

# Venture Capital Investment and the Post-IPO Performance of Entrepreneurial Firms: Evidence from the People's Republic of China

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We examine the effects of venture capital (VC) investment on the performance (measured by return on assets, return on equity, and Tobin's Q) and growth (measured by growth of total sales and total number of employees) of entrepreneurial firms in the People's Republic of China (PRC) after an initial public offering (IPO). Firm-level panel data analysis shows that VC investment contributes to the long-term performance and growth of entrepreneurial firms after an IPO. Meanwhile, we observe a significant and positive relationship between corporate governance of firms and VC investment. However, we do not find that experience or specialization of VC firms influences the effects of venture investment on post-IPO performance or growth of entrepreneurial firms in the PRC.

*Keywords:* venture capital, post-IPO performance and growth, corporate governance, specialization and experience

*JEL codes:* G24, G30

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## I. Introduction

Venture capital (VC) investment has attracted increasing interest from researchers and policymakers since the 1980s. It is widely believed that VC investment is a good way to fill up the funding gaps faced by young R&D-oriented ventures, and consequently, stimulate national innovation and economic growth (Bygrave 1987, Gompers and Lerner 1999). Since the 1980s, many nations in Europe and Asia have begun to initiate public programs to stimulate VC activities.<sup>1</sup> Most countries try to duplicate the "American model" and build up a friendly environment for the VC sector by stimulating both demand and supply sides of the investment (i.e., by providing subsidies and preferential tax policies to both start-up companies and VC

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<sup>1</sup>For example, Yozma in Israel, Beteiligungskapital für Technologieunternehmen (BTU) in Germany, Actions relating to Equity Finance for Innovation (AEFI) in Ireland, and Regional Venture Capital Funds (RVCF) in the UK.

institutions, undertaking regulatory changes in pension funds and insurance funds management, and building up secondary stock markets).<sup>2</sup> Currently, there are over 40 national VC associations around the world.

The People's Republic of China (PRC) numbers among the many countries that have made an effort to develop a vibrant VC industry to stimulate innovation. Starting from the mid-1980s, the government has initiated various programs to promote VC investment including injecting venture funds into government-controlled VC firms (VCFs), encouraging corporate VC arms, and attracting foreign venture funds. Indeed, the country's VC industry has developed dramatically over the past 2 decades.

The PRC has been the second largest VC market in the world since 2001. It has grown from a mere concept in the 1980s to an industry with over 400 domestic and foreign VCFs in 2011, managing over \$48.53 billion investible capital. Meanwhile, the annual disbursement of VC investment has increased from \$518 million in 2001 to \$13 billion in 2011.<sup>3</sup> Moreover, the PRC is now one of the most favored investment destinations of VC funds around the world.<sup>4</sup> More importantly, the impact of the country's VC investment is seen in the global market. From 2000 to 2011, over 600 VC-backed Chinese firms went public. Such firms have become the major driving force in the development of financial and VC markets, supporting the sustainable growth of the PRC and the rest of the world.

Despite the VC industry's rapid growth and growing impact on the global capital market, systematic analysis of the VC market in the PRC remains very limited. Guo and Jiang (2013) examine the role of VC investment in VC-backed firms based on firm-level panel data. However, they mainly focus on the effects of VC investment on the early development stages (i.e., prior to an initial public offering or IPO). Theoretical (Black and Gilson 1998) and empirical (Jeng and Wells 2000) studies suggest that a well-developed capital market is one of the most important factors behind VC investment. However, Chinese stock markets are far less developed, and their regulation has long been criticized (Allen, Qian, and Qian 2005; Wang 2005; Fan, Wong, and Zhang 2007; Kao, Wu, and Yang 2009; Allen et al. 2012; Piotroski and Zhang 2014). A natural question thus arises as to whether and how VC investments play a role in firms listed on such stock markets.

The present study tries to fill the existing gap by exploring the effects of VC investment on the post-IPO performance and growth of VC-backed firms in the PRC. Based on a panel dataset that covers all listed firms in the country's stock markets between 1990 and 2010, our study focuses on the following important questions.

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<sup>2</sup>For example, in the United States (US), the capital gains tax rate was reduced from 49.5% to 28% in 1978. Additionally, the amendment to the "prudent man" rule in 1979 confirmed that pension fund managers are allowed to invest part of the funds in high-risk assets.

<sup>3</sup>*China Venture Capital Annual Report 2011* published by Zero2IPO Research Center.

<sup>4</sup>Information obtained from the *Global Trend in Venture Capital 2012 Survey* conducted by Deloitte & Touche LLP.

First, we ask whether VC affects long-term post-IPO firm performance and growth. Second, we examine whether the experience or specialization of VCFs influences the effects of VC investment on post-IPO performance and growth of firms. Finally, we look at the relationship between VC investment and corporate governance of portfolio companies to further explore the mechanisms by which VC investment affects the long-term performance and growth of VC-backed firms.

We find that VC-backed firms in the PRC demonstrate significantly higher performance and growth than non-VC-backed firms after an IPO. However, different from the findings from the United States (US), we find that neither experience nor specialization of VCFs influences the effects of venture investment on post-IPO performance and growth of VC-backed firms in the PRC. Finally, we find that VC-backed firms have significantly higher probability of allocating ownership to executives than non-VC-backed firms and are able to better align the interests of the executives and the shareholders. Identification concerns are addressed by using instrumental variables.

## II. VC Industry in the PRC

### A. Institutional Background of VC Investment in the PRC

VC programs were initiated by the central government in the mid-1980s as part of its science and technology reform. The transformation of the centrally planned economy to a market-based system brought tremendous changes to the VC industry. However, the industry was merely a concept within the first 10 years since the reform, with local and central governments serving as major players.

The first breakthrough did not occur until the late 1990s when venture fund sources were enriched. Before 1996, individuals and corporations were prohibited from investing in VC funds. The restriction was removed with the passage of a law promoting the industrialization of technological achievements of the PRC. For the first time, VC investment was recognized as a legal commercial activity and funds were allowed to be raised from diverse sources, including national and local governments, enterprises, organizations, and individuals. Large corporations, universities, and individuals were also allowed to enter the industry for the first time. The number of VCFs increased from 17 in 1994 to 59 in 1998. The amount of annual investment rose to \$128 million in 1998 from \$27.2 million in 1994.<sup>5</sup> However, the VC market remained small in terms of both fund-raising and investment disbursement.

The second breakthrough came in 2001 when foreign VCFs (FVCFs) finally gained legal recognition in the PRC. Foreign institutional investors have been

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<sup>5</sup> *China Venture Capital Annual Report 2002* published by China Venture Capital Research Institute.

struggling for legitimacy in the PRC due to rigorous capital controls and other legal restrictions. In 2001, the Ministry of Foreign Trade and Economic Cooperation, together with the Ministry of Science and Technology and the State Administration for Industry and Commerce, issued provisional regulations on the establishment of foreign-invested VC investment enterprises. By clarifying registration requirements for FVCFs, this set of regulations was the first effort from the government to confirm the legitimacy of FVCFs in the country, although most of the requirements were not really feasible.<sup>6</sup>

FVCFs have been seeking effective vehicles to accommodate their investments in the PRC. Before the mid-1990s, FVCFs mainly worked in joint ventures with domestic investors. However, their performance was far from satisfactory (Zeng 2004). With the benefit of accumulated experience, FVCFs have explored new ways to accommodate their investments in the country. The most popular approach is to invest using an offshore model; that is, FVCFs incorporate overseas and raise funds from international markets. Without registering domestically, they establish representative offices to search, evaluate, and manage their investments in the country. The registration of their portfolio companies meanwhile follows a “round-trip” model, where the holding company is based overseas.<sup>7</sup> Following this pattern, an increasing number of mainstream FVCFs have since entered the PRC and become a dominant player in the country’s VC market, which saw record annual investments of \$992 million in 2003 and \$1.269 billion in 2004. Annual investment by FVCFs was more than 80% of total VC investment in 2003 (Guo and Ding 2010).

The third wave of development occurred in the second half of the 2000s when the PRC issued a series of laws and policies to relax regulations and saw a rapid growth of domestic VCFs (DVCFs). First, the constitutional rights of the private sector were fully and clearly recognized at the 10th National People’s Congress in 2004. In the same year, the Bankruptcy Law came into effect. These legal changes were initiated to provide better protection for external investors.

