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Voluntary disclosure of corporate venture capital investments ☆

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ABSTRACT

In this paper, we investigate drivers of corporate venture capital investment announcements. Consistent with voluntary information disclosure theories, we find that a public announcement is less likely to be made when the start-up firm is in the seed stage but more likely when the parent company is large, active in concentrated markets and in non-high-tech industries; spends heavily on internal R&D and capital expenditures; has low leverage ratio; and faces more information asymmetry problems. In addition, corporate venture capital programs managed externally disclose more often than internal programs. We find that parent companies facing more severe asymmetric information problems enjoy the highest abnormal returns in response to announcements. This study contributes to the literature on voluntary information disclosure in that it evidences that larger corporations use disclosure of some of their investments in innovative startups strategically as a way to convey valuable information to the market.

1. Introduction

In innovation-driven industries, corporations invest heavily in research and development (R&D) to maintain leadership in their current market or to become a leader in new markets in the future. Corporations are often silent about their current R&D projects in an effort to provide as little information to competitors as possible. Doing so could otherwise affect their future competitive position in the market. In contrast, other corporations issue clear announcements as a way to strategically communicate to investors their corporate objectives and thereby influence anticipations (Narayanan et al., 2000).

So far, little is known about the factors that affect voluntary disclosure of investments in innovation, though a few studies examine strategic disclosure of other relevant corporate information, such as loans (Maskara and Mullineaux, 2011) and dividend cuts (Chemmanur and Tian, 2012, 2014).[2] Chemmanur and Tian (2014) show that companies strategically disclose information to "prepare" the market. Disclosing privately valuable information can provide clear signals to the market, even though some of this information may also be valuable to competitors. Bhattacharya and Ritter (1983) show that under certain conditions, the gain resulting from a lower cost of capital outweighs the potential disadvantage of disclosure. One such cost factor results from disclosing information that is useful to competitors, especially under strong industry competition (Maksimovic and Pichler, 2001). On the gain side, Balakrishnan et al. (2013) find that voluntary information disclosure affects liquidity of shares and, thus, the cost of equity capital. These different findings suggest that disclosing information on investments in innovation is likely strategic.

In this paper, we examine what drives information disclosure of investments in innovative ideas in the context of corporate venture capital (CVC).[3] CVC programs have become integral parts

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[2] The literature in the area of accounting offers some insights into corporate voluntary disclosure (see Verrecchia, 2001, for a detailed discussion). These studies, however, involve disclosing financial accounting ratios (e.g., Skinner, 1994), the adoption of specific reporting standards and management earnings guidance.

[3] For example, Intel Capital, Intel's CVC program, officially announced on September 6, 2005, its $16 million investment in Grisoft, a leading manufacturer of the AVG antivirus program (Source: Intel News Release "Intel Capital To Acquire $16M Stake In Grisoft, A Leading Security Software Company" at http://www.intel.com/pressroom/archive/releases/2005/20050906corp.htm, accessed May 2, 2013). According to Intel's official press release, "Intel will work to help Grisoft improve security on computing platforms for small businesses and consumers."

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of innovation activities of many large corporations, such as 3 M, Adobe Systems, AT&T, Cisco, Dell, General Electric, Intel, Johnson & Johnson, Microsoft, Novartis, Oracle, Siemens, Walt Disney, Xerox, and many more.[4] They allow corporations to access innovative ideas outside their firm boundaries, next to developing their own R&D projects internally. CVC programs make direct equity investments into start-up firms (Cumming, 2006), mostly in business areas that are similar to or not too distant from those of the parent company (Dushnitsky, 2012). Many studies have shown that a CVC program can generate gains to parent companies, making it an important part of the innovation strategy of large companies (e.g., Gompers and Lerner, 1998; Hellmann, 2002; Masulis and Nahata, 2009; Basu et al., 2011; Chemmanur et al., 2014; see also Da Rin et al., 2010, for a comprehensive survey of recent research).

Several theories help explain what may drive corporations that run a CVC program to announce their CVC investments publicly. These theories argue that information disclosure may be strategically motivated and, thus, that specific factors affect the costs and benefits of issuing an announcement. One crucial factor we investigate is the extent to which the parent company faces information asymmetry in the market with its current activities (Fishman and Hagerty, 2003; Ferreira and Rezende, 2007), as disclosing information of other investment opportunities (here, CVC investments) may help reduce the information asymmetry with current assets or commitments. For example, Ferreira and Rezende (2007) argue that parent companies may disclose information on their ongoing innovation projects as a way to signal credible commitment to these projects, to induce future suppliers to make relationship-specific investments early. Should they fail to stick with the announced projects, parent companies would lose credibility for future announcements. We also explore whether the parent company's dependence on debt affects announcement decisions. According to Perotti and von Thadden (2005), companies that rely more on bank debt are less likely to disclose critical information, because banks can collect this information by monitoring the borrower. In contrast, companies that rely more on equity will disclose more, because they are more dependent on equity investors, who rely on corporate disclosure to price shares. Another factor arising from voluntary disclosure theories is firm size (Diamond and Verrecchia, 1991); larger corporations likely benefit more from disclosure because they rely more on the participation of institutional investors for whom liquidity of shares is more important. Quick and comprehensive disclosure improves liquidity of stocks. In contrast, shares of smaller firms tend to be held proportionately more by retail investors, who value liquidity less than institutional investors.

Other theories offer predictions regarding costs of disclosing innovation. One prominent factor affecting disclosure costs is industry competiveness (Maksimovic and Pichler, 2001). Parent companies in more competitive industries bear greater costs from revealing valuable information to competitors. For example, Chemmanur et al. (2010) find that firms in more concentrated industries are more likely to go public, because the costs associated with greater disclosure imposed to public firms are lower. Similarly, high-tech parent companies face higher costs of investment disclosure, because a greater fraction of their investments are in innovation and thus have more value to competitors.

We further expect that the structure of CVC programs and syndication affect the probability of announcement. Investments should be more often announced when the CVC program is externally managed and when independent, private venture capital (VC) firms participate in the deal. Both effects are consistent with increased benefits of disclosure for either the external CVC program or the private VC firm from greater visibility about its investment activities.

To perform the analysis, we select a sample of CVC investments made by US public corporations during the 2002–2012 period. Using the Factiva database, which aggregates corporate information from various sources (see Section 3 for more details), we then manually collect information on which of these investments were publicly announced and on which exact date. We find that approximately two-thirds of the investments were publicly announced. Of note, we observe little differences between the sample of announced investments and unannounced CVC investments; the only statistically significant difference pertains to seed investments, as such investments are present more often in the sub-sample of unannounced investments. This finding is consistent with the prior discussion that these announcements are more difficult to assess by outsiders and are "riskier" signals. Similarly, we find little differences between the two sub-samples in terms of characteristics of the parent companies.

We find that several characteristics of investments and parent companies shed light on the motivations of parent companies to publicly announce their CVC investments. Consistent with our predictions, we find that companies facing severe information asymmetry problems derive greater benefits from communicating any good news to the market and thus are more likely to disclose their CVC investments. Next, larger parent companies (measured in market capitalization) are more likely to issue announcements. This is consistent with Diamond and Verrecchia's (1991) theoretical prediction that larger firms benefit more from disclosing private information because they rely more on market liquidity than smaller firms. We further document that parent companies that invest more in internal R&D or have larger capital expenditures (in dollar amounts, not as a fraction of total assets) are more likely to announce. This is consistent with the idea that they may have competitive advantages and thus fear competition to a lesser extent. Along similar lines, parent companies active in high-tech industries are less likely to disclose, suggesting that costs are higher in these industries. Parent companies operating in competitive markets also disclose less often, as costs related to disclosure are likely to be higher in those markets.

Next, we examine the impact of syndication and structure on the disclosure probability. In many cases, the CVC parent company is not the sole investor but co-invests (syndicate) with independent VC firms. Because each investor may have its own incentives that affect its disclosure policy, we test our main predictions on the sub-sample of investments that are not syndicated (i.e., those for which the parent company is the sole investor). In this reduced sample of 122 deals, we find that the impacts of information asymmetry, firm size, and leverage of the parent company are even greater than those in the full sample. Moreover, the three effects are present in the other sub-sample of syndicated investments, though weaker than what we observe in the non-syndicated sub-sample. In terms of syndicate structure, we find that information is more likely to be disclosed when independent VC firms participate in the syndicate, in line with the idea that they need to communicate more because they depend on regular fundraising.

Finally, we investigate how the stock market reacts to these announcements. This extension helps understand whether disclosure affects stock prices, based on the sample of disclosed deals (but controlling for self-selection). We find that parents companies facing severe information asymmetry problems benefit most, with an average cumulative abnormal return (CAR) of 1.22% over the [−2,+2] window following a one-standard deviation increase in the information asymmetry measure used.

[4] Dushnitsky (2012) offers a comprehensive survey of research on CVC, as well as a discussion on the different forms of CVC. In terms of importance of the phenomenon, Basu et al. (2011) report that approximately 17% of *Fortune* 500 companies (the top 500 U.S. companies annually ranked by revenue) relied on CVC investments during the 1990–2000 period. Taking an international perspective, Da Gbadji et al. (2015) find that 29% of the *Fortune* Global 500 companies had active CVC programs during the 2008–2011 period.

