



Does investor identity matter? An empirical examination of investments by venture capital funds and hedge funds in PIPEs[☆]

Na Dai^{*}

Anderson School of Management, University of New Mexico, Albuquerque, NM 87131, United States

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Abstract

I examine the emerging phenomenon of PIPEs (private investments in public equity) invested by venture capital funds (VCs) and hedge funds (HFs) and analyze whether and how these investors add value to firms by comparing a sample of 113 VC-invested PIPEs to a sample of 397 PIPEs with HFs. I find that VCs gain substantial ownership, request board seats, and often keep their stake after the PIPEs. In contrast, HFs rarely join the board of directors and typically cash out their positions shortly after the PIPE. The stock performance of VC-invested firms is significantly better than HF-invested firms both in the short run and in the long run. The positive valuation effect of having VCs as PIPE investors appears to be a certification effect rather than a monitoring effect. A key implication from these findings is that investor identity matters. © 2007 Elsevier B.V. All rights reserved.

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1. Introduction

Venture capitalists (VCs) are active investors in the small privately held companies they finance, but there is very little information and evidence on VCs' investments in public

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^{*} Tel.: +1 505 277 1328.

E-mail address: dai@mgt.unm.edu.

companies.¹ Assets under management of the hedge fund industry totaled \$1.225 trillion at the end of the second quarter of 2006 according to the recently released data by Hedge Fund Research Inc. (HFR). Given the growing importance of hedge funds (HFs), nevertheless, we know very little about how HFs influence their portfolio firms.

Both HFs and VCs are important players in the emerging PIPE market. In a PIPE offering, investors commit to purchase a certain number of shares from the firm, and the firm, in turn, agrees to file a resale registration statement with the SEC so that investors can resell the shares to the public. The purpose of this study is to provide an overview of characteristics of PIPEs invested by VCs and HFs, investigate whether VCs and HFs add value to the public firms they invested through PIPEs and if yes, whether it is through active monitoring or merely a certification effect.

The investigation helps understanding whether institutional investors, particularly the two non-traditional institutional investors, VCs and HFs, who are often neglected in earlier studies, monitor management and add value to public firms. Recently, the Security and Exchange Commission (SEC) alleged that some PIPE investors have been involved in market manipulation, particularly in cases involving substantial declines in stock price after the PIPE offering.² SEC's investigation sets an alarm for firms that are interested in raising capital through PIPEs. There might be various reasons for the declines in stock price after the transaction. One of them could be investor identity. There are many different types of investors in the PIPE market including HFs and VCs. These investors have different investment objectives, investment horizons, and willingness to monitor the management, which may result in different effects on PIPE firms' performance. In this paper, I compare the performance of firms invested by VCs and HFs to determine whether investor identity plays an important role.

The study also sheds new light on the private placement puzzle documented in earlier literature. The puzzle refers to the positive returns that accompany private placement announcements even though firms often pay investors a substantial discount, and the contrasting negative returns that accompany announcements of seasoned equity offerings (SEOs). Two explanations have emerged for this puzzle, monitoring and undervaluation. [Wruck \(1989\)](#) suggests that the monitoring from private placement investors reduces management entrenchment and adds incremental value to firms. In contrast, [Hertzel and Smith \(1993\)](#) argue that firms forgo SEO and turn to private placement investors because firms believe that they are undervalued. The commitments of private placement investors, who presumably are better informed, signals the market that these firms are undervalued. Both [Wruck \(1989\)](#) and [Hertzel and Smith \(1993\)](#) use change in ownership as proxy for monitoring. Nevertheless, more recent studies, such as [Barclay, Holderness, and Sheehan \(2003\)](#) and [Wu \(2004\)](#), find that private placements of large-percentage blocks of common stock are often made to passive investors that do not monitor the management. These findings raise doubt whether ownership change is an appropriate measure of increased monitoring from PIPE investors. To address this problem, I use board membership of PIPE

¹ See [Barry, Muscarrella, Peavy, and Vetsuypens \(1990\)](#), [Megginson and Weiss \(1991\)](#), [Lerner \(1995\)](#), [Hellmann and Puri \(2000, 2002\)](#), and [Hochberg \(2004\)](#) for work on VC investments in private firms.

² On May 18, 2005, SEC filed a complaint against Hilary L. Shane alleging that Shane committed insider trading and registration violations by short selling securities of CompuDyne Corporation prior to the effective date of the resale registration statement for the PIPE shares. The SEC alleged that before the public announcement of the PIPE offering, Shane began short selling CompuDyne securities and continued short selling CompuDyne shares until she had sold the same number of shares she had been allocated in the PIPE offering. The stock price of CompuDyne declined from \$17.38 before the announcement of PIPE offering to \$12.02 on the first trading day after the resale registration statement for the PIPE shares became effective. Shane covered all of her short sales with the shares she obtained in the PIPE offering, making substantial profits.

investors as a proxy for monitoring and analyze whether it has effects on short-run market reaction to PIPE announcements and long-run stock performance after the PIPE transactions.

Three key findings emerge from the analysis. First, VCs and HFs are very different in terms of their investment horizons and willingness to monitor the management. For example, VCs often request board seats through PIPEs and often keep their stake for longer than one year. In contrast, HFs rarely sit on the board of directors of their portfolio firms and they cash out their positions acquired through PIPEs shortly.

Second, I find the stock performance of firms issuing PIPEs to VCs is much better than that of firms issuing PIPEs to HFs both in the short run and in the long run. The mean (median) four-day cumulative abnormal return (CAR (0,3)) of VC-led PIPEs is 5.6% (3.5%), both significantly more positive than that of HF-led PIPEs. Measured by buy-and-hold abnormal returns (BHAR) relative to equal-weighted market returns, the stock performance of firms issuing PIPEs to HFs deteriorates significantly after the PIPE transaction. In contrast, the BHAR of VC-invested firms improve significantly after the PIPE. The calendar-time Fama–French four factor model analysis also shows that VC-invested firms experience a significantly positive abnormal return in one year following the PIPE, while HF-invested firms have abnormal returns close to zero.

Third, the positive valuation effect of having VCs as PIPE investors seems to be mainly a certification effect instead of a monitoring effect. Additional board seats that VCs request through PIPEs, which is the direct measure of monitoring, are negatively related with CAR (0,3). The change in board seats of PIPE investors also does not affect firm stock performance significantly in the year following the transaction. Furthermore, although the operating performance of VC-invested firms has improved in the fiscal year after the PIPE compared to the fiscal year prior to the PIPE, so has the operating performance of HF-invested firms. The improvements of VC-invested firms are not significantly better than the improvements of HF-invested firms. On the contrary, two measures of how strong the commitments by PIPE investors are, ownership change and holding length, have significantly positive effects on firm stock performance. These findings support the certification hypothesis which argues that the commitments by PIPE investors signal the market that firms turning to PIPEs are undervalued.

The remainder of the paper is organized as follows. Section 2 provides an overview of the PIPE market and the investments by VCs and HFs in this market. Section 3 develops hypotheses. Section 4 discusses the sample and data, summarizes deal characteristics and attributes of firms issuing PIPEs, and analyzes changes in firms' ownership structure and board structure after the PIPE. Section 5 investigates the market reaction during the announcement period and analyzes the determinants of the short-run market reaction to PIPE announcements. Section 6 examines firms' long-run stock performance following the PIPE and firms' operating performance before and after the PIPE. Section 7 provides discussion and conclusion.

2. The PIPE market

According to Sagient Research, which collects data on PIPEs, a total of 5576 PIPE transactions between firms and all types of investors, with a total dollar amount of \$86.8 billion, took place from 1995 to 2003. Over the past several years, PIPEs have received increasing attention from hedge funds and venture capitalists who have traditionally been interested in private companies. In this section, I provide an overview of investments by VCs and HFs in the PIPE market.

A private placement is a private sale of unregistered securities by a public company to a selected group of individuals or institutions. Because the securities sold in a private placement are not registered, they cannot be re-sold into the public market until a registration statement (Form S-1,

SB-2, or S-3) has been filed and declared effective. To compensate for the inability to sell the securities immediately, private placement securities are often issued at a discount or are structured to provide the investors certain protections against decreases in the common stock price.

There are typically three types of private placements based on their legal structures: PIPEs, 144-A Convertible Transactions, and Regulation S transactions.³ Sagient Research, which provides PIPE data for this research, considers PIPEs as any type of Regulation D offering, Shelf Sale, or Equity Line Arrangement. Regulation D is a SEC Rule that allows public companies to issue stock privately to a group of accredited investors without the need for public registration prior to the transaction. Shelf Sales and Equity Line Arrangements actually require a registration statement to be effective prior to the sale of the stock, technically making them public offerings. Consequently, I only consider Regulation D transactions as PIPEs in this paper.

Sagient Research also categorizes PIPEs into traditional PIPEs and structured PIPEs based on whether PIPE investors are price protected. Securities issued in traditional PIPEs typically are common stocks or convertibles with a fixed conversion price. These traditional PIPEs have one fixed price that cannot change or fluctuate regardless of changes in market conditions of the common stock. Securities issued in structured PIPEs are often convertibles with floating conversion prices. In structured PIPEs, prices can be adjusted downward if there is a change in market conditions or fundamental conditions of the company. PIPEs invested by VCs are predominantly traditional PIPEs.