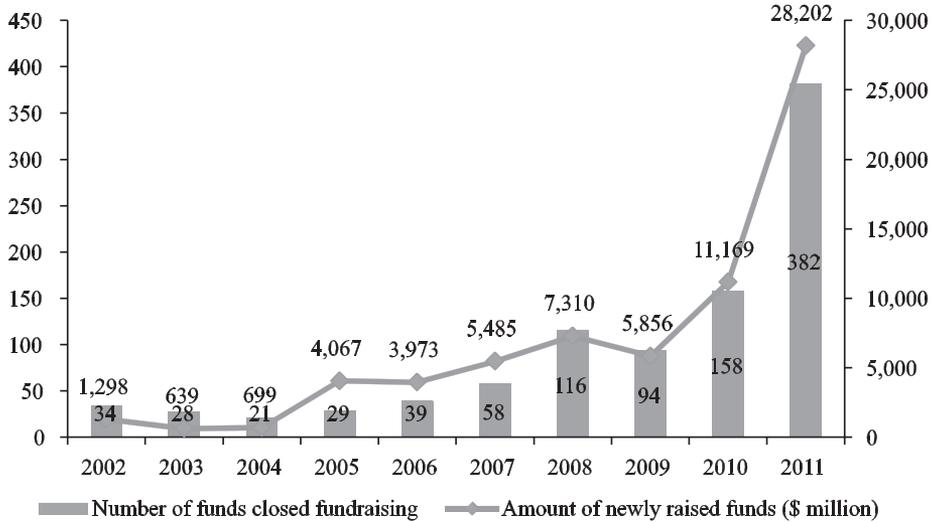
Meanwhile, in 2008, the central government allowed pension funds to invest in VCFs for the first time. Since then, VC funds have substantially increased. More importantly, after more than 10 years of discussion, ChiNext, a NASDAQ-type exchange for high-growth, high-tech start-ups, launched in October 2009. With

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<sup>6</sup>According to the regulations, FVCFs must pass through a strict, time-consuming approval process at various government agencies for registration. In addition, the only legal organizational form for FVCFs in the PRC is the limited company, which is different from the widely-used limited partnership governance structure. Furthermore, the rigid requirements for registered capital (at least \$20 million, 15% of which must be paid within 3 months after the issue of the business license, with the remainder paid within 3 years whether or not attractive investments are available) are also constraints for FVCFs. Foreign institutional investors may now legally invest and raise funds in the PRC if they register as qualified foreign investment institutions (QFIIs). However, the threshold of the requirements for registration as QFIIs is too high such that most FVCFs are unqualified.

<sup>7</sup>With this “round-trip” model, when an FVCF decides to invest in a project, it helps the founders to register an overseas holding company. Both the FVCF and the major founders of the company hold the majority shares in the holding company. The holding company then invests back in the original enterprise in the PRC, typically with 100% control.

Figure 1. Newly-raised Venture Capital Funds in the PRC, 2001–2011



PRC = People's Republic of China.

Source: China Venture Capital Annual Report 2012 published by Zero2IPO Ltd. Available online: <http://zero2ipo.com.cn/f/research/201305090222133683M.pdf>.

different IPO regulation systems, ChiNext enables VC-backed firms to be listed in the PRC that particularly widens the divesting channels for DVCFs. According to the *China Venture Capital Annual Report*, DVCFs in 2011 outshone their foreign counterparts in terms of capital under management for the first time, representing 50.5% of the yearly total and emerging as the backbone for the country's VC market.

## B. VCFs and Investment in the PRC

The PRC, including Hong Kong, China, has been the second largest VC market in the world since 2001, experiencing unparalleled growth in terms of fundraising in recent years.<sup>8</sup> As shown in Figure 1, the PRC in 2011 saw 382 new VC funds raise \$28.2 billion for investment in Chinese companies, or about 25 times the amount raised in 2001. Twenty of these new funds raised \$100 million or more in 2011. In comparison, newly raised VC investments amounted to \$16.2 billion in the US and US\$3 billion in Europe, respectively, during the period.<sup>9</sup> In 2011, Beijing ranked as the fifth hotbed in the world in terms of the amount of newly-raised venture funds, next to Silicon Valley, New England, South California, and New York. According to the statistics of Zero2IPO Research Center, investible VC in the PRC totaled \$48.53 billion in 2011.

<sup>8</sup>This ranking was calculated based on data provided by the Asian Venture Capital Journal Database.

<sup>9</sup>All the figures for 2011 are obtained from the *Global Venture Capital Insights and Trends Report 2012* published by Ernst and Young Ltd.

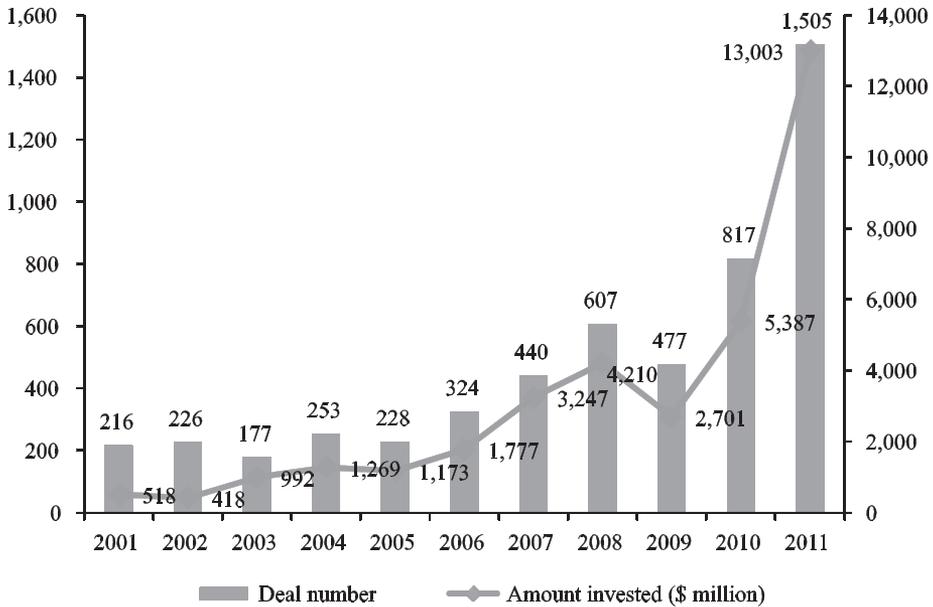
Data provided by the China Venture Capital Research Institute (CVCRI) show that in 2008, out of a total of 402 VCFs, 261 were domestic firms, while 141 were foreign firms. Most of the VCFs have 10 to 20 professional managers on average. The average size of capital under investment per VCF in 2008 was CNY1.32 billion (\$190 million). Meanwhile, VCFs, particularly the large ones, were concentrated in a few of the largest cities. By the end of 2008, over 73% of total available VC was being managed by VCFs located in Beijing, Shanghai, and Shenzhen.

DVCFs and FVCFs are different in many aspects because of institutional constraints. DVCFs are mainly established as state-owned subsidiaries or spin-offs of local governments, large corporations, and prestigious universities. In a survey conducted by CVCRI in 2008, government, corporations, and financial institutions accounted for approximately 75.1% of the sources of DVCFs. In comparison, institutional investors, limited partnership funds, and individuals made up approximately 97.3% of the sources of FVCFs. On average, DVCFs are much smaller than FVCFs in terms of capital under management. In 2008, 25.44% of DVCFs managed more than CNY500 million, while the percentage for FVCFs was 66.67%. Most of the prominent VCFs in the world such as Sequoia Capital, Softbank Asia Infrastructure Fund Partners, and Kleiner Perkins Caufield & Byers (KPCB) have entered the PRC. DVCFs and FVCFs are also different in terms of organizational structure. Almost all DVCFs (98%) were structured as limited liability companies before 2007 because limited partnership was not legal in the country as an organizational form until June 2007. In contrast, a majority of FVCFs are structured as limited partnerships.

Figure 2 shows the annual disbursements of VC investment in the PRC from 2001 to 2011. Annual disbursements visibly increased from \$518 million in 2001 to \$13.003 billion in 2011. Average investment size increased from \$2.40 million per deal in 2001 to \$8.64 million per deal in 2011. Similar to the fund-raising pattern, the disbursements of VC investment are concentrated in a few major cities and provinces. Although the distribution of VC investment has evened out in recent years and shifted from the eastern to the western side of the country, companies in Beijing and Shanghai still attracted \$2.86 billion (22% of the total) and \$1.278 billion (9.8% of the total) worth of VC investment in 2011, respectively.