This study contributes to the literature on voluntary information disclosure in that it evidences that larger corporations use disclosure of some of their investments in innovative startups strategically as a way to convey valuable information to the market. Disclosure helps reduce information asymmetry and has an economically important impact of the corporation's stock returns at time of announcement. We contribute to several strands of literature. First, the theoretical literature on voluntary information disclosure yields different empirical predictions (see Section 2 for a discussion), many of which, to the best of our knowledge, remain untested (see Fishman and Hagerty, 2003; Perotti and von Thadden, 2005; Ferreira and Rezende, 2007). We empirically test recent theories in the context of CVC investment announcements, which constitute potentially important investments in innovative ideas. Second, we contribute to a better understanding of how investors perceive the disclosure of information. Given their rather small size relative to parent companies, the value effect of these announcements is more likely to capture insights into the future strategic orientation of the parent company. In contrast, most studies on merger and acquisitions and corporate investments of larger companies focus on value generated by operating and financial efficiency (see Eckbo, 2010, for a comprehensive survey). Third, we complement the literature on the impact of CVC investments on start-up firms. Most studies typically focus on the divestment stage to measure impact, notably in connection with information asymmetry. For example, Megginson and Weiss (1991) show that VC investments enable reduction of information asymmetry, which leads to lower underpricing at the initial public offering. Cumming et al. (2005) find that returns from divestment impact fundraising capability of VC firms. More recently, Masulis and Nahata (2011) find that acquirers purchase VC-backed companies at a higher premium, leading to announcement returns of more than 3% for the acquirer than for non-VC-backed targets. We complement these studies by showing that some of the returns may already be incorporated in stock prices at the time of investment. CVC investments offer a suitable testing ground because we can observe announcement effects.

The remainder of the paper is structured as follows: Section 2 presents various theories of strategic information disclosure and testable hypotheses for empirical setting. Section 3 describes the data and offers summary statistics on the sample. Section 4 examines determinants of announcement decisions. Section 5 investigates stock price reactions following CVC investment announcements. Section 6 discusses robustness and extensions. Section 7 concludes.

2. Theories of strategic information disclosure and testable hypotheses

Several theories offer guidance on why corporations may strategically decide to disclose valuable information early to the market. As an underlying framework, these theories assume the presence of informational asymmetry, in which managers know something outsiders (e.g., equity investors) do not know. Signaling theory (Ross, 1977; Myers and Majluf, 1984) argues that managers may signal such information to the market. The incentives to disclose any value-relevant information are affected by costs and benefits derived from disclosing.

Several benefits may accrue to the parent company through disclosure. Important theoretical contributions on strategic information disclosure show that corporations may decide to disclose valuable information to affect product-market outcome because this information offers hints about the future business orientation of the corporation.[5] For example, Ferreira and Rezende (2007) present a theoretical framework in which a corporation may strategically disclose information on innovation activities as a means to signal commitment to this specific project (see Narayanan et al., 2000, for empirical evidence). Such an announcement may serve as a credible signal if reputation (e.g., in the form of career concerns) is at stake, in the event the corporation withdraws its commitment to the project at a later time. In this case, the corporation would not be able to credibly signal to the market in the future. Therefore, corporations only announce innovation projects they are confident in pursuing further; others are left unannounced. This may also lead corporate partners to commit strategy-specific investments.

Overall, disclosure helps reduce uncertainty about the parent company. If any announcement provides a signal of the overall quality of existing assets, the parent company may opt to announce its CVC investments. In the context of syndicated loans, Maskara and Mullineaux (2011) find that corporations that are more affected by information asymmetry tend to announce their loans more often. They argue that such announcements may reduce information asymmetry. This then leads to a positive link between the parent company's level of information asymmetry and the probability of announcements. We summarize this effect as follows:

H1 (information asymmetry): Parent companies suffering most from information asymmetry are more likely to disclose their CVC investments.

Consistent with these arguments on information asymmetry and disclosure benefits, Diamond and Verrecchia (1991) develop a theoretical framework in which they show that for publicly listed firms, large firms are more likely to benefit from private information disclosure than small firms because their shares are held by institutional investors who trade larger blocks of shares, for which the price impact is larger. Retail investors, who hold proportionately more shares in smaller firms, are less affected by such liquidity problems.[6] This leads to the testable hypothesis that the probability of observing public announcement is positively related to the size of the parent company.

H2 (size of parent company): Larger parent companies are more likely to disclose their CVC investments.

However, not all CVC investments are likely to offer the same signal quality. Following the preceding reasoning, we expect later-stage investments to be announced more often than early-stage investments, for which project feasibility is often uncertain. Committing to such projects early in the development phase is risky (Ferreira and Rezende, 2007), because they are more likely to fail. In a similar vein, Fishman and Hagerty (2003) show that projects that are more difficult to value by outsiders are less likely to be disclosed voluntarily because the market may not properly understand their potential. Given the significantly larger risk, early-stage investments are more difficult to assess by outsiders.

H3 (early-stage investment): Early-stage investments are less likely to be disclosed.

Another firm characteristic that may affect the gains from announcing CVC investments is the parent company's source of funding, as debt holders and equity holders may have different

[5] An early contribution to the product-market channel is that by Bhattacharya and Ritter (1983).

[6] Diamond and Verrecchia (1991) specifically distinguish between small and large firms in their study. However, an alternative way to test this prediction is to consider the holding of stocks by institutional investors and retail investors at time of the CVC investment. This alternative measure is presumably a more direct measure than size and consistent with Diamond and Verrecchia (1991). Unfortunately, we are not able to obtain this information for our sample.

ways of obtaining information about the parent company. Perotti and von Thadden (2005) argue that banks depend less on public disclosure than equity holders because they can also monitor companies and thus obtain the information privately. In contrast, equity holders must rely on public announcements to obtain the information. Thus, corporations with greater, private leverage (thus relying more on bank finance) may be less inclined to make announcements of CVC investments that can lead to information leakage to other relevant parties. In contrast, parent companies with low leverage benefit more from disclosure because it directly affects the cost of equity. We therefore expect the parent company's leverage ratio to be negatively related to the likelihood of issuing an announcement.

H4 (leverage of parent company): Parent companies that depend more on private debt are less likely to disclose their CVC investments.

Apart from the benefits of disclosure, costs-related factors can reduce the incentives of parent companies to disclose their CVC investments. One important source of costs associated with CVC investment disclosure is the degree of industry competition (Maksimovic and Pichler, 2001). Chemmanur et al. (2010) find that firms in less concentrated industries face higher costs of going public and thus are less likely to do so (which imposes more disclosure than when the firm is privately held). Consistent with this finding, we expect that parent companies in more competitive industries bear greater costs from revealing valuable information to competitors.

H5 (market competition): Parent companies operating in less concentrated and, thus, more competitive markets are less likely to disclose their CVC investments.

Another potential cost factor is the industry of the parent company. Aboody and Lev (2000) offer empirical evidence that technological firms possess more valuable insider information than other, less R&D-intense firms. This value differential leads to greater informational gains for insiders of high-tech firms. In our context, this translates into high-tech firms facing higher costs of investment disclosure as a result of increased risks of sensitive informational leakage, which in turn reduces their incentives to disclose. These risks of informational leakages may lead to substantial costs for the parent company who invested in the startup. Any informational leakage would reduce the value of the investment and of the possibility of the parent company to benefit in the future from these innovations.

H6 (high-tech industry): Parent companies active in high-tech industries disclose less, because costs of information leakage are higher.

In addition to investment and parent company characteristics, other related issues are likely to affect disclosure incentives. One is the structure of the CVC program itself. While some programs are structured as internal organizations, others are separate, forming a distinct legal identity, though it may remain a fully owned subsidiary controlled by the parent company. In other words, some CVC programs are structured as internal programs, and others are externally managed. The choice of organizational structure can affect the likelihood of issuing an announcement. In particular, we expect that externally managed programs are more likely to make public announcements, to show presence and attract interest. As Gompers and Lerner (1998) argue, CVC programs depend on the continued interest of top management and thus need to be more visible to secure long-term interest of the parent company's management. This is particularly important when the corporate link is more distant, as is the case for externally managed programs. Consistent with this intuition, Bandiera et al. (2014) show that CEO of large firms tend to limit their span of attention to internal teams rather than "cultivate external constituencies". In this case, we expect information disclosure by the manager of the external CVC program as a mean to enhance visibility on his activities to the business community, which is likely to also attract the attention of the parent company's management. While the information can also be communicated directly, public announcement is likely to increase visibility and impact on top management's interest in the CVC program.

H7 (organization structure of CVC program): Externally managed CVC programs have greater incentives to disclose.

Furthermore, most deals are syndicated, meaning that the CVC program invests along with other VC players (Lerner, 1994). Most of the venture capital is provided by independent firms that are not affiliated with a specific corporation or financial institution. These different types of VC players are likely to have different incentive schemes in terms of information disclosure policy. For example, Gompers (1996) shows that independent VC firms are likely to "grandstand" when they need to raise new funds. Such action is likely to affect the amount of information they disclose to the market on their current investments, because they benefit from disclosing more information to market players.

H8 (syndicated deals): CVC investments syndicated with independent VC funds are more likely to be disclosed.

In Section 4, we test the different predictions with respect to different sources of costs and benefits to disclose. To control for other sources of company heterogeneity, we include other company characteristics in our multivariate analysis, as detailed subsequently.

3. Data and sample statistics

To examine our hypotheses, we extracted from the VentureXpert database a random sample (i.e., sampling without replacement) of 1000 investments made by corporate-affiliated US VC firms during the 2002–2012 period from a pool of 2588 CVC investments. We use a random sample because of the use of a large amount of hand-collected data, as discussed subsequently. Starting our sample in 2002 avoids the need to consider the Internet bubble, while leaving a sufficiently long period of analysis. For our random sample, we consider only CVC programs held by public parent companies, thus excluding private ones. We use VentureXpert to collect investment-level information on deal characteristics, such as round amount, round number, number of investors participating in the considered round, investment stage of development, and investment date (i.e., the date the contract was signed and reported in VentureXpert). We then manually search the profiles of the CVC firms mentioned in VentureXpert and use other online sources to identify the ultimate parent company of the CVC firm or program. This search is necessary because, though VentureXpert reports the name of the CVC firm, this is often a subsidiary of the parent company only.