PIPEs are attractive to VCs due to their reasonable returns at a lower risk compared to investment in private firms. Many VCs believe that they can identify undervalued public companies.⁴ Particularly, some young public firms were taken to the public market during the 1999–2000 bubble period prematurely and had fallen on bad times, but retained promising business prospects and growth potential. To VCs, investments in these firms are natural extensions of their traditional investments in pre-IPO stage private firms. On the other hand, PIPEs are less risky than traditional venture investments in private firms. These firms are more likely to turn a profit than early-stage startups, and they are likely to have more seasoned, professional management. Furthermore, PIPEs provide better liquidity than traditional venture investments. VCs are able to resell their stake in the public market after the registration statement is filed with the SEC and declared effective.

As shown in [Table 1](#), a total of 659 PIPE transactions between 1995 and 2003 involved venture capital, with a total dollar amount of \$7.4 billion, or about 8.6% of the PIPE market. PIPEs have become popular for VCs since 1999. In 1999, the number of VC-invested PIPEs was more than twice that in 1998; the dollar amount of VC-invested PIPEs in 1999 was 10 times the amount invested in 1998, five times the total amount invested from 1995 to 1998; the percentage of VC-invested PIPEs out of the total PIPE market increased from 4.2% in 1998 to 11.2% in 1999.

³ 144-A transactions are private convertible debt or convertible equity offerings that allow the investors to resell their securities to other Qualified Institutional Buyers (QIB's) without registration. Normally 144-A transactions are larger in size than PIPE placements and are normally sold by the issuer to a financial intermediary and then resold by that financial intermediary to a group of QIB's. QIB's are larger institutions that have over \$1 B under management. Regulation S is a form of private offering involving only non-U.S. investors. Since 1997, Regulation S offerings have become less used because of changes to SEC regulations covering such offerings and because of the increase in popularity of PIPEs offerings.

⁴ The following citations are from *Daily Deal*, September 28, 2002. "We are definitely looking at these deals (PIPEs), particularly now that markets have caused an overreaction and lowering in the valuation of some good companies," said Tony Abate, a general partner with Battery Ventures. "It is a great time to be an investor in these types of deal (PIPEs) because you have quite a few companies that have advanced technologies that have taken a significant valuation hit because of the state of the capital markets," said Farah Champsi, a managing director with Alta.

Table 1
Summary statistics

Panel A: number of PIPE transactions 1995–2003

Year	Total number of firm-PIPE events	Number of VC-invested PIPEs	Percentage	Number of HF-invested PIPEs	Percentage
1995	114	7	6.1	43	37.7
1996	306	27	8.8	155	50.7
1997	448	49	10.9	268	59.8
1998	428	38	8.9	269	62.9
1999	676	98	14.5	333	49.3
2000	1,105	148	13.4	471	42.6
2001	896	121	13.5	358	40.0
2002	710	65	9.2	291	41.0
2003	893	106	11.9	504	56.4
1995–2003	5,576	659	11.8	2,692	48.3

Panel B: amount of capital invested in PIPEs 1995–2003

Year	Total amount invested (M)	Amount invested by VCs (M)	Percentage	Amount invested by HFs (M)	Percentage
1995	\$1334	\$6	0.5	\$186	13.9
1996	\$4101	\$41	1.0	\$883	21.5
1997	\$4747	\$100	2.1	\$1692	35.6
1998	\$2999	\$127	4.2	\$1240	41.4
1999	\$10,259	\$1145	11.2	\$2014	19.6
2000	\$24,090	\$3429	14.2	\$3788	15.7
2001	\$14,285	\$1058	7.4	\$2460	17.2
2002	\$12,258	\$503	4.1	\$2127	17.3
2003	\$12,677	\$1038	8.2	\$3219	25.4
1995–2003	\$86,750	\$7447	8.6	\$17,768	20.5

Panel A shows the number of PIPE transactions from 1995 to 2003. Panel A also shows the number of PIPE transactions invested by VCs and HFs from 1995 to 2003. Panel B shows the amount of capital invested in PIPEs from 1995 to 2003. Panel B also shows the amount of capital invested by VCs and HFs in PIPEs from 1995 to 2003. The data are from Sagient Research.

HFs are the predominant player in the structured PIPEs and also an important player in the traditional PIPEs. As shown in Table 1, a total of 2692 PIPE transactions between 1995 and 2003 involved hedge funds, with a total dollar amount of \$17 billion, or about 20.5% of the PIPE market.

Both VCs and HFs seem to concentrate their investments on a few industries, such as Pharmaceutical Products, Business Services, Medical Equipment, Communication, Computers, etc.⁵

3. Hypotheses

In this section, I develop hypotheses on whether and how VCs and HFs may add value to firms through PIPEs.

⁵ Fama–French 48 Industry definitions are used to define the industry of each PIPE firm. The five industries listed here are the top five industries that VCs and HFs invest through PIPEs according to the number of PIPE transactions.

This is the first study which directly examines whether HFs monitor and add value to their portfolio firms. On the other hand, extant literature on VC investments in private firms have documented that VCs add value to firms either through their certification of firm value, or advising and monitoring the entrepreneurs. It is expected that the public firms will benefit from VCs' either certification or monitoring if VCs play a similar role in these firms. Nevertheless, which function, certification or monitoring, is predominant is among the hottest debates. In the setting of VC-invested PIPEs, I test the monitoring hypothesis and the certification hypothesis to shed some light on this issue.

The monitoring hypothesis and the certification hypothesis are also examined in the private placement literatures, however, without appropriate measures of monitoring, it is not clear which hypothesis the empirical evidence supports so far.⁶ Given the availability of the data on how many board seats that VCs and HFs take through PIPEs, I have a more direct measure of monitoring, which helps differentiating the two hypotheses.

3.1. Monitoring

It is well documented that VCs are active investors in the small privately held companies they finance. VCs sit on the boards of directors, provide advice, and hire key managers. The extant literature documents that this active role of VCs in small privately held firms contributes to better stock price performance and operating performance of VC-backed firms in the long run after they go public.⁷ If VCs also actively advise and monitor the management of firms issuing PIPEs, they may also be able to add value to the public firms.

Some hedge funds seem to be quite active in both corporate governance and corporate control according to some media reports.⁸ Nevertheless, it is an open question whether most of the hedge funds are active investors or passive investors.

I gauge whether VCs or HFs actively monitor the management after the PIPE with *board seats change* after the PIPE. If VCs or HFs assign representatives to the board of the firm, they have more power to affect firms' strategic decision and reduce the entrenchment of the management. If the monitoring adds value to the firm, either by reducing management entrenchment, by helping the management develop better business strategies, or by bringing new networks which may help the business of the firm, it is expected that the short-run market reactions to the PIPEs invested by active investors should be positive and more positive than PIPEs invested by passive investors. The operating performance of the firm invested by active investors should also improve and improve more than the firm invested by passive investors after the PIPE under the monitoring hypothesis.

⁶ Typically, ownership concentration or ownership change is used as measures for monitoring in previous studies. However, recent studies have shown that most PIPE investors are passive investors even though they purchase a block stake through PIPE, which suggests those variables may not be measuring monitoring.

⁷ See Barry, Muscarella, Peavy, and Vetsuypens (1990), Megginson and Weiss (1991), Lerner (1995), Hellmann and Puri (2000, 2002), Brav and Gompers (1997), Hochberg (2004), and Ivonav and Xie (2005), for example.

⁸ Kahan and Rock (2006), "Hedge funds have pressured McDonalds to spin-off major assets in an IPO; asked Time-Warner to change its business strategy; threatened or commenced proxy contests over H.J. Heinz, Massey Energy, KT&G, infoUSA, Sitel, and GenCorp; pushed for a merger between Euronext and Deutsche Boerse; pushed for changes in management and strategy at Nabi Biopharmaceuticals; opposed acquisitions by Novartis of the remaining 58% stake in Chiron, by Sears holdings of the 46% minority interest in Sears Canada, by Micron of Lexar Media, and pushed for litigation against Calpine that lead to the ouster of its top two executives." For original sources of the reports of these events, also see Kahan and Rock (2006).

3.2. Certification

Another important role of VCs documented in the extant literature is their certification for the small and young private firms with severe information asymmetries. For example, [Megginson and Weiss \(1991\)](#) report that VC-backed firms experience lower IPO underpricing. On their view, VC participation signals a higher quality of the firm, attracting better underwriters and more analyst coverage.⁹ Earlier research suggests that firms issuing private placements are often small and young.¹⁰ The reputation of VCs as value-adding investors that invest for the long-term purpose signals that the firm is undervalued.

Investments by HFs may also help reducing the information asymmetry and signal the market that the firm is undervalued. On the other hand, HFs may be simply targeting for the discounts they are able to get in PIPEs and sell their shares immediately after the effective date of the registration statement or even short sell before that to clean their long positions that they acquired through PIPEs. These two possibilities will have different effects on firm stock performance.

I use two measures to gauge the certification effect of PIPE investors, ownership change and how long investors keep their stake after the PIPE transaction. A larger stake that investors purchase through the PIPEs should be a stronger signal to the market that they believe that firms are undervalued. Similarly, the longer the investors keep their stake after the PIPE transaction, the stronger the signal to the market of investors' confidence in the firm. Therefore, according to the certification hypothesis, it is expected that investor ownership change and how long they keep their stake should be positively related to the valuation of the firms.

4. Sample and data

This section describes the sample used in this paper and provides summary statistics about characteristics of VC-led PIPEs and HF-led PIPEs. I then examine firm ownership structure and board structure before and after the PIPE.