VC investment plays a major role in financing R&D-oriented firms in the PRC. Guo and Ding (2010) report that over 62% of VC investments in the country were in high-tech sectors by the end of 2007. Internet, computer hardware and software, bio-tech and healthcare, and communication industries have attracted the largest VC investment. However, compared to more mature VC markets of the US and Europe, VC investors in the PRC generally prefer later-stage companies. In 2011, less than 10% of VC investments in the country had been in companies at the start-up or product development stages compared to approximately 30% in the US and Europe (Ernst & Young Ltd. 2012).

Figure 2. Venture Capital Disbursement in the PRC, 2001–2011



PRC = People's Republic of China.

Source: China Venture Capital Annual Report 2012 published by Zero2IPO Ltd. Available online: <http://zero2ipo.com.cn/f/research/201305090222133683M.pdf>.

Similar to other emerging markets (e.g., India and Brazil), IPOs represent the bulk of exits of VC investment from the PRC, as they do in Japan, the Republic of Korea, and Taipei, China. From 2000 to 2010, over 600 VC-backed firms in the country went public. In 2011, 432 of 1,225 new IPOs in the global exchange markets were Chinese firms, 171 of which were VC-backed companies. These figures suggest that the development of the VC market affects not only the PRC's sustainable growth, but also the world's economic growth. However, systematic analysis on this market remains very limited.

### III. VC Investment, IPOs, and Post-IPO Performance of Firms

The impact of VC investment on entrepreneurship and innovation has attracted immense interest from scholars. While studies have provided solid evidence on the positive relationship between VC investment and entrepreneurial firms' productivity and innovation in the US, the development and impact of VC markets outside the US are mixed. For instance, Bottazzi and Da Rin (2002a) find that although the European Commission has made numerous efforts to stimulate the VC

industry, the gap between Europe and the US has widened over the years. Meanwhile, there seems to be no evidence that VC investment stimulates innovation in Europe. Similar observations are made with regard to the VC market in Germany and Japan (Mayer, Schoors, and Yafeh 2005). On the other hand, studies document sustainable growth of VC markets and its positive influences on entrepreneurial firms in Israel (Mayer, Schoors, and Yafeh 2005); Taipei, China (Saxenian and Li 2003); and the PRC (Guo and Jiang 2013).

IPOs of entrepreneurial firms are the favorite type of exit by VCFs because they bring great return and builds the reputation of VCFs. Studies document that VCFs not only play an important role in deciding when and how portfolio companies execute IPOs, but they also continue to be involved afterwards (Megginson and Weiss 1991). In particular, studies find that VCFs tend to hold equity stakes in the firms they previously backed beyond the lock-up period (normally 180 days) (Baker and Gompers 1998). Furthermore, some VC-backed firms are associated with more independent boards and board chairmen who are not CEOs (Baker and Gompers 2003).

Given the active involvement of VCFs in the IPO of portfolio firms, a natural question arises as to whether these efforts influence IPO performance and the long-term performance of the firms after an IPO. However, answers to these questions remain inconclusive. Most US-based studies suggest a positive relationship between VC investment and IPO performance of firms. Supporting the VC certification and monitoring assumptions, Barry et al. (1990), Megginson and Weiss (1991), and Brav and Gompers (1997) find that in the US, VC-backed firms are normally less underpriced at IPOs than non-VC-backed firms. Wang, Wang, and Lu (2003) arrive at similar results for Singapore. However, Gompers (1996) hypothesizes the “grandstanding” of young VCFs, which are more likely to push entrepreneurial firms to prematurely undertake an IPO in order to falsely signal their reputation and performance. At the same time, Francis and Hasan (2001) find that although VC-backed IPOs are managed by more reputable underwriters and are generally associated with lower underwriter compensation, they are more underpriced than non-VC-backed ones. Lee and Wahal (2004) provide further evidence that VC-backed IPOs experience larger first-day returns than comparable non-VC-backed IPOs after controlling for endogeneity issues.

Findings on the effects of VC investment on long-term performance of firms after an IPO are also inconclusive. Jain and Kini (1995), for example, observe that VC-backed companies exhibit superior post-IPO operating performance compared to non-VC-backed IPO companies. Brav and Gompers (1997) note higher long-term returns for VC-backed companies, suggesting that VCFs tend to put effective management structures in place, enabling firms to perform better in the long run. Recent studies further confirm the management structure explanation. For instance, Nahata (2008) finds that the better reputation of the lead VCF, the more likely the VC-backed firm would experience better long-term performance and market

recognition post-IPO. Moreover, Krishnan et al. (2011) provide evidence on positive relationships among the reputation of VCFs, corporate governance of VC-backed firms, and long-term post-IPO performance. Overall, the abovementioned studies indicate that VCFs improve IPO and post-IPO performance of issuing companies in the US.

Studies on the effects of VC investment on post-IPO performance in markets outside the US are scarce, and the results are more complicated. Based on firm-level panel data in Europe, Bottazzi and Da Rin (2002a, 2002b) find that VCFs have a limited effect on a firm's ability to raise equity capital and to grow and create jobs. Hamao, Packer, and Ritter (2000) find that firms in Japan with venture backing from subsidiaries of securities companies perform significantly worse over a 3-year period than other firms after an IPO. Wang, Wang, and Lu (2003) report that the post-IPO operational performance of VC-backed companies in Singapore is inferior to that of non-VC-backed companies, and that such gap widens over time, with operating returns on assets and sales being significantly lower.

The contradictory findings on the effects of VC on the IPO and post-IPO performance of firms remind us of the heterogeneity of the quality and impact of VC investment and associated institutions. Hence, it is necessary to further explore the role of VC investment on the performance of innovative entrepreneurial firms in markets in which economic and institutional systems differ from developed economies. Moreover, it is important to explore ultimately under what circumstances VC investment works more efficiently to help entrepreneurial firms grow faster and improve long-term performance, and what the mechanisms are for the outperformance.

The present study tries to extend existing literature by exploring the effects of VC investment on the post-IPO performance of VC-backed firms in the PRC. The country we have chosen to study is of special interest for several reasons. Most previous studies on VC investment are based on data from developed economies. Whether VC investment also contributes to the performance and growth of entrepreneurial firms in developing countries, such as the PRC, has undergone less scrutiny. Among the very few studies on Chinese VC markets, Guo and Jiang (2013) focus on the effects of VC investment on financial performance of privately held firms, while Wang and Wang (2011) and Humphery-Jenner and Suchard (2013) focus on the effects of foreign VC investment.

How VC investment affects post-IPO performance of firms has not been examined yet, even though VC-backed firms in the PRC have already become a major driving force in the development of financial and VC markets. Both theoretical (Black and Gilson 1998) and empirical (Jeng and Wells 2000) studies in existence suggest that a well-developed capital market is one of the most important factors for VC investment. However, Chinese stock markets are far less developed, and their regulation has long been criticized (Allen, Qian, and Qian 2005; Wang 2005; Fan, Wong, and Zhang 2007; Kao, Wu, and Yang 2009; Allen et al. 2012; Piotroski and Zhang 2014).

## IV. Data

### A. Sample

Our sample consists of IPOs in the PRC from 1990 to 2010. IPO and post-IPO data are taken from China Stock Market & Accounting Research (CSMAR). CSMAR covers daily market transactions and stores financial and corporate governance data of all listed firms in the country. We delete firms in the financial industry and those listed in both A and B boards.<sup>10</sup>

VCF data of IPO issuers are taken from the VentureXpert database. The dataset includes, among others, the name, location, and industry (in four digits) of each VC-backed firm; the total VC investment gained by the company; the name of the VCFs involved in each deal; data on each VCF, including age, location, and funds under management; and investment preference. Initially, we extract from the VentureXpert database a list of 2,527 VC-backed firms receiving their first VC investment prior to January 2011. The names are in English. We confirm their Chinese names through websites and other online sources, allowing us to obtain the Chinese names of 2,518 firms. We then match the list of Chinese names with CSMAR data to identify the listed VC-backed firms.

Out of the 2,518 VC-backed firms listed on Chinese stock markets by end-2010, we identify 195 of which 137 are listed on the primary boards (i.e., the Shanghai Exchange and the Shenzhen Exchange), and 58 are listed on the secondary board (i.e., ChiNext). Only a small portion of VC-backed firms have a chance to undertake an IPO. In particular, it is hard for entrepreneurial firms to be listed on stock markets in the PRC due to institutional restrictions.

We then build a panel dataset for the period 1990–2012 to calculate post-IPO performance and obtain 621 firm-year observations for the 195 VC-backed firms and 17,689 firm-year observations for the 1,881 non-VC-backed listed firms. Table 1 shows the distribution of VC-backed and non-VC-backed firms by IPO year. Most VC-backed firms initiated an IPO after 2006, while the number of non-VC-backed IPOs dropped after 2006.