As a next step, we identify which of these investments were publicly announced and, if so, on which day. To this end, we use the Factiva database to search each of the 1000 investments for whether it was announced by the CVC firm (or program), parent company, or start-up company by searching for their names in the database. Factiva collects information worldwide (in nearly 200 countries) using a large variety of leading newspapers, magazines, trade press, newswires, press releases, web media, social media,

and multimedia. Because our parent companies are among the largest ones in the United States, they are well covered by the database.[7] Our search window in Factiva is six months before and three months after the investment date. To ensure valid announcements, we require that the parent company (or at least its CVC unit) and the start-up are mentioned in the given Factiva report. Overall, less than 3% of the cases we identified involve multiple announcement dates. In the event of multiple announcement dates, we use the earliest date to the investment date as the announcement date. We treat an investment as announced if any article in the Factiva database mentions the investment. We do not use any coded algorithm to search for announcements. Rather, we use the news from Factiva to search any announcement manually, as a way to minimize measurement errors. For deals that were not publicly announced, we use the investment date as the event date for our event-study analysis. Note that CVC investments are generally not reported in SEC filings 8-K for their "materiality," because parents companies are much larger than the size of these investments. To ensure that this is indeed the case, we manually checked 30% of our publicly announced CVC investments for information disclosed in the 8-K filings of the parent companies. None of the CVC investments we searched were reported in the SEC filings. This lack of finding lends support to the notion that these announcements are not forced, but voluntary.

Although CVC investments are not reported by parent companies in 8-K filings, the issuing companies must report to the SEC to comply with Rule 506 of Regulation D when selling securities without registration with the SEC. This is accomplished by filing Form D, which can then be viewed by anyone in the EDGAR database. However, this information can hardly be used to infer investments by large corporations, because the filing only reports information about the issuing firm. Thus, there is no possibility of inferring from these filings who the investors are. This, however, does not constitute an announcement that would affect the parent company, because neither parent company nor its CVC program is mentioned in Form D.

A natural question is how VentureXpert attains access to deal information when it is not publicly disclosed. To answer this question, we turn to the data provider Thomson Reuters, which owns VentureXpert. Thomson Reuters sends surveys to VC and CVC investors on a quarterly basis to obtain their last investments and then may call the various parties involved to collect further information to complete the different variables included in the database. This helps explain why we have "unannounced" investments that are not reported in regular sources. Our sample contains very large parent companies, which are likely to be contacted by VentureXpert or to participate in deals with established VC funds that are surveyed by VentureXpert.

Finally, we collect accounting data and stock price information of the parent companies from the COMPUSTAT and CRSP databases. This information includes market value of the parent company (measured as the product of stock price and number of common shares outstanding), current assets, total assets, capital expenditure, cash, long-term debt, current liabilities, net income, property plant and equipment, sales, working capital, and R&D. We also use EDGAR filings and annual reports of parent companies to separate private from public debt for the calculation of "private" leverage.

To measure information asymmetry of the parent company to test H1, we create a composite index following Maskara and Mullineaux (2011). We construct the index using the same six common information asymmetry benchmarks. The first is analyst forecast errors, measured as the absolute difference between analysts' predicted earnings and actual earnings. The second is dispersion of analyst opinions, measured as the standard deviation of analysts' forecasts of annual earnings per share in the last month before the earnings announcement. Analyst forecast errors and dispersion of analyst opinions are standardized by share price and collected from the IBIS database. The third is volatility of abnormal returns around the earnings announcement, measured as the standard deviation of three days' abnormal returns around earnings announcements in the five years preceding the deal announcement. The fourth is residual volatility, measured as the standard deviation of market-adjusted daily stock returns in the year of deal announcement. The fifth is parent company age, measured as the number of years since the first firm observation in COMPUSTAT. The sixth is bid–ask spreads, measured as the average ratio of the difference between the daily bid and ask closing prices to the midpoint of the bid and ask closing prices. This measure is also similar to that of Chung and Zhang (2009). We calculate the information asymmetry index by grouping firms in our sample into quartiles according to each of the six measures in the year a deal is announced. Similar to Gomes and Philips (2010) and Maskara and Mullineaux (2011), we compute the information index as the average of the quartile ranking of a firm based on the six information measures.

In addition to this index, we use market-to book ratio of the parent company (denoted *market-to-book ratio*) as an alternative measure of information asymmetry. While the composite index remains our primary measures, we use this second one because it captures the extent to which the parent company faces growth opportunities. Such opportunities are an important source of information asymmetry because of the greater potential of insider information (see, e.g., Gao, 2011). While the market-to-book ratio remains often used as measure of information asymmetry, it also has been criticized. We therefore use it as secondary measure only. In our empirical analysis, we consider the company's market-to-book ratio as well as its ratio adjusted for industry median market-to-book ratio (*excess market-to-book ratio*). We calculate these measures using CRSP and COMPUSTAT data.

To proxy for costs of disclosure, in line with our predictions (H5 and H6), we use two measures. The dummy variable *high-tech* captures whether the parent company is active in one of the following three-digit SIC codes: 357, 366, 367, 372, 381, 382, and 384 (following Chemmanur et al., 2010). To evaluate the impact of market competition (H5), we calculate the Herfindahl–Hirschman Index (*HHIndex*) on the basis of sales.

Tables 1 and 2 present summary statistics of our sample. Table 1 lists characteristics of the CVC investments, and Table 2 provides characteristics of the parent companies. In both tables, we provide statistics for the full sample of 1000 observations (Panel A), the sample of announced CVC investments (Panel B), and the sample of unannounced CVC investments (Panel C). Of the 1000 CVC investments considered in this study, we find that 635 investments were announced.[8]

The average round amount for the full sample is $16.50 million (median of $10.0 million), though significant variation exists. In addition, the amount tends to be large because substantial parts of the investments are in ventures at the expansion and later stages of development, in which the amounts involved are a multiple of those invested at the early stage. With an average of 4.849 investors in the syndicate, the average amount provided per investor is $3.40 million. We also observe great variation in the development stage at which these investments take place. That is, 4.8% are seed-stage investments, 22.3% are early-stage

[7] More detailed information on Factiva's sources is available at http://www.dowjones.com/factiva/Factiva-Source-ReferenceSheet.pdf (accessed February 12, 2014).

[8] In Appendix 1, we show summary statistics on the CVC investment characteristics of the random sample of 1000 observations relative to the population of 2588 observations in VentureXpert. We find no statistical difference between the two groups, which confirms the representativeness of our sample.

Table 1
Summary statistics of CVC investments.

	Characteristics of CVC investments				
	Mean	Median	Std. dev.	Min	Max
Panel A: Full sample					
Round amount	16495.53	10000	25976.63	1.0000	460000
Round number	3.4181	3.0000	2.4251	1.0000	20.0000
Number of investors	4.8492	4.0000	3.3900	1.0000	26.0000
Seed stage	0.0481	0.0000	0.2141	0.0000	1.0000
Early stage	0.2230	0.0000	0.4171	0.0000	1.0000
Expansion stage	0.3500	0.0000	0.4770	0.0000	1.0000
Later stage	0.2681	0.0000	0.4432	0.0000	1.0000
Other stages	0.1090	0.0000	0.3121	0.0000	1.0000
Number of observations	1000				
Panel B: Announced investments					
Round amount	17526.7	10210.51	28116.10	1.1671	460000
Round number	3.4571	3.0000	2.4791	1.0000	14.0000
Number of investors	4.8301	4.0000	3.5681	1.0000	26.0000
Seed stage	0.0351	0.0000	0.1832	0.0000	1.0000
Early stage	0.2140	0.0000	0.4111	0.0000	1.0000
Expansion stage	0.3570	0.0000	0.4802	0.0000	1.0000
Later stage	0.2881	0.0000	0.4530	0.0000	1.0000
Other stages	0.1040	0.0000	0.3052	0.0000	1.0000
Number of observations	635				
Panel C: Unannounced investments					
Round amount	14790.41$^{n.s.}$	9413.01	21924.80	1.0000	21323
Round number	3.3521$^{n.s.}$	3.0000	2.3280	1.0000	20.0000
Number of investors	4.8821$^{n.s.}$	4.0000	3.0590	1.0000	26.0000
Seed stage	0.0710**	0.0000	0.2580	0.0000	1.0000
Early stage	0.2390$^{n.s.}$	0.0000	0.4271	0.0000	1.0000
Expansion stage	0.3380$^{n.s.}$	0.0000	0.4741	0.0000	1.0000
Later stage	0.2340$^{n.s.}$	0.0000	0.4240	0.0000	1.0000
Other stages	0.1180$^{n.s.}$	0.0000	0.3230	0.0000	1.0000
Number of observations	365				

This table shows the descriptive statistics of CVC investment characteristics. Panel A shows the statistics for the random sample of 1000 investments. Panel B shows the statistics for the announced investments, and Panel C for the unannounced investments. The variable *Round Amount* reports the size of the total amount (in thousands of dollars) invested in the given financing round. *Round Number* is the sequence of the financing round. *Number of Investors* is the number of investors involved in the given round financing. *Seed Stage*, *Early Stage*, *Expansion Stage*, *Later Stage*, and *Other Stages* are dummy variables taking a value of 1 for each corresponding financing stage and 0 otherwise. Panel C also provides significance levels of differences in means tests between values from Panels B and C. Significance levels: ***, **, * indicate 1%, 5%, and 10%, respectively (n.s. for >10%).

investments, 35.0% are expansion-stage investments, 26.8% are later-stage investments, and the rest are in other stages. No meaningful difference exists in these values between announced and unannounced CVC investments. The only exception is the proportion of seed-stage investments, which are higher for the sample of unannounced investments (7.1% vs. 3.5%). This difference is consistent with H3.