4.1. Sample

I match the 659 VC-invested PIPE events to CRSP data to obtain information on firm stock prices around the PIPE transactions. Following standard practice, I exclude 15 firm-PIPE events related to financial firms (SICs 6000–6999) and regulated utilities (SICs 4900–4999). I further exclude 202 firm-PIPE events where firms' stock prices during one year before and one year after the PIPE are missing on CRSP. In order to examine the change in firm operating performance around the PIPEs, I match the remaining 442 VC-invested PIPE events to COMPUSTAT data. I further exclude the 82 firm-PIPE events where firms' financial data one year before the PIPE are not reported by COMPUSTAT. The main purpose of this paper is to examine whether VCs are actively involved in firm management and thus influence firm performance after the PIPE. Therefore, I focus on the PIPEs where the securities purchased are common stock and convertible preferred stock, or traditional PIPEs, and PIPEs where VCs are

⁹ [Lee and Wahal \(2004\)](#) find that VC-backed firms do not have lower underpricing than non-VC-backed firms after controlling the endogeneity problem.

¹⁰ [Wruck \(1989\)](#), [Hertzel and Smith \(1993\)](#), [Wu \(2004\)](#), [Brophy, Ouimet, and Sialm \(2005\)](#), etc.

Table 2
Deal characteristics of PIPEs

	VC-led PIPEs		HF-led PIPEs		Difference	
	Mean	Median	Mean	Median	Mean	Median
Gross proceeds (M)	\$45.3	\$14.6	\$12.6	\$8.1	\$30.7**	\$6.5***
Proceeds from VC(HF) (M)	\$35.8	\$6.6	\$9.3	\$6.0	\$26.5*	\$0.6
Fraction placed	22.1%	16.7%	12.1%	10.6%	10.0%***	6.1%***
Discount	3.0%	6.2%	15.4%	14.8%	–12.4%***	–8.6%***
Fraction with premium	33.6%		12.8%		20.8%***	
N	113		397			

The sample consists of 113 VC-led PIPE transactions and 397 HF-led PIPE transactions during the period from 1995 to 2003. Fraction placed is measured as the ratio of shares placed to the total shares outstanding after the placement. Discount is measured as the percentage difference between offer price and the stock price on the closing day. It is negative if a premium actually is paid to firms. *P*-value is 2-tailed. ***, **, * represent that the result is statistically significant at 1%, 5%, and 10% levels, respectively.

the lead investors.¹¹ I determine whether VCs are the lead investors according to the percentage of shares they buy in each PIPE deal.¹² If the VC or the syndicate of the VCs buys the largest percentage of shares in the firm-PIPE event, this firm-PIPE event is counted as a VC-led PIPE. Among the 360 firm-PIPE events involving VCs, 120 firm-PIPE events are identified as VC-led PIPEs. To avoid the overlapping problem in long-run event studies, I exclude seven firm-PIPE events which involve the same firm in less than one year. After using the above filters, I have a sample of 113 PIPEs where VCs are the lead investors.

Following the similar filters, I get 397 HF-led traditional PIPEs.¹³

For the 113 VC-led PIPEs and 397 HF-led PIPEs, I collect information about the incremental percentage of ownership and board seats VCs or HFs obtain from the PIPE investment, how long VCs or HFs keep their shares, whether VCs were already investors when the firm was still private by looking through prospectuses, proxy statements, S-3s, 8-Ks, 10-Qs, and 10-Ks.

4.2. Deal characteristics and firm characteristics

Table 2 shows the characteristics of the 113 PIPEs led by VCs in comparison with the 397 PIPEs led by HFs. The mean (median) proceeds for VC-led PIPEs are \$45.3 (14.6) million, significantly larger than the mean (median) capital raised in HF-led PIPEs, which is about \$12.6 (8.1) million.¹⁴ The fraction placed is measured as the percentage of shares issued

¹¹ Venture capital funds often syndicate in the PIPE transactions as they do in investments in private firms. However, they are often alongside hedge funds and distressed funds in PIPE transactions, who are another two big players in the PIPE market. If venture capitalists are not the leading investor, their influence on firms might be tiny, or contaminated by completely different behaviors of hedge funds and distressed funds.

¹² The shares that each investor buys are disclosed in stock purchase agreement or S-3, which are available from the SEC.

¹³ See Appendix for the filters that I use to get the control sample.

¹⁴ It is also larger than what is found in earlier studies about private placement. For example, Wruck (1989) finds a mean proceeds of \$31.46 million using a sample of private placement from 1979 to 1985; Hertzel and Smith (1993) find a mean proceeds of \$11.38 million using a sample of private placement from 1980 to 1987; Brophy, Ouimet, and Sialm (2005) find that a mean proceeds of 14.7 million using a sample of PIPEs from 1995 to 2002.

Table 3
Characteristics of firms issuing PIPEs

	VC-led PIPEs		HF-led PIPEs		Difference	
	Mean	Median	Mean	Median	Mean	Median
ME (M)	\$257	\$63	\$137	\$72	\$120*	\$–9
Assets (M)	\$159	\$39	\$161	\$30	\$–2	\$9*
Sales (M)	\$74	\$14	\$70	\$15	\$4	\$–1
Firm age	11.8	9.0	13.5	12.0	–1.7	–3.0***
Years from IPO	5.4	4.0	7.1	6.0	–1.7***	–2.0***
OIBD/assets	–42.3%	–33.7%	–39.4%	–27.2%	–2.9%*	–6.5%*
ROA	–64.2%	–48.3%	–58.8%	–39.3%	–5.4%*	–9.0%*
M/B	6.6	3.6	6.3	2.8	0.3	0.8
N	113		397			

The sample consists of 113 VC-led PIPE transactions and 397 HF-led PIPE transactions during the period from 1995 to 2003. Market value of equity is measured 30 days prior to the announcement and is from CRSP. M/B is the ratio of market value of equity to the book value of equity in the end of fiscal year prior to announcement. Assets, sales, and M/B are from Compustat. Firm age and years from IPO are from Jay Ritter's website. *P*-value is 2-tailed. ***, **, * represent that the result is statistically significant at 1%, 5%, and 10% levels, respectively.

through the PIPE out of the total shares outstanding after the PIPE. On average, about 22% of the total shares outstanding are sold in VC-led PIPEs; the median is 17%. Both the mean and the median are significantly larger than those of HF-led PIPEs. I measure the discount as the percentage difference between the stock price on the closing date and the offer price.¹⁵ The mean (median) discount of VC-led PIPEs is 3.0% (6.2%), significantly lower than the mean (median) discount of HF-led PIPEs, which is 15.4% (14.8%). Firms receive a premium instead of giving VCs a discount in 34% of VC-led PIPEs. In contrast, only in 13% of HF-led PIPEs, firms receive a premium. The difference is statistically significant.

In Table 3, I compare the characteristics of firms issuing PIPEs to VCs to those of firms issuing PIPEs to HFs. More specifically, I examine firm size, age, profitability, and growth opportunity. The mean market value of equity 30 days before the announcement is \$257 million, significantly larger than the mean of HF-led PIPEs, which is \$137 million.¹⁶ The values of assets and sales in the fiscal year prior to the PIPE of VC-invested firms are close to those of HF-invested firms. Most of the firms are quite young either in terms of age (counting from the incorporation date) or the number of years since the IPO. Firms invested by VCs are even younger than firms invested by HFs. For firms invested by VCs, the mean (median) age is 12 (9) years and the mean (median) years since IPO is 5 (4). For firms invested by HFs, the mean (median) age is 14 (12) and the mean (median) years since IPO is 7 (6). Firms typically have poor profitability before the PIPE. VC-invested firms have significantly lower OIBD/assets and ROA than HF-invested firms in the fiscal year prior to the PIPE. Both VC-invested firms and HF-invested firms have high M/B ratios. The difference between the two groups is not significant. These findings suggest that companies

¹⁵ Hertz and Smith (1993) calculate the discount as the difference between offering price and the price 10 days after the announcement date. In PIPEs, the security purchase price is determined according to stock prices during a benchmark period, which is often 5 to 10 days before the close of the transaction. Discount measured as the difference between the purchase price and stock price before the announcement date is a better reflection of how the discounts are determined in the industry.

¹⁶ The mean market value of equity 30 days before announcement of the sample firms in Wruck (1989) is \$233.7 million. Brophy, Ouimet, and Sialm (2005) report the mean (median) market value of equity of all firms that issue PIPEs to all types of investors during 1995 to 2002 is \$183.7 (50.1) million. In Hertz and Smith (1993), the mean market value of equity of the sample firms is \$94.7 million.

issuing PIPEs, in general, are small and young firms with high growth opportunities but poor profitability. VC-invested firms are often younger and less profitable than HF-invested firms.

4.3. Ownership structure and board structure before and after the PIPE

It is well known that VCs actively advise and monitor the management in their private portfolio firms, in addition to providing capital. It seems plausible that VCs might also play an active role in public firms that they select to invest in through PIPEs. To examine whether VCs actively monitor the management, I examine the change in firm ownership structure before and after the PIPE, the change in board structure before and after the PIPE, and how long VCs keep their stake. Again, these characteristics are compared to those of firms invested by HFs. The results are shown in Table 4.