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<sup>10</sup>The shares of listed companies in the PRC are divided into A and B shares according to target investors. A-shares are officially called renminbi common stock. These shares are issued by Chinese companies for institutions, organizations, and individuals in the PRC (excluding investors from Taipei, China; Hong Kong, China; and Macau, China) and subscribed to and traded in the official domestic currency. B-shares are officially called renminbi special shares. In the early 1990s, the PRC was short on foreign exchange reserves and exercised foreign exchange control. Against this backdrop, the country allowed domestic enterprises to issue B-shares, which are denominated in the official domestic currency, on a trial basis at the end of 1991 in order to absorb international capital. Before 2001, only foreign investors could subscribe to and trade B-shares in US dollars or Hong Kong dollars. After 2001, even individual Chinese investors were allowed to do so. In the PRC, some firms are simultaneously listed on A and B boards.

Table 1. Distribution of IPOs by Year for the Sampled Firms

Time of IPO	Non-VC-backed Firms	% of Total	VC-backed Firms	% of Total	Total
1990–1995	277	98.93%	3	1.07%	280
1996–2000	694	98.30%	12	1.70%	706
2001–2005	312	96.59%	11	3.41%	323
2006	57	89.06%	7	10.94%	64
2007	84	73.68%	30	26.32%	114
2008	65	84.42%	12	15.58%	77
2009	63	64.95%	34	35.05%	97
2010	259	75.07%	86	24.93%	345
1990–2010	1,811	90.28%	195	9.72%	2,006

IPO = initial public offering, VC = venture capital.

Source: Authors' computations.

## B. Variables

We study the difference between VC-backed and non-VC-backed firms in two aspects, namely post-IPO performance and growth. Post-IPO performance and growth are measured in terms of profitability, market recognition, and firm growth. Profitability is measured by return on assets (*ROA*) and return on equity (*ROE*), while market recognition is captured by Tobin's *Q*. We focus on two aspects of growth—annual sales growth rate (*G\_Sales*) and growth rate in the number of employees (*G\_Emp*). The key explanatory variable is whether or not the firm is backed by VC. We assign *VC\_Dummy* the value of 1 if the firm is backed by VCFs and 0 otherwise. A significantly positive coefficient implies that VC-backed firms generally enjoy better post-IPO performance and growth.

We are also interested in how the experience and specialization of VCFs affect the post-IPO performance of VC-backed firms. VCFs typically syndicate investment, with the lead VCF intensively involved in governing portfolio companies. Following the literature (Lee and Wahal 2004, Nahata 2008), we define the lead VC investor as the one making the largest total investment across all rounds of funding in an entrepreneurial firm. We measure the experience of VCFs by the age of the lead VCF at the time of investment in the entrepreneurial firm. Each VC fund managed by VCFs normally lasts 7 to 10 years. VCFs need to constantly raise new funds based on their reputation. Hence, the older the firm, the more the VCF can accumulate investment experience (Gompers 1996, Lee and Wahal 2004, Gompers and Lerner 1999). Therefore, age is a good indicator for the experience of a VCF. Dummy variable *VC\_Age1* equals 1 if the lead VCF is younger than 10 years old at the time the VC-backed firm launched an IPO and 0 otherwise. Similarly, dummy variable *VC\_Age2* equals 1 if the lead VCF is older than 10 years at the time the VC-backed firm launched an IPO and 0 otherwise. The chosen cutoff for the age of VCFs is

based on the average life span of VC funds. Normally, a VCF that is older than 10 years has at least had more than twice the experience in raising VC funds.

In terms of the specialization of VCFs, we focus on their industry preferences. Information on VCF specialization is obtained from VentureXpert. Normally, VCFs disclose whether they are interested in particular industries. We construct two dummy variables, *VC\_Ind1* and *VC\_Ind2*, to measure the industry specialization of VCFs. *VC\_Ind1* is a dummy variable that equals 1 if the lead VCF is a generalist and does not have any specific industry preference and 0 otherwise. *VC\_Ind2* is a dummy variable that equals 1 if the lead VCF specializes in a particular industry and 0 otherwise.

Moreover, we look at the relationship between VC investment and corporate governance of VC-backed firms. We focus on two aspects of corporate governance—the interest alignment of shareholders and managers, and institutional ownership. In our study, we measure the alignment of interests in two ways, focusing on the stake holdings of executives and management teams. *Xcuhldn\_D* is a dummy variable that equals 1 if the firm allocates equities to executives as incentives and 0 otherwise. Similarly, *Mgnhldn\_D* is a dummy variable that equals 1 if the firm allocates equities to the management team as incentives and 0 otherwise. We measure institutional ownership by looking at the ratio of the shares held by the top 10 (*InsnShare10*) institutional shareholders of the firm.

Six control variables are included in the analysis. *Firm Age* is the age of the firm at the time of examination. *Firm size* is measured by the logarithm of total assets of the firm in a given year. We also include the leverage ratio (*LVRG*) in the estimates as this may affect the IPO or post-IPO performance of a firm. *LVRG* is defined as the total liability of a firm divided by total assets in a given year. Furthermore, we control for the ownership of the firm. *SOE* is a dummy variable assigned a value of 1 if more than 50% of the firm is controlled by the state and 0 otherwise. Being heavily involved in governing their portfolio companies, VCFs are concerned with the ownership structure of firms. Major institutional shareholders affect the extent to which VCFs may influence decision making in portfolio companies, consequently affecting IPO and post-IPO firm performance.

We further control for the length of time the firm has been listed. Firm performance and growth may be related to the maturity of the listed firm and the ability to access public capital. As shown in Table 1, the panel data is unbalanced with many VC-backed firms appearing in recent years. To address this concern, we add a control variable, *IPO\_Age*, which measures the number of years the firm has been listed in a stock exchange. Finally, to control for cross-market effects, we add a control variable to distinguish whether the firm is listed on main boards of exchange markets or the secondary board. *ChiNext* is a dummy variable that equals 1 if the firm is listed on ChiNext and 0 otherwise.

Table 2 presents the t-test results on the differences between VC-backed and non-VC-backed firms in all variables of interest for the subject period. VC-backed

Table 2. Summary Statistics

Panel A. Features of VC-backed and Non-VC-backed Firms													
Variables	Non-VC-backed Firms						VC-backed Firms						
	Observations	Mean	S.D.	Var.	Skewness	Kurtosis	Observations	Mean	S.D.	Var.	Skewness	Kurtosis	t-stat
<i>ROA</i>	16,622	0.033	0.082	0.007	-2.048	15.919	603	0.073	0.061	0.004	-1.615	14.774	15.816
<i>ROE</i>	16,161	0.063	0.191	0.037	-2.634	40.895	597	0.123	0.091	0.008	-0.29	9.46	14.709
<i>G_Emp</i>	12,878	0.022	0.487	0.237	-0.371	32.507	490	0.162	0.279	0.078	0.889	9.028	10.473
<i>G_Sales</i>	16,601	0.125	0.603	0.364	-0.464	66.959	603	0.226	0.255	0.065	1.675	14.929	8.841
<i>Tobin's Q</i>	16,549	2.665	1.835	3.369	2.9	15.182	604	3.621	2.114	4.47	1.926	8.338	10.966
<i>InsnsShare10</i>	10,515	0.54	0.153	0.023	-0.178	2.656	523	0.579	0.129	0.017	-0.297	2.714	6.857
<i>InsnsShare10</i>	10,515	0.574	0.151	0.023	-0.295	2.732	526	0.646	0.121	0.015	-0.72	3.591	13.185
<i>Xcwhldn_D</i>	10,512	0.502	0.5	0.25	-0.008	1	526	0.679	0.467	0.218	-0.765	1.586	8.437
<i>Mgnhldn_D</i>	10,514	0.645	0.479	0.229	-0.606	1.368	526	0.766	0.424	0.18	-1.258	2.582	6.357
<i>Total assets</i>	16,858	3827.37	17192.11	2.96E+08	19.80	506.88	608	2955.33	5835.90	3.41E+07	5.48	40.85	3.216
<i>SOE</i>	17,068	0.275	0.446	0.199	1.01	2.019	621	0.137	0.344	0.118	2.113	5.464	9.69
<i>LVRG</i>	16,619	2.411	1.997	3.989	4.955	41.319	603	1.789	0.909	0.826	4.725	56.943	15.518
<i>Firm Age</i>	17,067	8.807	4.893	23.944	0.381	2.658	621	7.454	4.201	17.648	0.732	3.393	7.837

Panel B. Features of VCFs			
	<i>Freq.</i>	<i>Percent</i>	<i>Percent</i>
<i>VC_Ind1</i>	18	13.43	60.23
<i>VC_Ind2</i>	116	86.57	39.77
<i>Total</i>	134	100	100

Panel C. Unit Root Tests for Dependent Variables			
Statistic for	Fisher-type	Unit Root Test	p-value
<i>ROA</i>	9361.8		0.000
<i>ROE</i>	9409.2		0.000
<i>G_Emp</i>	1.59E+04		0.000
<i>G_Sales</i>	1.44E+04		0.000
<i>Tobin's Q</i>	1.26E+04		0.000

VC = venture capital, VCFs = venture capital firms.  
Source: Authors' computations.

firms outperform non-VC-backed firms in almost all performance and growth measures. For instance, average ROA and ROE of VC-backed firms are both about twice those of non-VC-backed firms. VC-backed firms have significantly higher average Tobin's Q than non-VC-backed ones. On average, the growth of employees of VC-backed firms is almost eight times that of non-VC-backed ones, while the average growth of total sales of VC-backed firms is approximately twice that of non-VC-backed ones.