In terms of parent company characteristics (Table 2), we observe some important differences between corporations that announce investments and those that do not. We find significant differences in several of our main variables of interest, including *information asymmetry index* and *market-to-book ratio* (as well as *excess market-to-book ratio*). These measures reflect the degree of information asymmetry of the parent company. The other statistically significant difference pertains to working capital. The rationale, however, is unclear and no longer statistically significant in the multivariate analysis. We observe no meaningful differences in the other variables of interest (i.e., R&D Expenses, CAPEX) except for *leverage* (*private*) (defined as the ratio of long-term private debt to total assets[9]). Book leverage is lower in the sample of announced deals, in line with H4. Furthermore, we find support for H5 (on market competition) and H6 (on high-tech industry) in this univariate setting, because *high-tech* is lower and *HHIndex* is higher in the sample of announced deals. However, we find no substantial differences between the two sub-samples in terms of industry classification. As Appendix 2 shows, we find that most of the parent companies are concentrated in the business equipment sector (based on the Fama–French 12 industry classification of parent companies), regardless of whether the deals are announced (57% of the cases) or unannounced (48%). However, this difference is not statistically significant, nor are the differences for any other sector group reported.

Panel A in Table 2 also provides summary statistics on all parent companies that manage a CVC program. Compared with a more representative sample of COMPUSTAT firms (i.e., Faulkender and Petersen, 2006), our sample of parent companies tends to be larger and to hold more intangible assets.

Finally, we find no evidence that some parent companies systematically disclose all their CVC investments, while others disclose none. Indeed, Fig. 1 shows the average percentage of CVC investments announced by parent companies (for the sample of parent companies that have made at least five investments in our sample). Most parent companies announce 50–80% of their investments. This suggests that parent company characteristics cannot explain the entire variation observed in the summary statistics; time-varying and investee-specific factors may also be at play.

[9] Crucially, we only consider "private debt" in the calculation of leverage because our hypothesis pertains to bank finance. Thus, we explicitly exclude public debt such as corporate bonds. For the variable Long-Term Debt, however, we use public and private debt to be consistent with prior literature. We also use only long-term debt as control variable. Given the type of parent companies in our sample, excluding public debt makes no meaningful difference in the analysis, and the correlation between total debt and private debt is 0.9197.

Table 2
Summary statistics of parent companies.

	Mean	Median	Std. dev.	Min	Max
Panel A: Full sample					
Market value (in $ millions)	100594.40	81538.92	87143.54	13.7111	476115.50
Current assets/total assets	0.4421	0.4422	0.1811	0.0311	0.9810
Total assets (in $ millions)	74306.47	46784.00	175065.00	9.58	3211484.00
CAPEX/total assets	0.0600	0.0400	0.0410	0.0000	0.3200
Cash/total assets	0.1201	0.1000	0.0910	0.0000	0.8210
Leverage (Private)	0.1051	0.0522	0.1271	0.000	0.9303
High-tech	0.3187	0.0000	0.4598	0.0000	1.0000
HHindex	0.2698	0.1062	0.3272	0.01162	0.9236
Long-term debt (in $ millions)	16832.36	2049.00	106029.90	0.00	3038147.00
Current liabilities/total assets	0.2112	0.1811	0.1001	0.0300	0.6910
Net income	4308.73	3160.00	5597.27	−38732.00	104821.00
PPE/total assets	0.2201	0.1801	0.1301	0.0000	0.8911
Sales	34087.86	30141.00	34289.02	0.0000	255112.00
Working capital	8883.96	7311.85	9235.60	−6528.00	43845.00
R&D expenses/total assets	0.0801	0.0901	0.0512	0.0000	0.6701
Information asymmetry index	2.5573	2.2920	0.6840	1.0631	5.1012
Excess market-to-book ratio	1.6862	1.5722	1.6911	−1.0160	7.5160
Market-to-book ratio	3.5901	3.3601	1.9810	0.9800	11.9112
Number of observations	1000				
Panel B: Announced deals					
Market value (in $ millions)	101754.50$^{n.s.}$	85563.13	84682.34	18.9810	476115.50
Current assets/total assets	0.4401$^{n.s.}$	0.4311	0.1801	0.0301	0.9810
Total assets (in $ millions)	80344.98$^{n.s.}$	47143.00	202470.20	9.5801	3211484.00
CAPEX/total assets	0.0601$^{n.s.}$	0.0510	0.0401	0.0000	0.3210
Cash/total assets	0.1201$^{n.s.}$	0.1011	0.0911	0.0000	0.8201
Leverage (private)	0.0911**	0.0491	0.1063	0.000	0.8372
High-tech	0.2575***	0.0000	0.31454	0.0000	1.0000
HHindex	0.3468***	0.1198	0.2941	0.030626	0.96361
Long-term debt (in $ millions)	19659.83$^{n.s.}$	2049.00	129621.20	0.0000	3038147.00
Current liabilities/total assets	0.2010$^{n.s.}$	0.1701	0.1001	0.0302	0.5601
Net income	4512.91$^{n.s.}$	3247.00	5980.99	−16855.00	104821.00
PPE/total assets	0.2210$^{n.s.}$	0.1901	0.1302	0.0000	0.8911
Sales	35225.85$^{n.s.}$	30146.00	34074.99	0.0000	195341.00
Working capital	9714.80**	8260.34	9801.81	−6528.00	43845.00
R&D expenses/total assets	0.0831$^{n.s.}$	0.0921	0.0501	0.0000	0.6721
Information asymmetry index	2.6390**	2.3792	0.6671	1.0632	5.1012
Excess market-to-book ratio	1.8430**	1.7721	1.6330	−0.8161	7.5160
Market-to-book ratio	4.290**	4.1211	1.6901	2.0000	11.5300
Independent VC	0.4666**	0.5000	0.2769	0.0000	0.8888
External CVC	0.03571	0.0000	0.1858	0.0000	1.0000
Number of observations	635				
Panel C: Unannounced deals					
Market value (in $ millions)	98481.43	72753.59	91565.36	13.71	476115.50
Current assets/total assets	0.4310	0.4400	0.1901	0.0311	0.8921
Total assets (in $ millions)	63542.92	44224.00	109945.20	26.09	795337.00
CAPEX/total assets	0.0500	0.0411	0.0401	0.0001	0.1701
Cash/total assets	0.1212	0.1001	0.0901	0.0001	0.4601
Leverage (Private)	0.1206	0.0783	0.1178	0.0000	0.9100
High-tech	0.4223	0.0000	0.4937	0.0000	1.0000
HHindex	0.1933	0.083832	0.2273	0.0116	0.8825
Long-term debt (in $ millions)	11778.15	2022.00	35838.81	0.0000	360681.00
Current liabilities/total assets	0.2101	0.1810	0.1000	0.0611	0.6901
Net income	3944.77	3117.00	4825.09	−38732.00	23931.00
PPE/total assets	0.2202	0.1801	0.1311	0.0010	0.6810
Sales	32059.40	29321.00	34622.82	8.7212	255112.00
Working capital	7391.52	6536.74	7917.90	−5223.00	43845.00
R&D expenses/total assets	0.0800	0.0901	0.0510	0.0001	0.2911
Information asymmetry index	2.4151	2.2512	0.6901	1.1451	4.3350
Excess market-to-book ratio	1.4122	1.3970	1.7571	−1.0161	4.3810
Market-to-book ratio	2.3201	1.9401	1.8401	0.0702	9.0601
Independent VC	0.4244	0.5000	0.2527	0.0000	0.8750
External CVC	0.0315	0.0000	0.1749	0.0000	1.0000
Number of observations	365				

This table shows the descriptive statistics of parent company characteristics. Panel A shows the statistics for the full sample, Panel B for the announced CVC investments, and Panel C for the unannounced CVC investments. *Market value* is market value of the CVC parent company; i.e., stock price at the end of the calendar year (one year before the investment) multiplied by the number of shares outstanding. *Current assets, total assets, leverage (private), CAPEX* (capital expenditure), *cash, long-term debt, current liability, net income, PPE* (i.e., property, plant and equipment – net), *sales, working capital,* and *R&D expenses* are all accounting variables for the parent company. *Current assets, CAPEX, cash, current liabilities, PPE*, and *R&D expenses* are scaled by *total assets*. *Information asymmetry index* is an index measuring the level of information asymmetry in the parent company; more details are provided in Section 3. We compute the index the same way as Maskara and Mullineaux (2011). *Market-to-book ratio* is the market-to-book ratio of the parent company. *Excess market-to-book ratio* is the value of *Market-to-book ratio* in excess of industry median market-to-book ratio. All COMPUSTAT variables are measured in the year before the investment date. Panel B also provides significance levels of differences in means tests between values from Panels B and C. Significance levels: ***, **, * indicate 1%, 5%, and 10%, respectively (n.s. for >10%).

