches at lower cost and/or enjoy faster time-to-market. Third, CVC backing signals an endorsement to third parties and capital markets (Stuart *et al*., 1999). Taken together, these observations may explain why ventures in CVC portfolios experience liquidity events at a rate no lower than that of IVC portfolios. Nonetheless, note that—as echoed by the results—while CVCs may do well due to their corporate affiliation, they might do better had they put high-power incentives in place.

[22] IRR is a common indicator of investors' performance. The calculation requires detailed information about investor's cash flows. Unfortunately, such data are seldom reported for venture capital investors. To encourage investors to report their activity, VE adhered to a strict confidentiality policy whereby data concerning individual fund performance and cash flows was embargoed without time limit. The policy remains in place under the ownership of Thomson Financial ('With regards to Fund Performance information, individual fund performance information, cash flow information or residual values are not disclosed by individual fund name'; http://vx.thomsonib.com/VxComponent/vxhelp/VEmethodology.htm). In the only large-scale empirical study to date, Kaplan and Schoar (2005: 1794) faced strict restrictions and note 'We do not know the identities of the particular [venture capitalist]. . ..' These restrictions render impossible a comparison of CVC and IVC outcomes.)

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whether they necessarily result in optimal firm-level performance. How does CVC compensation affect the parent firm's performance? On the one hand, we expect the positive association to persist at the parent firm level. We know that firms' performance is positively tied to the compensation of division managers and R&D unit heads (Hoskisson *et al*, 1993; Lerner and Wulf, 2006). The success of a CVC program may thus translate into monetary and nonmonetary benefits to its parent. To the extent that CVCs' high liquidity rates reflect an ability to sponsor novel technologies, speed time-to-market, and grow ecosystems of related products and services, the parent firm stands to profit from its CVC program.

On the other hand, the positive effect may dissipate or even turn into a negative association. The presence of high-powered incentives could result in frictions between CVC personnel and other corporate employees (Nickerson and Zenger, 2008). The frictions may erode CVC's contribution to the parent firm. For example, Xerox abandoned the practice of high-powered incentives to its Xerox Technology Ventures personnel once it realized that their activities, while financially impressive, were failing to confer strategic benefits (Gompers and Lerner, 1998). Moreover, because a CVC program consumes capital and human resources that the firm could have allocated elsewhere, difficulties in materializing strategic benefits could mean CVC activity might actually have an adverse effect on the parent firm.

In closing, future work could investigate whether compensation schemes that stimulate CVC's performance necessarily lead to optimal firm-level outcomes. Initial evidence suggests that is the case. In unreported analysis, we study parent firms' Tobin's q (i.e., the market valuation of a firm over the value of firm tangible assets). All else being equal, the contribution to firm value is greater when firms award high-powered incentives to CVC personnel. These preliminary results should be interpreted with caution—it is possible that firms with brighter prospects are also more likely to award performance pay.

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APPENDIX

A1. Analysis of CVC investment across different samples

Feature	CVCs in Gompers and Lerner (1998)	CVCs in our sample		
		All CVCs	Compensation data:	
			Unavailable	*Available*
A. KEY FEATURES				
Venture's stage				
Seed rounds	[*incl. in early*]	11.9%	12.2%	10.9%
Early rounds	40.7%	26.0%	27.2%	24.2%
Expansion rounds	50.0%	45.9%	44.9%	48.8%
Later rounds	9.4%	16.3%	15.7%	16.1%
			(*Z-stat* = 1.26)	
Syndicate size				
Mean number syndicate members	NA	4.6	4.7	4.5
			(*Z-stat* = 0.48)	
Fund's performance				
Mean % portfolio companies exited	34.2%[(a)]	46.8%	46.7%	47.4%
Median % portfolio companies exited	33.3%[(a)]	50.0%	50.0%	47.3%
			(*Z-stat* = 0.08)	
B. OTHER FEATURES				
Venture's age				
Mean number of years	4.0	3.1	3.1	3.0
			(*Z-stat* = 0.01)	
Venture's industry				
Medical	25.9%	18.1%	16.1%	23.0%
Communication	14.2%	15.1%	16.3%	12.3%
Computer hardware	17.0%	11.0%	10.4%	12.3%
Computer software/Internet	15.1%	55.9%	57.3%	52.4%
Other	27.9%	NA	NA	NA
			(*Z-stat* = 2.11*)	
Venture's round valuation				
Mean ($M)	6.2	9.0	8.9	9.4
			(*Z-stat* = 1.53)	
CVC's duration of investment				
Mean number of years	2.5	3.0	3.0	4.7
			(*Z-stat* = 3.20**)	
CVC's parent firm size				
Mean firm's total assets ($B)	NA	14.5	14.3	16.2
			(*Z-stat* = 0.12)	

Analysis of key features for various CVC samples. Panels A and B present features underlying our dependent variables and other round features, respectively. The first column describes CVC rounds during the period 1983–1994 (Gompers and Lerner, 1998). The superscript [(a)] denotes aggregate IVC and CVC exit rates for the period 1980–1999, per Hochberg *et al*. (2007). The second column describes all CVC rounds in our sample (rounds where *CVC/IVC* = 1), for the period 1990–1999. The third and fourth columns describe subsamples for which CVCs' compensation scheme is available (*CVC/IVC* =1 and *CVC-other* = 0) and unavailable (*CVC/IVC* = 1 and *CVC-other* = 1), respectively. Numbers in parentheses report a Mann-Whitney-Wilcoxon test of a null hypothesis that CVC-rounds-where-compensation-data-available and CVC-rounds-where-data-unavailable are drawn from populations with the same distribution along the relevant round feature (significant at * $z<0.05$, ** $z<0.01$, *** $z<0.001$).

A2. Treatment effects model auxiliary table—first-stage results

	First stage (A2-1)	First stage (A2-1)
Industry tech opportunities	−0.516***	−0.037
	[0.15]	[0.16]
Industry IPP	−6.52***	−3.71
	[2.2]	[3.5]
Industry complementary assets	−10.53***	−3.58
	[2.4]	[3.2]
Firm cash-flow	0.166**	0.194*
	[0.08]	[0.13]
Firm R&D	9.04**	6.64
	[5.2]	[9.2]
Strategic CVC	1.03***	0.056
	[0.28]	[0.37]
Distance between HQ-CVC	0.001*	0.001*
	[0.00]	[0.00]
Constant	−0.193*	1.09***
	[0.14]	[0.28]
N	334	45
Log likelihood	−109***	−23.0***

The first-stage specification models the probability that CVC personnel receive performance pay. To the extent that strategically oriented programs are less likely to offer high-powered incentives, the independent variables include *Strategic CVC* as well as other variables known to drive strategic CVC (Dushnitsky and Lenox, 2005b, 2006). We also include the distance between CVC and its headquarters.