Corporate Venture Capital and the Acquisition of Entrepreneurial Firms

by

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DEDICATION

To my family: Amy, Katelyn, Daniel, and Ryan,
who make it all worthwhile.

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CHAPTER 1
INTRODUCTION

1.1 Introduction

Over the past two decades, established firms have increasingly acquired startups as a source of new products and new technologies (Chaudhuri & Tabrizi, 1999; Grandstrand & Sjolander, 1990; Link, 1988; Puranam, Singh, & Zollo, 2006). At the same time, the willingness of established firms to finance entrepreneurial startups has dramatically increased (see Figure 1). In this dissertation, I investigate how these two business development activities—corporate venture capital (CVC)[1] investing and the acquisition of technology startups—might be related and explore the implications for firm performance. Specifically, I seek to answer the following three questions: (1) How frequently do firms use CVC investments to screen potential acquisitions? (2) How does a prior equity investment affect the acquirer's returns if it subsequently chooses to acquire the startup? and (3) more broadly, do CVC investments represent a strategy for reducing information asymmetry in takeover markets for entrepreneurial firms?

This research is important for two reasons. First, startups have become an increasingly important source of research-and-development (R&D). According to National Science Foundation surveys (2005), the share of U.S. industrial R&D spending represented by firms with fewer than 1,000 employees climbed from 4.4% in 1980 to

[1] Corporate venture capital is defined as minority equity investments in privately-held, entrepreneurial firms by established corporations. I use the terms "young firm", "entrepreneurial firm" and "startup" interchangeably throughout my dissertation.

more than 25.3% in 2003.[2] As a result, established firms have increasingly acquired startups to gain access to new technologies (Ahuja & Katila, 2001; Chaudhuri & Tabrizi, 1999; Link, 1988; Puranam et al., 2006).

However, from the perspective of established firms, acquiring young, technological startups poses significant challenges. Such acquisitions, by definition, involve companies that are young and small and therefore lack the track record of larger, more established companies (Reuer & Ragozzino, 2008; Shen & Reuer, 2005). Moreover, these challenges are particularly acute when acquiring startups with few tangible assets and a heavy reliance on research and development (Coff, 1999, 2003).

A second reason for conducting new research on this topic stems from a simultaneous increase in the willingness of established firms to provide venture funding to entrepreneurial ventures. Between 1990 and 2000, annual CVC investments in startups grew from $156 million to $16 billion, and accounted for 15% of all venture capital investments that year (see figure 1, Venture Economics, 2005). Recent work suggests that nearly 25% of new ventures receive some form of corporate funding (Rosenberger, Katila, & Eisenhardt, 2006).

This dissertation investigates possible linkages between these business development activities – does corporate venture capital indeed represent a mechanism for "coping" in difficult entrepreneurial-firm takeover markets? My objectives are to evaluate both the prevalence of the use of this "coping mechanism" and how it affects the performance of established firms when acquiring startups.

[2] Small companies also tend to be young, so these NSF statistics approximate shifts toward R&D performed by entrepreneurial firms.

A distinguishing feature of corporate venture capital is the dual objectives that companies typically employ when making investments. In addition to seeking financial returns, CVC programs generally pursue strategic objectives as well (Yost & Devlin, 1993). For example, in surveys, CVC managers rate "exposure to new technologies and markets" and "identifying potential acquisition opportunities" as two of their top five reasons for investing in entrepreneurial firms (Alter & Buchsbaum, 2000; Siegel, Siegel, & MacMillan, 1988; Yost & Devlin, 1993). Despite the importance of these strategic objectives, prior empirical research has largely focused on financial metrics common to both independent and corporate venture capitalists[3] – the returns to investments upon exit events such as initial public offerings (IPOs) or sales to third parties (Gompers & Lerner, 2000; Maula & Murray, 2002).

In contrast, evidence on the use of CVC investments to inform acquisition decisions has largely been confined to surveys of managerial motives and case studies of individual CVC programs. For example Dyer, Kale, and Singh (2004), in interviews with managers at Cisco, find that Cisco uses its venture funds to "evaluate firms to determine if acquisitions will work," thus enabling them to make more informed decisions when purchasing innovative, young companies. In line with this view, the authors report that Cisco had a prior venture investment in one out of every four companies it acquired through 2003. Similarly, the director of Siemen's venture arm stated that he views "every investment as a potential acquisition opportunity" (Wieland, 2005). Despite such anecdotal evidence, however, this dissertation is the first to systematically examine (1) whether a prior CVC investment affects the performance of an acquisition of a portfolio

[3] Independent venture capitalists (e.g. Kleiner Perkins, Sequoia Capital, Benchmark Capital, etc) are venture capitalists not associated with an established corporation. I use the term "independent venture capitalists" and VCs synonymously.

company and (2) more broadly, whether CVC investments provide information that can affect *all* of the firm's acquisitions of startups (even those in which the firm has not directly invested).

1.2 Overview of the Dissertation Essays

I examine the above questions using a blend of quantitative and qualitative methods. Specifically, this dissertation includes two empirical studies that examine both the "direct" (e.g. the effect when acquiring portfolio companies) and "indirect" (the effect on *all* startups the firm acquires) impact of corporate venture capital investments and the acquisition of technology startups by established firms. I supplement the quantitative analysis with interviews with a number of individuals involved with corporate venture capital.[4] These interviews were very helpful in interpreting my econometric results (particularly for Chapter 2) as well as in the formulation of additional hypotheses (for Chapter 3). Table 1 provides a brief summary of the dissertation chapters, their primary research questions, and their research design and sample. I discuss each chapter in turn below.

In Chapter 2, co-authored with Rosemarie Ziedonis, we tackle question of CVC's direct effects. Specifically, we examine (1) to what extent do CVC investors have pre-existing venture investments with startups they acquire? And (2) how does such a prior investment affect the acquirer's returns? We then examine how such effects are

[4] During 2005 and 2006, I conducted 31 open-ended interviews with individuals involved with corporate venture capital. I conducted nine additional interviews in 2007-2008. I spoke with providers of such capital (managers involved with making the investments) as well as co-investors (independent VCs) and recipients (entrepreneurs). Some individuals had participated in corporate venture capital in multiple roles (e.g. had been at a corporate investor, but now was an independent VC, etc). Chapter 2 draws primarily from the earlier set of interviews, while Chapter 3 uses insights from both sets of interviews.

moderated by the structure of the CVC program through which the investment is made. We test for two competing hypotheses: On the one hand, one might expect that acquirers' returns will be higher for CVC acquisitions (e.g. acquisitions of startups from its CVC portfolio) than non-CVC acquisitions (startups acquired outright) because acquirers benefit from the enhanced information that CVC investments provide. On the other hand, prior theory also predicts that the direct investment may make the corporate investor prone one of a number of biases—for example, overconfidence because of the personal involvement of CVC managers with their portfolio companies, or agency problems caused by misaligned incentives between the manager making the CVC investment and the goals of the larger organization (Brockner 1992; Fama 1980; Jensen and Meckling 1976; Malmendier & Tate, 2005, 2008; Staw, 1981). We test these hypotheses using the stock market's reaction to compare the performance of CVC and non-CVC acquisitions made by 61 active corporate investors.

The main findings of Chapter 2 show that acquisition returns are significantly lower (and significantly negative) when acquirers purchase startups in which they have a prior equity investment. In contrast, acquirers earn positive and significant returns on average when they acquire startups outright (e.g. in which they have no prior equity investment). Our empirical analysis can then be divided into three parts: First, we examine whether the negative acquisition returns we observe truly indicate overpayment and do not merely reflect (1) the fact that the market incorporates information about the startup at the initial (CVC investment) stage, or (2) "disappointment" that the startup has been acquired and thus will not have an IPO (where investors generally earn higher returns). Second, we then empirically test between several alternate explanations for this

overpayment. Finally, we examine whether, and to what extent, the organizational structure of the firm's CVC program moderates acquisition returns.

A second set of findings in Chapter 2 reveals that dedicated units are significantly less likely to overpay when acquiring portfolio companies than are CVC investors with alternative organizational structures. Moreover, in supplemental analyses, we find that dedicated units were also significantly less likely to "throw good money after bad" by making follow-on investments in their portfolio companies that ultimately went bankrupt. Hence, while this chapter documents that CVC investors frequently invest in startups prior to acquiring them (in our sample, they had a prior equity stake in one out of every five startups they acquired), it also suggests that such investors may pay a price for "trying before they buy," particularly when the investments originate from product groups or business units.

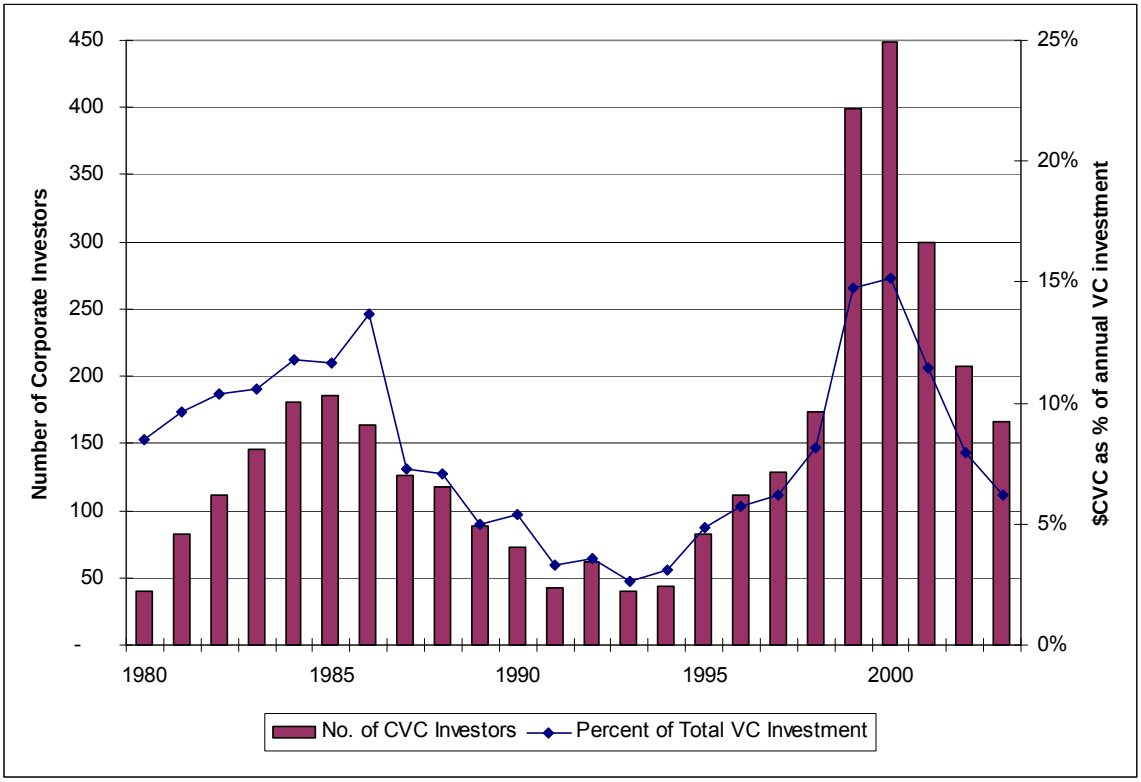
The relationship between Chapters 2 and 3 is represented in Figures 1.3 and 1.4. Chapter 2 focused on the effect of a prior equity investment if the portfolio firm was subsequently acquired. In Figure 1.4, this relationship corresponds to the impact of the prior investment when acquiring portfolio companies *a*, *b*, and *c*. Chapter 3, in contrast, focuses on the broader impact of CVC investments. In particular, Chapter 3 examines whether CVC investing provides information benefits that can "spill over" to affect *all* acquisitions of technology startups that the firm undertakes. Returning to Figure 1.4 as an example, this chapter examines how do the firm's investments in startups *a* through *e* affect the returns when the firm acquires startup *f*?

The initial motivation for Chapter 3 stemmed in part from the interviews conducted for Chapter 2. One particular interviewee, a manager at a frequent CVC

investor, stated, "*even if we overpay for some of our [CVC] acquisitions, it is still important for us to continue [CVC] investing in order to stay connected to the community of VCs and startups.*" Other managers expressed a similar sentiment. These comments, coupled with the empirical observation that CVC investors were good acquirers overall (their returns to non-CVC acquisitions were positive and significant), spurred me to examine whether information gathered through CVC investing might affect *other* acquisitions that CVC investors make. The results in Chapter 3 suggest that this is indeed the case. Using a sample of 219 established firms in information technology (IT) industries (including firms that do and do not make CVC investments), I find that CVC investors are indeed better acquirers, but only in years in which they are actively investing in startups. In contrast, I find no significant differences in acquisition performance in years when firms were *not* making investments. Similar results emerge from analyses that (1) test for differences in performance "between" CVC and non-CVC investors, while allowing for non-random selection by firms into corporate venture investing, and (2) use a firm fixed- effect specification that utilizes only the "within firm" differences among the subset of CVC investors. Moreover, consistent with the view that CVC investing provides an information benefit, these benefits erode quickly and are subject to diminishing returns. Contrary to my expectations, however, I do *not* find that acquisition returns are higher when firms' portfolio companies are concentrated in the same industries as the startups they acquired. Instead, investments in startups in IT and life science industries increase acquisition returns (when acquiring startups in IT) by roughly the same magnitude.

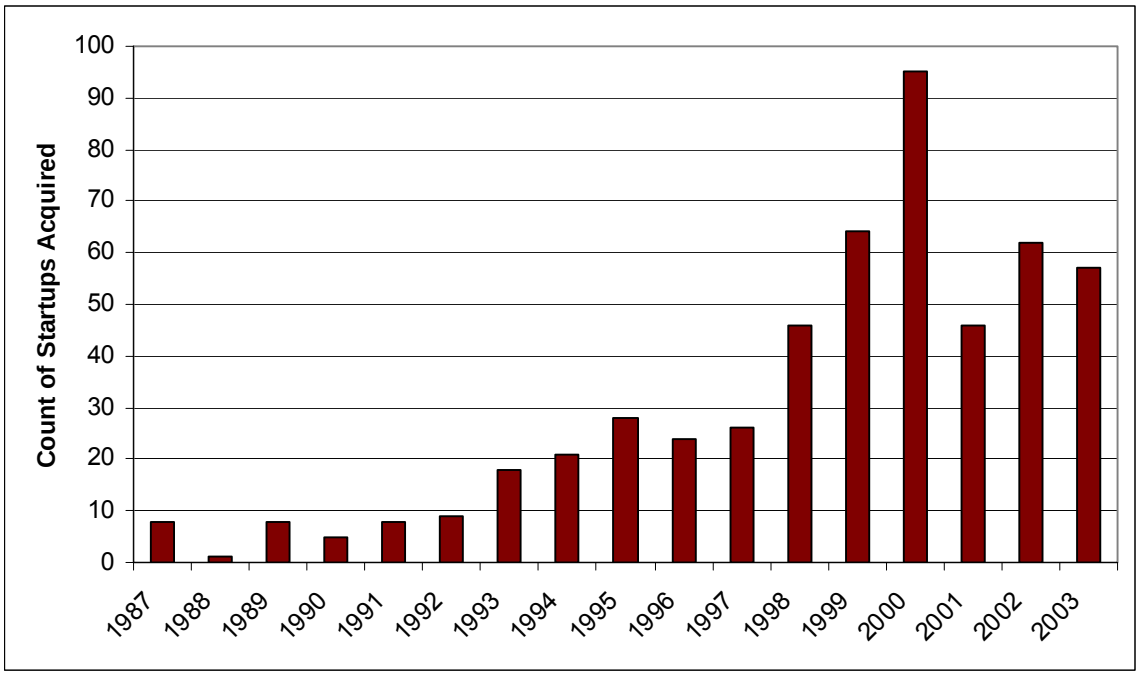
Chapter 4 summarizes the theoretical contribution of this dissertation. Chapter 4 also explores the managerial implications of this research, as well as identifies several directions for future research.

Figure 1.1 Number of Corporate Investors, 1980-2003
(by year and % of total venture capital investing)



Source: Venture Economics, 2005

Figure 1.2 Number of VC-Backed Startups Acquired by Established IT Firms, 1987-2003



Source: SDC Platinum, VentureOne, Venture Economics

Figure 1.3 Comparing the Research Question of Chapters 2 and 3, part 1

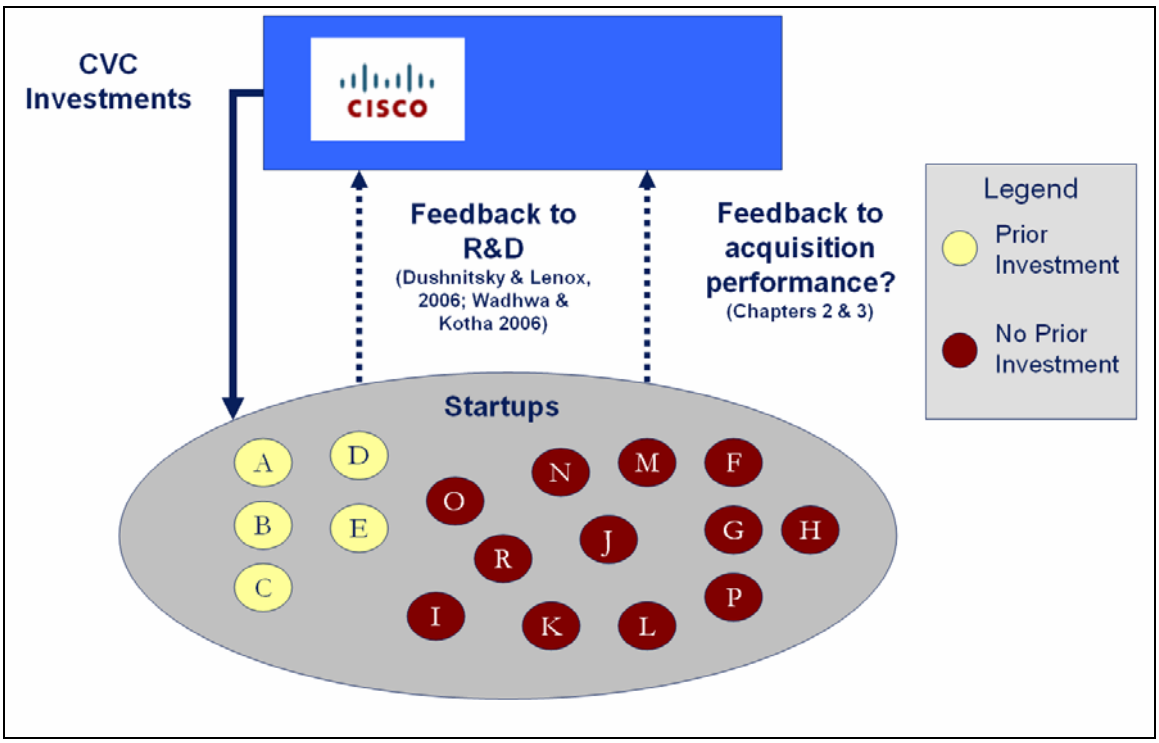


Figure 1.4 Comparing the Research Question of Chapters 2 and 3, part 2

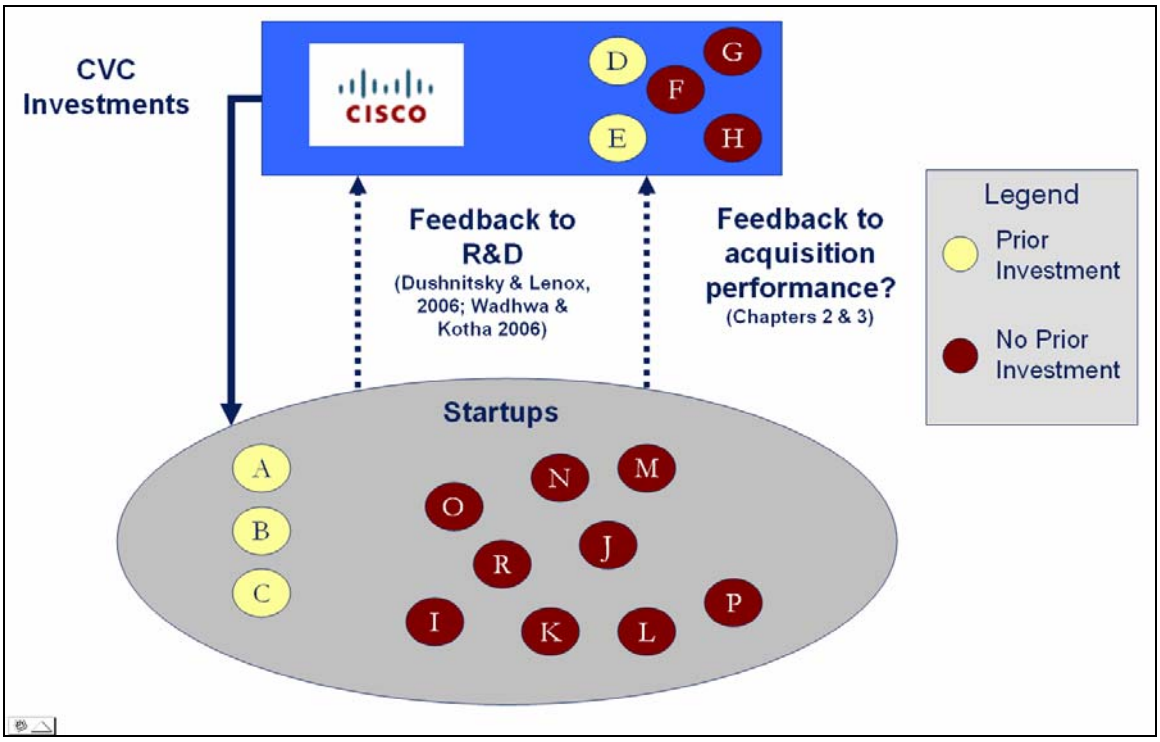


Table 1.1 Summary of Dissertation Essays

	Chapter 2	Chapter 3
Research Question	• How frequently do firms use CVC investments to screen potential acquisitions? • How does a prior CVC investment affect the value created (or destroyed) in an acquisition? • If CVC investors destroy value when acquiring portfolio companies, what causes this value destruction?	• Do CVC investments provide information benefits that are useful when acquiring startups (even for startups in whom the firm has not invested)?
Main Hypotheses	**H1**: Established firms will be *more* likely to overpay when acquiring startups in their venture portfolio than when acquiring startups outright. **H2**: This overpayment will be mitigated when the initial CVC investment originated from a dedicated CVC unit (than product groups or business units). **H3**: Dedicated CVC units will be less likely to continue re-investing in the subset of startups that ultimately fail.	**H1**: Relative to Non-CVC investors, CVC investments will improve acquisition performance when acquiring startups **H2**: The beneficial effects of CVC investing on acquisition performance will dissipate quickly. **H3**: As the size of a firm's venture portfolio increases, the added gains to acquisition performance will increase at a decreasing rate **H4**: The effects of CVC investing will be more pronounced the greater the similarity between startups invested in and startups acquired.
Research Sample	• 431 acquisitions of startups, made by top 100 CVC investors, 1987-2003. • 31 semi-structured interviews with corporate venture capitalists, independent venture capitalists, and entrepreneurs.	• 529 acquisitions of VC-backed startups made by 219 publicly-traded companies (both CVC and Non-CVC investors) in the IT industry, 1987-2003. • 9 interviews with current and former CVC managers, in addition to the 31 interviews conducted for chapter 2.
Research Design	A comparison of the returns to CVC (e.g. portfolio companies) and Non-CVC acquisitions (e.g. startups acquired outright) made by corporate investors.	Compare acquisition performance "between" CVC acquirers and Non-CVC acquirers (while allowing for non-random selection into CVC investing).

	Chapter 2	Chapter 3
		Use a fixed-effect specification to compare acquisition performance using only "within firm" variation in CVC investing (for subset of CVC investors).
Key Findings	• Firms had a prior investment in 20% of the startups they acquired • CVC investors are more likely to overpay for their CVC acquisitions (than startups acquired outright). • These effects are mitigated when the initial investment originates from a dedicated CVC unit	• CVC investments provide information affect all acquisitions of startups (even absent direct tie) • The information benefits are subject to diminishing returns • The information benefits of CVC investments are short-lived—only investments made in the current or prior year impact acquisition performance • Investments in both related and unrelated portfolio companies increase acquisition performance

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CHAPTER 2
DOES 'TRYING BEFORE YOU BUY' LEAD TO SYSTEMATIC OVERPAYMENT?

2.1 Introduction

From 1980 through 2003, established firms invested over $40 billion in entrepreneurial ventures (Venture Economics 2005). Like independent venture capitalists, corporate investors often seek financial returns through exit events such as initial public offerings (IPOs) or sales of portfolio companies to third parties (Gompers and Lerner 2000a). Corporations also invest for strategic reasons (Hellmann 2002). In surveys, managers rate "identifying acquisition opportunities" and the "potential to acquire companies" as prominent motives for investing in startups (Siegel et al. 1988; Alter and Buchsbaum 2000).

In principle, the provision of corporate venture capital (CVC) could help established firms assess the value of innovative young companies and gain efficiencies post-acquisition. Corporate investors commonly provide technical and commercial advice to portfolio companies and assume roles on boards of directors (Chesbrough 2002; Maula and Murray 2002). By reducing information asymmetries in markets to acquire entrepreneurial firms, the provision of venture capital could help corporations mitigate the "winner's curse" of overpayment in the event of subsequent acquisition (Thaler 1988). Despite survey and case study evidence that CVC investments are used to inform entrepreneurial acquisition decisions, little is known about the extent to which CVC

investors have pre-existing venture ties with startups they acquire. More generally, prior studies have not examined whether CVC investors earn positive abnormal returns (net of investment and acquisition premiums) when acquiring startups from their portfolios of investment companies.

This paper contributes new evidence based on the returns to top U.S. corporate investors when acquiring entrepreneurial firms.[5] Integrating acquisitions data with information from press releases, news articles, and venture financing databases, we distinguish between acquisitions of entrepreneurial firms that are (and are not) CVC portfolio companies of their acquirers, which we refer to as "CVC" and "non-CVC" acquisitions respectively. In total, we identify 530 entrepreneurial-firm takeovers by 61 CVC investors during 1987-2003. Of the entrepreneurial targets, 89 (17%) are portfolio companies.

The results of our event study are more surprising. For private takeovers of non-portfolio companies, we find a significant and positive acquirer return of 0.67% on average. This result closely approximates estimates of Moeller et al. (2004) for large acquirers of private targets and suggests that established firms in our sample are not necessarily "bad acquirers" of startups relative to the larger population of U.S. corporations. Indeed, private takeovers of non-portfolio companies created over $32 billion in shareholder value for these acquirers in 1999 and 2000, a period associated with "wealth destruction on a massive scale" in the market for corporate control (Moeller et al. 2005).