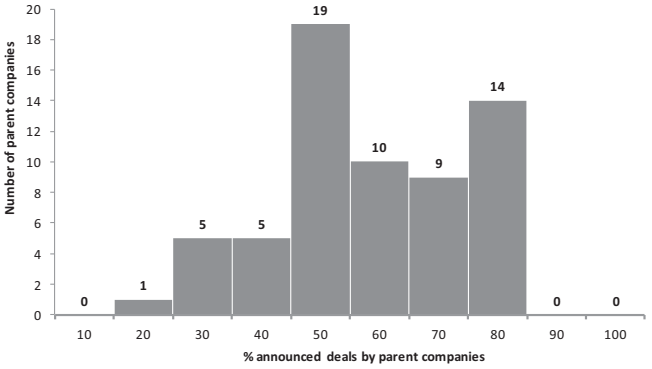

Fig. 1. Average percentage of investments announced by parent companies. This figure reports the number of parent companies that announced a certain percentage of their investments (*y*-axis) in our sample of 635 publicly announced CVC investments. The *x*-axis is the percentage of announced deals by CVC parent companies. We exclude in the figure parent companies that have fewer than 5 deals (announced or unannounced) in our sample.

4. Determinants of announcement decisions

In this section, we investigate the reasons for announcement decisions. In line with our theoretical discussion, we examine factors related to the parent company, the investment itself, and general market conditions. Table 3 provides logit regression results, in which the dependent variable is a dummy variable equal to 1 if the CVC investment was announced and 0 otherwise. Coefficients reported are marginal values so that we can interpret them as changes in probabilities. In all our regressions, we include industry (based on the Fama–French 12 industry classification) and year dummies and use clustered standard errors at the firm level.[10]

First, we find support for H1 that parent companies with severe information asymmetry are more likely to announce their investments. This is consistent with Ferreira and Rezende's (2007) findings on signaling, in which the announcement serves as a commitment device and enables a reduction of information asymmetry (similar to Maskara and Mullineaux's (2011) finding on syndicated loans). The effect is economically meaningful: a one-standard deviation increase in the *information asymmetry index* leads to an increase of 7.3% (=0.6840 × 0.1068) in the probability of announcing CVC investments.[11] Similarly, our alternative measure of information asymmetry, *market-to-book ratio*, shows the same sign and is statistically significant. Early investments are crucial for these companies because they rely more on innovation to sustain their future growth. Our results also indicate that parent companies with the strongest growth opportunities within their industry sector (the variable *excess market-to-book*) are more likely to announce their deals. This implies that higher growth opportunities increase the likelihood of announcing CVC investments, especially when the parent company enjoys higher growth opportunities than industry average. In terms of economic significance, a one standard deviation increase in the variable *excess market-to-book ratio* leads to a 9.3% (=1.6911 × 0.0551) increase in the likelihood of a CVC investment announcement. For *market-to-book ratio*, the corresponding increase is even more remarkable—that is, a 18.0% (=1.9810 × 0.0911) increase in the probability of announcing.

Second, we find that larger corporations (measured by market capitalization of equity) are more likely to publicly announce their CVC investments, which lends support to H2.[12] This finding is in line with the prediction of Diamond and Verrecchia (1991), who argue that larger firms have greater incentives to disclose such price-relevant information because of their greater reliance on institutional investors as shareholders (for which liquidity issues are more important than for smaller shareholders). Moreover, we find a positive link for corporations that spend more extensively in internal R&D and make larger capital expenditures.[13] In unreported results, we also find that internal R&D and capital expenditures only affect announcement decisions when we consider dollar amounts; the results disappear when scaled by total assets. This indicates a scale effect rather than a relative importance of these expenses. The finding that larger firms are more likely to announce their CVC investments is consistent with the notion that they have a greater need to do so (Diamond and Verrecchia, 1991) and that they are more closely covered by analysts, increasing the chances of observing a public announcement.

Third, leverage negatively affects the probability of announcing the investment (Model VII), consistent with H4. Perotti and von Thadden (2005) argue that debt-financed firms need to disclose less, because banks can obtain the information themselves in the course of their monitoring activities. Thus, announcing the investment would not affect their cost of debt financing. Our results provide support for this prediction.

Fourth, we find strong support for our predictions on the cost side. As H6 predicts, high-tech parent companies announce less by almost 6%. This finding is consistent with the higher costs of disclosing investments for high-tech industries (Model VIII), as information is more valuable. Similarly, parent companies in more competitive markets (*HHIndex*) are more likely to announce their investments (in line with H5). The effect is significant at the 10% level only, however.

Fifth, in Model X we show the results when including all the main explanatory variables in a single specification, though using only one variable for information asymmetry. The effect of information asymmetry remains significant. In addition, its economic significance (i.e., the magnitude of the coefficient, as we report marginal effects) remains largely unaffected. Our measures of leverage, market competition, and high-tech industry also remain statistically significant and with roughly similar economic impact.

Finally, seed-stage investments are less likely to be announced. This finding is consistent with our theoretical discussion (summarized in H3) that these investments are more difficult to value or to understand their ultimate impact on the parent company's future strategic orientation. The impact is economically important because seed-stage investments have a 17.7% lower probability of being announced than the base group (i.e., the group of *other stages*) in Model I. Taken in isolation (i.e., when we include only the dummy *seed stage*, while excluding all other stage dummies), the reduction in probability of announcement for seed-stage

[10] There is no evidence of parent company fixed effects in our sample. Most of the parent companies show up only a few times (and sometimes only once) in the random sample, which makes the inclusion of parent company fixed effects problematic. The only significant exception is Intel Corporation. In unreported analyses, we included a dummy variable that takes a value of 1 for Intel and 0 otherwise. The inclusion of this dummy does not affect our results.

[11] In unreported analyses, we examined the impact of individual sub-indices of the Information Asymmetry Index. This offers more insights into which specific dimensions drive our results. We find that four (five) of the six sub-indices are statistically significant at the 5% (10%) level. The sub-index on "analyst forecast errors" is not significant, while "volatility of market adjusted abnormal return" is significant at the 10% level.

[12] Using book value of equity yields qualitatively similar results.

[13] The argument that larger corporations are more likely to announce contradicts the assumption that such investments must be announced as "material events," as Maskara and Mullineaux (2011) argue in the context of loans. This would lead to a purely mechanical effect. An important difference from our study is that Maskara and Mullineaux (2011) examine syndicated loans that involve much larger amounts, often well over $250 million. The material impact on capital structure is likely to be more substantial than CVC investments in start-up companies (in which the impact on the balance sheet is rather marginal).

Table 3
Determinants of CVC investment disclosure.

	Model I	Model II	Model III	Model IV	Model V	Model VI	Model VII	Model VIII	Model IX	Model X
Information asymmetry index	0.1068***									0.1260***
Market-to-book ratio		0.0911***								
Excess market-to-book ratio			0.0551**							
ln(market value)				0.0152***						0.0534**
ln(R&D expenses)					0.0124**					
ln(CAPEX)						0.0155*				
Leverage (private)							−0.0436***			−0.0305**
High-tech								−0.0557**		−0.0413**
HHindex									0.3220*	0.2840**
ln(long-term debt)	−0.0009	0.0210***	0.0117**	0.0013	0.0025	−0.0035		0.0008	0.0044	
Negative NI	−0.0364	−0.1061*	−0.0885*	−0.1013*	−0.0655	−0.0747	−0.0776	−0.0760	−0.0691	−0.1628**
Sales growth	0.0004	0.001***	0.0004	0.0005*	0.0005	0.0005	0.0007*	0.0008*	0.0009*	0.0015*
Seed stage	−0.1770**	−0.1350	−0.1728**	−0.1487*	−0.1613*	−0.2435**	−0.2442**	−0.2372**	−0.2239**	−0.2280**
Early stage	−0.0261	−0.0020	−0.0202	0.0099	0.0010	−0.0891	−0.0538	−0.0823	−0.0693	−0.0666
Expansion stage	0.0224	0.0400	0.0193	0.0457	0.0416	−0.0421	0.0032	0.0471	0.0409	0.0367
later stage	0.0648	0.0830	0.0632	0.0763	0.0764	−0.0002	0.0446	0.0023	0.0036	0.0025
Constant	−0.4781	−0.2801*	0.1793	−0.2907	0.3333	0.7868*	0.2091*	0.3211*	0.4253*	−0.7973*
Likelihood ratio	−613.32	−540.79	−612.32	−580.53	−621.2	−619.07	−458.65	−622.23	−619.31	−546.75
Number of observations	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000

This table shows the results of logit regressions. The dependent variable is a dummy taking a value of 1 if CVC or parent company announced the deal and 0 otherwise. *Information asymmetry index* is an index measuring the level of information asymmetry in CVC parent company. We compute the index the same way as Maskara and Mullineaux (2010). *Excess market-to-book ratio* is the market-to-book ratio of the CVC parent company in excess of industry median market-to-book ratio. *Market-to-book ratio* is the market-to-book ratio of CVC parent company. *Leverage* (*private*) is measured as long-term private debt (thus, excluding public debt) divided by total asset. *High-tech* is a dummy variable equal to one if the parent company belongs to the three-digit SIC codes 357, 366, 367, 372, 381, 382 and 384. *HHindex* is the Herfindahl index of market concentration and computed by summing up the square of each firm's market share (in sales) at three-digits SIC codes. *ln*(*Market value*) is the logarithm of market value of the CVC parent company. *ln*(*R&D expenses*) is the logarithm of R&D expenses. *ln*(*CAPEX*) is the logarithm of capital expenditure expenses. *ln*(*Long-term debt*) is the logarithm of long-term debt. *Negative NI* is a dummy variable taking a value of 1 if the parent company has a negative net income and 0 otherwise. *Sales growth* is a change in sales for the parent company. *Seed stage, early stage, expansion stage*, and *later* stage are dummies. All COMPUSTAT variables are measured in the year before the announcement. *Other stages* serves as the base dummy in the regression. The coefficients reported are marginal effects. We control for industry and year effects. Significance levels (clustered standard errors at the firm level): ***, **, * indicate 1%, 5%, and 10%, respectively.

investments is even stronger, that is, 19.89% (result not reported in Table 3). Early-stage development, the next stage, however, is not significant, similar to all the other development stages.