The two groups have significantly different levels of corporate governance. On average, the top 10 institutional investors hold 27% of the total shares of VC-backed firms, while the figure for non-VC-backed firms is 21%. More VC-backed firms allocate equity incentives to executives and management teams than non-VC-backed firms. On average, 67.9% and 76.6% of VC-backed firms allocate equity incentives to executives and management teams, respectively; the respective figures for non-VC-backed firms are 50.2% and 64.5%.

The two groups are also significantly different in other aspects. For instance, the average size of non-VC-backed firms as measured by total assets is larger than that of VC-backed ones by 22.3%. Over 27% of non-VC-backed firms are state-owned, while only less than 14% of VC-backed firms are. At the time that they receive venture investment, 46.7% of VC-backed firms have lead VCFs that are older than 10 years. Meanwhile, 56.25% of VCFs specialize in particular industries.

We apply the Wilcoxon test on the median to ensure that our results are not affected by outliers. We use the two-tailed Wilcoxon rank-sum test to determine whether the difference in performance between VC-backed and non-VC-backed firms from the start of VC investment until after 2 years of the investment (Kazmier and Pohl 1984). The results are robust to outliers.

Finally, the dependent variables we are interested in are the performance and growth of firms. Whether firms' performance persists over time is hence of concern. If there is indeed persistence in the series, then the lagged performance measure is likely to be a significant explanatory variable of future performance. This concern is particularly important for short panel unbalanced data such as that used in this paper. To test the persistence of our dependent variables, we perform Fisher-type (Choi 2001) tests in Panel C of Table 2. The results show that all statistics for Fisher-type unit-root tests are statistically significant, suggesting it is safe to reject the null hypothesis that the dependent variables persist over time.

## **V. Empirical Findings**

### **A. VC Investment and Post-IPO Performance and Growth of Firms**

The first research question that we aim to address is whether VC-backed firms exhibit different levels of post-IPO performance and growth compared with

Table 3. **VC Investment and Post-IPO Performance and Growth of Firms**  
(Full sample)

	(1) <i>ROA</i>	(2) <i>ROE</i>	(3) <i>Tobin's Q</i>	(4) <i>G_Emp</i>	(5) <i>G_Sales</i>
<i>VC_Dummy</i>	0.018*** (0.005)	0.028*** (0.007)	0.393*** (0.134)	0.063*** (0.012)	0.059*** (0.012)
<i>SOE</i>	0.003 (0.002)	0.008** (0.004)	0.157*** (0.043)	-0.037*** (0.010)	-0.019** (0.009)
<i>Firm Age</i>	-0.001** (0.000)	-0.000 (0.001)	-0.018** (0.009)	-0.002 (0.001)	-0.004*** (0.001)
<i>IPO_Age</i>	-0.003*** (0.000)	-0.005*** (0.001)	0.009 (0.010)	-0.009*** (0.001)	-0.007*** (0.001)
<i>L_Assets</i>	0.013*** (0.001)	0.029*** (0.002)	-0.998*** (0.050)	0.060*** (0.005)	0.067*** (0.007)
<i>LVRG</i>	-0.005*** (0.001)	-0.015*** (0.003)	-0.057*** (0.011)	-0.007** (0.003)	0.007 (0.005)
<i>ChiNext</i>	0.011*** (0.004)	-0.022*** (0.006)	-0.099 (0.139)	0.123*** (0.022)	0.031 (0.021)
Constant	0.082*** (0.005)	0.154*** (0.010)	7.804*** (0.372)	-0.104 (0.122)	-1.786*** (0.030)
Industry effect	Y	Y	Y	Y	Y
Year effect	Y	Y	Y	Y	Y
No. of observations	17,222	16,758	16,921	13,307	17,189
Adj. R-square	0.133	0.083	0.385	0.034	0.035
p-value	0.000	0.000	0.000	0.000	0.000

\* =  $p < 0.1$ , \*\* =  $p < 0.05$ , \*\*\* =  $p < 0.01$ .

IPO = initial public offering, VC = venture capital.

Note: Standard errors in parentheses.

Source: Authors' computations.

non-VC-backed firms. Table 3 presents the results of panel regressions for performance and growth. *VC\_Dummy* is constantly significant and positively associated with all performance and growth measures, which suggests that VC-backed firms exhibit significantly higher financial returns, market recognition, and growth in size than non-VC-backed firms post-IPO. On average, the *ROA* and *ROE* of VC-backed firms are higher than those of non-VC-backed firms (by 0.018 and 0.028, respectively). Correspondingly, the return on assets (*ROA*) and return on equity (*ROE*) of non-VC-backed firms are roughly 35.6% and 29.5% of the average values of VC-backed firms.

Meanwhile, Model 3 shows that on average, VC-backed firms enjoy a higher Tobin's *Q* than non-VC-backed firms (by 0.39). The difference in Tobin's *Q* is approximately 11% of that for VC-backed firms. Similarly, we find that VC-backed firms exhibit significantly higher growth in employee number and sales, as shown in Models 4 and 5. On average, growth in the number of employees and total sales of VC-backed firms are higher by 0.063 and 0.059, respectively, than those of non-VC-backed firms, and these differences comprise roughly 55.6% of the growth of employees and 34.1% of the growth of total sales of VC-backed firms.

We also find ownership to be correlated with the performance and growth of a firm. Models 2 and 3 in Table 3 show that *SOE* is significantly and positively correlated with *ROE* and Tobin's Q, indicating that state-owned enterprises (SOEs) outperform non-SOEs in terms of financial performance and market recognition. However, *SOE* is significantly and negatively correlated with the growth of employee number and sales, as shown in Models 4 and 5, respectively. This finding suggests that SOEs grew more slowly than non-SOEs.

Meanwhile, firm size is significantly and positively related to financial performance and growth measures. These results suggest that larger firms are more likely to outperform smaller firms in terms of financial returns and growth in scale. However, firm size is significantly and negatively correlated with Tobin's Q, indicating that the value of large firms may generally be discounted by investors. Additionally, *LVRG* is significantly and negatively associated with all aspects of performance and growth in the number of employees.

The relationships between *ChiNext* and the performance measures are also notable. *ChiNext* is significantly and positively correlated with *ROA* and growth in the number of employees, but significantly and negatively associated with *ROE*. The results seem puzzling, with the potential explanation being that most firms listed on ChiNext are normally young and growing firms and may thus have limited access to loans as compared with those listed on the main boards of stock markets, such that these young firms often use equity investment for fund-raising.

Finally, we find that *IPO\_Age* is significantly and negatively correlated with most performance and growth measures. This implies that the performance and growth of a firm decrease over time post-IPO.

Overall, we find a significant and positive relationship between VC investment and post-IPO performance and growth of Chinese firms. However, some identification challenges remain. Given that VC investments were made before the IPO of firms, we are not concerned about reverse causality issues. Instead, we focus on the effects of missing variables or biases driven by our empirical strategies.

For one, the panel data used in our basic estimations are unbalanced, with many firms appearing in later years. In particular, we find that *IPO\_Age* has significant and negative effects on firm performance and growth. We are therefore concerned about whether the results are driven by unbalanced data. Moreover, most VC-backed firms were listed in recent years, whereas the majority of non-VC-backed firms were listed earlier. A natural question therefore is whether the significant and positive relationship between VC investment and firm performance and growth that we have found can be attributed to the IPO maturity of firms. VC investment and firm performance and growth may be difficult to link for a long post-IPO period.