In sharp contrast, CVC acquisitions tend to *destroy* value for shareholders of these same acquirers. For CVC (portfolio-company) acquisitions, acquirer returns are

[5] Targets are classified as "entrepreneurial" or "startups" if they are less than 12 years old when acquired.

significant and negative at both mean and median values (-0.97% and -0.75% respectively). We find no evidence that this negative market reaction reflects disappointment relative to higher payoffs anticipated from the initial investment. Moreover, the average return to CVC acquisitions remains more than 1.5% lower than the average return to non-CVC acquisitions in multivariate analyses that control for detailed characteristics of the acquirers, targets, and deals that could affect the market reaction. The results are not driven by "boom years" or outlier observations and remain stable across specifications that restrict the sample to matched pairs of CVC and non-CVC targets and that allow for unobserved heterogeneity among acquirers. On a dollar-value basis, our estimates suggest that acquiring-firm shareholders gain $8.5 million from the median non-CVC acquisition but *lose* $63 million from the median CVC takeover.

These findings naturally invite causal explanation: Why would acquisitions of portfolio companies destroy value for shareholders of the acquirers? As a first step toward investigating this issue, we explore three prominent explanations in the acquisitions literature: (1) overbidding due to "owner's curse"; (2) firm-level governance problems; and (3) managerial overconfidence. According to the "owner's curse" hypothesis, investors with a prior equity stake (toehold) may overbid in hopes of provoking higher counteroffers (Burkardt 1995; Singh 1998). Assuming that bidders are unable to renege on their offers, toehold investors may end up overpaying for some of the targets they acquire. A second hypothesis is that firms with weak governance structures disproportionately make value-destroying takeovers of portfolio companies. In this view, value destruction is rooted in classic agency problems and misaligned incentives (Jensen 1986). A third hypothesis is managerial "hubris" (Roll 1986) or "overconfidence"

(Malmendier and Tate 2005, 2008). In this view, value-destroying CVC acquisitions stem from upward biases among managers when valuing portfolio companies.

Empirically, we find no evidence that the negative market reaction to CVC acquisitions is due to competition-driven overbidding (owner's curse), firm-level governance problems, or hubris among CEOs of these investors. Probing deeper, our analysis does reveal more favorable outcomes for investors that do (versus do not) house CVC programs in autonomous organizational units—both in the value captured from portfolio-company acquisitions and in the proclivity to "throw good money after bad" by reinvesting in startups that languish. Consistent with overconfidence-based theories, managers from dedicated CVC units may be less prone to bias when valuing portfolio companies due to greater exposure to investment opportunities ("deal flow") or superior training in finance. Alternatively, organizing CVC activities in standalone units could enable superior monitoring and compensation of investment activities, thus helping mitigate intra-organizational agency problems. Our conversations with managers point toward both explanations.

This paper contributes to several strands of literature. First, we add to an emerging body of research on corporate venture capital and the vehicles used to finance entrepreneurial firms. Empirical studies on the returns to CVC investing primarily focus on the returns to corporate investors when portfolio companies exit via IPOs or acquisitions by third parties (e.g., Gompers and Lerner 2000a). We provide the first systematic evidence on how prior venture ties affect the returns to CVC investors as *acquirers* of entrepreneurial firms. Despite recent theoretical attention to the strategic nature of CVC investments (Hellmann 2002), empirical research is largely limited to case

studies and managerial surveys.[6] Within this literature, our study highlights the need for additional research on how and why program structure affects CVC financing decisions.

We also fill a gap in the large literature on factors that influence the value created or destroyed from takeover events. Growing evidence shows that acquisitions of private companies typically create value for acquiring-firm shareholders (e.g., Fuller et al. 2002; Moeller et al. 2004). The influence of preexisting venture ties between acquirers and private targets has not been examined in this stream of research. A related body of work suggests that use of "pre-acquisition information-gathering mechanisms" such as alliances improves the returns to acquirers in the event of subsequent acquisition. Using a methodology similar to ours, Higgins and Rodriguez (2006) show that purchases by pharmaceutical acquirers of former alliance partners create *more* value for acquiring-firm shareholders than do purchases of targets made outright (in their case, without involving a prior alliance). Because of its relevance to our study, we discuss the Higgins and Rodriguez (2006) article in some detail below. The sharp contrast in our findings suggests new lines of inquiry for further study.

In Section 2 below, we briefly discuss the widespread experimentation in CVC investing during the past three decades and review relevant findings from prior studies. Section 3 describes the sample, data sources, and methodology and presents our main results. In Section 4, we investigate causal explanations for value destruction in CVC

[6] In addition to generating returns on investment, CVC can stimulate internal R&D productivity through improved management of internal projects (Thornhill and Amit 2000) and information gained from portfolio companies (Hellmann 2002; Dushnitsky and Lenox 2005a, 2005b; Katila, Rosenberger, and Eisenhardt 2008). As discussed by Chesbrough (2002), investors such as Intel also use corporate venturing to foster the development of firms introducing complementary products and services, thus stimulating sales of core products without necessitating acquisition. These broader benefits attributed to CVC programs fall beyond the scope of our study.

takeovers and attempt to distinguish among them. Finally, in Section 5, we summarize our main findings and discuss their implications for future research.

2.2 Background and Related Studies

In the late 1970s, regulatory changes in the United States ushered in an era of unprecedented investments in startups by both independent venture capitalists and established firms (Gompers and Lerner 2000a). According to Venture Economics (2005), over 450 corporations ran venture capital programs in 2000 alone. The number of CVC investors fluctuates widely over time, however, with one wave of activity in the mid-1980s (until the 1987 stock market crash) and a more pronounced flurry of activity in the mid-to-late 1990s that subsided with the plummet in technology markets.

Established firms such as Xerox, Johnson and Johnson, and Motorola have long-standing CVC programs launched in the 1960s. Dushnitsky and Lenox (2005a) show, however, that the top 20 CVC investors by 1999—as measured by the dollar-value of investments since 1969—is dominated by information technology (IT) firms that initiated external venturing programs in the 1990s, including prominent investors such as Intel, Cisco Systems, and Microsoft. The over-representation of IT firms among top investors is attributed to several related factors, including uncertainty posed by emerging technologies during the 1990s, concerns about disruptions in core product markets, and corresponding attempts to supplement internal R&D activities with initiatives underway at entrepreneurial firms (Maula and Murray 2002; Dushnitsky and Lenox 2005b). The favorable climate for IPOs and the well-publicized success of startups such as eBay and

Yahoo! fueled interest among corporate executives in entrepreneurial financing opportunities (Gompers and Lerner 2004).

2.2.1 *Related studies on corporate venture capital*

The most systematic empirical research on corporate venture capital to date examines financial metrics common to independent and corporate venture capitalists—the returns to investments upon exit events such as IPOs or sales of portfolio companies to third parties. In general, these studies conclude that corporate investors place at least "as good of bets" as independent venture capitalists. Gompers and Lerner (2000a) provide the most comprehensive evidence by examining over 30,000 investments between 1983 and 1994 and tracing the status of recipient companies by the spring of 1998. The study finds that, for investments in related sectors, corporate investors are at least as successful as independent VCs, as measured by the probability of a portfolio company going public or being acquired for more than twice the value of the initial investment. Similar evidence is reported in sector-specific studies. Stuart et al. (1999) examine the IPOs of 301 venture-backed biotechnology firms during 1978-1991 and find that startups with prominent corporate investors launch IPOs more quickly and with higher valuations than startups lacking such ties. More recently, Maula and Murray (2002) examine 325 IT firms with IPOs in 1998 and 1999 and show that CVC-backed startups have higher market valuations than those financed by independent VCs alone.

By comparison, evidence on acquisitions of portfolio companies is largely confined to surveys of managerial motives (discussed earlier) and case studies of individual CVC programs. Dyer et al. (2004), for example, conduct interviews with managers at Cisco Systems and examine the company's history of acquisitions and

alliances. According to the authors, Cisco managers use venture funds to "evaluate firms to determine if acquisitions will work," thus enabling them to make more informed acquisition decisions (Dyer et al. 2004, p. 8).[7] The authors report that Cisco had prior venture ties with one of every four companies it acquired through 2003. Other corporate investors appear to pursue a similar approach. The director of Siemen's venture arm is reported to view "every investment as a potential acquisition" (Wieland 2005, p.1.). According to another report, Motorola acquired three of the five startups sold from its venture portfolio in 2004 (Loizos 2005). Contrasting approaches nonetheless exist within the IT sector, with Dell and Nokia focusing narrowly on financial returns and reporting little intent to acquire portfolio companies (Loizos 2005; Wieland 2005). While anecdotes exist, systematic evidence on the extent to which CVC investors have venture ties with startups they acquire remains lacking. More important, prior studies have not established whether takeovers of portfolio companies create (or destroy) value for shareholders of acquisitive CVC investors.

2.2.2 Related studies on acquisitions

In estimating acquirer returns to CVC and non-CVC acquisitions, our study also builds on a large body of work in corporate finance and strategy on the effects of restructuring events on shareholder value. Andrade et al. (2001) review this extensive literature. Within the acquisitions literature, three strands of research are particularly relevant, including studies on (1) the returns to acquirers of private companies; (2) the

[7] Managers interviewed further estimate that it takes around 12 to 18 months to "build trust with partners and decide if the companies can work together" (Dyer et al. 2004, p. 8). For example, Cisco worked with one of its portfolio companies, NETSYS Technologies, for 20 months before acquiring the firm in 1996 for its network infrastructure and software technologies. We find relationships of similar duration between corporate investors and acquired portfolio companies in our sample, with a median lag of 16 months between the initial investment and the subsequent acquisition announcement.

impact of pre-acquisition alliances on acquirer returns; and (3) the use and effects of toehold investments in takeover contests.

In contrast to the negative or insignificant acquirer returns from purchases of firms that are publicly traded, a growing body of evidence shows that acquiring-firm shareholders tend to earn positive abnormal returns from takeovers of private companies (Andrade et al. 2001; Moeller et al. 2004). Using a sample of 281 private firms acquired during 1981-1992, Chang (1998) reports a 2.6% abnormal return when stock is used to finance the deal. More recent studies report positive returns to acquirers of private targets regardless of financing method. Based on 3,135 takeovers made by frequent acquirers during 1990-2001, Fuller et al. (2002) report significant positive acquirer returns in purchases of private firms (2.1% on average) but significant *negative* returns when the same acquirers purchase public companies (-1.0% on average). In a more comprehensive study of deals announced during 1980-2001, Moeller et al. (2004) show a significant 0.7% return to large U.S. acquirers of private firms, the subset that most closely parallels the empirical context of our study. These studies do not examine the effect of prior venture ties between acquirers and targets and rely on SDC data for information on ownership stakes in targets. As shown below, we find significant underreporting by SDC of prior venture ties between acquirers and entrepreneurial targets in our sample.

A separate line of research focuses more narrowly on acquisitions of former alliance partners, albeit primarily in the context of non-equity alliances between public companies. Building on earlier work by Chan et al. (1997), Higgins and Rodriguez (2006) examine 160 acquisitions in the pharmaceutical industry during 1994-2001, of which 45 (28%) involve former alliance partners. On average, pharmaceutical acquirers

in their sample had four prior agreements, broadly defined as R&D, distribution, or marketing agreements, with partners they acquired during the period of study. Despite the fact that acquisitions between repeat alliance partners may be anticipated, at least partially, by the market, Higgins and Rodriguez find that the market responds *more* favorably when acquisitions of former alliance partners are announced than when targets are acquired outright—in their case, without a prior alliance. The authors argue that "pre-acquisition information gathering mechanisms" such as alliances reduce the likelihood that acquirers overpay in the event of subsequent acquisition and increase potential synergies from the deal. As suggested earlier, similar benefits should arise, at least in principle, through the provision of corporate venture capital.

A third set of acquisitions studies examines the use of minority equity investments in takeover contests, albeit solely in the context of public firms. As reviewed by Betton et al. (2009), toehold positions in public targets can deter competition, decrease managerial resistance, increase bidders' chances of winning takeover battles, and/or reduce premiums paid in the event of an acquisition. Nonetheless, others show that toehold investors may have incentives to bid aggressively, even overbid, given a positive probability of provoking a higher counteroffer (Burkart 1995; Singh 1998). Assuming that bidders cannot renege on their offers, toehold investors therefore may end up rationally overpaying for some of the firms they acquire, an effect referred to as owner's curse since overpayment arises because of the prior ownership stake. Empirical evidence of owner's curse remains inconclusive even among takeovers of public targets (e.g., Mikkelson and Ruback 1985; Betton and Eckbo 2000). The extent to which toeholds

affect the returns to acquirers of entrepreneurial firms remains an open empirical question.[8]

2.3 Announcement Returns for CVC and non-CVC Acquisitions

2.3.1 *Compiling the sample*

To investigate the returns to CVC investors from acquiring portfolio and non-portfolio companies, we assembled data from a variety of public and private sources. The acquiring-firm sample was drawn from the top 100 publicly traded U.S. corporations with direct VC investments during 1980-2003, based on the total count of startups in their investment portfolios as listed in Venture Economics. Rank-ordering firms by the dollar value of investments produced a similar list. From these top 100 CVC investors, we chose the subset that acquired at least one entrepreneurial firm between 1987 and 2003, irrespective of whether the startup was a portfolio company. This filter eliminated financial investors (such as Comdisco Holding Company) that did not participate in entrepreneurial takeover markets. As listed in the Appendix, information about acquisitions made by CVC investors was obtained from multiple sources, including the SDC Merger and Acquisitions database, the CorpTech business directory, press releases, news articles, and two leading venture finance databases, VentureOne and Venture Economics.

[8] As discussed by Bulow *et al.* (1999), predictions from formal models on toeholds rest on assumptions regarding the disclosure and size of ownership stakes, the private or common value of the bidders, and constraints on the subsequent reneging of offers. Since takeovers of private firms face less stringent disclosure and reporting requirements, predictions from the toeholds literature may not generalize to private-target settings. For example, the Williams Act of 1970 requires disclosure to the SEC (though 13-D filings) of ownership stakes greater than 5% in public firms. In contrast, investors currently are not required to disclose minority equity stakes in firms that are private. Similarly, bidders for public targets must refrain from withdrawing tender offers during a 20-day period, whereas acquisitions for private firms typically are made through private auctions or bilateral negotiations (Graebner and Eisenhardt 2004) that are not subject to this regulatory requirement.

To identify takeovers of "entrepreneurial firms," we selected the subset of targets that were 12 years old or younger in the year of acquisition, measured by the acquisition year minus the founding year of the firm. Hellmann and Puri (2000, 2002) similarly categorize startups as firms less than 11 years old based on years since founding. We experimented with more restrictive target criteria, including age cut-offs at 10 years and maximum sizes of 500 and 1,000 employees, and obtained similar results. To identify the existence (if any) of an acquirer's VC investment in an entrepreneurial-firm target, we hand-collected data from VentureOne, Venture Economics, news articles, and press releases. This process yielded 530 entrepreneurial-firm acquisitions by 61 corporate investors between 1987 and 2003. Of these entrepreneurial targets, 89 were portfolio companies of their acquirers (CVC acquisitions) while 441 were not (non-CVC acquisitions). In only six (7%) of the 89 CVC acquisitions was the acquirer's equity ownership stake listed in SDC's Mergers and Acquisitions database, the main source of data used in prior studies of acquisitions. For the remaining 83 cases, SDC failed to report the acquirer's prior VC ownership stake in the target.

Table 1 lists CVC and non-CVC acquisitions in the sample by year and for IT acquirers. As seen in Table 1, acquisition types are distributed similarly in time. In both cases, the largest share occurred in the merger wave of the late 1990s. Overall, 76% of the takeovers are by IT firms, which is not surprising given the overrepresentation of the IT sector among top CVC investors mentioned earlier.

2.3.2 The gains to acquiring-firm shareholders: univariate results

To estimate the cumulative abnormal returns (CAR) upon announcement of CVC and non-CVC acquisitions, we use a standard event study methodology.

Acquisition dates were compiled from SDC and VentureOne and verified using articles in *The Wall Street Journal*. The results reported are based on a two-day event window (-1,0), a 250-day estimation period ending on day -11 (-260, -11), and the CRSP value-weighted index. Following Brown and Warner (1985), p-values are corrected for serial correlation during the event window. We obtain similar estimates using a three-day event window (-1,+1), a 180-day estimation period (-190, -11), and the CRSP equal-weighted index.[9] Of the 530 entrepreneurial acquisitions, we eliminated 41 observations (15 CVC and 26 non-CVC) due to simultaneous takeovers of the acquirer or major unrelated news announcements in the event window (e.g., regarding the filing or settlement of a lawsuit or unexpected earnings announcements).[10] Our estimation sample therefore includes 489 announcements of 74 CVC and 415 non-CVC acquisitions.

Columns 1 and 2 in Table 2 present the average abnormal returns to shareholders of these corporate investors for non-CVC and CVC acquisitions respectively. Differences in acquirer returns are reported in Column 3. Panel A reports results for the full sample of private and public targets. Panel B restricts the sample to private targets. Only 3 of the 74 CVC acquisitions (4%) involved public targets whereas 77 of the 415 startups purchased outright (19%) were publicly traded when acquired. As discussed earlier, prior studies show that target ownership status is a significant predictor of acquirer returns (e.g., Fuller et al. 2002). We therefore report results separately for private targets in Tables 2 and 3 and treat public and private targets separately in all regressions.

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[9] In reviews of event studies, MacKinlay (1997) and McWilliams and Siegel (1997) recommend using short time windows, both to maximize the power of the statistical tests and to minimize the likelihood of confounding events. Mikkelson and Ruback (1985), Chang (1998), and Song and Walkling (2000) are examples of studies that use a two-day window. Andrade *et al.* (2001), Moeller *et al.* (2004) and Higgins and Rodriguez (2006) use a three-day window.

[10] Mean and median values of characteristics for CVC acquisitions included in the estimation sample are statistically indistinguishable from those omitted due to confounding news announcements.

As shown in Column 1 of Table 2, the estimated abnormal acquirer return is 0.37% on average for the full sample of non-CVC acquisitions and 0.67% for the subset involving private targets. The latter estimate approximates the 0.70% average return reported by Moeller et al. (2004) for large acquirers of private companies during 1980-2001 but is smaller in magnitude than the 2% reported by Fuller et al. (2002) for frequent acquirers of private targets in the 1990s.

In sharp contrast, Column 2 in Table 2 reveals that the average abnormal return to CVC acquisition announcements is *negative* and statistically significant. The average abnormal return to CVC acquisitions is -0.97% for the full sample in Panel A and is -1.05% for the subset of private targets in Panel B. In both samples, the median return to CVC acquisition announcements also is negative and significant at the 5% level. The return to CVC acquisition announcements is significantly different than the returns to non-CVC acquisitions for the full sample (1.33% lower) and subset of private targets (1.72% lower) respectively, as shown in Column 3.

On a dollar-value basis, these estimates suggest that the median non-CVC acquisition creates $8.5 million in value for shareholders of these acquirers whereas the median CVC acquisition destroys $63 million in shareholder value for these same acquirers upon announcement of the deal. In Panel B, the gap in returns widens further. For takeovers of private targets, the median non-CVC acquisition creates $18.7 million in value for acquiring-firm shareholders. In contrast, the median takeover of a private portfolio company destroys -$70.2 million in value for shareholders of acquisitive CVC investors.

Table 3 sub-divides acquirer returns and aggregate wealth effects into deals announced before, during, and after the boom years of 1999 and 2000. In investigating the "era of massive value destruction," Moeller et al. (2005) conclude that the value destroyed by the recent merger wave was driven by large takeovers of public targets. A similar pattern emerges for non-CVC acquisitions in our sample. Of the 135 non-CVC acquisitions made in 1999 and 2000, only 21 involved startups that were publicly traded. Nonetheless, inclusion of public targets swings the estimated dollar returns for non-CVC acquisitions from $32 billion in aggregate *gains* (for the subset of deals involving private targets in Panel B for the 1999-2000 period) to $13.8 billion in aggregate *losses* in the same sub-period.

Of particular importance, Table 3 also reveals consistent divergence across sub-periods in the returns to CVC and non-CVC acquisitions. For the subset of private startups acquired outright (Column 2, Panel B), the mean acquirer return hovers around the 0.67% average in each sub-period. In contrast, the average return to CVC acquisitions remains negative across sub-periods, as shown in Column 5. Interestingly, the market reaction to CVC acquisitions is more favorable on average (but still negative at -0.70%) in the boom period. These trends provide little indication that value-destroying CVC takeovers are rooted in market dynamics unique to the recent boom period.

2.3.3 *Do CVC acquisition announcements represent disappointing news?*

A natural concern when interpreting these statistics is that non-CVC acquisition announcements reveal unexpected news (potentially providing more reliable estimates of the value anticipated from the deals) while CVC acquisitions could be anticipated due to information previously disclosed about the minority equity investment. If CVC

acquisitions are fully anticipated by the market, however, we would expect an *insignificant* response—not the significant and negative reaction we observe. Moreover, as discussed earlier, Higgins and Rodriguez (2006) report a *more* favorable market response when acquisitions of former alliance partners are announced, albeit in the context of pharmaceuticals and for a broader range of pre-acquisition alliances.

When investing venture funds, however, there is a positive initial probability that a portfolio company will go public, an event that typically yields the highest returns for investors (Gompers and Lerner 2000a; 2004). As suggested earlier, prior studies find that startups with prominent CVC investors launch IPOs more quickly and with higher valuations than startups lacking such ties (Stuart et al. 1999). When a CVC acquisition is announced, the possibility of an IPO exit is eliminated. The negative reaction to CVC acquisition announcements therefore could represent a downward adjustment of payoffs initially anticipated from the equity investment (i.e., a market correction) rather than overpayment in the focal deal.

We test for possible disappointment in several ways. First, we compare the market reaction to CVC acquisitions where the venture tie is (versus is not) disclosed through a press release or news article prior to the acquisition announcement. For 50 of the CVC acquisitions (68%), the initial funding relationship between the acquirer and startup is announced prior to the acquisition announcement, typically through a press release issued by the startup. For the remaining 24 CVC acquisitions (32%), the venture tie is first announced to the public in the acquisition announcement. In supplemental analyses (available upon request), portfolio companies with identifiable media coverage pre-acquisition attracted more private equity investors and had a greater number of

employees when acquired relative to portfolio companies lacking media coverage. Assuming that "newsworthiness" correlates with profit anticipated from the initial CVC investment, investor disappointment should be greater for the subset of CVC acquisitions with prior media disclosure. Similarly, we should expect a downward correction of greater magnitude for disclosed (versus undisclosed) CVC acquisitions if market analysts fail to learn about undisclosed deals through non-media channels. At odds with either view, Panel A in Table 4 reveals a negative reaction of greater magnitude when prior funding is not disclosed prior to acquisition.

If our results are due to disappointment, we also should expect the negative reaction to CVC acquisition announcements to be preceded by a positive reaction upon disclosure of the initial CVC investment. For the 50 observations in which the initial CVC funds are clearly revealed pre-acquisition, however, Panel B of Table 4 shows that the market reaction also is negative upon announcement of the initial venture investment (-0.52%).[11] In contrast, Mikkelson and Ruback (1985) find a two-day acquirer return of 1.17% upon disclosure of toeholds in public firms.

As a final test, we estimate the abnormal returns upon announcement of CVC acquisitions to *non-acquiring* corporate investors in the entrepreneurial target. If the negative response to CVC acquisitions reflects disappointment due to the failure to launch an IPO, we should similarly observe a negative return to other corporate investors upon the acquisition announcement. Alternatively, a positive return to other corporate owners is consistent with overpayment by the acquirer and a transfer of wealth to the

[11] Interestingly, in supplemental analyses, the market response to all initial CVC investments made by these frequent investors (regardless of the venture's final outcome) also was negative yet statistically insignificant at mean and median values.

other equity owners. As reported in Panel C of Table 4, we find a positive abnormal return of 0.99% to non-acquiring CVC investors.

In each of these tests, we face inherent limitations due to small sample sizes once restrictions are placed on the subset of CVC acquisitions. In combination, however, the evidence is consistently at odds with the disappointment explanation.

2.3.4. *Acquirer, target, and other deal characteristics: CVC vs. non-CVC acquisitions*

A separate concern when interpreting abnormal return statistics is that the market response reflects updated investor expectations about the acquiring firm's value for reasons unrelated to the particular deal. Prior studies show, for example, that acquirers experience a lower abnormal return when they purchase companies with stock (e.g. Travlos 1987). Although this effect does not seem to hold when private targets are acquired (Fuller et al. 2002; Moeller et al. 2004), acquisitions paid for with equity may signal to the market that the acquiring firm's stock is overvalued. If acquirers use stock to purchase CVC targets but pay for non-CVC targets with cash, we could observe lower returns to CVC acquisition announcements for reasons unrelated to value expected from focal deals.

Numerous factors can affect the stock market reaction to acquisition announcements. Lang et al. (1989) and Servaes (1991) report that firms with a low market-to-book (Tobin's q) ratio have lower announcement returns than do high q bidders, possibly driven by concerns about exhaustion of internal growth opportunities. Using more comprehensive data, however, Moeller et al. (2004) find that q is an insignificant determinant of acquirer returns in takeovers announced in the 1990s. Instead, they report a significant size effect and show that the market responds more

negatively to deals made by large firms relative to smaller-firm acquirers. The market reaction also can hinge on the free cash flow available to acquiring-firm managers (Jensen 1986), the size of the target relative to the acquirer (Fuller et al. 2002), and acquirer R&D spending (Higgins and Rodriguez 2006). Finally, the market could respond more negatively to announcements made by IT acquirers given sector-specific concerns of overvalued stock (Perkins and Perkins 1999; Shiller 2000).

Transaction values (and correspondingly, acquirer returns) also can be affected by the degree of competition in takeover markets and, for startups, the opportunity costs of foregoing an IPO exit. Following Schlingemann et al. (2002), we therefore compiled a "Liquidity Index" to proxy for the degree of competition in takeover markets, by dividing the value of mergers and acquisitions (M&A) announced in the target sector by the book value of assets in that sector. As Moeller et al. (2004) report, firms may offer higher premiums to potential targets in more active takeover markets to deter rival bids. In this case, acquisition premiums may be elevated even if multiple bids are not observed. Since the identities of bidders for private companies are rarely made public, the liquidity index is a useful proxy for competition that otherwise would be difficult to discern. As a robustness check, we divided M&A activity by the market value of firms in the sector instead and obtained similar results.