Table 4
Ownership structure and board structure before and after PIPE

	VC-led PIPEs		HF-led PIPEs		Difference	
	Mean	Median	Mean	Median	Mean	Median
<i>Panel A: ownership structure before and after PIPE</i>						
CEO pre-PIPE ownership	5.3%	2.9%	8.1%	4.2%	−2.8%***	−1.3%***
CEO post-PIPE ownership	4.5%	2.4%	12.1%	3.6%	−7.6%*	−1.2%***
Blockholder pre-PIPE ownership	25.8%	21.4%	20.6%	16.0%	5.2%	5.4%***
Blockholder post-PIPE ownership	24.8%	18.8%	22.1%	12.5%	2.7%	6.3%***
VC(HF) pre-PIPE ownership	8.0%	0.0%	0.5%	0.0%	7.5%***	0.0%***
VC(HF) post-PIPE ownership	20.0%	13.0%	9.4%	7.6%	11.0%***	5.4%***
Change in VC(HF) ownership	12.0%***	13.0%***	8.9%***	7.6%***	3.5%***	5.4%
Ownership concentration pre-PIPE	859	544	595	365	264**	180***
Ownership concentration post-PIPE	1030	649	529	298	500***	351***
<i>Panel B: board structure before and after PIPE</i>						
Board size pre-PIPE	7.2	7	6.5	6	0.7***	1***
Board size post-PIPE	7.4	7	6.5	6	0.9***	1***
VC(HF) pre-PIPE board seats	0.5	0	0	0	0.5***	0***
VC(HF) post-PIPE board seats	1.0	1	0	0	1.0***	1***
VC(HF) board seats change	0.5***	1***	0	0	0.5***	1***
VC(HF)board seats as percentage of board size pre-PIPE	7.4%	0.0%	0.1%	0.0%	7.3%***	0.0%***
VC(HF)board seats as percentage of board size post-PIPE	12.9%	12.5%	0.5%	0.0%	12.4%***	12.5%***
Change in VC(HF) board seats as percentage of board size	5.5%***	12.5%***	0.4%	0.0%	5.1%***	12.5%***
VC(HF) have board seats before PIPE	37.2%		0.5%		36.7%***	
VC(HF) have board seats after PIPE	67.3%		3.0%		64.3%***	
<i>Panel C: investment length</i>						
Holding length (days)	898	749	157	0	741***	749***
Holding length is more than one year	71.0%		14.0%		57.0%***	
Holding length is more than two years	46.9%		7.1%		39.8%***	

All the information about firm ownership structure and board structure are collected from Lexis/Nexis news reports, 8-Ks, 10-Qs, 10-Ks, and proxy statements before and after the PIPE announcement. Insider is defined as all the directors and key executives. Ownership concentration is measured by the Herfindahl Index of the block holder ownership (greater than or equal to 5%). Holding length is measured as the days between the closing date and the date that VCs or HFs exit, indicated by whether the name of VCs or HFs disappears from the list of large shareholder in the proxy statements. *P*-value is 2-tailed. ***, **, * represent that the result is statistically significant at 1%, 5%, and 10% levels, respectively.

Table 4 Panel A shows the CEO ownership, the insider ownership, the PIPE investor ownership, and ownership concentration before and after the PIPE for both VC-invested and HF-invested firms. The insider ownership is the aggregate stake held by all directors and executive officers as a group. Ownership concentration is measured as the sum of the squared ownership of large shareholders (who hold more than or equal to 5%). Changes in the CEO ownership, insider ownership, and ownership concentration in either VC-invested firms or HF-invested firms are not statistically significant. In about 31% of the VC-invested firms, VCs also invested in the firm before the IPO. Some of them have exited completely and others still have some stake in the firm before the PIPE. The mean (median) VC ownership before the PIPE is 8% (0%). For the HF-invested firms, I do not find cases where HFs also invested in the firm before the IPO. For both VC-invested firms and HF-invested firms, the ownership by the lead investor of the PIPE increases significantly after the PIPE, but VCs request significantly more ownership through the PIPE than HFs and VCs hold a larger block stake than HFs after the PIPE. The mean (median) VC ownership after the PIPE is 20% (13%). The mean (median) HF ownership after the PIPE is 9.4% (7.6%). **Table 4** Panel A also shows that VC-invested firms have a more concentrated ownership structure, however, their CEOs hold a smaller fraction of the firm than CEOs of HF-invested firms both before and after the PIPE.

In **Table 4** Panel B, I examine the change in board structure of the firm before and after the PIPE. VCs commonly request at least one board seat through the PIPE. Before the PIPE, VCs own board seats in 37% of the firms and after the PIPE VCs own board seats in 67% of the firms. Before the PIPE, VCs have 0.5 (0) board seats on average (at median). After the PIPE, VCs have 1 (1) board seats on average (at median). The changes in both mean and median are statistically significant at the 1% confidence level. To control the effect of board size, I calculate the number of board seats by VCs as a percentage of board size. I find this number also increases significantly in VC-invested firms after the PIPE. In contrast, HFs rarely sit on the board of directors either before or after the PIPE.

In **Table 4** Panel C, I further examine how long VCs (HFs) keep their stake after the PIPE. I determine the holding length by examining whether the investor still hold some ownership as disclosed in the proxy statements right after the PIPE and in one, two, or three years after the PIPE. For cases where investors cash out their stake before the closest proxy statement, I define the holding length as zero. The mean (median) holding length of VCs is 898 (749) calendar days, significantly longer than the mean (median) holding length of HFs, which is 157 (0) days. In about 71% of VC-led PIPEs, VCs keep their stake for more than one year; in about 46.9% of VC-led PIPEs, VCs keep their stake for more than two years. On the contrary, only in 14% of HF-invested PIPEs, HFs keep their stake for more than one year and only in 7% of HF-invested PIPEs, HFs keep their stake for more than two years.

As shown in **Table 4**, VCs hold a substantial stake of the firm and sit on the board of the firm after the PIPE. Furthermore, they often keep their stake for a long period. Therefore, VCs have the control power to affect the management after the PIPE. In contrast, HFs rarely sit on the board of the firm and often exit from their investment shortly after the PIPE even though they also obtain a block stake through the PIPE. These findings confirm two notions. First, change in ownership, which is often used in previous studies on private placement puzzle, is not an appropriate measure for monitoring. Second, not all PIPE investors are passive investors as suggested by [Barclay, Holderness, and Sheehan \(2003\)](#); investor identity matters.

5. Market reaction to PIPE announcements

In this section, first, I examine how the market reacts to the PIPE announcements by doing the short-run event studies. Second, I analyze the factors influencing the short-run market reactions to the PIPE announcements.

Table 5

Cumulative abnormal returns around PIPE announcement

N			(−29,−10)	(−9,0)	(0,3)	(1,10)	(1,30)
			(%)	(%)	(%)	(%)	(%)
VC-led PIPEs	113	Mean	4.9	4.5*	5.6***	3.6	5.3
		Median	−0.2	2.9	3.5***	1.3	2.9
HF-led PIPEs	397	Mean	4.6***	2.7**	−1.2	−2.1*	−5.0***
		Median	0.3	0.1	−1.9	−2.8**	−4.1***
Difference		Mean	0.5	1.6	6.8***	5.7***	9.9**
		Median	−0.5	2.8	5.4***	4.1**	6.5**

The sample consists of 113 VC-led PIPE transactions and 397 HF-led PIPE transactions during the period from 1995 to 2003. Cumulative abnormal returns (CAR) are estimated using a market model with an estimation window (−149, −60). CRSP equally weighted index is used as a proxy for market return. *P*-value is 2-tailed. ***, **, * represent that the result is statistically significant at 1%, 5%, and 10% levels, respectively.

5.1. Announcement period performance of firms that issue PIPEs

Table 5 reports mean cumulative abnormal returns (CAR) for issuing firms around PIPE announcements. Abnormal returns are measured using a market model. The estimation period is 90 trading days before day −60. The mean (median) CAR (0,3) of VC-led PIPEs is 5.6% (3.5%), significantly different from zero and significantly larger than the mean (median) CAR (0,3) for HF-led PIPE, which is −1.2% (−1.9%). More interestingly, as shown in Fig. 1, CAR of VC-led PIPEs keeps going up after the PIPE announcement. In contrast, CAR of HF-led PIPEs turns south after it hits the peak point at the announcement date.

5.2. The determinants of short-run market reaction to PIPE announcement

5.2.1. Variables of interest

In this section, I test the hypotheses using cross-sectional regressions of CAR (0,3).¹⁷

I use four groups of independent variables in the cross-sectional regressions. The first group is the variable that serves as a proxy for investor identity, *VC indicator variable*, which is equal to 1 if the lead investor is VC. The summary statistics has suggested that VCs and HFs seem to have different investment objectives. VCs are more interested in firm fundamentals and usually keep their stake much longer than HFs, while HFs seem to be more interested in short-term trading profits from PIPE transactions. If the market is able to recognize the different roles of VCs and HFs, there should be different market reactions to the PIPE announcements.

The second group of independent variables control for the deal characteristics of the PIPE transaction, including fraction placed, the logarithm of gross proceeds, and discount. *Fraction placed* is measured as the ratio of shares placed to the total shares outstanding after the PIPE. The larger the fraction placed, the stronger the signal to the market that the issuing firm is undervalued.

¹⁷ According to Wruck (1989), the announcement period abnormal return, or CAR, has two components. One component is the abnormal return resulting from new information or an anticipated reallocation of resources that changes the market's assessment of the firm's net present value. The other component is the abnormal return representing any compensation to the purchaser for contributions to firm value or for promoting entrenchment. Therefore, using CAR as an estimate of the value of information understates that value if the purchaser receives a discount and overstates it if the purchaser pays a premium. I am interested in the net value-added by the PIPE investors in addition to the compensation to them, which is what the CAR measures.