To address all these concerns, we employ two different approaches. First, we build a balanced sample that restricts the post-IPO performance of firms within the first 3 years after an IPO for both VC-backed and non-VC-backed firms, similar to the strategy used by Krishnan et al. (2011). We present the results in the Appendix.

As shown in Table A.1, when considering only the performance and growth measures of firms within 3 years post-IPO, the effects of VC investment remain robust. These results suggest that the significant relationships between VC investment and firm performance and growth we observe in Table 3 are not driven by IPO maturity.

The second approach we use to address the concerns with the unbalanced data is to conduct a simple cross-sectional analysis of firm performance and growth in the first, second, and third year post-IPO, similar to the approach used by the study of Krishnan et al. (2011). Once again, the significant and positive effects of VC investment remain robust. Owing to space limitations, we do not present the results in this study, but the results can be provided by request.

Aside from IPO maturity, we are also concerned about selection issues and unobservable variables. First, VCFs may invest in better performing companies *ex ante*. Selected companies are more likely to take advantage of external opportunities than non-VC-backed firms; thus, they grow and perform at an improved pace, particularly after IPO when they have better access to public capital. Meanwhile, several missing variables, which coincidentally coexist with VC investment, may contribute to the superior performance of VC-backed firms post-IPO. Thus, the effects of VC investment in Table 3 may be inflated.

We address the above identification concerns with two approaches. First, we address the selection biases using propensity score matching (PSM) methodology to match VC-backed firms with non-VC-backed firms by industry, time of IPO, and firm age at the time of IPO to reduce potential selection issues. As shown in Table 4, the significant relationship between VC investment and all firm performance and growth measures remains robust.

Second, we address the identification concerns by employing a two-stage estimation procedure to identify the effects of VC investment (Li and Wooldridge 2002). We employ an instrumental variable called *IPO\_CN* which refers to the number of IPOs in Chinese stock markets in the city in which the firm is located 1 year before the VC investment is made. This is to predict the probability of a firm being backed by VC investment in the first-stage estimation. *IPO\_CN* is a qualified instrumental variable because it is correlated with the demand and supply of VC investment in the city but is independent of the performance of VC-backed firms. The probability of whether a firm will undertake an IPO may predict whether a firm may be selected by VCFs. An IPO is evidently the most successful exit approach for VC investment. Thus, firms with a higher chance to be listed soon appear more attractive to potential VCFs.

Chinese institutions determine the number of IPO cases across regions. The equity share issuance of firms has been heavily governed and influenced by the central government in the PRC. Under a quota system, the government determines the total number of shares to be issued locally and then allocates stock issuance quotas to regions and ministries. Regional governments, in turn, allocate quotas to selected companies that plan to go public through IPOs. Even after 2003, when

Table 4. **VC Investment and Post-IPO Performance and Growth of Firms**  
(PSM sample)

	(1) <i>ROA</i>	(2) <i>ROE</i>	(3) <i>Tobin's Q</i>	(4) <i>G_Emp</i>	(5) <i>G_Sales</i>
<i>VC_Dummy</i>	0.015*** (0.005)	0.027*** (0.007)	0.401*** (0.129)	0.051*** (0.012)	0.049*** (0.012)
<i>SOE</i>	-0.002 (0.003)	-0.001 (0.005)	0.118* (0.063)	-0.022 (0.015)	-0.024* (0.014)
<i>Firm Age</i>	-0.001** (0.001)	-0.002* (0.001)	-0.044*** (0.012)	-0.003 (0.002)	-0.003 (0.002)
<i>IPO_Age</i>	-0.004*** (0.001)	-0.005*** (0.001)	0.026* (0.016)	-0.012*** (0.002)	-0.010*** (0.002)
<i>L_Assets</i>	0.014*** (0.002)	0.034*** (0.004)	-0.860*** (0.080)	0.055*** (0.009)	0.069*** (0.010)
<i>LVRG</i>	-0.008*** (0.002)	-0.023*** (0.007)	-0.069*** (0.025)	-0.013 (0.008)	0.002 (0.011)
<i>ChiNext</i>	0.009** (0.004)	-0.018*** (0.007)	0.022 (0.153)	0.097*** (0.023)	0.021 (0.021)
<i>Constant</i>	0.017 (0.015)	-0.046* (0.025)	8.209*** (0.646)	0.187*** (0.047)	-0.262*** (0.085)
Industry effect	Y	Y	Y	Y	Y
Year effect	Y	Y	Y	Y	Y
No. of observations	6,896	6,791	6,791	5,508	6,882
Adj. R-square	0.195	0.136	0.365	0.048	0.046
p-value	0.000	0.000	0.000	0.000	0.000

\* =  $p < 0.1$ , \*\* =  $p < 0.05$ , \*\*\* =  $p < 0.01$ .

IPO = initial public offering, PSM = propensity score matching, VC = venture capital.

Note: Standard errors in parentheses.

Source: Authors' computations.

the quota system was abandoned, IPOs continued to be tightly controlled by the central government (i.e., China Securities Regulatory Commission [CSEC]). Thus, the number of annual IPOs indicated the ease of obtaining IPO approval from the government for the following year (Du and Xu 2009).

A number of VC-backed firms, particularly foreign ones, choose to be listed on foreign stock exchange markets. Nonetheless, even for IPOs abroad, a firm should gain approval from the Ministry of Foreign Trade and Commerce prior to 2005 and register with them after 2005. Stated differently, firms still need to undergo complicated approval procedures for IPO listing in overseas stock markets. IPO cases in the previous year have a significant implication on IPO cases for the subsequent year. Hence, we suggest that VCFs prefer investing in companies located in areas with higher quotas or that have better chances to list more firms in stock markets. The number of IPOs is not directly correlated with the performance of individual firms. Thus, we suggest that *IPO\_CN* could serve as a good instrumental variable.

Table 5 presents the two-stage estimations. Panel A shows first-stage estimations where we regress *VC\_Dummy* on the set of independent variables, including

Table 5. Two-stage Estimations for VC Investment Effects

Panel A. First-stage Estimations of the Two-stage Regressions					
	(1)	(2)	(3)	(4)	(5)
	<i>VC_Dummy</i>	<i>VC_Dummy</i>	<i>VC_Dummy</i>	<i>VC_Dummy</i>	<i>VC_Dummy</i>
<i>IPO_CN</i>	0.029*** (0.008)	0.030*** (0.008)	0.029*** (0.008)	0.031*** (0.008)	0.029*** (0.008)
Constant	-1.436*** (0.204)	-1.388*** (0.210)	-1.378*** (0.206)	-1.339*** (0.224)	-1.427*** (0.205)
Pseudo R-square	0.205	0.209	0.204	0.203	0.205
Panel B. Second-stage Estimations of the Two-stage Regressions					
	(1)	(2)	(3)	(4)	(5)
	<i>ROA</i>	<i>ROE</i>	<i>Tobin's Q</i>	<i>G_Emp</i>	<i>G_Sales</i>
<i>VC_Dummy</i>	0.130*** (0.023)	0.072 (0.060)	5.744*** (0.717)	0.272** (0.129)	-0.180 (0.150)
<i>SOE</i>	0.004*** (0.002)	0.007* (0.004)	0.266*** (0.033)	-0.030** (0.013)	-0.025** (0.011)
<i>Firm Age</i>	-0.001* (0.000)	0.000 (0.001)	0.012* (0.006)	-0.001 (0.002)	-0.005** (0.002)
<i>IPO_Age</i>	-0.002*** (0.000)	-0.005*** (0.001)	0.052*** (0.008)	-0.008*** (0.002)	-0.010*** (0.002)
<i>L_Assets</i>	0.014*** (0.001)	0.031*** (0.002)	-0.832*** (0.022)	0.065*** (0.006)	0.075*** (0.008)
<i>LVRG</i>	-0.005*** (0.001)	-0.013*** (0.004)	-0.051*** (0.009)	-0.006* (0.003)	0.007 (0.006)
<i>ChiNext</i>	-0.013 (0.008)	-0.032*** (0.011)	-0.939*** (0.309)	0.079** (0.035)	0.086** (0.035)
Constant	0.013 (0.009)	-0.028** (0.013)	7.727*** (0.178)	-0.403*** (0.044)	-0.272*** (0.062)
Industry effect	Y	Y	Y	Y	Y
Year effect	Y	Y	Y	Y	Y
No. of observations	15,264	14,824	14,996	11,448	15,237
Adj. R-square	0.073	0.075	0.145	0.027	0.028
p-value	0.000	0.000	0.000	0.000	0.000

\* =  $p < 0.1$ , \*\* =  $p < 0.05$ , \*\*\* =  $p < 0.01$ .