To capture IPO conditions, we tallied the number of IPOs in the target sector. (Alternative proxies using the dollar value of IPOs in the target sector and the quarterly NASDAQ index were highly correlated and generated similar results.) In unfavorable IPO environments, acquirers may provide a liquidity service to entrepreneurs and venture investors, thus increasing the likelihood of reaping gains from the deal. To allow

volatility in annual market conditions, the Liquidity Index and IPO counts are computed in the quarter of the focal acquisition announcement.

Table 5 reports summary statistics of acquirer, target, and deal characteristics by acquisition type (CVC and non-CVC) and for the pooled sample. Variable definitions and data sources are listed in the Appendix. Among top CVC investors, Panel A shows that those making non-CVC acquisitions are similar to those that acquire portfolio companies. In both cases, acquirers are large R&D-intensive firms with high market-to-book ratios. The distribution of deals made by IT firms is similar, at 77% and 76% for non-CVC and CVC acquisitions respectively. Panels B and C show that both non-CVC and CVC targets are small relative to acquirers, are similarly likely to own patents (an indicator of technological maturity and target bargaining power), and with rare exception are developing products that relate directly to existing businesses of the acquirer. While stock is used to finance a higher share of CVC acquisitions (70% vs. 67% for non-CVC takeovers), the difference is statistically insignificant.

The method of payment is not reported for 37% of the CVC acquisitions and 41% of non-CVC acquisitions. Similarly, transaction values are not disclosed for 26% and 32% of CVC and non-CVC acquisitions respectively. A recent study by Rodrigues and Stegemoller (2007) shows that SEC requirements failed to require disclosure of information pertaining to many value-relevant private-target takeovers over the past two decades. We therefore include observations with unreported deal values or payment methods in the estimation sample but treat them separately in regressions that follow with the *Deal Terms Undisclosed* indicator variable. Similar results are obtained if observations with missing terms or prices are removed from the sample.

The main differences revealed in Table 5 pertain to target-firm and environmental characteristics. As seen in Panel C, CVC targets tend to be younger and smaller than non-CVC targets. The median CVC target is 4 years old and has 60 employees whereas the median non-CVC target is older (5 years) and larger (77 employees) when acquired. While 19% of the non-CVC targets are public, CVC acquisitions—with rare exception—occur pre-IPO. Relative to their non-CVC counterparts, CVC acquisitions also tend to occur in less favorable IPO and takeover environments. If corporate investors perform a liquidity service by acquiring portfolio companies in periods with less attractive exit options, we should expect positive (or insignificant) acquirer returns rather than the negative returns shown earlier. Our event study results are even more perplexing in light of these statistics.

2.3.5 Multivariate regressions

This section investigates more formally whether the difference in acquirer returns to CVC and non-CVC acquisitions stems from other characteristics of the acquirers, targets, or deals that could affect the market reaction. Table 6 reports OLS estimates of two-day abnormal acquirer returns with acquirer-clustered robust standard errors. Annual time dummies are included in each specification.

Column 1 of Table 6 provides baseline estimates. In line with findings from prior studies, acquirer returns are significantly lower in takeovers of public targets. Acquirer returns also are lower on average in the IT sector and for deals with undisclosed deal terms or prices. Insignificant predictors on other variables could reflect our relatively homogenous sample of large, R&D-intensive acquirers.

Column 2 introduces the *CVC Acquisition* indicator variable. In univariate results shown earlier (Table 2), the average acquirer return to CVC acquisitions is 1.33% lower than that for non-CVC acquisitions. In Table 6, the gap in returns grows even wider (exceeding 1.5%) once we control for observable acquirer, deal, and target characteristics. In diagnostic analyses (available on request), we obtain similar results in regressions that (a) omit outlier observations at top and bottom 1% values, (b) restrict the sample to takeovers with known payment methods and deal values, (c) allow differential effects for larger (versus smaller) targets, and (d) replace year dummies with period categories defined in Table 3.

Columns 3-6 provide additional robustness checks. First, we explore whether the divergent returns to CVC and non-CVC acquisitions stem from differences in the types of entrepreneurial firms selected for initial funding and subsequent purchase. To investigate this possibility, we impose tighter restrictions on observable characteristics of targets by limiting the sample to venture-backed private targets (in Column 3) and to matched pairs of CVC and non-CVC targets (in Column 4). For the one-to-one matched sample, we select VC-backed private firms then match each CVC target with the non-CVC target that is (a) closest by date of acquisition announcement, irrespective of acquirer identity and (b) classified in the same Venture One product segment. Although VentureOne does not use numeric codes, the business sectors correspond roughly to 4-digit SIC codes. For example, "prepackaged software" (sic 7372) is distinguished from "systems software" (sic7371). If a suitable match is unidentified within two years of the CVC target's acquisition date, the focal target is removed from the sample. Using these criteria, 65 of the 74 CVC targets match to 65 corresponding non-CVC targets. As shown in Columns 3

and 4 in Table 6, the gap in returns remains similar or greater in magnitude after imposing these restrictions on the target-firm sample.

A separate concern is that the divergent return to CVC and non-CVC acquisitions is due to unobserved heterogeneity among acquirers that is insufficiently captured by the right-hand-side variables. In Columns 5 and 6 of Table 6, we allow for this possibility by using an acquirer-specific fixed effects specification. Column 5 uses the full estimation sample. Column 6 restricts the sample to corporate investors that make acquisitions of both types (CVC and non-CVC). These specifications are similar to those used in the Fuller et al. (2002) study of returns to frequent acquirers; they enable us to test for "within acquirer" differences in returns to CVC and non-CVC acquisitions. As shown in Columns 5 and 6, the gap in acquirer returns to CVC and non-CVC acquisition announcements narrows slightly to 1.5% but remains negative and significant in each specification.

2.4 Why would portfolio-company takeovers destroy value for shareholders of acquirers?

This section seeks to unravel these otherwise puzzling findings: *Why* would takeovers of portfolio companies systematically destroy value for shareholders of acquisitive CVC investors? This question is particularly intriguing since these same CVC investors otherwise are "good acquirers" of entrepreneurial firms. We investigate three explanations that figure prominently in the acquisitions literature: (1) competition-induced overbidding (owner's curse); (2) firm-level governance problems; and (3) managerial overconfidence. To gain additional insights, we also spoke with managers involved in corporate venturing programs either directly (as current or former directors of

programs) or indirectly through involvement with portfolio companies.[12] Below, we report results from our empirical analyses then turn to alternative explanations and interview insights.

2.4.1. *Owner's curse*

A central insight from models of owner's curse discussed earlier is that minority equity owners may bid aggressively, even overbid, in expectation of triggering higher counteroffers (Burkart 1995; Singh 1998). Assuming that bidders are unable to renege on their offers, toehold investors may end up overpaying for some companies. In this view, overpayment is fueled by competition in takeover markets and anticipation of counteroffers.

To test the owner's curse hypothesis, we interact *CVC acquisition* with a variety of indicators for competitive market conditions. First, we compute the total number of corporate investors in the focal target, which represent potential rival bidders. Second, we measure the intensity of M&A activity in the target sector more generally by using the Liquidity Index defined earlier. This index is a particularly useful proxy for competition in these takeover markets since failed bids for private companies rarely are made public. Third, we compute the number of IPOs in the target sector, since higher counteroffers may be easier to provoke in favorable IPO environments.

Table 7 reports the results of this analysis. If owner's curse explains the negative returns to CVC acquisitions, we should observe negative and significant effects when interacting *CVC Acquisition* with indicators of competitive market conditions. At odds

[12] In 2005-2007, we met informally with 31 individuals involved in corporate venture finance primarily within the IT sector. Early meetings were open-ended; later meetings were semi-structured and used interview templates. Our objective was to obtain general insights about the CVC and entrepreneurial-firm acquisition experiences of these managers.

with this view, each interaction effect in Columns 3-5 of Table 7 is statistically indistinguishable from zero.

2.4.2. *Firm-level governance problems*

A common criticism launched against corporate venturing programs is their use to fund CEO "pet projects" (Gompers and Lerner 2000a; Loizos 2005). It is reasonable to question therefore whether firms with weak corporate governance structures disproportionately make value-destroying takeovers of portfolio companies. In this view, value destruction stems from agency problems long studied by finance and strategy scholars.

To investigate this possibility, we compiled time-varying measures of governance quality using indices developed by Gompers, Ishii, and Metrick (GIM 2003) and Bebchuk, Cohen, and Ferrell (BCF 2009). The GIM Index tabulates 24 provisions that protect shareholder rights, as reported by the Investor Responsibility Research Center (IRRC). The BCF Index is derived from a sub-set of six provisions that, according to Bebchuk et al. (2009), yield greater explanatory precision when predicting firm value and shareholder returns.[13] In both cases, higher scores are used to proxy for greater managerial entrenchment. In turn, lower scores indicate superior governance quality.

Table 8 compares the mean and median governance scores of corporate investors in our sample with those reported for the larger population of 1,500 public U.S. corporations tracked by the IRRC. As shown in Columns 1 and 2, the governance quality of top corporate investors is comparable to that of other public U.S. corporations. The only significant difference pertains to median values of the BCF Index, which indicates

[13] The six provisions are (1) staggered boards, (2) limits to shareholder by-law amendments, (3) supermajority requirements for mergers, (4) supermajority requirements for charter amendments, (5) poison pills, and (6) golden parachutes.

superior governance quality (lower scores) for CVC investors. Columns 3 and 4 of Table 8 report within-sample scores by acquisition type (CVC or non-CVC). If firms with weak corporate governance mechanisms disproportionately acquire portfolio companies, we should expect lower governance quality (higher scores) in CVC acquisitions. Columns 3 and 4, however, reveal no discernable difference in governance scores between the groups.

Results from multivariate regressions in Table 9 corroborate these descriptive statistics. Again, there is little indication that value destruction in CVC acquisitions stems from firm-level governance problems, whether measured indirectly by traditional measures like free cash flow (Column 2) or by more direct proxies for governance quality (in Columns 3-4). For sake of brevity, we report results in Table 9 using the BCF Index. Similar results were obtained with the GIM Index. When interpreting these findings, it is important to acknowledge that the BCF and GIM indices may fail to discern heterogeneity among investors in program-level agency problems, a possibility that we return to in Section 4.4. In combination, however, evidence from Tables 8 and 9 suggests that the negative return to CVC acquisitions stems from factors other than governance problems at top levels of these firms.

2.4.3. *Managerial overconfidence*

A third explanation for value destruction in portfolio-company acquisitions is managerial overconfidence. Overconfidence is generally defined as "the tendency to overestimate one's own (relative) abilities and resulting outcomes" (Camerer and Malmendier 2007, p. 14). In this view, managers may seek to maximize shareholder

value when acquiring portfolio companies yet may nonetheless fail to do so due to upward biases when forecasting the value anticipated from the deals.

Building on pioneering work by Roll (1986), the acquisitions literature largely casts overconfidence as an individual-specific personality trait. Estimating the degree of overconfidence among individual CEOs, for example, Hayward and Hambrick (1997) and Malmendier and Tate (2008) show that firms led by hubristic CEOs are more prone to overpay in takeover markets than are firms with less hubristic leaders.

A separate strand of behavioral research attributes the degree of overconfidence bias to an individual's exposure to representative baselines of comparison, or "outside" views through which to frame and calibrate expectations.[14] Following influential work by Kahneman and Tversky (1979), evidence from experiments (Camerer and Lovallo 1999; Kahneman and Lovallo 1993) and case studies of technology development programs (e.g., Garud and Ahlstrom 1997) indicates that individuals lacking exposure to such "base-rates" of comparison are more prone to upward bias when estimating outcomes of uncertain projects, particularly when they are personally committed to the decision. In related work, Cooper et al. (1988) and Landier and Thesmar (2009) show that entrepreneurs systematically inflate estimates of their own firm's success, particularly when they are founders or key inventors. Similarly, Malmendier and Tate (2005, 2008) find that CEOs with technical backgrounds exhibit greater overconfidence when assessing the returns to investments than CEOs with finance backgrounds, possibly due to differential levels of personal commitment to the projects.

[14] As Camerer and Lovallo (1999, p. 315) explain, *"[a]n outside view ignores special details of the case at hand, constructs a class of cases similar to the current one, and guesses where the current case is in that class. [In contrast], an inside view forecast is generated by focusing on the abilities and resources of a particular group, constructing scenarios of future progress, and extrapolating current trends*." Put differently, *"[t]he inside view tells a colorful story; the outside view recites statistics*" (Camerer and Lovallo 1999, p. 315).

Building on insights from these studies, we undertake two sets of analyses. First, we explore whether firms making value-destroying CVC acquisitions are managed by more hubristic CEOs. Second, we identify organizational contexts likely to yield varying degrees of overconfidence among managers responsible for CVC investing and test for differential effects on investment performance.

CEO-level hubris. To investigate CEO-level hubris, we assembled the names of all CEOs of the 61 investors from annual 10-k filings and re-ran the abnormal returns analysis with a CEO-specific fixed effects specification. This approach allows CEOs to vary in time-invariant ways (e.g., hubristic personalities or finance backgrounds) that might alter the returns to acquiring portfolio companies. The results are reported in Table 10. As Column 2 shows, we continue to find a large and significant "within CEO" gap in the returns to CVC and non-CVC acquisitions with this more stringent specification. These findings suggest that, if managerial overconfidence leads to value-destroying takeovers in the context of our study, it resides deeper within these organizations.

Program Structure and Degree of Overconfidence Bias. Our second test for overconfidence-related bias exploits differences among firms in the internal organization of CVC programs. Prior studies suggest that firms find it easier to attract managers with backgrounds in finance or private equity investing by organizing CVC programs in autonomous subsidiaries or units (Siegel et al. 1988; Hill and Birkinshaw 2008). Doing so not only enables firms to offer responsibility for a broader array of investment projects but also increases the visibility of the program.[15] Others suggest that housing CVC

[15] In a study of organizational structures used to manage strategic alliances, Kale *et al.* (2002) similarly note that the creation of a dedicated alliance group increases the visibility of the program to employees and external parties. The authors do not discuss, however, whether the dedicated alliance structure enables firms to attract more qualified managers.

programs in dedicated units reduces expropriation risks for startups seeking funding (Dushnitsky and Shaver 2009), thus facilitating a broader "deal flow" of investment opportunities. If managers from dedicated CVC units are less involved in technological aspects of the projects yet gain exposure to more representative baselines of comparison, they may be less vulnerable than managers from less systematized programs to overconfidence bias when valuing portfolio companies.

An ideal test for overconfidence bias among lower-level managers would use proprietary data (unavailable to us) on the identities of individuals responsible for funding and/or acquiring portfolio companies, their exposure to deal flow, and their educational backgrounds. Absent that, our empirical strategy rests on the assumption that the degree of overconfidence bias among CVC managers varies systematically with program structure, with lower levels exhibited by managers from dedicated units. This approach is similar to that used by Barber and Odean (2001), where the (unobserved) degree of bias is assumed to correlate systematically with the (observed) gender of investors.

Program Structure and Returns to Acquiring Portfolio Companies. If managers from dedicated CVC units are less prone to judgment bias when valuing portfolio companies, they should capture higher returns when acquiring portfolio companies than managers from less systematized programs. To explore this possibility, we categorize structure type based on investor names reported in VentureOne and create a new variable, *Dedicated CVC unit,* which equals 1 if a dedicated organizational unit (like Motorola Ventures or Intel Capital) is listed; else it is set to zero. Of the 61 corporate investors in our sample, 35 (57%) made investments through autonomous CVC units while 26 (43%)

did not.[16] Of the 74 acquired portfolio companies, however, only 17 (23%) received initial backing from a dedicated CVC unit; the remainder (77%) received initial financing from product groups or other corporate departments.

Consistent with the view that program structure correlates with the degree of overconfidence bias among CVC investors, Table 10 shows that the average return for portfolio-company acquisitions is significantly higher when managers from dedicated CVC units are responsible for the initial funding decision. As shown in Columns 3, the coefficient on the interaction term, *CVC acquisition * Dedicated CVC unit*, is positive and significant at the 5% level. In Columns 4-6, we obtain similar results even controlling for differences among firms in CVC investment experience (Column 4), acquisition experience (Column 5), and governance quality (Column 6). Using the coefficients from Column 6, these estimates suggest that when initial venture funds originate from a dedicated CVC unit, the average return to CVC acquisitions is only 0.5% lower than the return to non-CVC acquisitions (-2.90% + 2.43%). In contrast, the estimated gap in returns to CVC and non-CVC acquisitions widens to 2.9% when initial funds originate from product groups or other corporate departments.

In unreported regressions (available upon request), we ran numerous diagnostic tests and obtained similar findings. First, we omitted deals made by either Intel Corporation, an unusually prolific investor with a dedicated unit, or Cisco Systems, a frequent acquirer with controversial CVC contract practices (Cohen 2002). Second, we experimented with alternative measures for acquisition experience (restricting counts to entrepreneurial-firm takeovers only) and CVC experience (using dollar values rather than

[16] In earlier work, Siegel et al. (1988) report similar statistics; roughly 40% of 52 CVC investors included in their study organized venture financing programs in autonomous organizational units.

counts of portfolio companies). Third, we allowed for added sources of variation among acquirers by controlling separately for either the longevity of CVC programs (based on either the total or consecutive number of years in which the acquirer made direct CVC investments) or differences among acquirers in receipt of venture financing pre-IPO. Finally, using prior IPO exits to capture time-varying differences among firms in their levels of success in CVC investing, we investigated whether lower returns to CVC acquisitions systematically follow recent success in CVC investing given evidence that success fuels higher levels of overconfidence (Barber and Odean 2002; Hilary and Menzly 2006). The results of this analysis continued to reveal persistent performance differences between dedicated and non-dedicated CVC units rather than time-sensitive effects driven by recent success in venture financing.[17]

Program Structure and Reinvestments in Portfolio Companies. If managers in dedicated and non-dedicated CVC units systematically differ in their degree of overconfidence when valuing portfolio companies, then we would expect them to make divergent forecasts more generally—not just when integrating portfolio companies through acquisition. As a final test of the overconfidence hypothesis, we therefore explore whether differences among firms in the internal organization of CVC programs similarly affect their proclivities to "throw good money after bad" when investing in portfolio companies. As Gompers and Lerner (2004) and Guler (2007) discuss, knowing when to "pull the plug" on under-performing investments is difficult even for independent venture capitalists. Indeed, Hardymon et al. (2007, p.8) report a common

[17] The absence of a time-varying effect could reflect the aggregate nature of our data. Prior evidence that "success breeds overconfidence" is based on studies of individuals, not organizations.

view among professional VCs that "[VCs] don't fail because they back bad companies but because they keep shoveling money into them."

To implement this supplemental test, we compiled investment histories from VentureOne of all portfolio companies for the 61 CVC investors in our sample, including rounds in which the focal investor did not participate. Between 1980 and 2003, these corporate investors financed 2,224 portfolio companies and participated in 3,534 rounds of financing. Roughly half (49%) of the investment rounds involved firms with dedicated CVC units.

Gompers and Lerner (2000b) identify numerous factors unrelated to CVC program structure that can affect the probability that a startup will receive follow-on rounds of financing. Our baseline specification therefore controls for a variety of startup and investor characteristics, including startup age and stage of development and the size and sector of the corporate investor. Following Moeller et al. (2004) and Gompers et al. (2008), we also control for quarterly conditions in takeover and IPO environments. Finally, to address concerns that investors with dedicated CVC units simply may be better governed or more experienced investors, we control for each investor's *BCF governance index* and *CVC experience*, defined earlier.

We compare the reinvestment behavior of dedicated and non-dedicated CVC units through a series of analyses reported in Table 11. The likelihood that a corporate investor will reinvest in a given portfolio company (after making an initial investment) is computed with a Probit estimator and robust standard errors clustered by investor. Results from the baseline specification in Column 1 are not surprising. Startups that are older, in later investment rounds, and in more advanced stages of development are less

likely than more nascent ventures to receive follow-on rounds of financing. The likelihood of refinancing also is higher in more favorable environmental conditions, as evidenced by the positive and significant coefficient on *Liquidity Index*. As a group, corporate investors in the IT sector are less likely to refinance portfolio companies than are investors from other sectors.

In Columns 2-4, we divide the sample based on known outcomes of portfolio companies (IPOs, third-party acquisitions, failures) by the end of 2005 and compare the willingness of investors with different program structures to reinvest in each subsample. Controlling for other factors likely to affect refinancing decisions, dedicated CVC units are significantly more likely than non-dedicated units to reinvest in ventures with successful exits, by 18.4% for IPOs (in Column 2) and 10.8% for third-party acquisitions (in Column 3). Surprisingly, the absolute likelihood of refinancing failed ventures is statistically indistinguishable for dedicated and non-dedicated CVC units (Column 4). The *relative* propensity to refinance promising versus under-performing ventures nonetheless appears to differ between the groups.

Columns 5 and 6 probe this difference further by splitting the sample by organizational structure type and estimating whether, *within* program type, investors systematically discriminate between projects of varying success. For non-dedicated units in Column 5, the probability of reinvestment fails to differ significantly for successful and unsuccessful ventures. In contrast, dedicated CVC groups in Column 6 are 11.4% *less* likely to reinvest in companies that fail, again implying superior proficiencies in the allocation of reinvestments toward more promising projects.[18]

[18] This finding is difficult to explain through a simple selection process whereby non-dedicated units pick lower quality startups for initial funding. If such groups invest in lower quality portfolio companies yet are

Finally, Column 7 in Table 11 combines the sample and estimates whether reinvestment practices differ significantly *between* group types. To do so, we interact *Dedicated CVC unit* with *Startup failed*, which is set to 1 if VentureOne lists the company as "bankrupt" or "out of business" by the end of 2005. Controlling for other factors likely to affect reinvestment decisions, Column 7 shows that dedicated CVC units have a higher overall baseline probability of refinancing portfolio companies, a fact that the specification in Column 5 would fail to discern. Nonetheless, the negative and significant coefficient on the *Dedicated CVC unit * Startup failed* interaction term further indicates that dedicated groups are *less* likely to continue to fund languishing ventures in their investment portfolios.[19]

Following Gompers (1995), our assumption in the above specifications is that failing ventures emit warning signals (e.g. missed milestones or product delays) that are observable to investors in a given round but that are unobservable to us until *ex post*. We then test whether CVC groups (dedicated/non) respond differently to those warning signals.[20] An alternative interpretation is that the decision of the corporate investor to discontinue investing *causes* the startup to fail, thus calling into question the direction of causality. At apparent odds with this view, Column 5 in Table 11 reports that failed and

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as adept as dedicated units at "pulling the plug" on failing ventures, then the *Startup failed* variable also should be negative and significant in Column 5.

[19] Interpreting the economic significance of this statistic is difficult due to lack of data on specific levels of corporate funding across rounds. In total, however, non-dedicated units in our sample invested $1.776 billion in portfolio companies that were disbanded by 2005. Decreasing that amount by 7% would reduce these collective losses by $123 million ($1.776 billion * 0.07).

[20] In estimating the ability of independent VCs to refinance projects of varying success, Gompers (1995, Table VII) similarly uses the final outcomes of startups to predict receipt of multiple rounds of financing. He explains, "*a plausible explanation for these results is that venture capitalists gather information about the potential profitability of projects over time. If venture capitalists receive favorable information about the firm…[they] continue to fund the project. Firms that have little potential are liquidated.*" (p. 1483). Similar specifications have also been used in the labor economics literature to analyze the relationship between women's labor participation and future divorce (Johnson & Skinner 1986; Sen 2000, 2002). In that literature, future divorce (used to proxy for "anticipation of divorce") is used as an independent variable to predict current labor participation.

successful ventures are similarly likely to receive follow-on funds from non-dedicated units. For reverse causality to explain the empirical regularities in Table 11, the termination (continuation) of funding by dedicated CVC units also would need to cause greater harm (value) to portfolio companies than equivalent actions of corporate investors with non-dedicated units. Absent a natural experiment or finer-grained data, it is difficult to empirically distinguish between these interpretations. Reverse causality alone seems unlikely to explain, however, the broad consistency in our findings: Investors that house CVC programs in autonomous organizational units realize more favorable outcomes than do corporate investors with less systematized programs—both in the value captured from portfolio-company acquisitions (Table 10) and in the allocation of reinvestments toward successful (versus languishing) venture projects (Table 11).

2.4.4. *Interpretational Issues and Interview Insights*

As noted earlier, interpretation of this "dedicated unit" effect is not without ambiguity. Consistent with behavioral theories, managers from dedicated CVC units could be less prone to judgment bias when valuing portfolio companies, possibly due to greater exposure to investment opportunities or superior training in finance. An alternative explanation, which we are unable to rule out, is that housing CVC activities in standalone units enables superior monitoring or compensation of investment activities, thus helping mitigate program-level agency problems. Future research could disentangle these explanations more fully through access to data on the backgrounds and compensation packages of managers involved in CVC financing activities.

Our conversations with corporate venturing and business development managers point simultaneously to overconfidence and agency-based explanations. An executive

from a large diversified IT firm explained that his firm's corporate venturing activities were reorganized under one organizational umbrella to ensure greater accountability. In his view, budgets for CVC investments were being used to support discretionary spending within business units with little accountability for results. While not mentioned in the interview, the reorganization also could have improved the firm's ability to attract managers with superior training or experience in private equity investing.

At the same time, several interviewees described the challenges in managing relationships between technical experts from product groups or R&D departments and entrepreneurs from portfolio companies. On one hand, some felt that champions are needed to ensure sufficient "buy-in" so that employees have incentives to provide technical or marketing assistance to portfolio companies when requested. On the other hand, others observed a tendency among engineers to become "overcommitted" to projects of portfolio companies. Consistent with professional VCs interviewed by Guler (2007) and Hardymon et al. (2007), corporate investors we met with frequently cited "emotional attachment" to portfolio companies.

Interestingly, CVC managers voiced particular concerns about technical experts "falling in love" with technology under development at portfolio companies or "pushing too hard" to ensure success in the projects. This latter insight resonates with evidence from Malmendier and Tate (2005, 2008) that managers with technical backgrounds are more prone to upward bias when assessing the future value of projects that involve them. More broadly, these interviews reveal both economic and behavioral influences on CVC investment decisions and the outcomes associated with those investments.

2.5 Conclusion

Despite theoretical attention to the strategic nature of corporate venture capital investments (Hellmann 2002), empirical research on this topic remains limited. This study contributes new evidence by estimating the returns to 61 top CVC investors when acquiring entrepreneurial firms. Surprisingly, we find that acquisitions of portfolio companies tend to destroy value for shareholders of these corporate investors, even though these same investors otherwise are "good acquirers" of entrepreneurial firms. We explore numerous explanations for these puzzling findings, which appear to stem from managerial overconfidence or agency problems at the CVC program level.