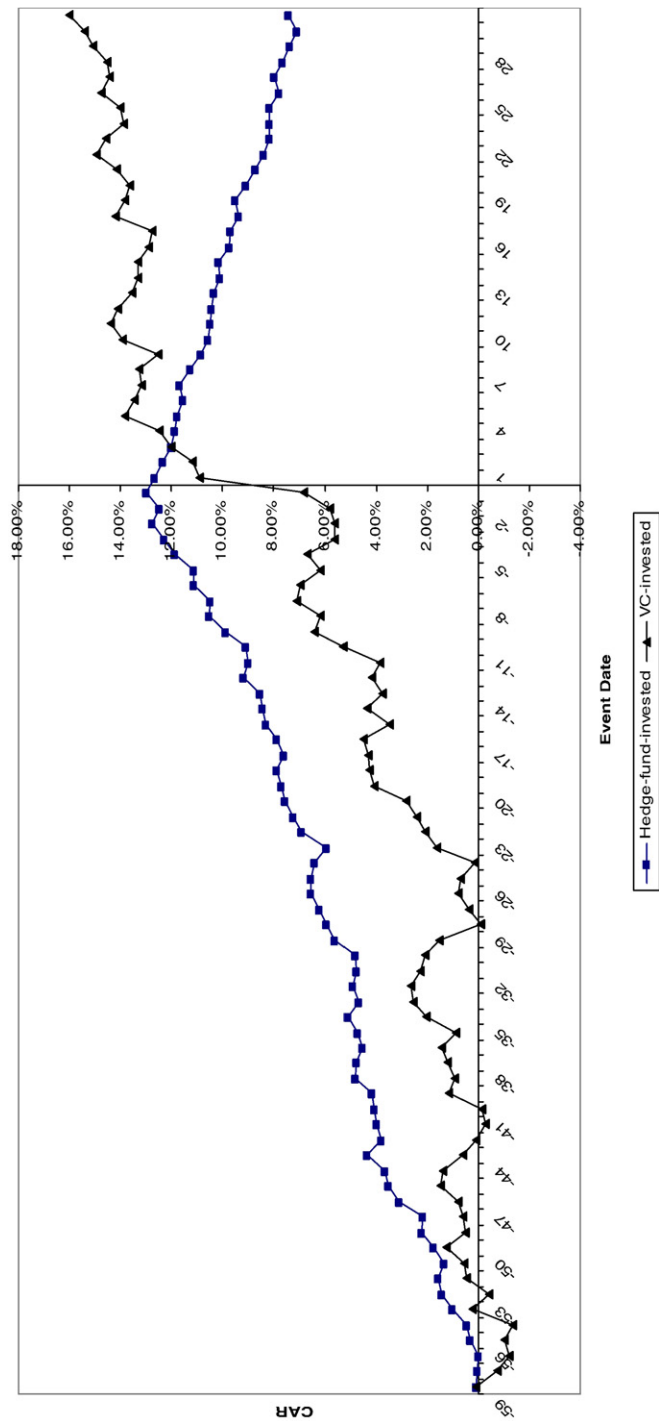


Fig. 1. CAR of event firms during (-59, 10).

Table 6
Cross-sectional regressions of CAR

Panel A: determinants of CAR					
	1	2	3	4	5
Intercept	0.045 (0.728)	0.062 (0.653)	0.078 (0.547)	0.087 (0.504)	0.080 (0.562)
VC			0.034* (0.080)	−0.005 (0.861)	−0.012 (0.676)
Fraction placed	0.242*** (0.005)	0.171* (0.100)	0.199** (0.023)	0.170 (0.124)	0.167 (0.136)
Ln(proceeds)	0.008 (0.494)	0.012 (0.302)	0.007 (0.512)	0.009 (0.423)	0.013 (0.245)
Discounts	−0.156*** (0.0001)	−0.161*** (0.0001)	−0.142*** (0.0001)	−0.129*** (0.0001)	−0.155*** (0.0001)
Distressed	−0.009 (0.555)	0.002 (0.902)	−0.013 (0.397)	−0.012 (0.248)	−0.0002 (0.992)
M/B	0.0001 (0.770)	0.0001 (0.800)	0.0001 (0.762)	0.0001 (0.813)	0.00004 (0.857)
Ln (ME)	−0.009 (0.372)	−0.014 (0.191)	−0.011 (0.298)	−0.012 (0.248)	−0.016 (0.149)
Lead investor ownership change		0.034 (0.792)		−0.122 (0.469)	−0.165 (0.350)
VC ownership change				0.394** (0.025)	0.419** (0.023)
Lead investor board seats change		0.044 (0.115)			0.029 (0.491)
VC board seats change					−0.018 (0.690)
<i>N</i>	510	442	510	510	442
<i>F</i>	8.98	6.5	8.17	7.09	5.38
<i>R</i> -square (%)	10.57	10.73	11.17	12.35	12.12
Adjusted <i>R</i> -square (%)	9.39	9.08	9.8	10.61	9.87

Panel B: robust check

	First stage Dependent variable=VC	Second stage Dependent variable= CAR (0,3)
Intercept	−6.668*** (0.003)	0.070 (0.585)
Ln(ME)	0.237** (0.049)	−0.012 (0.249)
M/B	−0.004 (0.611)	0.0001 (0.672)
Distressed	0.809** (0.010)	−0.019 (0.231)
Ownership before	2.896*** (0.000)	
Fraction placed		0.207** (0.017)
Ln(proceeds)		0.009 (0.429)
Discounts		−0.146*** (0.000)

(continued on next page)

Table 6 (continued)

Panel B: robust check

	First stage	Second stage
	Dependent variable=VC	Dependent variable=CAR (0,3)
phat		0.078** (0.046)
Industry fixed effect	YES	
N	510	510
Likelihood ratio	20.42	
Wald	17.06	
F		8.32
R-square (%)		11.35
Adjusted R-square (%)		9.98

Panel A analyzes determinants of CAR. The dependent variable is CAR (0,3). VC is an indicator variable which is equal to one if the lead investor is a VC fund, or zero if the lead investor is a hedge fund. Fraction placed is measured as the ratio of shares placed to the total shares outstanding after the placement. Discount is measured as the percentage difference between offer price and the stock price on the closing date. Ln(ME) is the logarithm of the market capitalization 30 days before the announcement date. Distressed is an indicator variable which is equal to one if the firm has negative OIBD during the two years prior to the PIPE transaction. M/B is the ratio of market value of equity to the book value of equity in the end of fiscal year prior to announcement. Lead investor ownership change is the change in ownership after the PIPE transaction. VC ownership change is an interaction term of VC dummy and lead investor ownership change. Lead investor board seats change is an indicator variable which is equal to 1 if the lead investor requests one or more board seats through PIPE. VC investor board seats change is an interaction term of VC dummy and lead investor board seats change. Panel B adopts the instrumental variable approach to control the endogeneity. In the first stage regression, the dependent variable is VC dummy. The independent variables include Ln(ME), M/B, Distressed dummy, Ownership before dummy, which is equal to 1 if the PIPE investor had stake in the firm before the PIPE transaction. I also control industry effect in the first-stage regression. In the second-stage regression, the dependent variable is CAR (0,3). The independent variables are the same with the ones used in regression 3 in Panel A. The only difference is that instead of using VC dummy directly, I use phat which is the estimated probability that a firm will be invested by VCs from the first-stage regression. *P*-value is 2-tailed. ***, **, * represent that the result is statistically significant at 1%, 5%, and 10% levels, respectively.

Discount serves as an additional control variable proxying for the cost of the PIPE offering. Discount is measured as the percentage difference between the offering price and the stock price on the closing date. It represents the compensation to the PIPE investors for the costs that they assume, including the cost of collecting and analyzing the information about the firm quality, the cost of taking risk to invest in firms with a record of poor performance, or the cost of actively monitoring the management. If the market believes that the firm is paying too much to PIPE investors, CAR should be smaller or even negative.

The third group of variables control for the characteristics of firms issuing PIPEs. Those proxies include (a) firm size, measured as the logarithm of market value of equity 30 days prior to the PIPE announcement; (b) growth opportunity, measured as the M/B at the end of the fiscal year prior to the PIPE; (c) profitability, represented by a distressed indicator variable equal to 1 if the firm has two consecutive years of negative OIBD prior to the PIPE.

Finally, I use four measures as proxies for the ownership structure and board structure of the issuing firm: (a) *lead investor ownership change*, (b) *VC ownership change*, (c) *lead investor board seats change*, and (d) *VC board seats change*. Lead ownership change is the stake that VC or HF requests through the PIPE. The larger stake that PIPE investors obtain through the PIPE, the stronger signal to the market that firms issuing PIPEs are undervalued. Consequently, lead investor ownership change should be positively related with CAR. Lead investor board seats

change is an indicator variable which is equal to 1 if the lead investor requests one or more board seats through PIPEs. This measure is the direct proxy for monitoring by the PIPE investors after the PIPE. It is expected to be positively related with CAR according to the monitoring hypothesis. VC ownership change is an interaction term between the VC indicator variable and lead investor ownership change. VC board seats change is an interaction term between lead investor board seats change and VC indicator variable.

5.2.2. Regression results

Table 6 contains the ordinary least squares (OLS) analysis of CAR (0,3).

Discounts has a significantly negative effect on CAR, which makes sense since the larger the discounts that the PIPE investors receive, the larger the cost of PIPE to the existing shareholders. Fraction placed has a significantly positive effect on CAR, consistent with Hertz and Smith (1993).

The VC dummy is positively related with CAR, suggesting that the market does differentiate VCs and HFs. The positive effects of having VCs as PIPE investors are captured by VC ownership change in the fourth and fifth regressions in Table 6. The significantly positive effect of VC ownership change on CAR and the negligible effect of hedge fund ownership change on CAR further suggest that investor identity is critical for whether and how much existing shareholders are able to benefit from the PIPE transactions.