VC = venture capital.

Note: Standard errors in parentheses. The first stage regressions are full estimations with all control variables included, but we do not show them to save space.

Source: Authors' computations.

our instrumental variable. First-stage regressions in Panel A confirm that *IPO\_CN* is a statistically qualified instrumental variable that is both significantly and positively correlated with *VC\_Dummy* for all estimates.

Panel B of Table 5 shows the results of second-stage regressions, in which *VC\_Dummy* is instrumented by *IPO\_CN*. *VC\_Dummy* is significantly and positively correlated with profitability measured by *ROA* and *ROE*, market recognition measured by *Tobin's Q*, and growth in the number of employees. The results are generally consistent with those shown in Table 3, suggesting that firm differences in terms of profitability, market performance, and growth are driven by VC investment.

We also conduct two-stage estimations for the PSM sample and find that the effects of VC investment on firm performance and growth remain robust (the results are provided by request). Overall, using two-stage Heckman estimation enables us to identify the likelihood of a firm being selected by VC investment. The results of the two-stage regressions confirm the post-IPO effects of VCFs on the performance and growth of firms.

## **B. Do Experience and Specialization of VCFs Matter?**

We determine whether VCF investment experience and specialization vary in their effects on post-IPO performance and growth. As previously discussed, the post-IPO effect of venture investment is mainly focused on two mechanisms, the certification and value-added effects of VCFs. VC backing may be a signal to investors that a firm has more potential than its peers. This attracts more investments and leads to better performance and faster growth. Meanwhile, the outperformance and faster growth of VC-backed firms after IPO may relate to the monitoring efforts of VCFs before exit or the effective corporate governance structures implemented before exit (Brav and Gompers 1997, Krishnan et al. 2011). The arguments suggest two major requirements—reputation and expertise—that enable VCFs to certify or add value to efficiently monitor and guide the firms they support. Logic implies that if venture investment can certify and add value to portfolio companies, companies backed by VCFs with greater experience and expertise should outperform those backed by VCFs with less experience and expertise.

Table 6 reports the regression results of the relationship between VCF experience and post-IPO performance and growth of firms. As mentioned earlier, we use age to measure VCF experience. The results show that *VC\_Age1* is significantly and positively correlated with all the post-IPO performance and growth measures of firms. Similar results are found with *VC\_Age2*. The only exception is that no statistically significant relationship exists between *VC\_Age2* and *Tobin's Q*. Overall, the results suggest that VC-backed firms enjoy higher profitability, better market recognition, and faster growth than non-VC-backed ones regardless of the experience of the lead VCF. Meanwhile, we observe that the coefficients of *VC\_Age1* are larger than those of *VC\_Age2* in most cases, with *ROE* as the only exception. In order to determine whether the effects of the two types of VCFs are significantly different, we further conduct Lincom tests for the coefficients of *VC\_Age1* and *VC\_Age2*. As shown in Table 6, none of the p-values of the Lincom tests is smaller than 10%, which suggests that the coefficients of *VC\_Age1* and *VC\_Age2* are not significantly different. The results indicate that the experience of VCFs does not significantly influence performance or growth of entrepreneurial firms in the PRC.

Next, we focus on the specialization of VCFs and its effects on post-IPO performance and growth of firms. While some VCFs focus on investing within

Table 6. Experience of VCFs and Post-IPO Performance and Growth of Firms

	(1) <i>ROA</i>	(2) <i>ROE</i>	(3) <i>Tobin's Q</i>	(4) <i>G_Emp</i>	(5) <i>G_Sales</i>
<i>VC_Age1</i>	0.019*** (0.006)	0.025** (0.011)	0.556*** (0.173)	0.080*** (0.019)	0.062*** (0.016)
<i>VC_Age2</i>	0.016** (0.006)	0.029*** (0.010)	0.219 (0.214)	0.054*** (0.014)	0.057*** (0.014)
<i>SOE</i>	0.003 (0.002)	0.008** (0.004)	0.156*** (0.043)	-0.037*** (0.010)	-0.018** (0.009)
<i>Firm Age</i>	-0.001** (0.000)	0.000 (0.001)	-0.019** (0.009)	-0.002 (0.001)	-0.004*** (0.001)
<i>IPO_Age</i>	-0.003*** (0.000)	-0.005*** (0.001)	0.009 (0.010)	-0.009*** (0.001)	-0.007*** (0.001)
<i>L_Assets</i>	0.013*** (0.001)	0.030*** (0.002)	-1.000*** (0.050)	0.060*** (0.005)	0.067*** (0.007)
<i>LVRG</i>	-0.005*** (0.001)	-0.015*** (0.003)	-0.057*** (0.011)	-0.007** (0.003)	0.007 (0.005)
<i>ChiNext</i>	0.011*** (0.004)	-0.021*** (0.006)	-0.084 (0.149)	0.118*** (0.023)	0.028 (0.022)
Constant	0.082*** (0.005)	0.154*** (0.010)	7.820*** (0.374)	-0.105 (0.122)	-1.787*** (0.030)
Industry effect	Y	Y	Y	Y	Y
Year effect	Y	Y	Y	Y	Y
Lincom Tests	-0.003	0.004	-0.337	-0.025	-0.005
<i>VC_Age2-VC_Age1</i>	(0.009)	(0.014)	(0.269)	(0.22)	(0.019)
No. of observations	17,175	16,711	16,874	13,281	17,142
Adj. R-square	0.133	0.083	0.386	0.034	0.035
p-value	0.000	0.000	0.000	0.000	0.000

\* =  $p < 0.1$ , \*\* =  $p < 0.05$ , \*\*\* =  $p < 0.01$ .

IPO = initial public offering, VCFs = venture capital firms.

Note: Standard errors in parentheses.

Source: Authors' computations.

particular industries, others apply more generalist approaches and diversify investments across industries. Theories suggest different predictions on the relationship between specialization and performance. Some studies argue that organizational diversification (i.e., generalist investors) is an important element of efficient capital allocation. However, Rajan, Servaes, and Zingales (2000), Scharfstein (1998), and Scharfstein and Stein (2000) suggest that diversified firms may have difficulty redeploying capital into sectors with better investment opportunities. Empirically, Gompers, Kovner, and Lerner (2009) find that firms backed by more specialized VCFs enjoy higher profitability after IPO than those backed by generalist VCFs. The authors mainly attribute the success of specialized VCFs to their better judgment of the quality of potential portfolio companies and better implementation of monitoring functions than non-specialized VCFs.

Table 7 presents the results pertaining to the relationship between VCF specialization and firm performance and growth. It shows that *VC\_Ind1* is significantly

Table 7. Specialization of VCFs and Post-IPO Performance and Growth of Firms

	(1) <i>ROA</i>	(2) <i>ROE</i>	(3) <i>Tobin's Q</i>	(4) <i>G_Emp</i>	(5) <i>G_Sales</i>
<i>VC_Ind1</i>	0.015** (0.006)	0.023** (0.010)	0.092 (0.183)	0.050*** (0.013)	0.051*** (0.012)
<i>VC_Ind2</i>	0.019*** (0.006)	0.032*** (0.010)	0.644*** (0.179)	0.086*** (0.020)	0.068*** (0.018)
<i>SOE</i>	0.003 (0.002)	0.008** (0.004)	0.156*** (0.043)	-0.037*** (0.010)	-0.019** (0.009)
<i>Firm Age</i>	-0.001** (0.000)	-0.000 (0.001)	-0.018** (0.009)	-0.002 (0.001)	-0.004*** (0.001)
<i>IPO_Age</i>	-0.003*** (0.000)	-0.005*** (0.001)	0.008 (0.010)	-0.009*** (0.001)	-0.007*** (0.001)
<i>L_Assets</i>	0.013*** (0.001)	0.030*** (0.002)	-0.999*** (0.050)	0.060*** (0.005)	0.067*** (0.007)
<i>LVRG</i>	-0.005*** (0.001)	-0.015*** (0.003)	-0.057*** (0.011)	-0.007** (0.003)	0.007 (0.005)
<i>ChiNext</i>	0.011*** (0.004)	-0.023*** (0.006)	-0.151 (0.139)	0.118*** (0.022)	0.030 (0.021)
Constant	0.082*** (0.005)	0.154*** (0.010)	7.814*** (0.372)	-0.105 (0.122)	-1.786*** (0.030)
Industry effect	Y	Y	Y	Y	Y
Year effect	Y	Y	Y	Y	Y
Lincom Tests	0.004	0.009	0.552**	0.036	0.017
<i>VC_Ind2-VC_Ind1</i>	(0.008)	(0.013)	(0.244)	(0.023)	(0.02)
No. of observations	17,191	16,727	16,890	13,291	17,158
Adj. R-square	0.133	0.083	0.386	0.034	0.035
p-value	0.000	0.000	0.000	0.000	0.000

\* =  $p < 0.1$ , \*\* =  $p < 0.05$ , \*\*\* =  $p < 0.01$ .