In general, our other control variables are not significant. If they are, statistical significance only occurs for some, but not all, of the specifications. Thus, the results for our control variables do not appear robust. However, their inclusion allows us to show robustness of our main factors.

5. The impact of deal syndication and organizational structure of CVC programs

In this section, we further explore the potential factors that may affect the propensity of CVC programs to publicly disclose their investments. First, we explicitly control for the idea that most investments are syndicated and that other syndicate members likely have their own incentives to disclose information (H8). Second, we examine whether the organizational structure of the CVC program affects announcement decisions, because externally managed programs may have different motivations than internally managed ones to make announcements (H7). We therefore test our hypotheses on the CVC and syndicate structures developed in Section 2. Furthermore, we examine whether our previous findings are robust to these extra determinants of investment announcements.

5.1. The impact of syndicate size and structure

In many cases, a set of investors provides the amount invested, not just the parent company's CVC program. This is also the case in our sample. As Table 1 reports, the average number of investors in our sample is 4.849, on average 3.849 investors other than the CVC program of the parent company. These investors may face other incentives in terms of information disclosure, especially if they are independent VC firms. In this section, we examine whether the size and structure of the syndicate affect the probability of announcing a CVC investment.

Because it is enough for just one investor to decide to disclose, we might expect the probability to increase in the syndicate size. We test this prediction by running our analysis on two separate sub-samples, one for investments that only involve the parent company's CVC program and one for the syndicated investments. We expect our predictions discussed in Section 2 to be most relevant in the second sub-sample. Thus, our approach is to test whether our predictions are robust, rather than investigating the impact of syndicate size. The reason is that the decision to syndicate is endogenous, which limits our ability to also test the impact of syndication in the framework examined here. Table 4 reports the results. Overall, 122 investments from our sample are not syndicated, while 878 are syndicated. We find no evidence that the results would be different for the sub-sample of non-syndicated investments. The results remain significant for all our main factors in each sub-sample. The results are, however, statistically stronger in general for the sub-sample of syndicated deals, especially for the variables *high-tech* and *HHIndex*. Still, as mentioned previously, these estimations should be interpreted with caution because syndicate size may itself be affected by the disclosure policy of the parent company. Indeed, a firm that does not want to disclose its CVC investments at all may decide not to syndicate in the first place. Therefore, we view the results reported in Table 4 as complementary to previous results. Overall, syndication does not appear to affect our conclusions about our hypotheses.

In addition, we examine the impact of the structure of syndicates, by controlling for the possible heterogeneity in the syndicate members. This allows us to test H8 on the relationship between the presence of independent VC firms and announcement. To capture specificities of independent (or private) VC firms, we construct a variable that corresponds to the fraction of independent VC firms participating in the syndicate. The VentureXpert database categorizes them as fund type "PRIV." We then include this additional variable in our regressions, which we denote *independent VC participating*. Building on the previous discussion, we expect this variable to have a positive effect on the likelihood of issuing an

Table 4
The impact of syndication on disclosure.

	Model I: No syndicated investments		Model II: Syndicated investments only		*Z*-score
	Coefficient	*P*-value	Coefficient	*P*-value	
Information asymmetry index	0.1021**	(0.0450)	0.1301***	(0.0000)	0.158
ln(Long-term debt)	−0.0013	(0.1660)	−0.0055	(0.3830)	−0.701
High-tech	−0.0312*	(0.0880)	−0.074**	(0.0220)	−1.572
HHindex	0.2411*	(0.0910)	0.4351**	(0.0440)	1.631
Negative NI	−0.0161	(0.4580)	−0.0589	(0.4110)	−0.571
Sales growth	0.0016	(0.1120)	0.0001	(0.1730)	−0.188
Seed stage	−0.0361	(0.2130)	−0.0885*	(0.0910)	−1.662*
Early stage	−0.0449	(0.0880)	−0.0106*	(0.3210)	1.624
Expansion stage	0.0689*	(0.1780)	0.0121	(0.0790)	−1.435
Later stage	0.1141	(0.6300)	0.0851	(0.1520)	−0.714
Constant	0.9071	(0.5600)	−1.1381**	(0.0110)	
Number of observations	122		878		
Panel B: Leverage					
Leverage (Private)	−0.4122**	(0.0210)	−0.2694**	(0.0360)	1.551
High-tech	−0.0011	(0.2450)	−0.0836**	(0.0310)	−1.642*
HHindex	0.0800*	(0.0950)	0.5735**	(0.0110)	1.783*
Negative NI	−0.0102	(0.8970)	−0.0726	(0.2310)	−1.211
Sales growth	0.0327**	(0.0430)	0.0006*	(0.0810)	−1.277
Seed stage	−0.0555**	(0.0210)	−0.0984*	(0.0980)	−1.620
Early stage	−0.0119	(0.1610)	0.0463	(0.3420)	1.612
Expansion stage	−0.0063	(0.2310)	0.0631	(0.1980)	1.531
Later stage	0.0108	(0.4560)	0.1081*	(0.0710)	1.511
Constant	3.143**	(0.0010)	1.0121**	(0.0110)	
Number of observations	122		878		
Panel C: Size					
ln(Market value)	0.0602**	(0.0320)	0.0561***	(0.0000)	−1.515
ln(Long-term debt)	−0.0181	(0.1330)	0.0103	(0.1910)	1.211
High-tech	−0.0055	(0.1540)	−0.0350*	(0.0920)	−1.660*
HHindex	0.0561*	(0.0950)	0.5614**	(0.0200)	1.760*
Negative NI	−0.0678*	(0.0780)	−0.1883*	(0.0570)	−1.510
Sales growth	0.1529*	(0.0720)	0.0007*	(0.0590)	−1.591
Seed stage	−0.1331*	(0.0560)	−0.0637	(0.5960)	1.671*
Early stage	0.0548	(0.1540)	−0.0331	(0.2830)	−1.383
Expansion stage	0.0942	(0.1770)	−0.0091	(0.1810)	−1.679*
Later stage	0.0629	(0.4860)	0.1297**	(0.0230)	1.022
Constant	−1.174	(0.1770)	−1.2623*	(0.0610)	
Number of observations	122		878		
Panel D					
Information asymmetry index	0.0440**	(0.0380)	0.1677***	(0.0000)	1.217
Leverage (private)	−0.3431**	(0.0220)	−0.2875**	(0.0320)	1.511
ln(Market value)	0.0060**	(0.0440)	0.0704***	(0.0000)	1.671*
High-tech	−0.0092	(0.2210)	−0.0123*	(0.0780)	−1.571
HHindex	0.0590*	(0.0870)	0.5999**	(0.0210)	1.771*
Negative NI	−0.0657	(0.1670)	−0.1955**	(0.0270)	−1.311
Sales growth	0.1389**	(0.0220)	0.0002**	(0.0260)	−0.027
Seed stage	−0.1757*	(0.0820)	−0.1150	(0.2190)	1.451
Early stage	−0.0134	(0.2510)	0.0165	(0.7710)	1.010
Expansion stage	−0.0430	(0.1870)	0.0654	(0.1120)	1.101
Later stage	0.0605*	(0.0890)	0.1111**	(0.0410)	1.131
Constant	−1.4059**	(0.0440)	−3.5417**	(0.0350)	
Number of observations	122		878		

This table shows the results of logit regressions on the probability of announcement separately for the sub-samples of investments that are not syndicated (i.e., there is only one investor, which is the parent company's CVC program) and investments that are syndicated (i.e., at least one other investor participated in the financing round). Panel A shows the results of information asymmetry, Panel B the results of leverage, and Panel C the results of size effect. Panel D shows the results with all three factors included in the same specification. The dependent variable is a dummy taking a value of 1 if the parent company announced the CVC investment and 0 otherwise. All other variables are defined in Table 3. *Other stages* serves as the base dummy in the regression. The coefficients reported are marginal effects. We control for industry and year effects. Significance levels (clustered standard errors at the firm level): ***, **, * indicate 1%, 5%, and 10%, respectively. The last column reports the *Z*-score for the test of differences in coefficient values between Model I and Model II.

announcement. Table 5 reports the results. Our main results on the impact of information asymmetry, reliance on debt finance, and size remain unchanged.[14] However, we find that the presence of independent VC firms positively affects the disclosure probability. This is consistent with the idea that they have their own disclosure policy and may find it worthwhile to communicate on their investments, potentially due to the impact on fundraising.

5.2. The impact of the organizational structure of CVC programs

Next, we test our hypothesis regarding how CVC programs are structured (H7), that is, whether they are managed as an internal division or a separate legal entity (subsidiary) of the parent company (Gompers and Lerner, 1998; Dushnitsky, 2012). In accordance

[14] In Table 5, we miss one observation owing to lack of reliable information on the key variable *Independent VC Participating*.

Table 5
The impact of independent VCs participating in the syndicate.