A number of unresolved issues invite further study. First, future studies could probe more deeply into why and how program structure affects overconfidence bias and/or agency problems in CVC investing, ideally through use of individual-level data or more structured qualitative investigation. Similarly, the trade-offs firms face when designing CVC programs warrant more systematic investigation. If dedicated units out-perform non-dedicated units, why do so many firms (almost 50% in our sample) relegate venture financing activities to product groups or other corporate departments?

Finally, it is unclear why our findings contrast so sharply with those reported in Higgins and Rodriguez (2006), where pharmaceutical firms are shown to earn positive and significant returns when acquiring former alliance partners. In principle, alliances and corporate venture capital both enable firms to gain information about potential candidates for acquisition. Future research could investigate whether our contrasting findings are due to sector-specific factors, the involvement of venture capitalists as

intermediaries, or organizational factors that differentially affect the management and performance of corporate venturing programs.

In a review of the acquisitions literature, Andrade et al. (2001, p. 118) conclude that research on how acquisitions create or destroy value is a "wide open [area of investigation], spanning the fields of corporate finance, industrial organization, organizations, and strategy." Our findings suggest that CVC investing is a fruitful arena in which to further explore how organizational structure affects the value created or destroyed by corporate finance decisions.

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Table 2.1 Sample Distribution by Announcement Year and Acquisition Type

The sample includes acquisitions of entrepreneurial firms (less than 12 years old) made by 61 corporate venture capital (CVC) investors from 1987 through 2003. CVC (non-CVC) acquisitions are acquisitions in which the acquirer had (had not) provided venture funds to the target at an earlier stage of development. Information technology acquirers are firms with primary lines of business in software (SIC737), computer hardware (SIC357), semiconductors (SIC367), telecommunications (SIC481, 484), communications equipment (SIC366), and electronic instruments (SIC381, 382).

Announcement Year	Non-CVC Acquisitions		CVC Acquisitions		Pooled Sample		
	#	% all non-CVC	#	% all CVC	#	% total	% with IT acquirer
1987	7	2%	1	1%	8	2%	50%
1988	6	1%	1	1%	7	1%	57%
1989	10	2%	4	4%	14	3%	86%
1990	6	1%	0	0%	6	1%	67%
1991	3	1%	2	2%	5	1%	100%
1992	8	2%	1	1%	9	2%	67%
1993	8	2%	4	4%	12	2%	100%
1994	13	3%	3	3%	16	3%	75%
1995	30	7%	3	3%	33	6%	64%
1996	31	7%	4	4%	35	7%	83%
1997	28	6%	2	2%	30	6%	80%
1998	48	11%	7	8%	55	10%	82%
1999	77	17%	11	12%	88	17%	83%
2000	67	15%	19	21%	86	16%	78%
2001	37	8%	9	10%	46	9%	67%
2002	33	7%	13	15%	46	9%	74%
2003	29	7%	5	6%	34	6%	76%
Total	441	100%	89	100%	530	100%	76%

Table 2.2 Acquirer Abnormal Returns by Acquisition Type

This table presents the two-day (-1,0) cumulative abnormal return (CAR) to 61 corporate venture capital (CVC) investors from acquiring entrepreneurial firms (less than 12 years old) during 1987-2003. CVC (non-CVC) acquisitions are defined as acquisitions in which the acquirer had (had not) provided venture funds to the target at an earlier stage of development. Panel A reports results for the full sample, while Panel B restricts the sample to private targets only. Confounding events and acquisitions announced during overlapping event windows are omitted from the sample. Economic impact is calculated as the CAR multiplied by the market capitalization of the acquirer at t-30. Column 3 tests for significant differences in the mean and median abnormal returns to non-CVC (column 1) and CVC (column 2) acquisition announcements using t-tests for equality in means and non-parametric tests for equality of medians.

	Non-CVC Acquisitions	CVC Acquisitions	Difference (Col 1 vs. Col 2)
	(1)	(2)	(3)
Panel A: Full Sample (n=489)			
$CAR_{(-1,0)}$	0.37%**	-0.97%**	1.33%***
	[0.18%]	[-0.75%]**	[0.93%]***
Economic Impact ($M)	$106.5	-708.1	
	[$8.5]	[-$63.0]	
N	415	74	
Panel B: Private Targets Only (n=409)			
$CAR_{(-1,0)}$	0.67%***	-1.05%**	1.72%***
	[0.50%]***	[-0.78%]**	[1.28%]***
Economic Impact ($M)	257.3	-730.1	
	[$18.7]	[-$70.2]	
N	338	71	

** significant at 10%; ** significant at 5%; *** significant at 1%; Col 3 reports statistical significance of differences in CAR values*

Table 2.3 Acquirer Returns and Aggregate Wealth Effect by Acquisition Type and Period

This table reports the average two-day (-1,0) cumulative abnormal returns (CARs) to 61 corporate venture capital (CVC) investors when acquiring entrepreneurial firms (less than 12 years old) during 1987-2003. CVC (non-CVC) acquisitions are defined as acquisitions in which the acquirer had (had not) provided venture funds to the target at an earlier stage of its development. Panel A reports results for the full sample, while Panel B restricts the sample to private targets only. In both panels, results are first reported over all years in the sample period. The sample is then sub-divided into acquisitions announced before, during, and after the boom period of 1999 and 2000. Confounding events and acquisitions announced during overlapping event windows are omitted from the sample. Economic impact is calculated as the cumulative abnormal return (CAR) multiplied by the market capitalization of the acquirer at t-30. Economic impact is then summed (within deal types) to create the aggregate dollar return. Both measures are reported in constant 1996 dollars.

	Non-CVC Acquisitions				CVC Acquisitions			
	N	Mean CAR (-1,0)	Median CAR (-1,0)	Aggregate Dollar Return ($M)	*N*	Mean CAR (-1,0)	Median CAR (-1,0)	Aggregate Dollar Return ($M)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Full Sample (n=489)								
All Years (1987-2003)	415	0.37%***	0.18%***	44,190.1	74	-0.97%	-0.75%	-52,400.51
Sub-divided by Period:								
Pre-Boom (1987-1998)	188	0.49%**	0.25%**	26,315.7	29	-1.05%	-0.82%	-12,008.43
Boom (1999-2000)	135	0.08%	-0.30%	-13,882.4	24	-0.70%	0.04%	-28,332.26
Post-Boom (2001-2003)	92	0.52%*	0.63%	31,756.8	21	-1.15%	-1.84%	-12,059.82
Panel B: Private Targets (n=409)								
All Years (1987-2003)	338	0.67%***	0.50%***	86,958.4	71	-1.05%	-0.78%	-51,834.1
Sub-divided by Period:								
Pre-Boom (1987-1998)	151	0.64%***	0.41%**	14,956.1	27	-1.08%	-1.10%	-11,412.9
Boom (1999-2000)	114	0.67%	0.58%	32,311.4	24	-0.70%	0.04%	-28,332.3
Post-Boom (2001-2003)	73	0.71%*	0.68%*	39,691.0	20	-1.40%	-1.90%	-12,089.0

Columns 2 and 3 report the statistical significance of differences in CAR values for non-CVC vs CVC acquisitions at 10% (*), 5% (**), and 1% (***) levels.

Table 2.4 Tests for Possible Disappointment (CVC Acquisitions Only)

Panel A presents the two-day cumulative abnormal return (CAR) to CVC acquisition announcements reported in Table 2 overall then for observations in which the initial CVC investment is (is not) previously disclosed. Panel B presents the returns to acquirers at the time of the initial CVC investment announcement for the subset of observations (n=50) in which venture ties are disclosed prior to acquisition. Panel C reports the two-day abnormal returns upon the acquisition announcement for non-acquiring corporate investors in the target.

	N	Average excess return, CAR (-1,0)	Percent Positive
	(1)	(2)	(3)
Panel A: Acquirer Returns at Acquisition Announcement	74	-0.97%**	39%
A.1. Subsample for which Prior CVC Funding is Disclosed	50	-0.72%*	40%
A.2. Subsample for which Prior CVC Funding is Not Disclosed	24	-1.48%*	38%
Panel B: Acquirer Returns at Initial CVC Investment Announcement	50	-0.52%	42%
Panel C: Returns to Non-Acquiring CVC Investors at Acquisition Announcement	43	0.99%	53%

** significant at 10%; ** significant at 5%; *** significant at 1%*

Table 2.5 Summary Statistics by Acquisition Type

Sample includes entrepreneurial firms (less than 12 years old) acquired by 61 corporate venture capital (CVC) investors during 1987-2003. In CVC (non-CVC) acquisitions, the acquirer had (had not) provided venture funds to the target at an earlier stage of development. Variable definitions and data sources are listed in the appendix. Financial data are in millions of constant 1996 dollars. Statistical tests are t-tests for equality in means, Wilcoxon tests for equality of medians, and one-tail tests of proportions for percentages. Median values are in brackets.

	Non-CVC Acquisitions (1)	CVC Acquisitions (2)	Pooled Sample (3)
Panel A: Acquirer Characteristics			
Ln assets	9.1	9.2	9.1
	[9.2]	[9.5]	[9.3]
R&D intensity	40.6	46.7	41.5
	[34.1]	[37.3]	[34.8]
Tobin's q	4.8	4.5	4.7
	[2.9]	[2.2]	[2.7]
Free cash flow	0.14	0.14	0.14
	[0.15]	[0.14]	[0.14]
In IT sector	77%	76%	77%
In Life Science sector	12%	11%	12%
In other sector	11%	13%	11%
Panel B: Deal Characteristics			
Liquidity index in target sector	0.07	0.04**	0.06
	[0.04]	[0.03]	[0.03]
# IPOs in target sector	25.5	21.9	25.0
	[16.0]	[14.0]	[16.0]
Deal value, if reported	379.0	243.4	357.3
	[101.0]	[107.7]	[103.1]
Relative size	0.03	0.02	0.03
	[0.01]	[0.01]	[0.01]
Payment includes stock	67%	70%	67%
Payment method undisclosed	41%	37%	40%
Deal value undisclosed	32%	26%	30%
Panel C: Target Characteristics			
Target age	5.3	4.3***	5.1
	[5.0]	[4.0]**	[5.0]
Employees, if identified	215.4	159.8*	206.0
	[76.5]	[60.0]***	[75.0]
Target is publicly-traded	19%	4%***	16%
Target owns patents	36%	34%	36%
Target in same sector as acquirer	97%	97%	97%
Employee data identified?	79%	89%	81%

,,*** Significant difference between non-CVC and CVC values at 10%, 5%, and 1% levels, respectively.*

Table 2.6 Main Results & Robustness Checks

OLS estimates of acquirer returns to CVC and non-CVC acquisition announcements. The dependent variable is the two-day (-1,0) cumulative abnormal return. Sample includes entrepreneurial firms (less than 12 years old) acquired by 61 corporate venture capital (CVC) investors during 1987-2003. *CVC Acquisition* equals one when the acquirer provided venture funds to the target pre-acquisition; the omitted category is startups acquired outright (non-CVC acquisitions). Other variables are defined in the appendix. Columns 1 and 2 report the baseline model and main results. The remaining columns report robustness checks. In Column 3, the sample is restricted to venture-backed private targets. In Column 4, the sample is restricted further to pairs of CVC and non-CVC targets matched by lines of business and acquisition dates. Columns 5 and 6 allow for unobserved heterogeneity among acquirers for the full sample (in column 5) and for the subset that make both CVC and non-CVC acquisitions (in column 6). Each specification includes year dummies and a dummy variable when acquirer R&D is not reported. Financial data are in millions of constant 1996 dollars. Robust standard errors, clustered by acquirer, are in brackets.

	Baseline	Main Results	Private Targets, VC-Backed Only	Matched Pairs of CVC & Non-CVC Targets	Full Sample: Acquirer Fixed Effects	Acquires Both CVC & Non-CVC: Acquirer Fixed Effects
Variables	(1)	(2)	(3)	(4)	(5)	(6)
CVC acquisition		-0.0173***	-0.0177***	-0.0245***	-0.0152**	-0.0154**
		[0.0058]	[0.0057]	[0.0057]	[0.0058]	[0.0058]
Acquirer Characteristics						
Ln assets	-0.0011	-0.0008	0.0011	0.0000	-0.0033	-0.0038
	[0.0012]	[0.0013]	[0.0017]	[0.0028]	[0.0040]	[0.0038]
R&D intensity	0.0002	0.0002*	0.0002**	0.0004***	-0.0004*	-0.0005**
	[0.0001]	[0.0001]	[0.0001]	[0.0001]	[0.0002]	[0.0002]
Tobin's q	0.0004	0.0004	-0.0008	-0.0037***	0.0012	0.0010
	[0.0009]	[0.0009]	[0.0008]	[0.0011]	[0.0012]	[0.0014]
Free cash flow as % assets	-0.0012	-0.0008	-0.0142	0.0237	-0.0187**	-0.0369**
	[0.0041]	[0.0040]	[0.0099]	[0.0222]	[0.0092]	[0.0139]
In IT sector	-0.0091**	-0.0097**	-0.0103*	-0.0123	--	--
	[0.0042]	[0.0042]	[0.0052]	[0.0091]	--	--
Target Characteristics						
Target age	-0.0002	-0.0004	0.0006	0.0015	-0.0010	-0.0007
	[0.0008]	[0.0007]	[0.0010]	[0.0016]	[0.0008]	[0.0007]
Target owns patents	-0.0020	-0.0016	-0.0008	-0.0013	-0.0015	-0.0011
	[0.0040]	[0.0039]	[0.0042]	[0.0057]	[0.0043]	[0.0046]
Target is publicly-traded	-0.0144***	-0.0175***	--	--	-0.0188***	-0.0166***
	[0.0051]	[0.0049]	--	--	[0.0048]	[0.0048]
Target in same sector as acquirer	0.0092	0.0095	0.0058	-0.0152	0.0170	0.0124
	[0.0087]	[0.0085]	[0.0119]	[0.0234]	[0.0108]	[0.0109]
Deal Characteristics						
Liquidity index in target sector	0.0103	0.0045	-0.0425	-0.0026	-0.0026	-0.0239
	[0.0224]	[0.0220]	[0.0364]	[0.0537]	[0.0239]	[0.0242]
# IPOs in target sector	-0.0000	-0.0000	-0.0001	-0.0001	0.0001	0.0001
	[0.0001]	[0.0001]	[0.0002]	[0.0002]	[0.0001]	[0.0001]
Relative size	-0.0813	-0.0781	0.0162	0.0782	-0.0820	-0.0819
	[0.0652]	[0.0677]	[0.0532]	[0.0620]	[0.0582]	[0.0652]
Payment includes stock	-0.0070	-0.0064	-0.0063	-0.0139	-0.0051	-0.0052
	[0.0052]	[0.0051]	[0.0060]	[0.0118]	[0.0062]	[0.0058]
Deal terms undisclosed	-0.0123**	-0.0132**	-0.0129**	-0.0179	-0.0146**	-0.0137**
	[0.0053]	[0.0052]	[0.0063]	[0.0119]	[0.0059]	[0.0053]
Constant	0.0337*	0.0353*	0.0131	0.0608	0.0784*	0.0816**
	[0.0196]	[0.0200]	[0.0204]	[0.0376]	[0.0414]	[0.0401]
Time Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Firm Dummies	No	No	No	No	Yes	Yes
N	489	489	270	130	489	413
Adjusted R-squared	0.038	0.059	0.050	0.215	0.113	0.137

** significant at 10%; ** significant at 5%; *** significant at 1%*

Table 2.7 Tests for Competition-Driven Overpayment ("Owner's Curse")

OLS estimates of acquirer returns to CVC and non-CVC acquisition announcements. The dependent variable is the two-day (-1,0) cumulative abnormal return. Sample includes entrepreneurial firms (less than 12 years old) acquired by 61 corporate venture capital (CVC) investors during 1987-2003. *CVC Acquisition* equals one when the acquirer provided venture funds to the target pre-acquisition; the omitted category is startups acquired outright (non-CVC acquisitions). Other variables are defined in the Appendix. Each specification includes year dummies and a dummy variable when acquirer R&D is not reported. Financial data are in millions of constant 1996 dollars. Robust standard errors, clustered by acquirer, are in brackets.

	Main Results	# Corp Investors	# Corp Investors *	Liquidity * CVC Acq	# IPOs * CVC Acq
Variables	(1)	(2)	(3)	(4)	(5)
CVC acquisition	-0.0173***	-0.0167***	-0.0158**	-0.0161**	-0.0185**
	[0.0058]	[0.0058]	[0.0064]	[0.0063]	[0.0079]
# Corporate investors		-0.0014	-0.0009		
		[0.0015]	[0.0021]		
# Corporate investors * CVC acquisition			-0.0013		
			[0.0033]		
Liquidity index * CVC acquisition				-0.0251	
				[0.0823]	
Number of IPOs * CVC acquisition					0.0001
					[0.0002]
Acquirer Characteristics					
Ln assets	-0.0008	-0.0008	-0.0008	-0.0008	-0.0008
	[0.0013]	[0.0013]	[0.0013]	[0.0013]	[0.0013]
R&D intensity	0.0002*	0.0002*	0.0002*	0.0002*	0.0002*
	[0.0001]	[0.0001]	[0.0001]	[0.0001]	[0.0001]
Tobin's q	0.0004	0.0004	0.0004	0.0004	0.0004
	[0.0009]	[0.0009]	[0.0009]	[0.0009]	[0.0009]
Free cash flow as % assets	-0.0008	-0.0009	-0.0010	-0.0008	-0.0008
	[0.0040]	[0.0040]	[0.0040]	[0.0040]	[0.0040]
In IT sector	-0.0097**	-0.0092**	-0.0092**	-0.0096**	-0.0097**
	[0.0042]	[0.0043]	[0.0043]	[0.0042]	[0.0042]
Target Characteristics					
Target age	-0.0004	-0.0004	-0.0004	-0.0003	-0.0004
	[0.0007]	[0.0007]	[0.0007]	[0.0007]	[0.0008]
Target owns patents	-0.0016	-0.0012	-0.0013	-0.0017	-0.0016
	[0.0039]	[0.0041]	[0.0041]	[0.0039]	[0.0039]
Target is publicly-traded	-0.0175***	-0.0179***	-0.0177***	-0.0175***	-0.0175***
	[0.0049]	[0.0049]	[0.0050]	[0.0049]	[0.0049]
Target in same sector as acquirer	0.0095	0.0093	0.0094	0.0094	0.0097
	[0.0085]	[0.0085]	[0.0086]	[0.0085]	[0.0084]
Deal Characteristics					
Liquidity index in target sector	0.0045	0.0048	0.0048	0.0051	0.0050
	[0.0220]	[0.0220]	[0.0220]	[0.0222]	[0.0225]
# IPOs in target sector	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000
	[0.0001]	[0.0001]	[0.0001]	[0.0001]	[0.0001]
Relative size	-0.0781	-0.0758	-0.0763	-0.0785	-0.0785
	[0.0677]	[0.0664]	[0.0667]	[0.0676]	[0.0679]
Payment includes stock	-0.0064	-0.0067	-0.0066	-0.0065	-0.0064
	[0.0051]	[0.0050]	[0.0050]	[0.0051]	[0.0051]
Deal terms undisclosed	-0.0132**	-0.0135**	-0.0133**	-0.0133**	-0.0132**
	[0.0052]	[0.0051]	[0.0051]	[0.0052]	[0.0052]
Constant	0.0353*	0.0356*	0.0353*	0.0354*	0.0355*
	[0.0200]	[0.0198]	[0.0199]	[0.0200]	[0.0201]
Time Dummies	Yes	Yes	Yes	Yes	Yes
N	489	489	489	489	489
Adjusted R-squared	0.059	0.058	0.056	0.057	0.057

** significant at 10%; ** significant at 5%; *** significant at 1%*

Table 2.8 Governance Quality for CVC Investors

Comparison of firm-level governance quality based on indices by Gompers-Ishii-Metrick (GIM) and Bebchuk-Cohen-Ferrell (BCF) compiled from IRRC Corporate Takeover Defense publications. The GIM index is a 24-pt scale, whereas the BCF index is a 6-pt scale. In both cases, lower scores indicate superior governance quality. Mean scores are compared using two-sample t-tests. Median scores (reported in brackets) are compared using Wilcoxon equality tests. Columns 1 and 2 compare scores for our acquiring-firm sample with those reported for the population of 1,500 public companies tracked by the IRRC. Columns 3 and 4 report governance scores for acquirers in our sample at the time that CVC and non-CVC acquisitions were announced.

	Sample firms vs. all firms tracked by IRRC		Sample firms only - Governance quality by acquisition type	
	Sample firms	All IRRC	CVC	Non-CVC
	(1)	(2)	(3)	(4)
GIM Governance Index	8.8	9.0	8.1	8.2
	[9.0]	[9.0]	[8.0]	[8.0]
BCF Governance Index	1.8***	2.3	1.3	1.4
	[2.0]	[2.0]	[1.0]	[1.0]

,,*** Statistical significance of difference at 10%, 5%, and 1%, respectively.*

Table 2.9 Tests of Firm-Level Governance Explanations

OLS estimates of acquirer returns to CVC and non-CVC acquisition announcements. The dependent variable is the two-day (-1,0) cumulative abnormal return. Sample includes entrepreneurial firms (less than 12 years old) acquired by 61 corporate venture capital (CVC) investors during 1987-2003. *CVC Acquisition* equals one when the acquirer provided venture funds to the target pre-acquisition; the omitted category is startups acquired outright (non-CVC acquisitions). Other variables are defined in the Appendix. Firm-level governance indices by Gompers-Ishii-Metrick (GIM) and Bebchuk-Cohen-Ferrell (BCF) are compiled from IRRC Corporate Takeover Defense publications, with lower scores indicating superior governance quality. Each specification includes year dummies and a dummy variable when acquirer R&D is not reported. Financial data are in millions of constant 1996 dollars. Robust standard errors, clustered by acquirer, are in brackets.

	Main Results	Cash Flow	GIM Index	BCF Index	CVC Acq * BCF Index
Variables	(1)	(2)	(3)	(4)	(5)
CVC acquisition	-0.0173***	-0.0229**	-0.0172***	-0.0173***	-0.0213***
	[0.0058]	[0.0098]	[0.0059]	[0.0058]	[0.0069]
CVC acquisition * Free cash flow		0.0407			
		[0.0444]			
GIM governance index			-0.0001		
			[0.0006]		
BCF governance index				-0.0002	-0.0007
				[0.0012]	[0.0014]
CVC acquisition * BCF index					0.0031
					[0.0039]
Acquirer Characteristics					
Ln assets	-0.0008	-0.0010	-0.0008	-0.0009	-0.0008
	[0.0013]	[0.0012]	[0.0013]	[0.0014]	[0.0014]
R&D intensity	0.0002*	0.0002	0.0002*	0.0002	0.0002
	[0.0001]	[0.0001]	[0.0001]	[0.0001]	[0.0001]
Tobin's q	0.0004	0.0003	0.0004	0.0004	0.0004
	[0.0009]	[0.0009]	[0.0009]	[0.0009]	[0.0009]
Free cash flow as % assets	-0.0008	-0.0018	-0.0006	-0.0008	-0.0007
	[0.0040]	[0.0038]	[0.0039]	[0.0040]	[0.0040]
In IT sector	-0.0097**	-0.0095**	-0.0099**	-0.0098**	-0.0099**
	[0.0042]	[0.0041]	[0.0044]	[0.0042]	[0.0042]
Target Characteristics					
Target age	-0.0004	-0.0004	-0.0003	-0.0004	-0.0004
	[0.0007]	[0.0007]	[0.0007]	[0.0007]	[0.0007]
Target owns patents	-0.0016	-0.0020	-0.0015	-0.0016	-0.0015
	[0.0039]	[0.0041]	[0.0039]	[0.0039]	[0.0040]
Target is publicly-traded	-0.0175***	-0.0172***	-0.0175***	-0.0175***	-0.0175***
	[0.0049]	[0.0049]	[0.0050]	[0.0049]	[0.0050]
Target in same sector as acquirer	0.0095	0.0093	0.0093	0.0094	0.0086
	[0.0085]	[0.0086]	[0.0085]	[0.0085]	[0.0081]
Deal Characteristics					
Liquidity index in target sector	0.0045	0.0049	0.0044	0.0045	0.0043
	[0.0220]	[0.0218]	[0.0220]	[0.0220]	[0.0221]
# IPOs in target sector	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000
	[0.0001]	[0.0001]	[0.0001]	[0.0001]	[0.0001]
Relative size	-0.0781	-0.0769	-0.0778	-0.0782	-0.0773
	[0.0677]	[0.0698]	[0.0675]	[0.0678]	[0.0681]
Payment includes stock	-0.0064	-0.0071	-0.0065	-0.0063	-0.0064
	[0.0051]	[0.0053]	[0.0052]	[0.0051]	[0.0051]
Deal terms undisclosed	-0.0132**	-0.0137**	-0.0131**	-0.0132**	-0.0132**
	[0.0052]	[0.0054]	[0.0052]	[0.0052]	[0.0052]
Constant	0.0353*	0.0377*	0.0368*	0.0362	0.0370*
	[0.0200]	[0.0205]	[0.0216]	[0.0217]	[0.0216]
Year Dummies	Yes	Yes	Yes	Yes	Yes
N	489	489	489	489	489
Adjusted R-squared	0.059	0.061	0.057	0.057	0.056

** significant at 10%; ** significant at 5%; *** significant at 1%*

Table 2.10 Tests of Overconfidence-based Explanations

OLS estimates of acquirer returns to CVC and non-CVC acquisition announcements. The dependent variable is the two-day (-1,0) cumulative abnormal return. Sample includes entrepreneurial firms (less than 12 years old) acquired by 61 corporate venture capital (CVC) investors during 1987-2003. *CVC Acquisition* equals one when the acquirer provided venture funds to the target pre-acquisition; the omitted category is startups acquired outright (non-CVC acquisitions). Column 2 tests "within CEO" differences. Column 3 interacts *CVC acquisition* with an indicator set to 1 if the initial investment in the target originated from a dedicated CVC unit; the omitted category is investments originating elsewhere in the organization (e.g., product groups). Other variables are defined in the Appendix. Financial data are in millions of constant 1996 dollars. Robust standard errors, clustered by acquirer, are in brackets. In Column 2, error terms are clustered by CEO.