Neither Lead investor board seats change nor VC board seats change has a significant effect on short-run market reactions to PIPE announcement, which is inconsistent with the prediction of the monitoring hypothesis.

To sum up, the two most important factors that determine the short-run market reaction are the cost of PIPE transactions, which is measured by discounts, and investor identity, which is captured by the VC dummy and VC ownership change. The cost of PIPE transaction decreases CAR, while having VCs as PIPE investors increases CAR. Furthermore, the larger the stake that VCs take, the more positively the market reacts.

5.2.3. Robust check

It remains, however, to address the endogeneity problem that arises from the selection issue of who receives venture capital in the first place. The better stock performance of VC-invested firms may be simply due to VCs' better selection ability. I use the instrumental variable approach to control the endogeneity issue.

In the first-stage regression, the VC dummy is the dependent variable. The independent variables include (a) firm size, measured as the logarithm of market value of equity 30 days prior to the PIPE announcement; (b) growth opportunity, measured as the M/B at the end of the fiscal year prior to the PIPE; (c) profitability, represented by a distressed indicator variable equal to 1 if the firm has two consecutive years of negative OIBD prior to the PIPE; (d) ownership before dummy, which is equal to 1 if the PIPE investor had stakes in the firm before the PIPE transaction. I also add the industry fixed effect in the first stage regression. In the second stage regression, the dependent variable is CAR (0,3). The independent variables are the same with the ones used in regression 3 in Table 6 Panel A. The only difference is that the predicted probability of being invested by VCs estimated from the first-stage equation replaces the VC dummy in the second-stage regression. The results are reported in Table 6 Panel B.

The coefficient of ϕ is 0.078 and statistically significant at 5% confidence level. The coefficients of other variables are consistent with the results in both signs and magnitude in regression 3 in Table 6 Panel A. This finding shows that after controlling the selection effect of

receiving financing from VCs, investor identity still has a significant effect on short-run market reactions to PIPE announcements, or having VCs as PIPE investors significantly increases CAR (0,3).

5.2.4. Pre-IPO VC investors vs. new VC investors

In 35 out of 113 VC-invested PIPEs, VC investors had investments in the firm before they went public, who are defined as pre-IPO VC investors. It is documented in several studies that

Table 7
Pre-IPO VC investors vs. new VC investors

		Pre-IPO VC investors		New VC investors		Difference	
		Mean	Median	Mean	Median	Mean	Median
<i>Panel A: deal characteristics</i>							
Gross proceeds (M)		\$30.9	\$16.9	\$51.7	\$13.4	\$–20.8	\$3.5
Proceeds from VCs (M)		\$21.1	\$7.3	\$42.3	\$6.0	\$–21.2	\$1.3
Fraction placed		21.6%	16.9%	22.4%	16.7%	–0.8%	0.2%
Discount		–7.0%	–0.2%	7.4%	8.3%	–14.4%*	–8.5%**
Fraction with premium		51.4%		25.6%		25.8%**	
N		35	78				
<i>Panel B: firm characteristics</i>							
ME (M)		\$311	\$48	\$232	\$66	\$79	\$–18
Assets (M)		\$170	\$42	\$154	\$31	\$16	\$11
Sales (M)		\$111	\$16	\$57	\$14	\$54	\$2
Firm age		6.9	6	7.7	6	–0.8	0
Years from IPO		4.4	4	6.0	5	–1.6**	–1
OIBD/assets		–38.3%	–35.1%	–44.1%	–32.5%	5.8%	–2.6%
ROA		–56.3%	–48.9%	–67.7%	–47.3%	11.4%	–1.6%
M/B		5.1	3.7	7.2	3.3	–2.1	0.4
N		35	78				
<i>Panel C: ownership change and board seats change</i>							
Change of VC ownership		8.1%	5.9%	13.6%	9.3%	–5.5%**	–3.4%**
Change of VC board seats		0.2	0	0.6	0	–0.4**	0**
Change in VC board seats as percentage		2.8%	0%	6.9%	0%	–4.1%**	0%
Holding length (days)		650	553	983	852	–333**	–299**
N		35	78				
<i>Panel D: cumulative abnormal returns</i>							
		N	(–29, –10) (%)	(–9, 0) (%)	(0, 3) (%)	(1, 10) (%)	(1, 30) (%)
Pre-IPO investors	35	Mean	3.2	1.4	5.0	4.0	4.9
		Median	–3.6	0.8	3.7	1.6	15.2
New investors	78	Mean	4.4	4.7	5.9	1.6	4.7
		Median	3.1	–0.4	3.0	2.4	0.1
Difference		Mean	–1.2	–3.3	–0.9	2.4	0.2
		Median	–6.7	1.2	0.7	–0.8	15.1

This table compares PIPEs invested by pre-IPO VC investors and PIPEs invested by new VC investors. Panel A examines the deal characteristics of PIPE transactions. Panel B examines firm characteristics. Panel C examines the ownership structure and board structure. Panel D compares the short-run market reactions. *P*-value is 2-tailed. ***, **, * represent that the result is statistically significant at 1%, 5%, and 10% levels, respectively.

Table 8
Cross-sectional regressions of discounts and CAR within VC-led PIPEs

	1	2
Intercept	−0.096 (0.779)	−0.103 (0.766)
Pre-IPO investor	−0.024 (0.603)	−0.027 (0.681)
Fraction placed	0.262 (0.201)	0.263 (0.208)
Ln(proceeds)	−0.021 (0.531)	−0.022 (0.497)
Discounts	−0.245*** (0.001)	−0.244*** (0.002)
Ln(ME)	0.019 (0.536)	0.021 (0.508)
M/B	0.003 (0.146)	0.003 (0.127)
Distressed	0.050 (0.299)	0.047 (0.324)
VC ownership change	0.411* (0.052)	0.530** (0.032)
Pre-IPO VC ownership change		−0.302 (0.371)
VC board seats change	−0.013 (0.794)	−0.028 (0.579)
Pre-IPO VC board seats change		0.062 (0.384)
<i>N</i>	113	113
<i>F</i>	3.06	2.62
<i>R</i> -square (%)	24.04	25.29
Adjusted <i>R</i> -square (%)	16.18	15.62

This table examines the determinants of discounts and CAR within VC-led PIPEs. The dependent variable is market-adjusted CAR (0,3). Pre-IPO investor dummy is equal to 1 if the venture capital fund invested in the firm before the firm goes public. Fraction placed is measured as the ratio of shares placed to the total shares outstanding after the placement. Ln (ME) is the logarithm of the market capitalization 30 days before the announcement data. M/B is the ratio of the market value of equity to the book value of equity at the end the fiscal year prior to the PIPE. Distressed is an indicator variable which is equal to 1 if the firm has negative OIBD during the two years prior to the PIPE transaction. VC ownership change is calculated as the difference of VC ownership after the PIPE and VC ownership before the PIPE. VC board seats change is an indicator variable which is equal to 1 if VCs request one or more board seats through PIPE. Pre-IPO VC ownership (board seats) change is an interaction term of pre-IPO investor dummy and VC ownership (board seats) change. Ownership and board seats data are collected from the PIPE related security purchase agreement, or S-3, or the Proxy Statement right after or before the PIPE. *P*-values are 2-tailed. ***, **, * represent that the result is statistically significant at 1%, 5%, and 10% levels, respectively.

VCs exit their investments gradually after the firm goes public.¹⁸ It often takes a few years for VCs to cash out their stake completely. For these VC investors, their motivation for investing in the same firms through PIPEs could be that they believe the firms are undervalued, but also could be the following. VC investors are locked in these firms due to their poor stock performance after the IPO. For these firms, pre-IPO VC investors are probably the only resource for additional capital. Simultaneously, to keep the liquidity of the stock and wait for opportunity to exit in the

¹⁸ Gompers and Lerner (1998), Field and Hanka (2001), Ljungqvist and Wilhelm (2003), and Dai, Anderson, and Bittlingmayer (2005).

future, VCs may be willing to infuse additional capital through PIPEs. This potential difference in investment objectives between pre-IPO VC investors and new VC investors may result in the difference in PIPE transaction structure and the role of VCs in firms.

In Table 7, I examine various characteristics of PIPEs invested by pre-IPO VC investors and PIPEs invested by new VC investors. I find that pre-IPO VC investors behave differently from new VC investors in several aspects. First, pre-IPO VC investors require smaller discounts than new VC investors. Second, new VC investors request larger stake through PIPEs and are more likely to request board seats than pre-IPO VC investors. Third, new VC investors keep their stake longer than pre-IPO investors. I do not find significant differences in firm characteristics or short-run market reactions between firms invested by pre-IPO VC investors and firms invested by new VC investors though.