	Model I		Model II		Model III	
	Coefficient	*P*-value	Coefficient	*P*-value	Coefficient	*P*-value
Information asymmetry index	0.0994***	(0.0000)				
Size			0.0432**	(0.001)		
Leverage (private)					−0.0661***	(0.0000)
Independent VC participating	0.1638**	(0.0110)	0.1594**	(0.0020)	0.1556**	(0.0110)
ln(Long-term debt)	−0.0049	(0.4460)	0.0094	(0.2300)		
High-tech	−0.0998**	(0.0110)	−0.0694**	(0.0170)	−0.0962**	(0.0120)
HHindex	0.3798**	(0.0470)	0.7619**	(0.0100)	0.6227**	(0.0410)
Negative NI	−0.0593	(0.2960)	−0.1576*	(0.0520)	−0.0831	(0.1140)
Sales growth	0.0003**	(0.00120)	−0.0005**	(0.0310)	0.0001*	(0.0710)
Seed stage	−0.1638*	(0.0570)	−0.1336	(0.1810)	−0.2351**	(0.0270)
Early stage	−0.0323	(0.3310)	−0.0020	(0.7120)	−0.0599	(0.1550)
Expansion stage	−0.0054	(0.7810)	0.0188	(0.6120)	−0.0281	(0.5870)
Later stage	0.0376	(0.3220)	0.0550	(0.4570)	−0.0182	(0.6610)
Constant	−0.8418*	(0.0710)	−0.6530	(0.2100)	0.8274	(0.1210)
Likelihood ratio	−604.37		−564.48		−507.09	
Number of observations	999		999		999	

This table shows the results of logit regressions on the probability of announcement when independent VCs participate in the syndicate. The dependent variable is a dummy taking a value of 1 if the parent company announced the CVC investment and 0 otherwise. *Independent VC participating* is the percentage of private VCs in the syndicate. All other variables are defined in Table 3. *Other stages* serves as the base dummy in the regression. The coefficients reported are marginal effects. We control for industry and year effects. Significance levels (clustered standard errors at the firm level): ***, **, * indicate 1%, 5%, and 10%, respectively.

Table 6
The impact of CVC structure on disclosure.

	Model I		Model II		Model III	
	Coefficient	P-value	Coefficient	P-value	Coefficient	P-value
Information asymmetry index	0.1027***	(0.0000)				
ln(Market value)			0.0436***	(0.0010)		
Leverage (private)					−0.1304***	(0.0000)
External CVC	0.0555**	(0.021320)	0.0318*	(0.0610)	0.0522**	(0.0430)
ln(Long-term debt)	−0.0055	(0.3610)	0.0098*	(0.0610)		
High-tech	−0.0821**	(0.0100)	−0.0528*	(0.0670)	−0.0206*	(0.0530)
HHindex	0.3773**	(0.0310)	0.7620**	(0.0310)	0.6746**	(0.210)
Negative NI	−0.0732	(0.2810)	−0.1641*	(0.0710)	−0.1007*	(0.0980)
Sales growth	0.0001	(0.1610)	0.0007**	(0.0250)	0.0008*	(0.0530)
Seed stage	−0.1557*	(0.0620)	−0.1244*	(0.0810)	−0.3167**	(0.0210)
Early stage	−0.0121	(0.5120)	0.0169	(0.1210)	−0.0949	(0.1210)
Expansion stage	0.0210	(0.4680)	0.0441	(0.3920)	−0.0402	(0.4170)
Later stage	0.0721	(0.1850)	0.0873	(0.1240)	0.0147	(0.7630)
Constant	−0.7037*	(0.0510)	−0.4636	(0.1240)	0.3959*	(0.1320)
Likelihood ratio	−607.83		−587.09		−477.70	
Number of observations	1000		1000		1000	

This table shows the results of logit regressions on the probability of announcement when the VC is external managed. The dependent variable is a dummy taking a value of 1 if the parent company announced the CVC investment and 0 otherwise. *External CVC* is a dummy variable taking a value of 1 if the CVC program is structured as a separate legal entity (subsidiary) and 0 otherwise. All other variables are defined in Table 3. *Other stages* serves as the base dummy in the regression. The coefficients reported are marginal effects. We control for industry and year effects. Significance levels (clustered standard errors at the firm level): ***, **, * indicate 1%, 5%, and 10%, respectively.

with H7, we expect external divisions to disclose more, to show presence, and to attract interest from management of the parent company. In contrast, internal CVC programs benefit from a closer corporate link. Admittedly, the categorization of internal versus external program is difficult to realize. However, one simple way to perform this categorization is to compare the name of the CVC program in the VentureXpert database with the name of the parent company. For a separate legal entity (thus, an external program rather than an internal business department), we would expect two names. Otherwise, we expect the program to be an "internal" program because it is not structured as a separate legal entity. This categorization is also independent of syndication structures, since syndication involves direct investments by each syndicate member in the startup. In Table 6, we adopt this categorization and analyze the impact of the organizational structure of CVC programs on the disclosure probability. We denote the constructed dummy variable as *external CVC*. We find that externally managed programs lead to more announcements. This is consistent with the idea that such programs have greater incentives to attract attention of the market and the parent company, because their relationship with top management is not as immediate as that for internally managed programs.

Relatedly, the incentives to disclose may be driven by the degree of organizational complexity of the parent company. In less hierarchical structures, CVC managers can more easily communicate in an informal way to the management of the parent company. Conversely, in more hierarchical structures, informal communication may be more difficult. To shed light on this specific channel, we explore whether information is more likely to be disclosed when the parent companies have a more hierarchical organization. As a first proxy, we use the number of industries in which they are active by counting the number of industries reported in the COMPUSTAT Segment database. We regard companies that are active in more industries (based on the categorization "STYPE = BUSSEG") as more likely to have more complex organizational structures. As a second proxy, we assess whether parent companies sell internationally, using the same database ("STYPE = GEOSEG"). In unreported results, we find that information on the CVC investment is

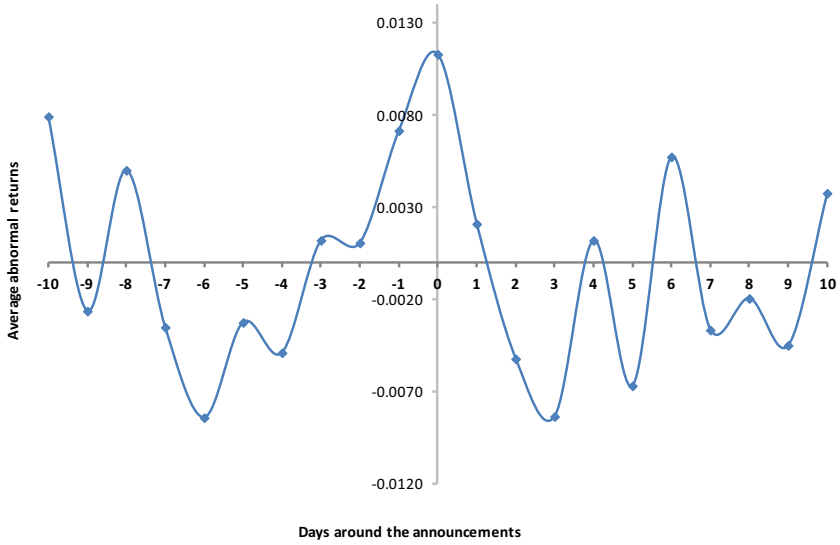

Fig. 2. Average abnormal returns for CVC investments. This figure shows the average abnormal returns (in percent) for announced deals over the [−10, +10] window around the announcement date. We compute the average abnormal returns using the market model.

Table 7
Stock price reaction to information disclosure.

Variables	Model I OLS Dep. Var. = CAR [−2,+2] Coefficient	Model II Outcome equation: Dep. Var. = CAR [−2,+2] Coefficient	Selection equation: Dep. Var. = announced dummy Coefficient
Information asymmetry index	0.0202***	0.0183***	0.1061***
ln(Round amount)	0.0016	0.0011*	
ln(Total assets)	0.0022*	0.0019**	
ln(Long-term debt)	0.0005	0.0003	−0.0010
High-tech	−0.0019	−0.0034	
HHindex	0.0078*	0.0064**	
Negative NI	−0.0092*	−0.0082	−0.0367
Sales growth	0.0001	0.0001	0.0004
Lambda (inverse Mills ratio)		−0.0773*	
Seed stage			−0.1750**
Early stage			−0.0266
Expansion stage			0.0240
Later stage			0.0679
Constant	0.0145	0.0131	−0.2856
Number of observations	635	635	1000

This table shows the stock market impact of disclosure. The first column shows an OLS estimation. The second column shows the second-step (outcome) self-selection Heckman estimation, with the first step (selection) equation shown in the third column. The dependent variable in the first two columns is CAR[−2,+2] and estimated with the sample of announced deals only. The dependent variable in the third column (first-step equation of the Heckman estimation) is *announced dummy* and thus uses the full sample. All the variables are defined in Tables 2 and 3. Lambda is the inverse Mills ratio, which corrects for possible sample selection biases in the outcome equation. We control for industry and year effects. Significance levels (clustered standard errors at the firm level): ***, **, * indicate 1%, 5%, and 10%, respectively.

more likely to be disclosed when the parent company is more diversified (more industry segments) and operates internationally. However, the result is only statistically significant for industry segments (at the 5% level). Combined with the previous results, these findings strengthen the notion that announcements are more likely to be made when communication with the parent company is less formal, due to its organizational complexity, and thus offer empirical support for H7.

6. Stock price reactions to CVC investment announcements

In this section, we examine whether CVC investments generate stock market reactions when they are announced. The objective of this analysis is to assess the value impact of parent company characteristics, following a CVC investment disclosure. We rely on the CAR/AR methodology, using the market model as reference for calculating abnormal returns (see Brown and Warner, 1985) of the sample of announced investments. This methodology is widely used in event studies, which is also the empirical framework we use in this section. Following the literature (Brown and Warner, 1985; Gao, 2011; Masulis and Nahata, 2011), we use the [−2,+2] window for calculating CAR but also perform robustness checks with other, larger windows (including [−10, +10]). Again, we use firm-level clustered standard errors in the regressions. The parameters of the market model are estimated over a 100-day window, ending 16 trading days before the announcement day. We use the S&P 500 value weighted index as a benchmark of the market portfolio. We require at least 50 daily stock returns in the estimation period to estimate the parameters used to calculate CAR/AR. We stop our estimation period 16 days before the announcement day to avoid bias in the parameters estimations due to changes in firm characteristics around the deal announcement day. This

Table 8
Stock price reaction to information disclosure for alternative CAR windows.