	Main Results	Control for CEO-Specific Effects	CVC Acq * Dedicated Unit	Col 3, with CVC experience	Col 3, with Acq Experience	Col 3, with Governance Quality
Variables	(1)	(2)	(3)	(4)	(5)	(6)
CVC acquisition	-0.0173***	-0.0173***	-0.0225***	-0.0226***	-0.0225***	-0.0290***
	[0.0058]	[0.0063]	[0.0062]	[0.0062]	[0.0062]	[0.0067]
CVC acquisition * Dedicated CVC unit			0.0220**	0.0218**	0.0206**	0.0243**
			[0.0106]	[0.0106]	[0.0111]	[0.0101]
Acquisition experience				-0.0001		
				[0.0001]		
CVC experience					0.0000	
					[0.0000]	
BCF governance index						-0.0005
						[0.0013]
CVC acquisition * BCF governance index						0.0046
						[0.0038]
Acquirer Characteristics						
Ln assets	-0.0008	-0.0095**	-0.0010	-0.0007	-0.0011	-0.0008
	[0.0013]	[0.0043]	[0.0013]	[0.0015]	[0.0013]	[0.0014]
R&D intensity	0.0002*	-0.0005	0.0002*	0.0002*	0.0002*	0.0002*
	[0.0001]	[0.0003]	[0.0001]	[0.0001]	[0.0001]	[0.0001]
Tobin's q	0.0004	0.0012	0.0004	0.0004	0.0004	0.0004
	[0.0009]	[0.0013]	[0.0009]	[0.0009]	[0.0009]	[0.0009]
Free cash flow as % assets	-0.0008	-0.0255	-0.0006	-0.0007	-0.0007	-0.0005
	[0.0040]	[0.0169]	[0.0038]	[0.0038]	[0.0038]	[0.0038]
In IT sector	-0.0097**	-0.4419**	-0.0095**	-0.0100**	-0.0098**	-0.0093**
	[0.0042]	[0.1847]	[0.0041]	[0.0045]	[0.0042]	[0.0041]
Target Characteristics						
Target age	-0.0004	-0.0013	-0.0004	-0.0004	-0.0004	-0.0004
	[0.0007]	[0.0010]	[0.0007]	[0.0007]	[0.0007]	[0.0007]
Target owns patents	-0.0016	-0.0011	-0.0020	-0.0021	-0.0023	-0.0018
	[0.0039]	[0.0053]	[0.0038]	[0.0038]	[0.0039]	[0.0039]
Target is publicly-traded	-0.0175***	-0.0200***	-0.0169***	-0.0171***	-0.0169***	-0.0169***
	[0.0049]	[0.0054]	[0.0048]	[0.0048]	[0.0048]	[0.0048]
Target in same sector as acquirer	0.0095	0.0167	0.0090	0.0093	0.0088	0.0080
	[0.0085]	[0.0125]	[0.0087]	[0.0088]	[0.0086]	[0.0083]
Deal Characteristics						
Liquidity index in target sector	0.0045	0.0013	0.0050	0.0048	0.0060	0.0048
	[0.0220]	[0.0279]	[0.0220]	[0.0219]	[0.0221]	[0.0221]
# IPOs in target sector	-0.0000	0.0002	-0.0000	-0.0000	-0.0000	-0.0000
	[0.0001]	[0.0002]	[0.0001]	[0.0001]	[0.0001]	[0.0001]
Relative size	-0.0781	-0.0512	-0.0866	-0.0864	-0.0857	-0.0860
	[0.0677]	[0.0564]	[0.0652]	[0.0654]	[0.0656]	[0.0653]
Payment includes stock	-0.0064	-0.0056	-0.0053	-0.0051	-0.0053	-0.0054
	[0.0051]	[0.0076]	[0.0052]	[0.0053]	[0.0052]	[0.0052]
Deal terms undisclosed	-0.0132**	-0.0135*	-0.0133**	-0.0132**	-0.0132**	-0.0133**
	[0.0052]	[0.0073]	[0.0054]	[0.0054]	[0.0054]	[0.0054]
Constant	0.0353*	0.5581***	0.0368*	0.0348	0.0385*	0.0373*
	[0.0200]	[0.1862]	[0.0201]	[0.0224]	[0.0206]	[0.0216]
Time Dummies	Yes	Yes	Yes	Yes	Yes	Yes
N	489	489	489	489	489	489
Adjusted R-squared	0.059	0.135	0.064	0.062	0.063	0.063

** significant at 10%; ** significant at 5%; *** significant at 1%*

Table 2.11 Supplemental Analysis: Reinvestments in Portfolio Companies

Probit regressions for whether a corporate investor reinvested in a portfolio company. Marginal effects are reported. The unit of analysis is an investor-portfolio company investment round. The sample comprises investments made by 61 corporate venture capital (CVC) investors in 2,224 portfolio companies during 1980-2003. *Dedicated CVC unit* equals 1 if an investment is made by a dedicated CVC unit; the omitted category is investments originating elsewhere in the organization (e.g., in product groups). Financial data are in millions of constant 1996 dollars. Robust standard errors, clustered by corporate investor, are shown in brackets.

		Subsamples by Start-up Outcomes			Subsamples by Program Structure		Full Sample
	Controls Only	Had IPO	Acquired by Third Parties	Out of Business	Investors without dedicated CVC units	Investors with dedicated CVC units	Main Results
Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dedicated CVC unit		0.1840***	0.1079**	0.0241			0.1477***
		[0.0581]	[0.0544]	[0.0494]			[0.0297]
Startup failed					-0.0301	-0.1152***	-0.0310
					[0.0259]	[0.0275]	[0.0286]
Ded. CVC unit * Startup failed							-0.0669**
							[0.0331]
BCF governance index	-0.0207	-0.0139	0.0368	-0.0003	-0.0029	-0.0087	-0.0078
	[0.0131]	[0.0191]	[0.0289]	[0.0226]	[0.0107]	[0.0284]	[0.0104]
CVC experience	0.0002***	-0.0002	0.0004***	0.0004***	-0.0015**	0.0002	0.0000
	[0.0001]	[0.0003]	[0.0002]	[0.0001]	[0.0007]	[0.0002]	[0.0001]
Corporate Investor Characteristics							
Ln assets	-0.0100	0.0251	0.0285	-0.0133	-0.0014	0.0056	-0.0105
	[0.0112]	[0.0153]	[0.0242]	[0.0169]	[0.0108]	[0.0272]	[0.0100]
R&D intensity	-0.0005	0.0010	0.0001	0.0000	0.0008	-0.0022	0.0002
	[0.0005]	[0.0012]	[0.0009]	[0.0010]	[0.0006]	[0.0020]	[0.0005]
Tobin's q	-0.0054*	0.0024	0.0067	-0.0006	-0.0040	0.0034	-0.0048
	[0.0030]	[0.0052]	[0.0056]	[0.0078]	[0.0030]	[0.0163]	[0.0033]
Free cash flow as % assets	0.0100	-0.0286	-0.2765*	0.0097	0.0201	-0.0239	0.0133
	[0.0447]	[0.0989]	[0.1466]	[0.0615]	[0.0445]	[0.0729]	[0.0431]
In IT sector	-0.1571***	-0.0139	-0.1174	-0.1847**	-0.0796**	-0.2963***	-0.1478***
	[0.0474]	[0.0782]	[0.0759]	[0.0766]	[0.0372]	[0.0542]	[0.0414]
Startup Characteristics							
Startup age	-0.0137***	-0.0035	-0.0211*	-0.0108	-0.0097**	-0.0199***	-0.0135***
	[0.0028]	[0.0121]	[0.0109]	[0.0105]	[0.0043]	[0.0031]	[0.0028]
Investment round number	-0.0278***	-0.0555***	-0.0022	-0.0103	-0.0210***	-0.0482***	-0.0296***
	[0.0074]	[0.0187]	[0.0127]	[0.0227]	[0.0077]	[0.0075]	[0.0067]
In product development stage	-0.0989**	0.0423	-0.1629	-0.2114***	-0.0784	-0.1358***	-0.1013**
	[0.0449]	[0.1664]	[0.1070]	[0.0808]	[0.0643]	[0.0496]	[0.0433]
In beta testing stage	-0.1188**	-0.1575	-0.2342***	-0.1595*	-0.0836	-0.1712***	-0.1234***
	[0.0462]	[0.1054]	[0.0440]	[0.0897]	[0.0658]	[0.0569]	[0.0442]
In shipping product stage	-0.1865***	-0.1251	-0.2706*	-0.3090***	-0.1885***	-0.1814***	-0.1935***
	[0.0532]	[0.1348]	[0.1470]	[0.1132]	[0.0690]	[0.0553]	[0.0494]
In profitable stage	-0.2129***	-0.1348	-0.1984**	-0.2262***	-0.2111***	-0.0837	-0.2144***
	[0.0434]	[0.1120]	[0.0935]	[0.0311]	[0.0315]	[0.1020]	[0.0405]
Startup in IT sector	0.0552*	0.0137	0.0263	0.1164*	0.0367	0.1447***	0.0701**
	[0.0293]	[0.0790]	[0.0684]	[0.0638]	[0.0354]	[0.0298]	[0.0276]
Environment Characteristics							
Liquidity index in startup sector	2.0838***	3.2841	3.6692*	2.5367**	2.1469**	2.5065***	2.2367***
	[0.5346]	[2.3786]	[1.9734]	[1.1632]	[0.9746]	[0.4929]	[0.5683]
# IPOs in startup sector	0.0003	-0.0022*	-0.0009	-0.0009	0.0003	-0.0001	0.0002
	[0.0004]	[0.0012]	[0.0014]	[0.0012]	[0.0007]	[0.0004]	[0.0004]
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
# Observations	2939	504	483	501	1581	1354	2939
Log-likelihood	-1609.25	-263.32	-249.00	-244.62	-792.96	-771.36	-1587.17
Pseudo R-squared	0.103	0.160	0.156	0.188	0.108	0.126	0.115

** significant at 10%; ** significant at 5%; *** significant at 1%*

Appendix A. Variable Definitions and Data Sources

Variable	Definition	Data Sources
	Panel A: Acquirer Characteristics	
Ln assets	Log of book value of total assets (item6).	Compustat
R&D intensity	Annual R&D spending (item46) divided by # employees (item29).	Compustat
Tobin's q	Market value of assets over book value of assets: (item6-item60-item25*item199)/item6.	Compustat
Free cash flow	Net income before extraordinary items (item14) + depreciation and amortization (item18). [Due to high correlations with firm size, we use *Free Cash Flow as a % Asset* in our regressions, which divides *Free cash flow* by book value of assets (item6).]	Compustat
In IT sector	Dummy variable: 1 if information technology is primary sector, 0 otherwise. Set to 1 if primary line of business is in software (SIC737), computer hardware (SIC357), semiconductors (SIC367), telecommunications (SIC481, 484), communications (SIC366) or electronic instruments (SIC381, 382); else set to zero.	Compustat
In life science sector	Dummy variable: 1 if life science is primary sector, 0 otherwise. Set to 1 if primary line of business is in biopharmaceuticals (SIC283) or medical devices (SIC384).	Compustat
In other sector	Dummy variable: 1 if primary sector in 3-digit SIC other than ones listed above, 0 otherwise. Includes automotive and chemical firms and conglomerates such as General Electric.	Compustat
	Panel B: Deal Characteristics	
Liquidity index in target sector	The value of all corporate control transactions exceeding $1 million in the target sector in the quarter of the focal acquisition announcement divided by the total book value of assets for Compustat firms in the same two-digit SIC code. Following Schlingemann, Stulz, and Walkling (2002) higher indices indicate more competitive takeover markets.	SDC, Compustat
# IPOs	Number of initial public offerings completed in target sector in quarter of acquisition announcement.	Venture Economics
Deal value	Total price paid by acquirer minus fees and expenses.	SDC, news articles
Relative size	Deal value divided by equity market capitalization of acquirer at end of prior fiscal year.	Compustat
Payment includes stock	Dummy variable: 1 for deals at least partially stock-financed, 0 otherwise.	SDC, news articles
Payment method undisclosed	Dummy variable: 1 for deals with undisclosed methods of payment, 0 otherwise.	SDC, news articles
Deal value undisclosed	Dummy variable: 1 for deals with undisclosed purchase prices, 0 otherwise.	SDC, news articles
Deal terms undisclosed	Dummy variable: 1 for deals with undisclosed methods of payment or purchase prices, 0 otherwise.	SDC, news articles
	Panel C: Target Characteristics	
Target age	Acquisition year minus founding year	Venture One
Employees, if identified	Number of employees in acquisition year, if identified, or as last reported	Venture One, CorpTech, news articles
Target owns patents	Dummy variable: 1 if target was awarded one or more U.S. patents prior to acquisition.	Delphion
Target in same sector as acquire	Dummy variable: 1 if target competes in acquirer line of business, 0 otherwise. For example, if General Electric, which has a large medical devices business unit, acquires a start-up developing technologies used in medical imaging, *Target in same sector as acquirer* is set equal to one.	Venture One, Compustat
Target is publicly-traded	Dummy variable: 1 if target is public when acquired, 0 otherwise.	SDC
	Panel D: Other Variables used in Regressions (not otherwise listed above)	
CVC acquisition	Dummy variable: 1 if the acquirer provided venture capital to a target prior to acquisition; 0 otherwise.	Venture One, VenturXpert
Number of CVC investors	Total number of corporate investors in target.	Venture One, VenturXpert
GIM governance index	Gompers-Ishii-Metrick (2003) governance index based on 24 antitakeover provisions. Higher levels correspond to more managerial power.	GIM (2003)
BCF governance index	Bebchuk-Cohen-Ferrell (2009) governance index based on 6 antitakeover provisions. Higher levels correspond to more managerial power.	BCF (2009)
Dedicated CVC unit	Dummy variable: 1 if investment was made by a dedicated internal unit responsible for corporate venturing (e.g., Intel Capital; Motorola Ventures), 0 otherwise.	Venture One, VenturXpert
Acquisition experience	Number of companies purchased by acquirer in 3 years prior to focal deal	SDC
CVC experience	Number of direct venture capital investments made by firm in 3 years prior to focal deal	Venture One
Start-up failed	Dummy variable: 1 if a start-up is listed as either "Out of Business" or "Bankrupt" by the end of 2005.	Venture One
Investment round number	Ordinal rank of the venture financing round.	Venture One
In [X] stage	A series of dummy variables for start-up stage of development in a given financing round.	Venture One
Start-up in IT sector	Dummy variable: 1 if information technology is listed as primary sector of portfolio company.	Venture One

CHAPTER 3
DO CORPORATE VENTURE CAPITALISTS GAIN AN INFORMATION ADVANTAGE IN ENTREPRENEURIAL TAKEOVER MARKETS?

3.1 Introduction

Acquisitions of entrepreneurial firms provide a vital means by which established firm speed time to market and enhance existing product offerings (Ahuja & Katila, 2001; Chaudhuri & Tabrizi, 1999; Link, 1988; Puranam et al., 2006). As Mark Bailey, vice-president in charge of mergers and acquisitions (M&A) at the software company Symantec, explains:

> "*De novo innovations are becoming riskier, more expensive, and more time consuming in markets where survival depends on speed. Hence, high tech firms… are going outside to get companies with talented people and proven products that can meet market demands and generate technological 'throw-offs' for the future.*" (Bailey, 1995, p. 31)

Indeed, between 1987 and 2003, established firms in the information technology (IT) sector spent more than $140 billion purchasing technology startups—a figure representing more than one quarter (26%) of the dollar amount these same firms invested in research and development (R&D) over the same time period.

While the motives for acquiring startups are well established (Bower, 2001; Chaudhuri & Tabrizi, 1999; Link, 1988; Ranft & Lord, 2002), the performance implications for established firms remain unclear. On one hand, acquisitions of young innovative companies can be particularly difficult to value and integrate, leading some

scholars to caution acquirers "caveat emptor"—let the buyer beware (Coff, 1999). On the other hand, the resource-based view (RBV) would suggest that it is *only* in cases where there is considerable uncertainty regarding the value of inputs that the acquirer can hope to earn supra-normal returns (Amit & Schoemaker, 1993; Barney, 1986, 1988)

However, the prior literature has largely focused on the first part of this duality, and emphasized the *challenge* of acquiring startups. Consequently, an extensive literature has developed on how startups can more fully signal their value, for example, through affiliations with prominent third-parties (Gulati & Higgins, 2003; Hsu, 2004; Stuart, Hoang, & Hybels, 1999), filing for patents (Hsu & Ziedonis, 2007), or taking their company public through an initial public offering (IPO) (Ragozzino & Reuer, 2007; Shen & Reuer, 2005b). One limitation of signaling approaches (from the acquirer's perspective) is that the startup signals its value to *all* potential acquirers, thereby driving up the price that any one acquirer must ultimately pay to acquire it and reducing the acquirer's opportunity for gain.

In this paper, I take a different approach, and examine one way that acquirers have tried to this reduce this information asymmetry while still preserving the opportunity for gain – by making investments in external information. Specifically, I focus on a single type of investment, minority equity investments in privately-held startups by established firms, or corporate venture capital (CVC). Such investments could aid corporate investors in (1) becoming more aware of technological "bets" being placed; (2) assisting them in valuing the technology under development; and (3) in the case of an acquisition, by making better use of the target once they have acquired it. In principle, one by-product of CVC activities is that investing firms will have an

information advantage relative to other acquirers in the market to acquire technology startups. Moreover, if CVC investments represent "external investments in information", their effect on acquisition performance should be (a) subject to diminishing returns as the number of startups in a firm's venture portfolio increases; (b) highly time sensitive, with recent engagement conferring advantages that are greatest in magnitude; and (c) more pronounced the greater the technological similarity between portfolio companies and the startups being acquired.

To test these predictions, I assemble a unique database of all venture capital backed (VC-backed) technology startups acquired by 219 acquirers in the information technology (IT) sector between 1987 and 2003. I then compare the acquisition performance of firms making CVC investments to those that do not. I supplement this quantitative analysis with interviews with entrepreneurs, corporate investors, and independent VCs, which I use to inform the hypotheses developed in this chapter, as well as to aid in the interpretation of the econometric results.[1]

I find a statistically significant and economically large effect of CVC investing. Relative to firms that never invest, CVC investors gain $16M more on their average acquisition (the median deal size is $200 million). This estimate is net of controls for characteristics of the acquirer, the target, the deal, and the market environment. It is also robust to sample specifications that control for the time invariant heterogeneity of acquirers. I also find that these gains dissipate quickly—only investments made in the current or prior year affect acquisition performance—and that the benefits of investing are subject to diminishing returns.

[1] As discussed in the previous chapter, I conducted 31 open-ended interviews with individuals involved with corporate venture capital in 2005-2006. In 2008, I conducted nine additional interviews with directors or vice-presidents involved with their firm's corporate venture capital program.

This study contributes to four main strands of literature. First, this study contributes both conceptually and empirically to the emerging literature on acquisitions of entrepreneurial firms (Capron & Shen, 2007; Coff, 1999, 2003; Reuer & Ragozzino, 2008; Shen & Reuer, 2005b). As mentioned, this literature has largely focused on mechanisms for entrepreneurial firms to signal their value to others. Consequently, the literature has under-emphasized means by which acquirers may reduce information asymmetry while still preserving the opportunity for gain. By examining one way that acquirers may gain an information advantage *relative to others*, I hope to move this literature beyond a focus on the challenges of acquiring entrepreneurial firms to the opportunities for strategic advantage in this important factor market.

Empirically, despite the focus on the uncertainty and inscrutability of entrepreneurial targets, prior studies in this tradition have generally focused on settings in which information asymmetry is relatively low: samples from low-technology industries (e.g. waste disposal, floor coverings, etc) or where targets were mature companies with substantial operating histories. For example, the average target in the Shen and Reuer (2005) and Capron and Shen (2007) studies is 54 and 39 years old, respectively. Similarly, to be included in the Coff (1999) sample, the target firm needed to be publicly-traded for at least five years prior to being acquired. By focusing on the acquisition of young, technology startups, a setting where information asymmetry is rampant, my results provide a useful counterpoint.

This change in emphasis to how firms can gain an information advantage relative to others may, in turn, help to address a common criticism of the resource-based view (RBV) — despite the importance that the theory places on purchasing assets for less than

their economic value, the RBV does not specify *how* firms could accomplish this objective (Nothnagel & Leiblein, 2008; Priem & Butler, 2001a, b). Barney's original argument was that in any reasonably efficient strategic factor market, a rent-generating resource should command a price that reflects its downstream profit potential. Hence, the only way for the purchasing firm to make supra-normal profits, barring luck, is (1) for the firm to purchase the assets for a lower price (because the acquirer has more accurate expectations than others regarding their future value) or (2) to create more value with the assets once purchased. [2] As Nothnagel and Leiblein (2008) point out, research on how firms can accomplish these two objectives has been neglected in the RBV literature, perhaps due to Barney's (1986) skepticism that firms could improve their performance through investments in external information. In this paper, I contribute to the RBV by suggesting, and empirically testing, whether firms' external investments may provide the type of valuable, private information that can explain systematic performance differences in takeover markets for entrepreneurial firms.

Third, this paper contributes to the literature on corporate venture capital, particularly the nascent literature regarding the use of CVC investments to inform acquisition decisions. In chapter 2, I compare the performance of CVC investors when acquiring startups they have invested in (i.e. portfolio companies) versus startups they acquired outright (i.e. no prior investment). More recently, Benson and Ziedonis (hereafter BZ 2009) show that some CVC investors, particularly those with a stable pattern of investing and that devote a moderately high share of their R&D externally, earn higher returns on their acquisitions than others. A limitation of both prior studies,

[2] While Barney (1986) focused on the first explanation, Makadok (2001) explicitly captured both explanations by distinguishing between "resource picking" and "capability building" explanations of firm-specific rents.

however, is that because the samples were limited to CVC investors, neither study was able to examine more generally whether CVC investing caused a boost to acquirer returns above that otherwise earned by non-investors. By explicitly comparing the performance of CVC investors to non-CVC investors, this paper builds on and extends that research.

Finally, this study contributes to the broader literature on strategic alliances. Corporate venture capital investments can be considered as one very specific type of strategic alliance—those characterized by an equity stake, and involving a large, established firm investing in a much smaller startup. In that sense, this study is similar to prior work that has established that strategic alliances are a powerful source of learning about technologies developed at partner firms (e.g. Inkpen, 1998; Mowery, Oxley, & Silverman, 1996; Simonin, 1999). This study departs from the prior strategic alliance literature by examining to what extent, if at all, information gathered through one means (e.g., strategic alliances or CVC investing) can spill over to affect performance in another (e.g., acquisition performance). In contrast, the prior alliance literature has focused more narrowly on two types of potential benefits from alliances: (1) firms using alliances to learn about new technologies from partner firms (e.g. Inkpen, 1998; Mowery et al., 1996; Simonin, 1999); or (2) firms learning from their prior alliance experience lessons they use to forge more successful alliances in the future (e.g. Anand & Khanna, 2000; Kale, Dyer, & Singh, 2002; Sampson, 2005). Hence, one contribution of this paper is to consider evidence of information spillovers *across* business development activities.

3.2 Theory and Hypotheses

3.2.1 Imperfections in the market to acquire startups

While established firms frequently acquire startups as a source of new products and new technologies, nevertheless, such acquisitions pose real challenges to acquirers. Within the broader literature on acquisitions, studies have repeatedly shown that profiting from acquisitions (from the perspective of the acquirer) is both difficult and rare (Andrade, Mitchell, & Stafford, 2001; Bradley, Desai, & Kim, 1988; Jarrell, Brickley, & Netter, 1988; Moeller et al., 2005). Indeed, most acquisitions fail to create value for the acquiring firm (Bruner, 2002).[3]

In addition to these well-documented challenges, the acquisition of entrepreneurial firms poses several additional hurdles. First, by definition, such acquisitions involve firms that are young and small, and plagued by high levels of uncertainty. Such uncertainty is particularly acute for companies with few tangible assets and whose performance is difficult to assess, such as early-stage, high technology companies with a heavy reliance on research and development (Coff, 1999, 2003). Moreover, in contrast to the market for publicly-traded firms, the market to control privately-held firms is less transparent. Public firms must meet a number of regulatory disclosures and file detailed financial and operating information at regular intervals; private firms are not required to make similar disclosures. Finally, private firms lack the

[3] This is also a commonly-held view in the practitioner literature. For example, one recent practitioner book on acquisitions noted, "*The sobering reality is that only about 20 percent of all mergers really succeed. Most mergers typically erode shareholder wealth.*"(Grubb & Lamb, 2001, p.9-10). Surveys of top managers point to similarly depressed perceptions of success (Bekier, Bogardus, & Oldham, 2001; KPMG, 1999). Indeed, Warren Hellman, the former head of Lehman Brothers concluded, "*So many mergers fail to deliver what they promise that there should be a presumption of failure. The burden of proof should be on showing that anything really good is likely to come out of one*" (Sirower, 1997).

observable price (in the form of a stock price on an exchange) of their publicly-traded counterparts, making it more difficult for acquirers to calibrate their bids.

In contrast, the resource-based view has emphasized the importance of uncertainty in creating opportunities for gain (Barney, 1989; Yao, 1988). Indeed, one of Barney's key insights was that one way for firms to obtain needed resources at a price that can create competitive advantage is to purchase them in imperfect markets with more accurate expectations of their future value. However, as mentioned earlier, he did not elaborate on how firms could develop this improved foresight (Barney, 1986). Indeed, Barney held out little hope that firms could gain competitive advantage through investments in environmental analysis or competitive intelligence, arguing that information gleaned through these means would already be in the public domain.[4] Whatever its source, the RBV would indicate that in order to provide an advantage relative to other acquirers, the information would need to be (1) relevant (valuable) to the acquisition at hand, and (2) private.

3.2.2 Why might CVC investments provide an information advantage?

In principle, CVC investments conform well to these criteria. Specifically, CVC investing may provide three types of related, but conceptually distinct, information that meet those criteria: (1) information about new technologies, both where the "state of the art" stands and where it is heading (2) information about the quality (and price)

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[4] Barney states, "*Of these two sources of insights into the future value of strategies* [e.g. analysis of (1) a firm's competitive environment and (2) its internal skills and capabilities], *environmental analysis seems less likely to systematically generate the expectational advantages needed to obtain above normal returns. This is because both the methodologies for collecting this information and the conceptual models for analyzing it are in the public domain.…Thus, analyzing a firm's competitive environment cannot, on average, be expected to generate the expectational advantages that can lead to above normal returns in strategic factor markets*." (1986, p. 1238).

distribution of startups in the environment, and (3) private deal information regarding what *other* firms are willing to pay for startups. I examine each in turn below.