Table 8 contains the OLS regression analysis of discounts and CAR (0,3) within the sample of VC-led PIPEs. Most of the independent variables are the same with the ones used in Table 6. Pre-

Table 9

Long-run stock performance following PIPEs

Panel A: buy-and-hold returns relative to market

	VC-led PIPEs		HF-led PIPEs		Difference in mean	Difference in median
	Mean	Median	Mean	Median		
BHAR (−12, −1)	−0.9%	−38.9%***	57.4%***	−0.7%***	−58.3%	−38.2%***
BHAR (1, 12)	7.6%	−1.7%	−5.7%	−34.8%***	13.3%	33.1%***
BHAR (1, 12)−BHAR(−12, −1)	8.6%	30.2%***	−63.1%***	−24.6%***	−	−

Panel B: calendar-time Fama–French long-run abnormal returns

	VC-led PIPEs		HF-led PIPEs	
	Coefficient	P-value	Coefficient	P-value
α	0.028**	0.023	0.008	0.316
Market-Rf	0.952***	0.002	1.218***	0.0001
SMB	1.712***	0.0001	1.491***	0.0001
HML	−1.023***	0.009	−0.488*	0.054
UMD	−0.710***	0.001	−0.218**	0.100
N	98		117	
F	35.94		59.73	
R -square (%)	60.72		68.08	
Adjusted R -square (%)	59.03		66.94	
Implied one-year AR (%)	39.29		10.03	

This table examines the long-run stock performance following PIPEs. Panel A reports the buy-and-hold returns relative to equal-weighted market returns (BHAR). Panel B reports the calendar-time Fama–French long-run abnormal returns. The dependent variables are the equal-weighted abnormal returns of the calendar-time event portfolios of VC-led PIPEs or HF-led PIPEs. For each month from October 1996 to December 2004, I form equal-weighted portfolios of all sample firms that announce PIPE with VCs or HFs within the previous one year. Portfolios are rebalanced monthly to drop all firms that reach the end of their one-year period and add all firms have just announced a PIPE. The portfolio excess returns are regressed on the three Fama and French (1993) factors and the momentum factor proposed by Carhart (1997). SMB is the return difference between portfolios of “small” and “big” stocks. HML is the return difference between portfolios of “high” and “low” stocks. UMD is the return difference between portfolios of high prior momentum and low prior momentum stocks, or “up” minus “down”. The intercept (α) measures the monthly abnormal return. The implied 1-year AR is measured as $(1 + \alpha)^{12} - 1$, which is the total buy-and-hold return from earning the intercept return every month for 12 months. P -values are 2-tailed. ***, **, * represent that the result is statistically significant at 1%, 5%, and 10% levels, respectively.

IPO investor is an indicator variable which is equal to one if VC investors also invested in the firm before IPO, otherwise zero. I also include interaction terms between pre-IPO investor indicator variable and VC ownership change and VC board seats change in the regressions.

As shown in regression 1 in Table 8, pre-IPO VC investor dummy does not have significant effect on CAR (0,3). Nevertheless, there is some evidence that the ownership change of pre-IPO VC investors have different effects on CAR (0,3) from those changes of new VC investors. As shown in regression 2 in Table 8, the ownership changes of new VC investors significantly increase CAR (0,3), however, the ownership changes of pre-IPO VC investors has an insignificant effect on CAR (0,3). This finding is consistent with the notion that some pre-IPO VC investors infuse more capital through PIPEs in order to keep the liquidity of their earlier investments, therefore, their commitment is a weak or an inexplicit signal whether the firm is undervalued.

The board seats change of both new VC investors and pre-IPO VC investors do not have a significant effect on CAR (0,3), consistent with the result from Table 6.

6. Long-run effects of PIPEs

In this section, I examine the long-run stock performance and operating performance of firms following their PIPEs to see whether VCs and HFs add value to firms in the long run.

6.1. Long-term stock performance post-announcement

I examine the buy-and-hold abnormal returns (BHARs) of firms invested by VCs and HFs, adjusted by equal-weighted market returns, in one year before the PIPE and one year after the PIPE. The results are shown in Table 9 Panel A. During the one year prior to the PIPE offering, the median BHAR of VC-invested firms, which is -38.9% , is significantly negative and significantly worse than HF-invested firms, which is -0.7% . In one year following the PIPE offering, the median BHAR of VC-invested firms is -1.7% , not significantly negative and significantly smaller in magnitude than BHAR $(-12, -1)$. On the contrary, the stock performance of HF-invested firms deteriorates significantly in the year following the PIPE. The median BHAR (1,12) of HF-invested firms is -34.8% , which is significantly negative and worse than their BHAR $(-12, -1)$. This finding is consistent with Brophy, Ouimet, and Sialm (2005). Brophy, Ouimet, and Sialm (2005) report that firms issuing PIPEs to HFs have more negative long-run abnormal returns.

The results of long-run event studies are often dependent on the methodology chosen. Most of the sample firms in this paper belong to the small- or mid-cap category. The market return is probably not an appropriate benchmark. Furthermore, a few studies note that the BHARs and CARs, the traditional methodologies to measure long-horizon stock performance, assume independence of individual-firm abnormal returns and are highly vulnerable to the problems of cross-sectional dependence among firms.¹⁹ Failing to control for cross-sectional correlation among firms can yield overstated *t*-statistics. The calendar-time portfolio approach has become a standard methodology to fix this issue. In the calendar-time approach, the event portfolio is formed each period to include all firms that have completed the event within the prior *n* periods. By forming event portfolios, the cross-sectional correlations of the individual event firm returns are automatically accounted for in the portfolio variance at each point in calendar-time.

¹⁹ For example, Fama (1998), Mitchell and Stafford (2000), and Boehme, Danielsen, and Sorescu (2006).

For each month from April 1995 to December 2004, I form equal-weighted portfolios of sample firms that announce PIPE with VCs or HFs within the previous one year. Portfolios are rebalanced monthly to drop all firms that reach the end of their one-year period and add all firms that have just announced a PIPE. The portfolio excess returns are regressed on the three Fama and French (1993) factors and the momentum factor proposed by Carhart (1997), as in the following equation:

$$R_{p,t} - R_{f,t} = a_p + b_p(R_{m,t} - R_{f,t}) + s_p\text{SMB}_t + h_p\text{HML}_t + u_p\text{UMD}_t + e_{p,t} \quad (1)$$

The four factors are zero-investment portfolios representing the excess return of the market; the difference between returns on portfolios of “small” stocks and “big” stocks; the difference between returns on portfolios of “high” BE/ME stocks and “low” BE/ME stocks; and the difference between returns on portfolios of high prior momentum stocks and low prior momentum, or “up” minus “down”. The intercept, a_p , represents the average monthly abnormal return on the portfolio of event firms, which should be zero under the null of no abnormal performance. The results are shown in the Table 9 Panel B.

In the first column, the dependent variable is equal-weighted excess returns of the VC-led PIPEs. The intercept, a_p , is 2.8% and statistically significant at the 5% confidence level. In the second column, the dependent variable is equal-weighted excess returns of HF-led PIPEs. The intercept, a_p , is 0.8%, and not statistically significant. To examine the economic significance of a_p , I estimate the implied one-year abnormal return, which is the estimated average buy-and-hold abnormal return from earning a_p every month for 12 months.²⁰ For the VC-led PIPEs, the intercept translates to a one-year abnormal return of approximately 40%. For the HF-led PIPEs, the intercept translates to a one-year abnormal return of approximately 10%.

The results of the long-run stock performance analysis, that firms issuing PIPEs to VCs have a positive long-run abnormal return and firms issuing PIPEs to HFs have negative or close-to-zero long-run abnormal return, support the idea that the identity of PIPE investors influences firm performance. The puzzle is why VC-led PIPEs do better. Is it because of VCs’ active monitoring that may improve firm operating performance or merely a certification effect to which other investors underreact?

6.2. Changes in operating performance

Loughran and Ritter (1997) find that the operating performance of firms issuing SEO deteriorates after their offering although they had performed better than a control group just prior to the offering. They view this as evidence of investor over-optimism, interpreted as investors putting too much weight on historical and current performance and believing wrongly that this trend will continue in the future. Hertz, Lemmon, Linck, and Rees (2002) study the long-horizon stock performance of public firms that issue equity privately and find that firms experience negative post-announcement stock price performance, opposite to the positive announcement period stock-price reaction. Hertz et al. (2002) provide another rationale of investor over-optimism to explain the negative long-run stock performance of firms after private placements, where investors are over-confident in expecting firm performance will improve in the future despite its poor historical operating performance. They find that firms doing private placements have poorer operating performance than the industry median right before the offering

²⁰ I follow the approach used in Hertz et al. (2002). The implied one-year abnormal return = $(1 + a)^{12} - 1$.

Table 10

Operating performance around the PIPE

Investor	Year	N	OIBD/assets (%)	ROA (%)	CERD/assets (%)	M/B
<i>Panel A: median operating performance of VC-invested firms compared to HF-invested firms</i>						
VC	–1	113	–33.7	–48.3	26.3	3.6
	0	111	–33.8	–45.0	26.0	2.6
	1	100	–29.2	–35.4	25.7	2.8
	year 1 – year (–1)	100	4.1*	8.5*	–3.9**	–0.4
HF	–1	397	–27.2	–39.3	24.6	3.2
	0	389	–20.6	–29.9	19.1	3.9
	1	363	–16.8	–25.6	16.8	3.6
	year 1 – year (–1)	363	3.0***	4.9***	–3.1***	0.3
VC-HF	–1		–6.5*	–9.0*	1.7	0.4
	0		–13.2**	–15.1**	6.9**	–1.3***
	1		–12.4**	–9.8*	8.9***	–0.8**
	year 1 – year (–1)		1.1	3.6	0.8	–0.7
<i>Panel B: median operating performance of VC-invested firms compared to matched-firms</i>						
VC-matched firms	–1	113	–0.1	–4.0**	5.4**	0
	0	111	–4.8**	–12.6***	6.5*	–0.4
	1	100	–4.5**	–8.1**	1.8	–0.7**
	year 1 – year (–1)		–5.0	1.9	–3.1*	–0.8

Panel A shows the median operating performance for the VC-invested firms and HF-invested firms one year before and one year after the PIPE. Panel B reports the samples' median industry-adjusted operating performance, which is the difference between the sample median and industry median (based on the two-digit SIC codes). Year represents the firm's fiscal year relative to the year of the PIPE. Year 0 is the year of the PIPE. *N* is the number of observations with available COMPUSTAT data. OIBD/assets is the ratio of the OIBD to the total assets at the end of the fiscal year. ROA is percentage of the net income before the extraordinary items of total assets. CERD is the sum of capital expenditure and R&D expense. M/B is the ratio of market value of equity at the fiscal year end to the book value of equity. *P*-value is 2-tailed. ***, **, * represent that the result is significantly different from zero at the 1%, 5%, and 10% levels, respectively, based on the Wilcoxon rank sums test (two-sided).

and there is no significant improvement afterwards. In previous sections, I find significantly positive abnormal returns both in short run and long run for a sample of firms that issue PIPE to VCs. In this section, I examine the operating performance of firms from one year before the PIPE to one year after the PIPE and attempt to link it to the pattern of firm stock performance in the long run.