Variables	Dep. var. = CAR [−10,+10] Model I	Dep. var. = CAR [−3,+3] Model II	Dep. var. = CAR [−4,+2] Model III
Information asymmetry index	0.0207***	0.0361***	0.0426***
ln(Round amount)	0.0011	0.0012*	0.0010
ln(Total assets)	0.0027**	0.0012	0.0022**
ln(Long-term debt)	0.0021	0.0005	0.0005
High-tech	−0.0271**	−0.0082	−0.0068
HHindex	0.0116**	0.0173**	0.0285**
Negative NI	0.0068	0.0017	0.0021
Sales growth	0.0002	0.0002	0.0002
Lambda (inverse Mills ratio)	−0.0657*	−0.0079	−0.0128
Constant	0.0336	0.0042	−0.0204
Number of observations	635	635	635

The table shows similar regressions to Table 7 but with different windows of CAR measurements. The variables are defined in Tables 2 and 3. Lambda is the inverse Mills ratio, which corrects for possible sample selection biases in the outcome equation. We control for industry and year effects. Significance levels (clustered standard errors at the firm level): ***, **, * indicate 1%, 5%, and 10%, respectively.

approach is consistent with previous studies that follow a well-established methodology (Brown and Warner, 1985).

Fig. 2 shows the abnormal returns during the window of [−10, +10] days for announced CVC investments. Fig. 2 indicates a stronger stock price impact on the day of announcement for the sample of announced deals. For the sample of announced investments, the average CAR for the window of [−2,+2] is 1.65%, which is significantly different from 0 (p-value of 0.000). As mentioned in the previous section, the sample of announced investments is however not random but the result of strategic choices of parent companies.

To obtain more insights into these differences, we run multivariate regressions on CARs for the [−2,+2] window. This analysis helps identify which factors affect CARs of CVC investment announcements. Table 7 provides the estimation results based on OLS and the Heckman self-selection two-stage least squares. Under OLS, the sample is restricted to announced investments only. Under the two-stage least squares methodology, the selection equation estimates the probability of deal announcement (logit regressions), while the outcome equation estimates the determinants of CARs for the [−2,+2] window. The selection equation follows the base specification (Model I) in Table 3, using the full sample. The outcome equation (second step) only uses announced deals, similar to the OLS in the first column.

We obtain qualitatively comparable results for OLS and under the two-stage least squares methodology. We find that especially parent companies exhibiting greater information asymmetry problems gain the most from disclosing. This finding is consistent with the previous conclusions about the increased incentives of these parent companies to disclose their CVC investments. Moreover, parents companies active in more competitive industries gain most from disclosing, which is also consistent with our prior findings that they disclose more.

Finally, Table 8 shows robustness along other windows of analysis, following the Heckman methodology. It confirms the robustness of our results obtained for shorter windows: [−10, +10], [−3, +3], and [−4, +2]. The results mentioned above even become larger in magnitude, as evidenced by larger coefficients.

7. Concluding remarks

This paper examines the announcement effects of CVC investments by controlling explicitly for the endogenous nature of the decision to announce such investments. CVC investments by large corporations are a valuable settiVng for testing different theories of voluntary information disclosure because the size of these investments is not a "material event," and thus these investments are not subject to compulsory reporting to the SEC. Moreover, these investments are likely to offer insights into strategic re-orientation of parent companies due to their highly innovative nature.

Consistent with several empirical predictions derived in this study, we find that investments are more likely to be publicly announced if the parent company of the CVC program exhibits higher degrees of information asymmetry, has more growth

Appendix 1
Comparison of the VentureXpert sample and our random sample.

	Characteristics of CVC investments				
	Mean	Median	Std. dev.	Min	Max
Panel A: Full sample					
Round amount	16650.44	10000	30069.91	1.0000	585000
Round number	3.3401	3.0000	2.3841	1.0000	20.0000
Number of investors	4.8081	4.0000	3.4882	1.0000	26.0000
Seed stage	0.0561	0.0000	0.2290	0.0000	1.0000
Early stage	0.2202	0.0000	0.4141	0.0000	1.0000
Expansion stage	0.3641	0.0000	0.4810	0.0000	1.0000
Later stage	0.2633	0.0000	0.4402	0.0000	1.0000
Other stages	0.0970	0.0000	0.2961	0.0000	1.0000
Number of observations	2588				
Panel B: Random sample					
Round amount	16479.28$^{n.s.}$	10000	25964.76	1.0000	460000
Round number	3.4191$^{n.s.}$	3.0000	2.4261	1.0000	20.0000
Number of investors	4.8461$^{n.s.}$	4.0000	3.3922	1.0000	26.0000
Seed stage	0.0482$^{n.s.}$	0.0000	0.2140	0.0000	1.0000
Early stage	0.2230$^{n.s.}$	0.0000	0.4171	0.0000	1.0000
Expansion stage	0.3501$^{n.s.}$	0.0000	0.4772	0.0000	1.0000
Later stage	0.2682$^{n.s.}$	0.0000	0.4430	0.0000	1.0000
Other stages	0.1091$^{n.s.}$	0.0000	0.3120	0.0000	1.0000
Number of observations	1000				

The table shows the descriptive statistics of the CVC characteristics. Panel A shows the statistics for the full sample of CVC from 2002 to 2012 extracted from VentureXpert. Panel B shows the statistics of the random sample during the same period. Panel B also provides significance levels of differences in means tests between values in Panels A and B. Significance levels: ***, **, * indicate 1%, 5%, and 10%, respectively (n.s. for >10%).

Appendix 2
Summary statistics on industry classification of parent companies.

	Mean	Median	Std. dev.	Min	Max
Panel A: Announced deals					
Consumer non-durables	0.0095	0.0000	0.0971	0.0000	1.0000
Consumer durables	0.0127	0.0000	0.1120	0.0000	1.0000
Manufacturing	0.0428	0.0000	0.2025	0.0000	1.0000
Oil, gas, and coal extraction and products	0.0143	0.0000	0.1187	0.0000	1.0000
Chemicals and allied products	0.0206	0.0000	0.1422	0.0000	1.0000
Business equipment	0.5689	1.0000	0.4956	0.0000	1.0000
Telephone and television transmission	0.0919	0.0000	0.2891	0.0000	1.0000
Utilities	0.0032	0.0000	0.0563	0.0000	1.0000
Wholesale, retail, and some services	0.0475	0.0000	0.2130	0.0000	1.0000
Healthcare, medical equipment, and drugs	0.1094	0.0000	0.3123	0.0000	1.0000
Money finance	0.0238	0.0000	0.1525	0.0000	1.0000
Other	0.0555	0.0000	0.2291	0.0000	1.0000
Number of observations	635				
Panel B: Unannounced deals					
Consumer non-durables	$0.0225^{n.s.}$	0.0000	0.1486	0.0000	1.0000
Consumer durables	$0.0028^{n.s.}$	0.0000	0.0531	0.0000	1.0000
Manufacturing	$0.0394^{n.s.}$	0.0000	0.1949	0.0000	1.0000
Oil, gas, and coal extraction and products	$0.0169^{n.s.}$	0.0000	0.1291	0.0000	1.0000
Chemicals and allied products	$0.0085^{n.s.}$	0.0000	0.0917	0.0000	1.0000
Business equipment	$0.4761^{n.s.}$	0.0000	0.5001	0.0000	1.0000
Telephone and television transmission	$0.1408^{n.s.}$	0.0000	0.3484	0.0000	1.0000
Utilities	$0.0113^{n.s.}$	0.0000	0.1057	0.0000	1.0000
Wholesale, retail, and some services	$0.0451^{n.s.}$	0.0000	0.2078	0.0000	1.0000
Healthcare, medical equipment, and drugs	$0.1493^{n.s.}$	0.0000	0.3569	0.0000	1.0000
Money finance	$0.0282^{n.s.}$	0.0000	0.1657	0.0000	1.0000
Other	$0.0592^{n.s.}$	0.0000	0.2362	0.0000	1.0000
Number of observations	365				

This table shows the distribution of our sample by industry using the Fama–French 12 industry classification of parent companies. Panel A shows the distribution of announced investments, and Panel B shows the distribution of unannounced investments. Panel B also provides significance levels of differences in means tests between values in Panels A and B. Significance levels: ***, **, * indicate 1%, 5%, and 10%, respectively (n.s. for >10%).

opportunities, and has lower leverage. Moreover, investments that are still at the seed stage are less likely to be disclosed. In contrast, parent companies active in high-tech industries and in more competitive industries announce their CVC investments less often, consistent with the hypothesis that these factors increase costs related to disclosure. Externally managed CVC programs and investments syndicated with private VC firms are also announced more often. We find that announced investments lead to positive abnormal returns for the stocks of parent companies and especially those with the most severe information asymmetry problems.

More generally, our results stress the endogenous nature of public announcements by listed companies, making them a strategic decision. While listed corporations are required to report "material events," such as acquisitions, by filing an 8-K document at the SEC, other corporate decisions do not need to be reported. Our results support the view that public announcements of investments in innovative startups may indicate important information about the company's future.

Appendix A

See appendix 1 and 2.

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