First, CVC investments may provide information about the direction of new technologies. Indeed, the most common objective listed by CVC investors is to gain a "window on new technologies and new markets" (Alter & Buchsbaum, 2000; Siegel et al., 1988; Yost & Devlin, 1993). In my conversations with managers, they pointed to similar objectives, with comments like, "*I call them 'eyes and ears' investments, because they serve as my eyes and ears into that market.*" Another referred to his investments as his "technology headlights." Through their CVC investments, established firms gain exposure to projects underway at startups, and they gain experience evaluating and valuing emerging technologies (Block & MacMillan, 1993; Wadhwa & Kotha, 2006). Moreover, by observing the progress (and setbacks) of these technical undertakings, investing firms can gain an understanding of the direction of technological trajectories in the external entrepreneurial environment and their viabilities and potential for growth. Thus, external investments can lead to insights unlikely to emerge had the firm "turned inward" and relied solely on input from its internal R&D activities. Taken together, such information could not only raise awareness of potential acquisition opportunities, but could also aid (1) in the pricing of startups considered for acquisition or (2) in creating more value with the startup once acquired.

Second, CVC investments may provide investing firms with information about the landscape or distribution of startup firms in the environment. Through evaluating and investing in startups as part of a CVC program, firms are exposed to a broader set of startups than they might otherwise consider. Such information is particularly valuable

regarding privately-held startups (or young, technology startups) where information about their existence or quality is otherwise difficult to obtain, information gained through CVC investments may allow firms to "fill in the gaps" regarding the distribution of startups. For example, one senior manager explained, "*When we announced* [our CVC program]*, startups started coming out of the woodwork—companies we had never heard of."*

Moreover, as the value of any technology is affected not only by its intrinsic value, but also by such factors as the number and quality of firms developing competing technologies, CVC investments can aid in acquisition decisions by "filling in the gaps" regarding the condition of rival technologies.[5] For example, another manager remarked:

> "*My experience has been that market research gives you a perspective that is a mile wide but an inch deep. This way [by making a CVC investment], we would fly these guys [the startup's top management team] out every month for a half-day meeting to have them talk through issues with our senior management—their view of trends, perspective on competitors, and so on….For example, they would give us detailed presentations on each of their competitors. I would say, 'Take me under the hood of competitor X's technology – how does it work? Who are their customers? What demographic is adopting their technology? How are they making money?' It wasn't the kind of stuff I could get by commissioning a market research firm to do a survey."*

Equally important, several managers also pointed to the value of learning what wasn't working, particularly that substitute technologies were worth less than they had previously thought. One manager said, "*We were interested in [a wireless technology]. What we found in our investing was that none of the firms in that space were ready for*

[5] Similarly, consider Ebay's 2005 acquisition of Skype. At the time of the acquisition, many analysts expressed concern over the high price, given that many alternate technologies (and alternate VOIP providers) offered similar functionality, including Google Talk, Yahoo Messenger, AOL Instant Messenger, Vonage, and startups Teleo and Jajah. As one analyst noted, "All of these companies are coming from [only] slightly different directions and could all play a part in the future of [online communications]." Subsequent events seemed to bear this out, as Ebay wrote off $1.4 billion of Skype's $2.6 billion purchase price in late 2007 (Kharif, 2007).

prime time because they didn't scale well." Similarly, another manager noted, "*I looked at five startups in [a new battery technology], but I passed on all of them because none of them were up to snuff….It made great copy for a press release or news article, but when you looked under the hood, there was nothing there.*" In addition, other managers noted the importance of understanding market conditions in these new areas more generally. One commented, "*We learned that a lot of things that we thought would be big trends turned out not to be….I can't count all of the trends that we thought would persist that didn't.*" Such knowledge can be particularly useful in shaping acquisition decisions, because CVC investors can better compare a particular acquisition target against the distribution (both in terms of quality as well as price) of other startups and technologies in the marketplace.

Finally, through engaging in CVC activities, firms may gain access to private deal information that would otherwise be difficult to obtain. Corporate investors generally acquire only a small percentage of the companies in their portfolios (Maula & Murray, 2000). More commonly, such startups "exit" through acquisitions by third-parties or by offering shares to the public in an IPO (Gompers & Lerner, 2000b). By virtue of their equity stake, CVC investors are privy to information about sales of startups not available to outsiders, such as deal terms, purchase price, and rival bids not disclosed to the public.[6] Moreover, because private information gathered through exit-event negotiation is acquired in "real-time," to the extent the deal price is subsequently disclosed (in databases such as VentureOne or VentureXpert), investing firms gain access to the

[6] For example, in my sample nearly one quarter (24%) of startups do not disclose either their purchase price or the terms of the deal.

information sooner. In the meantime, the CVC investor can draw upon this information to inform its own negotiations when acquiring startups.

In summary, I suggest that investments in external information can improve acquisition performance. Specifically, CVC activities provide three types of information that may be relevant to acquisition performance, and that are not readily available to non-investors: (1) information about new technologies (2) information about the "landscape" of startups, and (3) private deal information about what other firms are willing to pay. Together, this logic leads to the following empirical prediction:

HYPOTHESIS 1. *Ceteris paribus, CVC investing will improve the performance of established firms when acquiring startups.*

If CVC investing confers information advantages to potential acquirers (relative to others), then several related predictions follow: First, the benefits should be subject to diminishing returns; second, they will be highly time sensitive; and third, the benefit will be more pronounced the greater the similarity between investment firms and acquisition firms. I elaborate on each of these ideas below.

Startups are more likely to work on R&D projects that are more novel and riskier than those of established firms (Aghion & Tirole, 1994). Hence, by working with startups, established firms may be exposed to technologies that differ from the ones they are working on internally. When a firm's CVC portfolio is small, each additional investment may provide a large amount of "new" information that the firm did not hitherto have. As the firm's portfolio increases in size, I expect that each additional portfolio company will provide some information that is new and some that is redundant

(e.g., information that the CVC investor already possessed). Hence, each additional investment provides less and less new information. Therefore, I predict diminishing marginal returns (to acquisition performance) to increases in CVC portfolio size.[7] Stated more formally:

HYPOTHESIS 2. *Ceteris paribus, as the size of an established firm's venture portfolio increases, the added gains to acquisition performance will increase at a decreasing rate.*

Third, while CVC investments may confer informational advantages to acquiring firms, such benefits are likely to be short-lived. There are two primary reasons to expect that the value of the information will erode quickly. First, information gleaned from CVC investing is valuable (with respect to acquisitions) only to the extent that is not available to other acquirers (Barney, 1986, 1988). As time passes, technical information may leak out as consulting reports get published, employees switch jobs, or information otherwise becomes public (Almeida & Kogut, 1999; Hall, 2005; Rosenkopf & Nerkar, 2001). Hence, the private information received through CVC investing becomes less valuable because other potential acquirers become aware of it. Second, the information loses its value as markets conditions change. First, technologies change; what is state-of-the-art in one time period can become obsolete in the next. Therefore, information about technologies can rapidly become outdated. Moreover, the value of other types of

[7] The organizational learning literature, particularly the literature involving learning curves makes a similar prediction, but for slightly different reasons (Argote, 1999; Argote & Epple, 1990). In the organizational learning literature, firms are predicted to learn from experience. These lessons learned are, in turn, expected to improve firm performance in some fashion (often measured as reductions in direct labor costs, time to completion, mistakes per batch, etc). Generally experience is measured as the firm's cumulative production. However, in that literature the mechanism of action is the lessons learned from prior experience. In this study, the mechanism of action is new information gathered in the process of making investments.

information that CVC investments provide—about the distribution of startups and what other acquirers are willing to pay—also erodes quickly. New startups may enter or exit, existing startups may shift their focus, and deal terms can leak out or become irrelevant. Hence, I expect that a firm's recent CVC activities are far more informative when deciding which startups to acquire and how much to pay than investments made long ago. Consequently, I predict that:

HYPOTHESIS 3. *The beneficial effects of CVC investing on the acquisition performance of established firms will dissipate quickly.*

Finally, prior research suggests that not all investments will be of equal value in providing new information to the corporate investor. In particular, the information gathered must be relevant to the acquisition at hand if it is to improve acquisition performance (Ahuja & Katila, 2001). Prior studies regarding both acquisitions and alliances have found that similarity *within* a business development activity (e.g. alliances or acquisitions) enhances performance. For example, both Anand and Khanna (2000) and Sampson (2005) find that value creation was increasing in the amount of technical overlap between prior alliances and the focal alliance. Similarly, both Haleblian and Finkelstein (1999) and Hayward (2002) find that acquirers are able to draw more valuable inferences the greater the similarity between current and prior acquisitions. In this paper, I extend this general logic to argue for benefits *across* business development activities. That is, the potential for information spillovers is likely to be greatest when the startup being acquired is similar to the startups in which the acquirer has been investing. As relatedness increases, the information regarding technology gleaned from

the portfolio companies is more likely to be relevant. Moreover, the information about potential substitutes and what other startups are "out there" is more likely to be finely tuned to the acquisition at hand. And finally, the information regarding deal terms and valuation will be more pertinent. Hence:

HYPOTHESIS 4. *Ceteris paribus, the beneficial effects of CVC investing on the acquisition performance of established firms will be more pronounced the greater the similarity between the startups being invested in and the startups being acquired.*

3.3 Empirical Analysis

The central objective in this study is straightforward – to establish a causal link between the CVC-related activities of established firms and their performance when acquiring startups. Without a natural experiment that sorts otherwise identical firms randomly into CVC investors and non-investors, however, establishing a causal link poses an empirical challenge. Indeed, a natural concern is that CVC investing, rather than having a causal effect, is merely proxying for a "good firm" effect. In response, I use two complementary approaches to triangulate my results. First, I estimate differences in performance "between" CVC investors and non-investors while allowing for non-random selection into CVC investing. Second, I estimate "within firm" differences among the sub-set of CVC investors in periods associated with varying degrees of CVC-related activity using a firm fixed-effect specification. If CVC investing is merely

proxying for good firm effect, the effect should be wiped out in this second set of analyses.[8]

3.3.1 Sample and Data Sources

These hypotheses are tested using acquisitions of startups in the information technology (IT) industry between 1987 and 2003. Several characteristics of the IT industry make it an appropriate setting for this study. First, firms in the information technology industry have been among the most active in using corporate venture capital to invest in technology startups, a fact that is not surprising given the rapid pace of technological change in the industry (Dushnitsky & Lenox 2005a). Second, established IT firms frequently use the acquisition of young, entrepreneurial startups as a way to develop new products and access new technologies (Ranft & Lord 2002; Chaudhuri et al. 1999; Goldblatt 1999). Finally, acquisitions are an important mode of exit for startups in the IT sector, representing the most common exit event for VC-backed IT startups over the last two decades (VentureOne, 2005). Moreover, restricting the sample to a single sector (albeit broadly defined) also allows me to hold several industry-level factors constant, such as technological opportunities and the strength of intellectual property (Dushnitsky & Lenox, 2005a).

To construct the sample, I first identified all publicly-traded IT firms that acquired at least one VC-backed startup firm between 1987 and 2003. The "information

[8] However, the fixed effect model, while useful in looking for causal effects, is not as well-suited to answering the related question, "*what would be the expected gain, if any, for the marginal (generally much smaller and resource-contrained) firm adopting CVC investments?*". Consider the case where only large firms adopt CVC programs and small firms do not. The counterfactual outcome—what performance enhancement, if any, a small firm would gain if it started CVC investment—is not parametrically identified. Instead, the linear functional form identifies this counterfactual outcome.

technology" sector is defined in accordance with standard NSF categories and includes all firms with primary lines of business in computer hardware, software, semiconductor, telecommunications, and electronics equipment. To ensure that acquirers are "established firms," the sample was limited to publicly-traded firms that report R&D spending for five or more years. This restriction omitted numerous short-lived internet firms that launched IPOs in the late 1990s but exited soon thereafter. I then utilized the SDC and VentureOne databases to identify all acquisitions of VC-backed startups made by these firms between 1987 and 2003. Since VentureOne tracks firms only until they have an initial exit event (such as an IPO), SDC was utilized to include venture-backed firms that had an IPO but were later acquired. By imposing the "VC-backed" restriction on the acquisitions, I ensure a minimum threshold in the (unobserved) quality of startups acquired and am able to capture key control variables (e.g. year founded, target age, and prior equity ties between the acquirer and startup) that are otherwise difficult to observe.

Firms were considered startups if they were less than 12 years old (acquisition year minus founding year) when acquired. While the entrepreneurship literature has been divided over whether it is better to define entrepreneurial firms using a size (e.g. 500 or 1000 employees) or an age (e.g. less than 10 or 12 years old) threshold, the age threshold seemed more appropriate given my interest in young, innovative companies.[9] Moreover, using a size threshold would have thrown out the fastest growing (and hence, some of the most successful) firms in the sample. The 12-years-old cutoff seems appropriate because

[9] For example, Puranam et al. (2005) define "technology start-ups" as firms with fewer than 1,000 employees when acquired while Acs and Audretsch (1988) and Petersen and Rajan (1994) use a 500-employee threshold. Hellman and Puri (2000, 2002) define "start-ups" as firms less than 11 years old and do not impose an upper bound on firm size. In the Stuart et al. (1999) study, the maximum age of venture-backed biotechnology firms at IPO is 12 years since founding.

most venture capital funds have a 10-year lifespan, and they generally must liquidate their stakes in their portfolio companies at that point (Gompers & Lerner, 1996). Hence, most VC-backed startups must exit through either an acquisition or IPO by that time. For example, per VentureXpert, between 1987 and 2003, the average portfolio firm was 8.1 years old at IPO. Also, as will be seen in the results section, my results are unchanged when the age cutoff is changed to 10 or 8 years.

Finally, supplemental information about target firms and their acquisition was gathered from SDC Platinum, VentureSource, VentureXpert, Delphion, as well as from searches of news articles and press releases. Based on these selection criteria, 545 acquisitions made by 219 acquirers between 1987 and 2003 were identified.

3.3.2 Dependent Variable

I estimate acquisition performance using the stock market's reaction to an acquisition announcement, a methodology that is widely used to evaluate value creation by scholars in both management and finance (Andrade et al., 2001; Haleblian & Finkelstein, 1999; Hayward, 2002; Moeller, Schlingemann, & Stulz, 2004). While such a measure captures the market's expectations of anticipated gains (or losses) *ex ante*, a sizeable body of evidence has confirmed that it is a good predictor of *ex post* performance, such as return on assets, cash flow, and innovative performance (Healy, Palepu, & Ruback, 1992; Higgins & Rodriguez, 2006).

The unexpected, or "abnormal," return generated from a particular acquisition is calculated as the difference between the acquirer's actual return and the return that would

have been expected had the acquisition not taken place. Following standard practice, I calculate the unexpected return for firm *I* at time *t* as follows:

$$\text{Unexpected return}_{it} = \text{Actual Return}_{it} - \text{Expected Return}_{it}$$

The actual return is merely the observed change in the firm's daily stock price. The expected return is calculated using the market model:

$$\text{Expected return}_{it} = \alpha_i + \beta_i R_{mt}$$

Where R_{mt} is the return on the broader market on day t, and $\alpha_i + \beta_i$ are firm-level measures that are estimated over a period (250 days) prior to the event. Following Brown and Warner (1990), p-values are corrected for serial correlation in the event window.

Acquisition dates were compiled from the SDC and VentureOne databases. Since VentureOne generally reports the date an acquisition was *completed*, rather than the date it was *announced* (the relevant date for an event-study), I searched SDC Platinum and Factiva for the first date that an acquisition was announced. In addition, a market-based event-study provides an unbiased measure of an acquisition only if other major corporate events are not announced during the event window (MacKinlay, 1997). Consequently, I searched news accounts to determine whether the acquirer announced another acquisition or other significant corporate events during the event window. Of the 545 acquisitions originally identified, 19 were eliminated due to confounding events (such as the announcement of another acquisition or the settlement of a lawsuit). After completing these steps, the final estimation sample consists of 526 acquisitions made by 219 acquirers.

3.3.3 Explanatory Variables

I am interested in assessing the potential benefits (or lack thereof) of CVC-investing activities on the acquisition performance of established firms. There are many possible ways of estimating these effects. As a result, I discuss my primary ways of operationalizing key variables below, but later introduce alternative measures to test the robustness of my results. I use four primary measures of a firm's CVC investing, capturing several different aspects regarding both the existence and the level of CVC-investing made by established IT firms. My first two measures of CVC activity are simple 0/1 indicator variables (*Acquirer is a prominent CVC investor* and *Acquirer is an Active CVC investor in current year*) for whether the acquirer was ever among the 100 most active CVC investors and whether the acquirer made CVC investments in the year of the focal acquisition, respectively[10]. While these measures are coarser than the continuous variables used later (*CVC spending* and *Count of CVC investments*), they serve as useful baseline estimates and are significantly correlated with the more refined measures ($r = 0.51$ between *active CVC investor* and *CVC spending*). Use of the 0/1 dummy variable has the added advantage of enabling me to estimate a two-stage model in which the first stage takes into account factors that affect the firm's decision to invest in CVC in a given year. I then move from the coarse indicator variables to more refined measures of firms' level of CVC investment. The variable *CVC spending* captures the dollar amount of CVC investing an acquiring firm made in millions of constant 1996

[10] The top 100 firms represent nearly 90% (89.3%) of the investments made by corporate investors in IT industries. While Intel (the most active investor) made 220 investments in 2000 alone, corporate investors below the top 100 made a total of three investments, on average, over the entire period of 1987 to 2003.

dollars, while *Count of CVC investments* is a count of the number of investments made by the acquiring firm.

Relatedness of CVC investments to Focal Acquisition. I conceive of relatedness as the similarity of the technologies used by the two sets of firms (those invested in versus those acquired). Given that concern for technological similarity, a natural measure would be the degree of overlap in patent classes between the startups invested in and the startups acquired. Unfortunately, this measure proved infeasible, as nearly two-thirds (62%) of the acquired startups had no patents prior to being acquired. As an alternative, I measure relatedness using VentureOne's industry group (Information Technology, Life Science, and Other) categories. While each industry group is further subdivided into industries (e.g., semiconductors, software, and communications) a closer inspection suggested a great deal of overlap in the industry categories. For example, startups classified as "Network devices" were sometimes device manufacturers, sometimes produced software for devices, and other times produced chips for network devices. Rather than code each startup by hand, a time-consuming (and inherently subjective) exercise, I count investments as being related if they are in IT startups, and unrelated if they are not in IT. As an alternative measure, I use the count of startups (rather than the dollar amount).

3.3.4 Control Variables

Differences in acquirer returns can be attributable to numerous factors unrelated to a firm's CVC investing activities. Indeed, prior studies in both strategy and finance identify a host of variables that can affect the stock market's reaction to an acquisition announcement (see McWilliams and Siegel 1997 and Andrade et al 2003 for two recent

reviews). I control for these variables below to rule out the most important alternate explanations and to estimate the effects of interest more precisely. For ease of discussion, control variables are divided into characteristics of (1) the acquirer, (2) the target, and (3) the deal and market environment.[11] They are described in turn below.

Acquirer attributes

Startup acquisition experience. Prior studies suggest that firms' acquisition performance can improve with experience (Haleblian & Finkelstein 1999; Hayward 2002). If firms that make CVC investments are also more experienced at acquiring startups, then any difference in performance could be the result of increased experience in conducting acquisitions rather than differential informational advantage due to CVC-related activities. I therefore control for the firm's prior acquisition experience (*Startup acquisition experience*), calculated as the number of startups acquired in the prior three years (as reported in SDC), in each of my regressions. Moreover, as some prior research into the effects of acquisition experience suggests a U-shaped relationship (Haleblian & Finkelstein 1999; Hayward 2002), I also include a squared term, *Startup acquisition experience*^{2}.

Acquirer size. It is important to control for firm size for two reasons. First, larger firms may have more resources to devote to both investing in startups and acquiring startups. Second, despite these additional resources, recent studies suggest that

[11] It is important to note that many of the deal variables (e.g., *Acquirer paid with stock*, *Deal terms not disclosed*) are not exogenous because they represent choices made by the acquirer. Indeed, most of them stem from the decision by the acquirer to make an acquisition. For example, given that a firm decides to make an acquisition, it then must decide to pay with cash or stock, disclose the deal terms, etc. However, because prior empirical work has documented that the market reacts to these decisions, I have included them in my regressions, and endogenized the decision to make CVC investments. One can imagine, however, important follow-up work that endogenizes the decision to acquire.

acquisition returns are lower for larger acquirers relative to smaller acquirers (Moeller et al., 2004). I control for firm size, calculated as the firm's assets in the year of the acquisition (using data from COMPUSTAT), and which is logged due to the positive skewness in the measure.

R&D intensity. Firms with greater R&D investment may be better positioned to generate future profits from technology startups (Higgins & Rodriguez, 2006), consequently, I control separately for R&D spending. Since R&D expenditures are highly correlated with firm size (ρ =.83 in my sample), they are scaled by the number of employees to create an R&D intensity measure.

Cash flow / assets. In light of Jensen's (1986) "free cash flow" hypothesis (that managers at firms with large amounts of free cash flow are more likely to make value-destroying acquisitions), I control for the cash flow available to managers, defined as earnings before extraordinary items plus depreciation. Like R&D spending, free cash flow is highly correlated with firm size. I therefore scale *Free Cash Flow* by the acquiring firm's assets.

Target attributes

Acquirer has prior VC investment in target. Prior research has found that returns are systematically lower when acquirers purchase startups in which they have previously invested, perhaps because as prior investors, they "over-commit" to their portfolio firms, leading to an "escalation of commitment" (as described in chapter 2). Consequently, I include an indicator variable (*Acquirer has prior VC investment in target*) set to 1 if the acquirer has previously invested in the target, 0 otherwise.

Target age. Prior empirical work has established that the age of a target can affect acquisition performance – either because younger firms have difficulty in signaling their value, or because acquisitions become more disruptive to targets as they become more established and more routinized in their processes (Puranam *et al.*, 2006; Ransbotham & Mitra, 2006). *Target age* is calculated as the acquisition year minus the year that the startup was founded. Founding years were gathered from VentureOne, and where missing, were supplemented with data from news accounts and press releases.

Target is publicly-traded. Recent empirical work in finance suggests that firms that are publicly-traded are acquired at a premium (20–25% on average) to observationally equivalent privately-held firms because of the increased liquidity provided by public equity markets (Cooney, Moeller, & Stegemoller, 2007; Faccio, McConnell, & Stolin, 2006). *Target is publicly-traded* is a binary variable that takes the value of 1 if the target is publicly-traded and 0 if it is privately-held.

Target relative size. Finally, integrating and utilizing acquired technologies may be less complicated when targets are small relative to their acquirer (Ahuja & Katila, 2001). Therefore, my models control for the relative size of the target to the acquirer, measured as the purchase price (from SDC or VentureOne) divided by the market capitalization of the acquirer (from COMPUSTAT).

Deal and environment attributes

Payment includes stock. Prior empirical work has confirmed that how an acquisition is financed (e.g. with cash or stock), can affect the performance of the deal

(Fuller, Netter, & Stegemoller, 2002; Travlos, 1987). *Payment includes stock* is a binary variable set to 1 if any of the financing involves payment of stock, and 0 otherwise.

Deal terms undisclosed. In addition, because acquirers are not required to disclose deal information when target firms are small, nearly one-quarter (24%) of my transactions are missing either information regarding the deal value or the method of payment. To avoid omitting such observations, an indicator variable, *Deal terms undisclosed*, set to 1 if either the value of the transaction or the method of payment is undisclosed, is included in the regressions.[12]

Boom period (1999–2000) and *Post-boom (2001–2003)*. To address concerns that the market may have reacted differently to acquisition announcements during the "boom" years of 1999–2000 (Moeller et al., 2005; Park & Mezias, 2005), I include two time-period dummies in my regressions: one for whether the acquisition was made in the boom years of 1999–2000, and another for whether the acquisition was made in the "post-boom" period of 2001–2003. The omitted category is the "pre-boom" period of 1987–1998. As a robustness check, I included year dummies, or measures of market conditions, such as the dollar amount of M&A activity in the industry (as described in Schlingemann, Stulz, & Walkling, 2002) and the dollar amount of IPOs in the target sector. Each of these measures generated similar results.

[12] Rodrigues and Stegemoller (2007) provide an interesting critique of SEC rules that do not require acquirers to disclose details of acquisitions of privately-held targets that are less than 20% of the size of the acquirer because the SEC deems them "immaterial." Rodrigues and Stegemoller demonstrate, however that such acquisitions nevertheless have a significant (and hence, "material") impact on the acquirer's stock price.

3.3.5 Results

Table 1 provides descriptive statistics and correlations among all variables used in my study. Not surprisingly, the startups are quite young and small relative to their acquirers. The average startup in the sample is just over 5 years old (mean = 5.09 years) and roughly 7% of the size of its acquirer (mean = 7.2%). Most of the startups were privately-held (86%) at the time of acquisition. The average acquirer in the sample had purchased six VC-backed startups prior to the focal acquisition (mean = 5.9). Just under a third of the acquisitions (30.2%) occurred during the technology boom of 1999–2000, with the remainder divided between the pre-boom (38.4%) and post-boom periods (31.4%).

Table 2 compares the means of several variables between CVC investors and non-investors. Consistent with the findings reported in Dushnitsky and Lenox (2005a), I find that CVC investors, on average, are much larger (in both sales and assets), older, and have much higher cash-flow, than non-investors.

Table 3 reports the multivariate results using the pooled sample of 219 CVC investors and non-investors. Robust (White) standard errors are clustered by firm to account for correlation among returns to acquisitions made by the same firm. Column 1 reports the baseline model using control variables common in the strategy and finance literatures. The first test (shown in column 2) estimates the average difference in acquisition performance in the IT sector between CVC investors (n=36) and non-investors (n=183). Column 2 shows, perhaps surprisingly, that on average, CVC investors in the sector do not "out-perform" non-investors when estimated over entire time-frame of the study (1987–2003), despite the fact that they are larger and more cash-rich, on average, than non-investors.

Column 3, however, shows a striking (and statistically significant) difference in performance between CVC investors and non-investors in years when CVC investors are actively engaged in venture financing activities. The coefficient on "*Acquirer is Active CVC Investor in t_0?*" suggests that (holding constant the acquisition experience of these firms and other observable characteristics of the acquirers, startups, and environmental conditions), established firms actively engaged in CVC investing generate an additional 1.6% in value to shareholders than would otherwise be expected. For an acquirer with a $1 billion market capitalization, this differential enhancement in performance would generate $16 million in added gains to shareholders for the average deal.