To gauge the operating performance of my sample firms, following Loughran and Ritter (1997) and Hertz et al. (2002), I compute the ratio of OIBD to total assets (OIBD/assets), the ratio of net income to total assets (ROA), the ratio of the sum of capital expenditure and R&D expenses to total assets (CERD/assets), and the ratio of market value of equity to book value of equity (M/B) during the years surrounding the PIPE. All the data are obtained from COMPUSTAT.

First, I compare firm operating performances in year 1 to those in year –1 to see whether there are improvements relative to their performance prior to the offering. The results are shown in Table 10 Panel A. Both VC-invested firms and HF-invested firms have significant improvements in their profitability and spend less in capital expenditure or R&D in the year following the PIPE. Before the PIPE, VC-invested firms have significantly worse profitability than HF-invested firms and spend significantly more on capital expenditure or R&D. In the fiscal year following the PIPE, it is still so. I also compare the improvements in operating performance between VC-invested and HF-invested firms, but I do not find significant differences.

As suggested by Barber and Lyon (1996), the operating performance of the sample firm must be compared to a proper benchmark to ensure that the change is not simply a manifestation of the mean reversion in operating ratios. Therefore, I compare the operating performances of sample firms with those of non-issuers. Each sample firm is matched with a non-issuer chosen on the bases of industry, asset size, and previous operating performance. Follow the suggestions by Barber and Lyon (1996) and Loughran and Ritter (1997), the specific algorithm for choosing a matching firm is as follows. Candidate matching firms are those listed in the AMEX, NYSE, or Nasdaq that have not issued PIPEs. From this universe, firms in the same industry (using 2-digit SIC codes) with asset size as of the end of year -1 between 25% and 200% of the issuer are ranked by their year -1 OIBD relative to assets. The firm with the closest OIBD/assets ratio from among these non-issuing firms is picked as the matching firm. If there are no non-issuers in the appropriate industry meeting the above requirements, a matching firm is then chosen without regard to industry. All non-issuers with assets within 90% to 110% of the issuer are ranked by

Table 11
Cross-sectional regressions of BHAR (1,12)

	Coefficient	P-value
Intercept	1.682*	(0.062)
VC	0.097	(0.609)
Fraction placed	-0.145	(0.838)
Ln(proceeds)	-0.032	(0.677)
Discounts	-0.371	(0.160)
Ln(ME)	-0.068	(0.340)
Distressed	0.111	(0.270)
Lead investor ownership change	-0.366	(0.733)
VC ownership change	-0.267	(0.820)
Lead investor board seats change	0.035	(0.910)
VC board seats change	-0.272	(0.403)
Holding more than 1 year	0.253*	(0.087)
Change in OIBD/assets	0.158	(0.189)
Change in CERD/assets	-0.308*	(0.065)
Change in M/B	0.002*	(0.074)
BHAR (-12,-1)	-0.005	(0.818)
CAR (0,3)	0.831***	(0.007)
N	442	
F	3.02	
R-square (%)	10.37	
Adjusted R-square (%)	6.94	

This table examines the determinants of stock performance in one year following the PIPE, which is measured as BHAR (1,12). VC is an indicator variable which is equal to one if the lead investor is a VC fund, or zero if the lead investor is a hedge fund. Fraction placed is measured as the ratio of shares placed to the total shares outstanding after the placement. Discount is measured as the percentage difference between offer price and the stock price on the closing date. Ln(ME) is the logarithm of the market capitalization 30 days before the announcement data. Distressed is an indicator variable which is equal to one if the firm has negative OIBD during the two years prior to the PIPE transaction. Lead investor ownership change is the change in ownership after the PIPE transaction. VC ownership change is an interaction term of VC dummy and lead investor ownership change. Lead investor board seats change is an indicator variable which is equal to 1 if the lead investor requests one or more board seats through PIPE. VC investor board seats change is an interaction term of VC dummy and lead investor board seats change. Holding more than 1 year is an indicator variable which is equal to 1 if PIPE investors keep their stake for more than one year, otherwise 0. Change in OIBD/assets (CERD/assets, M/B) is the difference between OIBD/assets (CERD/assets, M/B) in the fiscal year following the PIPE and OIBD/assets (CERD/assets, M/B) in the fiscal year prior to the PIPE. P-value is 2-tailed. ***, **, * represent that the result is statistically significant at 1%, 5%, and 10% levels, respectively.

OIBD/assets, and the firm with the closest, but higher, ratio is chosen as the matching firm. The results are shown in Table 10 Panel B.

In the fiscal year prior to the PIPE, issuing firms have similar OIBD/assets with matching firms as constructed, but they have significantly lower ROA and spend significantly more on capital expenditure and R&D. In the event year and one year after the PIPE, issuing firms have significantly lower OIBD/assets and ROA, as well as M/B. I also compare the changes in operating performances of VC-invested firms and those of their peer firms. I do not find significant differences except that VC-invested firms significantly cut more of their capital expenditure or R&D.

In summary, firms issuing PIPEs to VCs have better profitability and spend less on capital expenditure after PIPEs, however, they have worse profitability and spend more on capital expenditure after the PIPE in comparison to their matching firms. The results from this section suggest that monitoring does not create significantly more value, or is not reflected in firm operating performance in the year following the PIPE.

6.3. Cross-sectional regressions of BHAR (1,12)

In this section, I use cross-sectional regression to test whether the positive long-run abnormal returns of VC-invested firms are due to the active monitoring by VCs or merely a certification effect of having VCs as investors which the market under-reacts to at the time of PIPE announcements. The long-run stock performance of firms issuing PIPEs is measured by BHAR (1,12). Board seats change by PIPE investors represents the monitoring effect of PIPE investors. Variables representing the certification effect include the VC indicator variable, ownership change by PIPE investors, and an indicator variable which is equal to 1 if investors keep their stake for longer than one year. I also include CAR (0,3) to see how the long-run stock performance is related to short-run market reaction. Control variables include deal and firm characteristics at the time of PIPE offering, changes in firm operating performance in the year following the PIPE relative to the fiscal year prior to the PIPE, and BHAR (−12, −1). The results are shown in Table 11.

BHAR (1,12) is significantly and positively related with CAR (0,3), which suggests that the markets under-reacts to the PIPE announcements. BHAR (1,12) is also positively affected by another two factors, although only marginally significant. One is the improvement in operating performance in the year following the PIPE. The other is how long PIPE investors keep their stake after the offering. An arguable explanation for this finding would be that the length that PIPE investors keep their stake serves as a signal that PIPE investors are investing in the fundamentals of the firm instead of getting quick profits from trading. Therefore, the longer the PIPE investors keep their stake, the more confident the market becomes about the firm.

7. Conclusion

I find that VCs add to the equity value of public firms both in the short-run and long-run after the PIPE. I show that VCs often request board seats from the firms they select to invest through PIPEs, and they often keep their stake for longer than one year. In contrast, HFs rarely join the board of directors and often cash out their positions shortly after the offering. These differences indicate that VCs are the type of investors who are more interested in investing in the fundamentals of the firm, while HFs are more likely to target for the quick profits from trading around the PIPE offerings. The market appropriately incorporates this information when reacting

to the PIPE announcements. VC-led PIPEs are associated with higher short-run CAR and with higher long-run BHAR than HF-led PIPEs.

The positive valuation effect of having VCs as PIPE investors seem to be a certification effect rather than a monitoring effect. Board seats change of VC investors, which is a measure of the potential monitoring, does not have a significant effect on firm stock performance either in the short run or in the long run. Furthermore, the operating performance of VC-invested firms has not improved significantly more than HF-invested firms. Hence, a conservative conclusion would be that even that VCs do actively monitor the management after PIPE, the monitoring of VCs fails to improve firm performance significantly at least in the period of one year. In contrast, two measures of how strong the commitments by PIPEs investors are, ownership change and holding length, have significantly positive effects on firm stock performance. These findings indicate that the positive short-run market reaction and the positive long-run stock performance after the PIPE seem to be driven by the certification effect of VCs' active and long-term commitments.

Appendix A. Identification of sample

A.1. Panel A: VC-led PIPEs

VC-invested PIPE transactions from 1995 to 2003	659
Financial firms (SICs 6000–6999) and regulated utilities (SICs 4900–4999)	–15
Stock prices are missing on CRSP	–204
COMPUSTAT data are missing	–82
VC is not the lead investor	–240
PIPEs that happen to the same firm in less than one year	–7
Final sample	113

A.2. Panel B: HF-led PIPEs

Transactions from 1995 to 2003 where HFs are the lead investors	823
Financial firms (SICs 6000–6999) and regulated utilities (SICs 4900–4999)	–24
Stock prices are missing on CRSP	–125
COMPUSTAT data are missing	–154
PIPEs that happen to the same firm in less than one year	–123
Final sample	397

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