Column 4 in Table 2 allows firms to "self select" into CVC investing in a given year. As has been increasingly recognized in the management literature, if endogeneity in firms' choices is not dealt with, the resulting coefficient estimates of variables of interest may be biased (Hamilton & Nickerson, 2003; Shaver, 1998). Indeed, a natural concern in this study is that "better" firms may be both more prone to invest in startups and to do better when making acquisitions. Hence, OLS regressions that do not allow for this possibility may overstate the impact of CVC investing. To correct for this potential bias, I use Heckman's (1979) two-stage estimation procedure.[13] In the first stage (shown in Appendix A.1), firms' decision to make CVC investments in a given year is modeled using a probit model. In the first stage I draw on prior research that examines why firms

[13] Though this procedure is often called the Heckman selection model or simply a Heckman, it is more accurately described as the bivariate normal selection model utilizing the Heckman estimator (since models can have more than one estimator). The *estimator* is an algorithm for estimating the parameter of interest, in this case, the omitted variable (such as motivation) that is causing the bias. In this case, there are two estimators that can be used in the selection model—the Full Information Maximum Likelihood (FIML) and the Heckman two-step—to estimate the size of the omitted variable. Each estimator, of course, carries its own set of assumptions. In this analysis I use the Heckman two-step estimator rather than the FIML estimator because, despite being less efficient, it is more robust to misspecifications in functional form. I thank Jeffrey Smith for pointing this out.

make CVC investments in the first place (Basu, Phelps, & Kotha, 2009; Dushnitsky & Lenox, 2005a). In particular, these prior studies highlight that larger, R&D-intensive firms with slack resources are more likely than others to adopt CVC programs. These results are confirmed in table A.1, with the variables *firm size* and *firm free cash flow* each being significant at the 1% level. Interestingly, R&D intensity is not significant once firm size is controlled for. This contrast with prior work may be because prior studies used industry R&D intensity (rather than firm) and included firms from a broad swath of industries. Within the confines of a single, R&D-intensive sector (IT), firm-level R&D intensity was not a significant predictor.

In the second stage of the Heckman procedure, a model of acquirer abnormal returns is estimated, including the Lambda endogeneity bias control variable (the inverse of the Mills ratio [λ]) estimated from the selection model. The variable Lambda in the second stage therefore serves as a proxy for the unobserved heterogeneity between firms that choose to make CVC investments and those that do not.

To meet the exclusion restrictions that are important for the Heckman procedure[14], I include one variable in the probit (selection) model that is not included in the second-stage regression, namely, venture capital inflows (*VC_inflows*). To give the variable a firm-specific component, *VC_inflows* is interacted with the firm's free cash flow in the focal year. To serve as an exclusion restriction, the variable needs to be correlated with the propensity of firms to make CVC investments, but be otherwise unrelated to the acquisition performance of acquirers. VC inflows seem to meet these two

[14] While technically the first-stage regression can be estimated without an exclusion restriction (e.g. a variable included in the first-stage that is not included in the second-stage), by so doing the model is identified only through the non-linearity of the probit model. Moreover, subsequent econometric research has documented that, absent an exclusion restriction, the results obtained through the Heckman procedure are generally poor (Bushway, Johnson, & Slocum, 2007; Puhani, 2000; Stolzenberg & Relles, 1990).

conditions. Prior empirical work has documented that corporate investors often "chase" the returns of independent VCs, such that CVC investments tend to be highly correlated with the capital inflows to independent venture capitalists (Gompers & Lerner, 2000a; Gompers, 2002; Gompers, Lerner, Blair, & Hellmann, 1998). Indeed, in the model shown in appendix 1, VC inflows is a significant predictor of whether firms choose to make CVC investments ($p<.01$). Moreover, VC inflows are unlikely to affect the acquisition returns to startups acquired by established firms. Conceptually, this is because corporate venture capitalists often make investments for both financial and strategic reasons (Alter & Buchsbaum, 2000; Siegel *et al.*, 1988; Yost & Devlin, 1993). Empirically, Gompers and Lerner (2000) show that startups funded during high VC inflow periods are not significantly different in their propensity to be acquired or IPO than firms funded during low periods. The results in Column 2 suggest that CVC investors are not necessarily "better acquirers" as a group, and Column 4 provides little evidence that the results are explained by latent (unobservable) quality differences between CVC investors and non-investors. If "better" firms simultaneously select into CVC investing and earn greater returns when acquiring startups, we should see a positive and significant coefficient on the inverse Mills ratio reported at the bottom of Column 4. Instead, the Mills ratio coefficient is statistically indistinguishable from zero. Moreover, the coefficient on the indicator variable, "*Acquirer is Active CVC Investor in the current year?*", also increases in magnitude and remains significant at the 5% level. Columns 5 and 6 replace the blunt dichotomous variable with alternative continuous measures of investment activity, including the dollar amount invested in CVC (in Column 5) and the count of startups in which the acquirer invested (Column 6). Both continuous measures

are summed across the acquisition year and the two prior years. Since they are logged, they can be interpreted as percentages. Hence, the results from column 5 suggest that a 1% increase in CVC spending increases acquisition returns by 0.4%. In economic turns, this suggests a gain of approximately $40 million on a $200 million acquisition.

A second concern about the results reported in Table 3 is that they provide an "apples to oranges" comparison: both Table 2 and the selection models suggest that established firms that invest in CVC are disproportionately larger and more cash-rich than firms that do not. In Table 4, therefore, I conduct supplemental tests for "within firm" differences using the subset of acquirers that actively engage in CVC-related investments during the time frame of my study. These tests investigate whether the startup acquisition performance of CVC investors is greater in periods in which they are actively engaged in venture financing activities relative to periods in which they acquire but invest less intensively in CVC (if at all).

Column 1 in Table 4 estimates the same specification shown in Column 6 of Table 3 for the subset of CVC investors while allowing for time-invariant sources of heterogeneity between acquirers. The results show that the findings reported in Table 3 are not driven by artificial comparisons: Even within the sub-sample of CVC investors, established firms earn greater acquisition returns when acquiring startups in years when they have larger numbers of startups in their venture portfolios.

In line with hypothesis 3, Columns 2-4 in Table 4 also reveal strong "recency effects" in the informational benefits that CVC activities confer upon startup acquisition performance. While investments of CVC investors have a significant, positive effect on acquisition performance in the immediate timeframe of an acquisition decision, the effect

erodes quickly. For example, in this sample of IT acquisitions, CVC activities in the year of or the year prior to the focal acquisition are correlated with improved acquisition performance, while investments made two or more years earlier had no statistically discernible effect. In unreported regressions, I tested the effect going back as far as five years – none of the regression results using firms' CVC activities from these earlier years are statistically significant.

I test hypothesis 3 (regarding diminishing returns) in Column 5. As in columns 1-4, this test includes only the subset of investors who made CVC investments between 1987 and 2003. To test hypothesis 3, I split investor-years into quartiles based on the number of investments made in that year (years in which the firm made no investments is the omitted category). Quartile 1 is for firms that made 1-8 investments, quartile 2 is 9-25 investments, quartile 3 is 26-74 investments, and quartile 4 is companies that made more than 75 investments in a single year (Intel is the most active investor, making 220 investments in 2000). When I enter these quartile indicator variables, I expect the coefficients to be positive and significant, indicating that acquirer returns are higher as firms make CVC investments relative to years in which they make no investments. Moreover, if CVC investments are subject to diminishing returns, the coefficients on each quartile should become progressively larger, but the difference between quartiles should become smaller. Figure 1 shows this effect visually by plotting the coefficients associated with the quartile ranges reported in column 5, and indicates that the results are broadly supportive of this prediction. Interestingly, the results in column 5 suggest that having a few CVC investments in a firm's portfolio (the first quartile) does not improve performance significantly from not investing at all (the omitted category.) It is only at

higher levels (quartiles 2–4) that CVC investing improves performance and that diminishing returns are observed—apart from the 1st quartile, the differences in the estimated coefficients across quartiles is statistically significant. Based on the results of column 5, moving from the first quartile to the second is expected to increase performance by 1.29% (2.33% - 1.04%), while moving from the third quartile to the fourth increases performance by only 0.31% (4.01% - 3.7%). Hence, as predicted, the magnitude of added improvement becomes progressively smaller as portfolio size increases, which is consistent with diminishing returns to these investments.

Finally, I test hypothesis 4 (regarding the relatedness of the CVC investments to the firm being acquired) in Table 5. Because the amount of related versus unrelated investing is only relevant for firms undertaking investments, Table 5 only includes firms that made CVC investments. Each specification includes a fixed-effect for each acquirer. Column 1 is repeated from Table 4 for comparison purposes. In Column 2 I only include investments that the acquirer made in IT firms. The coefficient remains statistically significant ($p<.01$), but becomes roughly half the magnitude of the former coefficient. In Column 3, the total count of CVC investments is split into whether they were in IT startups or not and added separately into the regression. Interestingly, the coefficients on both the related (invests in IT startups) and seemingly unrelated investments (investments in startups not in IT) are statistically significant and almost equal in magnitude (0.0102 versus 0.0096). As a robustness check, in Columns 4-6 I substitute the dollar value of the CVC investments for the count of CVC investments and re-estimate my models. The patterns in both sets of analysis (Columns 1-3 versus. Columns 4-6) are very similar—the coefficient when I limit investments in IT startups are significant, but roughly half the

magnitude of the coefficient on overall investments, and the investments in both IT and Non-IT startups have a significant effect on acquisition returns (and almost equal in magnitude). Finally, in Columns 7-10 I examine more closely what is driving the results for the Non-IT investments. For example, VentureOne classifies software firms as Life Science if they are involved in making software for life science industries. In Columns 7-10 I re-classified these startups from Life Science to IT and re-calculated my regressions. In Columns 7 and 9, once investments in medical software startups are classified as IT investments, the coefficient on IT investments increases in magnitude (relative to the coefficients in Columns 2 and 5, respectively). Interestingly, even with this re-classification, investments in Non-IT startups continue to have a significant effect on IT acquisitions (see Columns 8 and 10). Taken together, however, these results run contrary to hypothesis 4, where I hypothesized that the returns to making investments in IT startups would have a larger effect than investments not in IT.

3.4 Discussion & Conclusion

How firms purchase strategic inputs for less than their ultimate "value in use" is a central question in strategy research (Barney 1986). This issue has become more salient in recent years, as established firms have increasingly acquired startups as "inputs" to develop new products and new technologies (Ahuja & Katila, 2001; Chaudhuri & Tabrizi, 1999; Link, 1988; Puranam *et al.*, 2006). Such acquisitions, nonetheless, pose significant challenges to acquirers because young, technology-intensive companies can be particularly difficult to value and integrate. In this paper, I used strategic factor market theory (Barney 1986) to suggest that firms' investments in external information,

to the extent that it provided information that was relevant and private, could grant them an information advantage in markets to acquire technology startups. This study provides new evidence that such investments (in this case, minority equity investments in startups) can improve acquisition performance, even when acquiring startups in which the firm has not invested (non-portfolio firms).

Two other results merit discussion. In Table 3, I examine how long the information benefits of CVC investing persist. The results suggest that the benefits of CVC investing dissipate rather quickly, with the effect almost entirely eroded after two years (the current year and the prior year), which is consistent with prior studies examining learning from strategic alliances (Sampson, 2005). As in this study, Sampson (2005) finds that alliances beyond the prior year have little to no effect on current performance. This rapid depreciation could be due to the rapid pace of change in the information technology sector, or to more organizational processes such as managerial turnover that can lead to organizational forgetting (e.g. Argote, Beckman, & Epple, 1990). However, because both studies used the IT sector as their setting, it is impossible to separate out the influence of these two processes. More generally, the slower the pace of technological change in an industry, the longer the information benefits of external investments should endure. Therefore, an intriguing possibility for future research is to examine how long information advantages persist in different sectors, and how this varies with the rate of technological change.

Table 3 also examines whether CVC investments are subject to diminishing returns. While I find evidence of diminishing returns, my results also suggest that firms need to reach a "critical mass" before CVC investments provide any benefit. In terms of

improved performance when acquiring startups, "dabbling" with a few investments (the first quartile in counts of portfolio companies) conferred little advantage over foregoing such activities entirely (the omitted category). In contrast, investors with larger numbers of startups in their venture portfolios accrued considerable gains.

This combination of rapid depreciation and significant threshold effects has at least two implications for managers. The first is that making a few investments or making investments over a short period of time will provide little benefit; rather firms must be consistently investing in order to sustain their advantage. The second implication is that it may be that only large firms with sufficient resources can reap the benefits of CVC investing, with the benefits to smaller firms being much smaller than those estimated in this paper. Together, these two characteristics may explain why the firms that choose to invest are significantly larger and have considerably greater cash flow (as a percentage of assets) than firms that do not. In that view, instead of making a mistake, these small firms may be rationally choosing not to invest. [15]

The results of this study also suggest a modification to the advice provided by the prior literature on acquisition "coping mechanisms." In general, this literature has emphasized the benefits of delaying acquisitions of startups, by prolonging negotiations or by postponing acquisition until the target has "proven" its value in an IPO (Coff, 1999, 2003; Reuer & Ragozzino, 2008; Reuer & Shen, 2004). However, while acquirers may benefit from waiting (in the form of gaining better information), this information comes at a cost. As targets are better able to signal their value to the market, other acquirers are

[15] Such differences in the expected treatment effect have gained considerable attention in the recent program evaluation literature (Djebbari & Smith, 2008; Heckman, Urzua, & Vytlacil, 2006; Heckman & Vytlacil, 2001) and the literature on the returns to education (Hastings, Kane, & Staiger, 2006; Tobias, 2003).

also able to observe these signals, and opportunities for differential advantage may be dissipated. Hence, delaying acquisition, instead of being a normative ideal, poses an interesting tradeoff between waiting for more information to be revealed and acting quickly to exploit market imperfections. Indeed, the net benefits to acquirers are significantly lower for takeovers of startups that have already gone public relative to their private counterparts, a result that is consistent with a growing body of evidence from finance (Faccio et al., 2006; Fuller et al., 2002; Moeller et al., 2004).

This study also highlights the seeming paradox regarding the effects of CVC investing on the acquisition of startups. I find that CVC investing increases acquisition performance when acquiring startups overall, but that, paradoxically, acquirers perform *worse* with the subset of acquisitions about which they have the *most* information (the subset of firms they have directly invested in). While this study does not test whether acquirers "overpay" per se when acquiring portfolio firms, in line with my results from chapter 2, I continue to find that returns to acquiring portfolio firms are significantly lower. Hence, this paper suggests that CVC investments may provide information benefits when making acquisitions, but that becoming too close to a potential acquisition can make acquirers susceptible to well-known decision biases such as overconfidence and escalation of commitment (Brockner, 1992; Hayward & Hambrick, 1997; Malmendier & Tate, 2005, 2008; Staw, 1981). If true, then one of the managerial implications of this study might be, "keep investing, but keep your distance."

Finally, the results of this study suggest a new line of inquiry for strategic alliance scholars. As mentioned, prior work generally examined using alliances to (1) develop capabilities in a new technology area (Inkpen, 1998; Mowery et al., 1996; Simonin,

1999) or (2) to gain experience that is valuable when forming new strategic alliances (Anand & Khanna, 2000; Kale et al., 2002; Sampson, 2005). This study suggests a third potential benefit – prior strategic alliance experience may provide information that is valuable for other types of business development activities. Hence, several fruitful areas of future research involve examining what types of information are most valuable and what is the most efficient way to collect them? What are the boundary conditions that limit the applicability of information from one realm to the other? And finally, how do firms become more effective at transferring this information internally?

Like most studies, this research is not without its limitations. One key limitation is the lack of a finer-grained measure of private information. While I have interpreted my findings as a sign that corporate venture capital provides investing firms with information advantages, I am unable to measure the quality or quantity of information directly. Thus, while the impact of CVC investing on acquisition performance conforms to what I would expect if CVC investments provided enhanced information, I am not able to conclusively rule out that the benefit of CVC investing is not due to other causes. Moreover, while I have argued that CVC investments provide three types of information that may be valuable, I am unable to distinguish which, if any, of these categories of information provides the most benefit, or to establish the relative importance of each type. Future research will benefit from better measures of private information available to acquirers.

A second limitation is that I am not able to observe how information gained through CVC investment activities gets transferred within the firm to inform the acquisition process. Hence, each of these areas is a fruitful arena for future research. In particular, rich qualitative research that describes what information managers gather and

how this information gets used inside the acquiring firm is greatly needed, and offers fertile ground for additional contribution.

In summary, this study was motivated by a tension in the entrepreneurial literature on the acquisitions of technology startups: while acquisitions of startups are difficult, it is only under conditions of uncertainty that abnormal gains are possible. Moreover, to succeed in such markets, acquirers must have more accurate expectations than other bidders regarding the future value of targets. If this is true, then understanding *how* firms improve their ability to collect, interpret, and disseminate private information becomes a crucial question in strategy research. This study provides new insights by examining the role of external investments in startups as one source of "information advantage" to established firms.

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Table 3.1 Prior literature on information asymmetry and acquisitions

Study	Key idea	Data & Sample	Conclusions
Coff (1999). "*How buyers cope with uncertainty when acquiring firms in knowledge-intensive industries: Caveat emptor.*" Organization Science, 10(2): 144-161.	*Are buyers more likely to adopt coping strategies when making acquisitions in knowledge-intensive industries?* The key argument is that greater knowledge-intensity makes the quality of the target more difficult to ascertain. Hence, as uncertainty around target firm increases, acquirers are more likely to adopt coping strategies (such as lengthening negotiations.)	Coff analyzes 218 acquisitions made 1988-1999. Both buyer and target were public. To be included in sample, both the deal value and deal terms needed to be disclosed. Target had to be public for at least 5 years. Sample included companies in many low-tech industries (waste disposal, floor coverings) although a breakdown by industry is not provided.	Main measure is the knowledge-intensity of the industry (from a survey by the Bureau of Labor Statistics [BLS]). Coff finds that, for targets in knowledge-intensive industries, acquirers are more likely to: 1) Offer a lower premium 2) Offer more stock (as part of deal terms) 3) Lengthen the negotiation process.
Coff (2002). "*Human capital, shared expertise, and the likelihood of impasse in corporate acquisitions*." Journal of Management, 28(1): 107-128	Similar to above. Increasing human capital makes it more difficult for the acquirer to ascertain value. Moreover, as the human capital increases, the acquirer is more dependent on retaining the human capital in order to create value with the acquisition. Hence, acquirers are more cautious about doing deals (and more likely to call off the acquisition).	324 acquisition attempts, 1988-1999. (Same sample as above, but including acquisition attempts, not just completed acquisitions). DV is probability that the deal is completed.	Main measure is the human capital of the industry (again, from the BLS survey). As human capital of the target (measured at the industry level) increases, the deal is more likely to be called off.
Shen and Reuer (2005). "*Adverse selection in acquisitions of small manufacturing firms: A comparison of public with private targets.*" Small Business Economics, 24(4): 393-407.	Acquirers face information asymmetry problems when acquiring companies that are young and/or small. In those cases, the acquirer is likely acquirer a publicly-traded target (because being public increases the amount of info about the target, as well as signaling its value.)	Their sample is 923 acquisitions in manufacturing industries (SIC codes 20-39), between 1996-1999. Targets needed to have < 500 employees. Of targets, 49.5% are public. Average target is 39 years old.	Generally used industry-level measures (except for target age and target strategic alliances). They find support for their thesis that as information asymmetry increases, acquirers are more likely to delay acquisition until the target is public. Hence, acquirer is more likely to acquire a public target:

Study	Key idea	Data & Sample	Conclusions
			1) The younger the target 2) The greater the target's intangible assets (measured at industry level) 3) The acquirer is in an unrelated industry (different 2-digit SIC code) as the target.
Shen and Capron (2007). *"Acquisitions of private vs. public firms: Private information, target selection, and acquirer returns.*" Strategic Management Journal 28(9):891-911.	Information asymmetry means it is hard to observe quality of target (particularly regarding the quality of its resources). Hence, acquirers are more likely to acquire public targets when (1) target is in an unfamiliar industry or (2) target has high-level of intangible assets.	Their sample is 101 acquisitions made by publicly-traded acquirers in Europe, 1988-1992. Of targets, 57% are public. Average target is 54 years old.	They find support for their hypotheses, however their empirics are problematic. 1) For the portion that uses a CAR, they use very long windows: [-20,+1] is the shortest window they use. 2) They use a Heckman selection model but have no exclusion restrictions.

Table 3.2 Descriptive Statistics & Correlation Matrix (n = 526)

No.	*Variable*	*Mean*	*S.D.*	1	2	3	4	5	6	7	8	9
1	Prominent CVC investor?	0.464	0.499	1								
2	Active CVC Investor in that year	0.346	0.476	0.78	1							
3	CVC Amount (3yrs)	86.183	226.384	0.41	0.51	1						
4	CVC Count (3yrs)	16.770	52.080	0.35	0.43	0.93	1					
5	R&D Intensity	53.888	51.476	-0.12	-0.01	0.07	0.04	1				
6	Startup Acquisition Experience	5.861	8.043	0.50	0.55	0.60	0.45	0.21	1			
7	Startup Acquisition Experience^2	98.914	317.616	0.31	0.37	0.48	0.35	0.18	0.91	1		
8	Acquirer Size (BV Assets)	7.095	2.285	0.77	0.69	0.49	0.41	-0.05	0.56	0.35	1	
9	Free Cash Flow (% assets)	-0.048	1.640	0.13	0.11	0.06	0.05	-0.06	0.06	0.04	0.15	1
10	Prior CVC investment in that startup?	0.095	0.294	0.35	0.25	0.25	0.24	-0.01	0.20	0.15	0.28	0.04
11	Target Age	5.089	2.940	-0.14	-0.21	-0.19	-0.13	-0.17	-0.21	-0.15	-0.15	0.02
12	Target Public	0.141	0.348	0.04	0.00	-0.05	-0.05	-0.02	0.01	0.02	0.03	-0.07
13	Relative Size	0.072	0.133	-0.36	-0.31	-0.19	-0.16	-0.01	-0.25	-0.15	-0.48	-0.28
14	Payment included stock?	0.546	0.498	-0.09	0.00	0.02	-0.04	0.25	0.05	0.09	-0.22	-0.08
15	Deal terms undisclosed?	0.243	0.430	0.16	0.08	0.03	0.06	-0.16	0.00	-0.06	0.21	0.06
16	Tech boom period (1999-2000)	0.302	0.460	0.04	0.19	0.27	0.19	0.24	0.17	0.12	0.08	-0.12
17	Post boom (2001-2003)	0.314	0.464	-0.09	-0.12	0.00	0.03	-0.05	0.09	0.08	0.04	0.02

No.	*Variable*	*Mean*	*S.D.*	11	12	13	14	15	16	17
11	Target Age	5.089	2.940	1						
12	Target Public	0.141	0.348	0.38	1					
13	Relative Size	0.072	0.133	0.22	0.31	1				
14	Payment included stock?	0.546	0.498	-0.09	0.16	0.27	1			
15	Deal terms undisclosed?	0.243	0.430	-0.02	-0.22	-0.27	-0.59	1		
16	Tech boom period (1999-2000)	0.302	0.460	-0.13	0.04	-0.03	0.29	-0.15	1	
17	Post boom (2001-2003)	0.314	0.464	-0.08	-0.05	-0.05	-0.21	0.04	-0.44	1

Table 3.3 Descriptive Statistics Comparing CVC Investors and Non-Investors
Means of the 219 acquirers included in the sample, split between CVC investors and non-investor. The unit of observation is a firm-year average. All dollar amounts (except R&D intensity) are in millions of constant 1996 dollars; *R&D Intensity* is expressed in thousands of dollars per employee (R&D / Employee). *Employees* is expressed in thousands. *Age* is the number of years the firm is listed in Compustat. *CVC Count* is the count of investments in startups the firm made that year; *CVC Amount* is the dollar amount invested in startups that year.

Variable	***Prominent CVC Investor***	***Non-CVC Investor***	***Overall***
Sales ($96 mil)	11,761.6	446.4	2,954.7
Assets ($96 mil)	3,725.1	545.9	3,563.9
R&D ($96 mil)	931.4	54.4	250.2
Employees (000's)	47.4	2.7	12.7
R&D Intensity	30.2	39.0	37.0
Cash Flow ($96 mil)	1,264.2	(13.7)	270.8
Cash Flow / Assets	0.14	(0.03)	0.01
Age (yrs in Compustat)	11.0	6.9	7.8
CVC Count (yr)	4.5	-	-
CVC Amount ($96 mil)	21.0	-	-
Number of Acquirers	36	183	219

Table 3.4 Acquirer Returns Using Full Sample of CVC Investors and Non-Investors

OLS estimates of acquirer returns to acquisition announcements. The dependent variable is the two-day (-1,0) cumulative abnormal return. Sample includes 526 startups (less than 12 yrs old) acquired in information technology industries, 1987–2003. Robust standard errors (clustered by firm) are in parentheses.

	Main Models						**Robustness Checks**			
	Controls only	Was firm ever a CVC investor?	Did firm make CVC invstmnt in acq year?	Heckman 2nd stage[1]	CVC Spending	CVC Count	Target <=10yrs	Target <=8yrs	Target <=6yrs	180-day beta
	(1)	(2)	(3)		(4)	(5)	(6)	(7)	(8)	(9)
Acquirer is a prominent CVC investor		0.0093	0.0010		0.0023	0.0039	0.0036	0.0019	-0.0040	-0.0017
		[0.0076]	[0.0072]		[0.0072]	[0.0074]	[0.0074]	[0.0089]	[0.0099]	[0.0078]
Acquirer is active CVC investor in current yr?			0.0160***	0.0391**						
			[0.0058]	[0.0200]						
CVC spending ($mil, ln)					0.0041**		0.0042**	0.0041**	0.0043*	0.0038**
					[0.0018]		[0.0019]	[0.0021]	[0.0023]	[0.0018]
Count of CVC investments (ln)						0.0046*				
						[0.0025]				
Acquirer Characteristics										
R&D Intensity	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	[0.0001]	[0.0001]	[0.0001]	[0.0001]	[0.0001]	[0.0001]	[0.0001]	[0.0001]	[0.0001]	[0.0001]
Startup Acquisition Experience	0.0006	0.0003	-0.0000	-0.0003	-0.0004	-0.0003	-0.0004	-0.0005	-0.0001	-0.0004
	[0.0007]	[0.0006]	[0.0007]	[0.0012]	[0.0007]	[0.0007]	[0.0007]	[0.0009]	[0.0008]	[0.0007]
Startup Acquisition Experience^2	-0.0000	-0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
Size (ln assets)	0.0011	-0.0001	-0.0006	-0.0034	-0.0011	-0.0006	-0.0015	-0.0005	0.0002	-0.0005
	[0.0018]	[0.0022]	[0.0023]	[0.0032]	[0.0025]	[0.0024]	[0.0026]	[0.0030]	[0.0031]	[0.0025]
Cash flow (as % assets)	0.0033	0.0032	0.0031	0.0029*	0.0031	0.0031	0.0030	0.0032	0.0016	0.0031
	[0.0025]	[0.0025]	[0.0025]	[0.0018]	[0.0025]	[0.0025]	[0.0025]	[0.0025]	[0.0023]	[0.0025]
Target & Deal Characteristics										
Acquirer has prior VC investment in target?	-0.0124*	-0.0144**	-0.0135**	-0.0122	-0.0152**	-0.0159***	-0.0155**	-0.0154**	-0.0177***	-0.0140**
	[0.0066]	[0.0063]	[0.0061]	[0.0098]	[0.0061]	[0.0061]	[0.0062]	[0.0067]	[0.0066]	[0.0064]
Target age	0.0030***	0.0031***	0.0032***	0.0032***	0.0032***	0.0031***	0.0028**	0.0029*	0.0043	0.0032***
	[0.0010]	[0.0010]	[0.0011]	[0.0011]	[0.0011]	[0.0010]	[0.0012]	[0.0017]	[0.0026]	[0.0010]
Target is public?	-0.0276**	-0.0283***	-0.0277***	-0.0266***	-0.0271**	-0.0274**	-0.0239*	-0.0204	-0.0228	-0.0252**
	[0.0108]	[0.0107]	[0.0106]	[0.0093]	[0.0107]	[0.0107]	[0.0122]	[0.0151]	[0.0179]	[0.0107]
Relative size	0.0040	0.0050	0.0033	-0.0013	0.0003	0.0020	-0.0072	0.0063	-0.0790	-0.0051
	[0.0471]	[0.0468]	[0.0465]	[0.0267]	[0.0470]	[0.0470]	[0.0557]	[0.0686]	[0.0690]	[0.0469]
Payment included stock?	0.0060	0.0051	0.0045	0.0044	0.0042	0.0046	0.0045	0.0045	0.0023	0.0038
	[0.0062]	[0.0063]	[0.0064]	[0.0074]	[0.0064]	[0.0064]	[0.0067]	[0.0072]	[0.0082]	[0.0065]
Deal terms undisclosed?	-0.0055	-0.0058	-0.0057	-0.0058	-0.0056	-0.0054	-0.0061	-0.0072	-0.0153*	-0.0056
	[0.0069]	[0.0070]	[0.0070]	[0.0080]	[0.0071]	[0.0070]	[0.0072]	[0.0074]	[0.0081]	[0.0070]
Tech boom period (1999-2000)	-0.0084	-0.0071	-0.0084	-0.0102	-0.0105	-0.0099	-0.0100	-0.0138	-0.0200*	-0.0099
	[0.0079]	[0.0080]	[0.0080]	[0.0074]	[0.0086]	[0.0085]	[0.0090]	[0.0097]	[0.0105]	[0.0085]
Post boom (2001-2003)	0.0153**	0.0170**	0.0180**	0.0194***	0.0161**	0.0157**	0.0170**	0.0160**	0.0079	0.0139*
	[0.0069]	[0.0072]	[0.0072]	[0.0071]	[0.0071]	[0.0072]	[0.0071]	[0.0077]	[0.0078]	[0.0072]
Constant	-0.0284*	-0.0244	-0.0216	-0.0072	-0.0164	-0.0192	-0.0129	-0.0182	-0.0139	-0.0175
	[0.0163]	[0.0167]	[0.0167]	[0.0205]	[0.0180]	[0.0175]	[0.0191]	[0.0214]	[0.0221]	[0.0179]
Inverse Mills ratio (λ)				-0.0148						
				[0.0117]						
Observations	526	526	526	526	526	526	498	441	367	526
R-squared	0.057	0.059	0.063	-	0.063	0.062	0.060	0.062	0.086	0.056
Chi-squared	-	-	-	192.7	-	-	-	-	-	-

*** p<0.01, ** p<0.05, * p<0.1

[1] - 1st stage of Heckman model is shown in Appendix 1.

Table 3.5 Acquirer Returns for Subsample of CVC Investors (with Acquirer Fixed Effects)

OLS estimates of acquirer returns to acquisition announcements. The dependent variable is the two-day (-1,0) cumulative abnormal return. Sample includes 526 startups (less than 12 yrs old) acquired in information technology industries, 1987–2003. Robust standard errors (clustered by firm) are in parentheses.

	Main results					Robustness Checks			
VARIABLES	Col 1: CVC Count 3yrs	Col 2: Current year only	Col 3: Prior year only	Col 4: 2yrs ago	Col 5: Investment quartiles	Col 6: Target <= 10 yrs	Col 7: Target <= 8 yrs	Col 8: Target <= 6 yrs	Col 9:180 day beta
Count of CVC investments - 3yr (ln)	0.0101***					0.0109***	0.0115***	0.0115***	0.0097***
	[0.0022]					[0.0022]	[0.0025]	[0.0029]	[0.0022]
Count of CVC investments - current yr (ln)		0.0085**							
		[0.0036]							
Count of CVC investments - prior yr (ln)			0.0139***						
			[0.0034]						
Count of CVC investments - two yrs ago (ln)				0.0044					
				[0.0027]					
Count of CVC investments - 1st quartile (1-8 inv.)					0.0104				
					[0.0072]				
Count of CVC investments - 2nd quartile (9-25 inv.)					0.0233**				
					[0.0089]				
Count of CVC investments - 3rd quartile (26-74 inv.)					0.0370***				
					[0.0132]				
Count of CVC investments - 4th quartile (75+ inv.)					0.0401**				
					[0.0197]				
Acquirer Characteristics									
R&D Intensity	-0.0001	-0.0001	-0.0001	0.0000	0.0000	-0.0000	-0.0001	-0.0001	-0.0000
	[0.0002]	[0.0002]	[0.0002]	[0.0002]	[0.0003]	[0.0002]	[0.0002]	[0.0002]	[0.0002]
Startup Acquisition Experience	-0.0017*	-0.0016**	-0.0019*	-0.0017*	-0.0017*	-0.0019**	-0.0017*	-0.0013	-0.0018**
	[0.0009]	[0.0008]	[0.0010]	[0.0009]	[0.0010]	[0.0009]	[0.0009]	[0.0008]	[0.0008]
Startup Acquisition Experience^2	0.0000*	0.0000**	0.0000*	0.0000	0.0000	0.0000*	0.0000*	0.0000*	0.0000**
	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
Size (ln assets)	-0.0016	0.0001	-0.0005	0.0029	-0.0013	-0.0014	0.0006	-0.0007	-0.0022
	[0.0032]	[0.0026]	[0.0033]	[0.0033]	[0.0044]	[0.0035]	[0.0034]	[0.0037]	[0.0034]
Cash flow (as % assets)	-0.0220	-0.0334	-0.0207	-0.0177	-0.0266	-0.0152	-0.0004	-0.0146	-0.0102
	[0.0263]	[0.0225]	[0.0265]	[0.0262]	[0.0303]	[0.0249]	[0.0325]	[0.0316]	[0.0267]
Target & Deal Characteristics									
Acquirer has prior VC investment in target?	-0.0211***	-0.0215***	-0.0208***	-0.0206***	-0.0204***	-0.0210***	-0.0215***	-0.0195***	-0.0183***
	[0.0056]	[0.0059]	[0.0053]	[0.0057]	[0.0059]	[0.0055]	[0.0060]	[0.0065]	[0.0063]
Target age	0.0004	0.0007	0.0004	0.0003	0.0005	0.0001	-0.0008	-0.0003	0.0006
	[0.0009]	[0.0009]	[0.0009]	[0.0009]	[0.0011]	[0.0009]	[0.0014]	[0.0019]	[0.0009]
Target is public?	-0.0168***	-0.0173***	-0.0152**	-0.0180***	-0.0187***	-0.0125**	-0.0147**	-0.0140	-0.0154**
	[0.0057]	[0.0055]	[0.0059]	[0.0058]	[0.0064]	[0.0049]	[0.0064]	[0.0084]	[0.0063]
Relative size	0.0126	0.0117	0.0139	0.0238	0.0235	0.0170	0.0657**	0.0750**	-0.0195
	[0.0285]	[0.0279]	[0.0311]	[0.0259]	[0.0337]	[0.0298]	[0.0276]	[0.0339]	[0.0461]
Payment included stock?	-0.0047	-0.0014	-0.0069	-0.0023	-0.0037	-0.0059	-0.0106	-0.0127	-0.0084
	[0.0077]	[0.0070]	[0.0075]	[0.0083]	[0.0084]	[0.0075]	[0.0084]	[0.0078]	[0.0080]
Deal terms undisclosed?	-0.0067	-0.0064	-0.0079	-0.0072	-0.0068	-0.0071	-0.0044	-0.0073	-0.0097*
	[0.0058]	[0.0057]	[0.0053]	[0.0059]	[0.0062]	[0.0057]	[0.0066]	[0.0066]	[0.0056]
Tech boom period (1999-2000)	-0.0129	-0.0113	-0.0123	-0.0025	-0.0111	-0.0142	-0.0169**	-0.0161	-0.0112
	[0.0087]	[0.0094]	[0.0083]	[0.0075]	[0.0109]	[0.0084]	[0.0082]	[0.0098]	[0.0088]
Post boom (2001-2003)	-0.0001	0.0122	0.0007	0.0079	0.0069	0.0007	-0.0020	-0.0014	0.0032
	[0.0090]	[0.0086]	[0.0087]	[0.0106]	[0.0100]	[0.0086]	[0.0093]	[0.0090]	[0.0099]
Constant	0.0208	0.0121	0.0190	-0.0101	0.0172	0.0162	0.0044	0.0126	0.0238
	[0.0261]	[0.0214]	[0.0255]	[0.0263]	[0.0310]	[0.0277]	[0.0278]	[0.0307]	[0.0280]
Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	242	242	242	242	242	233	205	180	242
Number of Acquirers	34	34	34	34	34	33	32	30	34
R-squared	0.163	0.151	0.186	0.127	0.154	0.174	0.190	0.184	0.136
F test:	26.3	31.3	24.6	32.3	25.5	34.1	27.6	37.7	25.3

*** p<0.01, ** p<0.05, * p<0.1

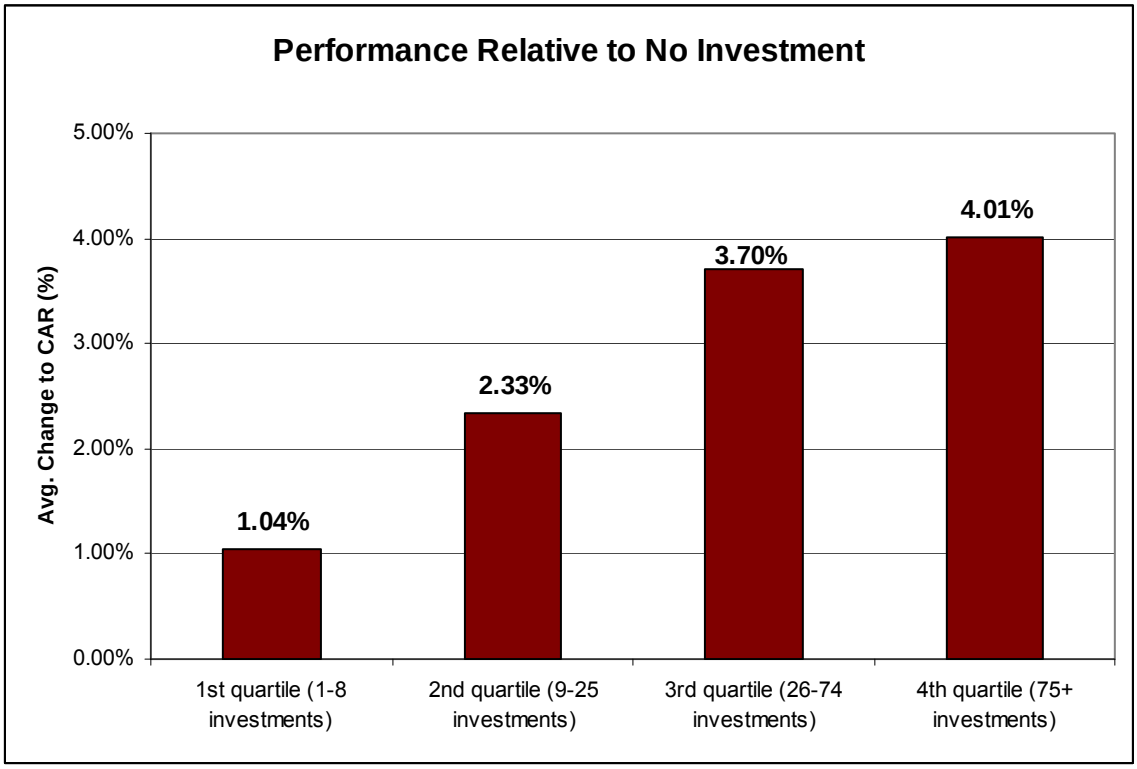
Table 3.6 Acquirer Returns Using Relatedness of CVC investments to Acquisitions

	Medical software classified as "Life Science"						Medical software classified as "IT"			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Count of CVC investments - 3yr (ln)	0.0101***									
	[0.0022]									
Count of CVC investments - IT		0.0056***	0.0102***				0.0094***	0.0107***		
		[0.0017]	[0.0020]				[0.0021]	[0.0022]		
Count of CVC investments - Not in IT			0.0096**					0.0079*		
			[0.0037]					[0.0044]		
CVC Spending - 3yr ($mil, ln)				0.0068***						
				[0.0017]						
CVC Spending - 3yr IT					0.0035***	0.0068***			0.0059***	0.0070***
					[0.0012]	[0.0015]			[0.0017]	[0.0017]
CVC Spending - 3yr Not in IT						0.0068**				0.0063**
						[0.0026]				[0.0028]
Acquirer Characteristics										
R&D Intensity	-0.0001	-0.0000	-0.0001	0.0000	-0.0000	0.0000	-0.0000	-0.0000	0.0000	0.0000
	[0.0002]	[0.0002]	[0.0002]	[0.0002]	[0.0002]	[0.0002]	[0.0002]	[0.0002]	[0.0002]	[0.0002]
Startup Acquisition Experience	-0.0017*	-0.0016*	-0.0017*	-0.0019**	-0.0016*	-0.0019**	-0.0019*	-0.0018*	-0.0020**	-0.0019**
	[0.0009]	[0.0009]	[0.0009]	[0.0009]	[0.0009]	[0.0009]	[0.0010]	[0.0009]	[0.0009]	[0.0009]
Startup Acquisition Experience^2	0.0000*	0.0000	0.0000*	0.0000**	0.0000	0.0000**	0.0000**	0.0000*	0.0000**	0.0000*
	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
Size (ln assets)	-0.0016	0.0023	-0.0016	-0.0027	0.002	-0.0027	-0.0006	-0.0018	-0.001	-0.0027
	[0.0032]	[0.0028]	[0.0033]	[0.0038]	[0.0029]	[0.0039]	[0.0031]	[0.0032]	[0.0036]	[0.0037]
Cash flow (as % assets)	-0.0220	-0.0242	-0.0222	-0.0236	-0.0253	-0.0236	-0.0173	-0.0205	-0.0208	-0.0232
	[0.0263]	[0.0272]	[0.0266]	[0.0273]	[0.0273]	[0.0274]	[0.0271]	[0.0267]	[0.0284]	[0.0278]
Target & Deal Characteristics										
Acquirer has prior VC investment in target?	-0.0211***	-0.0203***	-0.0210***	-0.0206***	-0.0203***	-0.0206***	-0.0210***	-0.0211***	-0.0208***	-0.0206***
	[0.0056]	[0.0057]	[0.0055]	[0.0057]	[0.0057]	[0.0056]	[0.0058]	[0.0056]	[0.0058]	[0.0057]
Target age	0.0004	0.0004	0.0004	0.0005	0.0004	0.0005	0.0005	0.0004	0.0005	0.0005
	[0.0009]	[0.0009]	[0.0009]	[0.0009]	[0.0009]	[0.0009]	[0.0009]	[0.0009]	[0.0009]	[0.0009]
Target is public?	-0.0168***	-0.0166***	-0.0166***	-0.0185***	-0.0178***	-0.0185***	-0.0157**	-0.0163***	-0.0178***	-0.0183***
	[0.0057]	[0.0058]	[0.0057]	[0.0056]	[0.0058]	[0.0057]	[0.0058]	[0.0058]	[0.0058]	[0.0057]
Relative size	0.0126	0.0191	0.012	0.0162	0.0218	0.0162	0.0139	0.0112	0.0169	0.0157
	[0.0285]	[0.0267]	[0.0284]	[0.0286]	[0.0264]	[0.0283]	[0.0286]	[0.0287]	[0.0279]	[0.0285]
Payment included stock?	-0.0047	-0.0016	-0.0046	-0.0042	-0.0011	-0.0042	-0.0031	-0.0046	-0.0021	-0.0041
	[0.0077]	[0.0073]	[0.0077]	[0.0078]	[0.0073]	[0.0079]	[0.0075]	[0.0077]	[0.0076]	[0.0078]
Deal terms undisclosed?	-0.0067	-0.0071	-0.0068	-0.0074	-0.0075	-0.0074	-0.0064	-0.0066	-0.0073	-0.0074
	[0.0058]	[0.0060]	[0.0058]	[0.0064]	[0.0063]	[0.0063]	[0.0061]	[0.0059]	[0.0066]	[0.0065]
Tech boom period (1999-2000)	-0.0129	-0.006	-0.0128	-0.0103	-0.0047	-0.0103	-0.0082	-0.0125	-0.0057	-0.0101
	[0.0087]	[0.0072]	[0.0088]	[0.0084]	[0.0071]	[0.0085]	[0.0080]	[0.0088]	[0.0078]	[0.0085]
Post boom (2001-2003)	-0.0001	0.0070	-0.0001	0.0045	0.0094	0.0045	0.0040	0.0001	0.0085	0.0047
	[0.0090]	[0.0098]	[0.0090]	[0.0090]	[0.0097]	[0.0091]	[0.0094]	[0.0090]	[0.0097]	[0.0090]
Constant	0.0208	-0.0069	0.0203	0.0262	-0.0053	0.0262	0.0114	0.0215	0.0136	0.0266
	[0.0261]	[0.0226]	[0.0265]	[0.0281]	[0.0225]	[0.0288]	[0.0258]	[0.0264]	[0.0261]	[0.0280]
Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	242	242	242	242	242	242	242	242	242	242
R-squared	0.163	0.14	0.163	0.164	0.138	0.164	0.154	0.164	0.151	0.164

*** p<0.01, ** p<0.05, * p<0.1

Figure 3.1 Acquisition Performance by CVC Investment Quartile (Sub-sample of CVC Investors)

Coefficients on CVC quartile variable (from Table 4, column 5). All models are relative to years in which the firm made no CVC investments. Firm-fixed effects are included in the model. Note that the coefficient on the 1st quartile is not significantly different from making no investment. All other coefficients are significant at $p<0.05$.



Appendix B. Results from First-Stage Selection Model

	First-stage probit model	Did firm make CVC invstmnt in acq year? (No correction)	Did firm make CVC invstmnt in acq year? (With endogeneity correction)
	(1)	(2)	(3)
Acquirer is active CVC investor in current yr?		0.0160***	0.0391**
		[0.0058]	[0.0200]
CVC spending ($mil, ln)			
Count of CVC investments (ln)			
Acquirer Characteristics			
R&D Intensity		0.0000	0.0000
		[0.0001]	[0.0001]
Startup Acquisition Experience		-0.0000	-0.0003
		[0.0007]	[0.0012]
Startup Acquisition Experience^2		0.0000	0.0000
		[0.0000]	[0.0000]
Size (ln assets)		-0.0006	-0.0034
		[0.0023]	[0.0032]
Cash flow (as % assets)		0.0031	0.0029*
		[0.0025]	[0.0018]
Target & Deal Characteristics			
Acquirer has prior VC investment in target?		-0.0135**	-0.0122
		[0.0061]	[0.0098]
Target age		0.0032***	0.0032***
		[0.0011]	[0.0011]
Target is public?		-0.0277***	-0.0266***
		[0.0106]	[0.0093]
Relative size		0.0033	-0.0013
		[0.0465]	[0.0267]
Payment included stock?		0.0045	0.0044
		[0.0064]	[0.0074]
Deal terms undisclosed?		-0.0057	-0.0058
		[0.0070]	[0.0080]
Tech boom period (1999-2000)		-0.0084	-0.0102
		[0.0080]	[0.0074]
Post boom (2001-2003)		0.0180**	0.0194***
		[0.0072]	[0.0071]
Constant		-0.0216	-0.0072
		[0.0167]	[0.0205]
Inverse Mills ratio (λ)			-0.0148
			[0.0117]
First-stage probit			
R&D Intensity	0.0030		
	[0.0019]		
Size (ln assets)	0.6149***		
	[0.0493]		
Free cash flow (as % assets)	15.3311***		
	[4.6197]		
VC inflows	0.4746***		
	[0.1220]		
VC inflows * Free cash flow	-1.2217***		
	[0.4250]		
Constant	-10.6062***		
	[1.3774]		
Observations	526	526	526
R-squared	-	0.063	-
Chi-squared	192.7	-	192.7

*** p<0.01, ** p<0.05, * p<0.1

Robust standard errors, clustered by firm, in brackets

CHAPTER 4
CONCLUSION

As startups have become more important actors in research and innovation, it is not surprising that established firms have acquired them in ever greater numbers. Moreover, given the very real risks associated with such acquisitions, it is also not surprising that managers have experimented with ways to reduce that risk, such as by "trying before they buy" through equity investments in those startups. By examining the tradeoffs associated with using corporate venture capital to inform acquisition decisions, this dissertation sheds new light on this important managerial issue.

The findings of this research have several implications for both theory and practice. Theoretically, this dissertation contributes to at least three literatures. First, this research contributes to the nascent literature on corporate venture capital. Despite the large body of survey and anecdotal evidence that established firms use CVC investments to identify and screen potential acquisition targets, prior empirical work has ignored this aspect of corporate venture capital investing. Indeed, this study represents the first systematic study to examine: (1) the extent to which firms use equity investments to screen potential acquisitions, and (2) how such investments affect subsequent acquisition performance (if at all.) While prior studies have examined the financial returns of corporate venture capital (Gompers and Lerner, 1998) or the impact of CVC investments on internal R&D (Dushnitsky and Lenox, 2006; Wadhwa and Kotha, 2006), the use of

corporate venture capital to reduce information asymmetries in acquisitions has not been previously explored.

Second, this research contributes more generally to the emerging literature on technology acquisitions, particularly the "coping mechanisms" available to firms when making decisions under high uncertainty (Coff, 1999; Reuer and Raggozzsino, 2006; Shen & Reuer, 2005). However, this literature has largely focused on mechanisms for entrepreneurial firms to signal their value to others. Consequently, the literature has under-emphasized means by which acquirers may reduce information asymmetry while still preserving the opportunity for gain. By examining one way that acquirers may gain an information advantage relative to others, I hope this dissertation will help to move this literature beyond a focus on the challenge of acquiring startups to the opportunities for strategic advantage in this important factor market.

Finally, this dissertation also addresses a key question that has been understudied in the resource-based view (RBV); namely, how do firms purchase the resources they need at a price that allows them to create competitive advantage? Although Barney (1986) acknowledged that more accurate expectations can lead to competitive advantage, he did not elaborate on *how* firms could develop this improved foresight. Indeed, in the original 1986 article, Barney was skeptical that firms could improve their performance through external information, arguing that this information would be in the public domain (and hence available to all). Consequently, subsequent research has largely focused on advantages through better use of *internal* information. This dissertation contributes to the RBV by suggesting, and empirically testing, whether firms' *external* investments may

provide the type of valuable, private information that can explain systematic performance differences in takeover markets for entrepreneurial firms.

The results of this dissertation also have implications for managers. First, the results suggest that CVC investing can have two opposing impacts on acquisition performance. On the one hand, CVC investing can increase overall acquisition performance when acquiring startups. At the same time, CVC investing can make managers prone to destroy value when acquiring their portfolio companies. If correct, then one implication for managers may be, "keep investing, but recognize the challenges of such investments."

A second implication for managers is that CVC investing may provide information benefits in the form of information not available to rivals, but that such information has a short "shelf life." For instance, the results in Chapter 3 indicate that only investments made in the current or prior year had any effect on acquisition performance. In contrast, investments made in earlier years had little to no impact on current acquisitions. Thus, while CVC investing may provide an advantage, that advantage is fleeting; moreover, once the firm ceases to invest, it loses its advantage.

Finally, given the information benefits that CVC investing can provide, managers might be tempted to conclude that firms *not* making such investments are making a mistake. However, such a conclusion would be premature. The firms in my sample that choose to make CVC investments are considerably larger and control considerably greater cash flow than firms that do not. If it is the case that only large firms with ample resources can exploit the benefits of CVC investing, then the returns to CVC investing to small firms may be smaller (and perhaps much smaller) than those estimated in this

dissertation. If true, then small firms, instead of making a mistake are rationally choosing not to investment.

This research also points to several directions for future research. First, future studies could probe more deeply into why and how CVC program structure changes firm investing behavior. For example, I find that dedicated units are less likely to overpay when acquiring portfolio firms, and that they are also less likely to "throw good money after bad" by continuing to reinvest in their underperforming portfolio firms. This finding begs the question, what is it that dedicated groups do differently from other corporate groups making CVC investments? Is it that dedicated units attract higher quality managers or managers with different perspectives? Or is it that dedicated units have incentives that are more closely attuned to the performance of their investments? Or, finally, is it that dedicated units are more likely to adopt practices that allow them to make better investment decisions? Answering these questions will require finer-grained data regarding the individuals, the practices, and the incentives of the different types of CVC groups, particularly for the non-dedicated groups (about whom data is much harder to come by.)

A second, related question is, if dedicated units outperform non-dedicated units, why do so many firms relegate their venture financing activities to non-dedicated units (e.g. product groups or other corporate departments?) More generally, future studies could explore the tradeoffs that firms face when designing CVC programs. For example, while dedicated units may facilitate better decisions regarding the acquisition of or reinvestment in portfolio firms, such units may also pose organizational barriers that reduce the transfer of knowledge gleaned from the investments to other groups within the

firm. Future studies could also investigate more fully the process by which information gathered through CVC investing moves to other parts of the organization.

Finally, future work could examine what types of information are most valuable and is CVC investing the most efficient way to collect it? For example, how does the information gained through CVC investments (which by definition involve an equity stake) differ in degree or in kind from information gathered through strategic alliances (e.g. without an equity stake?) In other words, could established firms gain a similar advantage merely through forming alliances with technology startups, or is the equity stake required? For example, it may be that the equity stake, by increasing the alignment between startup and CVC investor, may increase the interaction between the two (and thus provide better information.) On the other hand, the equity stake creates a potential sunk cost on the part of the investor, which may promote an "escalation of commitment", particularly to portfolio firms that underperform.

Established firms have dramatically increased their willingness to finance technology startups. This dissertation advances the field by identifying and empirically testing the effects of corporate venture capital on the performance of firms in entrepreneurial takeover markets.