IPO = initial public offering, VCFs = venture capital firms.

Note: Standard errors in parentheses.

Source: Authors' computations.

and positively correlated to almost all measures of post-IPO performance and growth, with Tobin's Q as the only exception. Nonetheless, *VC\_Ind2* shows a significant and positive correlation with all performance and growth measures across Models 1 to 5. These results indicate that VC-backed firms outperform non-VC-backed firms in performance and growth no matter whether the lead VCF has a specific industry preference or not. Meanwhile, we observe that the coefficients of *VC\_Ind2* are constantly larger than those of *VC\_Ind1* for all performance and growth measures. Once again, we conduct Lincom tests for the coefficients of *VC\_Ind1* and *VC\_Ind2*. As shown in Table 7, almost all the p-values for the Lincom tests are larger than 10%, with Tobin's Q as the only exception. The results of Lincom tests suggest that whether a firm is backed by VCFs with specific industry preference or not does not affect the post-IPO financial performance or growth of the firm. However, the Lincom tests show that the coefficients of *VC\_Ind1* and *VC\_Ind2* are significantly different for Tobin's Q, indicating that firms backed by specialized VCFs normally

enjoy significantly higher market recognition than those backed by VCFs without specific industry preference.

Overall, we do not find experience or specialization of VCFs significantly affecting the post-IPO performance or growth of entrepreneurial firms in the PRC. The only exceptional case is that firms backed by VCFs with specific industry preference are better recognized by investors than those backed by generalist VCFs. In general, these results are consistent with findings in Japan (Hamao, Packer, and Ritter 2000), Europe (Bottazzi and Da Rin 2002a, 2002b), and Singapore (Wang, Wang, and Lu 2003). However, the results contrast with the findings in the US (Lerner 1994, Brav and Gompers 1997, Nahata 2008, Krishnan et al. 2011) where experience of VCFs is found to be positively correlated with firm performance.

### C. Corporate Governance and VC Investment

We have provided evidence on the positive effects of VC investment on firm performance and growth post-IPO. However, a challenging question left unanswered is why VC-backed firms outperform non-VC-backed ones. In particular, we try to determine why outperformance continues in the long-term, even after an IPO, when VCFs normally exit soon afterward.

Existing studies try to link the monitoring function of VCFs and the out-performance of VC-backed firms. Brav and Gompers (1997), for example, suggest that VCFs tend to place effective management structures that may affect long-term performance. However, little evidence differentiates the management structures of VC-backed firms from those of others. Among the few studies that consider the corporate governance of VC-backed firms, Krishnan et al. (2011) provide evidence on positive relationships among VC investment, corporate governance, and VC-backed firm performance based on the US data.

We also link VC investment and corporate governance to explore further the factors that explain the post-IPO performance of VC-backed firms in the PRC. We first focus on the alignment of interests between shareholders and managers. Conflict of interest between executives and shareholders is a classic issue that results in principal-agent problems. A compensation plan that aligns the interests of the two parties may give managers the incentive to maximize shareholder return and improve performance (Jensen and Murphy 1990). Meanwhile, Kaplan and Strömberg (2003) find that the more a project is associated with information asymmetry issues and higher uncertainty in the US, the more likely executives and management teams are allocated equity stock. As previously mentioned, we measure the alignment of interests in two ways, with a focus on the stockholdings of executives and management teams.

We also consider institutional ownership of firms. Aghion, Van Reenen, and Zingales (2013) find that institutional ownership is positively associated with R&D productivity, indicating that institutional investors are more likely to be focused on long-term performance. Given that VCFs themselves are institutional investors, we

Table 8. VC Investment and Corporate Governance of Firms after IPO

	(1) <i>Mgnhldn_D</i>	(2) <i>Xcuhldn_D</i>	(3) <i>InsnShare10</i>
<i>VC_Dummy</i>	1.302*** (0.318)	1.166*** (0.353)	-0.004 (0.007)
<i>SOE</i>	-0.346*** (0.080)	-0.311*** (0.086)	0.039*** (0.004)
<i>Firm Age</i>	0.140*** (0.027)	0.120*** (0.033)	-0.004*** (0.001)
<i>IPO_Age</i>	-0.065*** (0.024)	-0.129*** (0.028)	-0.014*** (0.001)
<i>L_Assets</i>	0.214*** (0.037)	0.291*** (0.048)	0.029*** (0.003)
<i>LVRG</i>	-0.030*** (0.011)	-0.011 (0.012)	-0.001** (0.001)
<i>ChiNext</i>	3.562*** (0.571)	3.304*** (0.460)	0.029*** (0.008)
Constant	2.413*** (0.084)	2.639*** (0.086)	0.514*** (0.022)
Industry effect	Y	Y	Y
Year effect	Y	Y	Y
No. of observations	10,927	10,925	10,927
Adj. R-square			0.329
p-value	0.000	0.000	0.000

\* =  $p < 0.1$ , \*\* =  $p < 0.05$ , \*\*\* =  $p < 0.01$ .

IPO = initial public offering, VC = venture capital.

Note: Standard errors in parentheses.

Source: Authors' computations.

explore whether VC-backed firms may constantly attract institutional investors even after the exit of VCFs and consequently perform better in the long-term.

Table 8 presents the estimates on the corporate governance of firms. Models 1 and 2 show that *VC\_Dummy* has a significant and positive association with *Mgnhldn\_D* and *Xcuhldn\_D*, suggesting that VC-backed firms are more likely to allocate equity incentives to executives and management teams than non-VC-backed firms. Meanwhile, Model 3 shows that *InsnShare10* is also positively associated with *VC\_Dummy*, although the relationship is not statistically significant. These results suggest that compared with non-VC-backed firms, VC-backed firms seem more likely to give higher incentives to executives and management teams by aligning interests among investors, executives, and management teams.

To address potential identification concerns, we conduct two-stage Heckman estimations with the instrumental variable, *IPO\_CN*, to identify whether the difference in corporate governance shown in Table 8 is driven by VC investment. Our findings remain robust, as shown in Table 9.

In sum, we find positive relations among VC investment, ownership concentration, and the alignment of interests between shareholders and investors in the PRC. Our findings are consistent with those of Brav and Gompers (1997), and

Table 9. Two-stage Estimations for VC Effects on Corporate Governance

<b>Panel A. First-stage Estimations of the Two-stage Regressions</b>			
	(1)	(2)	(3)
	<i>VC_Dummy</i>	<i>VC_Dummy</i>	<i>VC_Dummy</i>
<i>IPO_CN</i>	0.028*** (0.008)	0.028*** (0.008)	0.028*** (0.008)
Constant	-1.426*** (0.224)	-1.425*** (0.224)	-1.426*** (0.224)
Pseudo R-square	0.219	0.219	0.219
<b>Panel B. Second-stage Estimations of the Two-stage Regressions</b>			
	(1)	(2)	(3)
	<i>Mgnhldn_D</i>	<i>Xcuhldn_D</i>	<i>InsnShare10</i>
<i>VC_Dummy</i>	1.607*** (0.209)	1.518*** (0.207)	0.655*** (0.076)
<i>SOE</i>	-0.108*** (0.016)	-0.127*** (0.016)	0.122*** (0.005)
<i>Firm Age</i>	0.013*** (0.002)	0.013*** (0.002)	-0.005*** (0.001)
<i>IPO_Age</i>	0.016*** (0.003)	0.007*** (0.003)	-0.004*** (0.001)
<i>L_Assets</i>	0.056*** (0.005)	0.069*** (0.005)	0.013*** (0.002)
<i>LVRG</i>	-0.009*** (0.003)	-0.011*** (0.002)	0.001** (0.001)
<i>ChiNext</i>	0.071 (0.086)	0.106 (0.087)	-0.086** (0.034)
Constant	-0.048 (0.051)	-0.217*** (0.050)	0.496*** (0.017)
Industry effect	Y	Y	Y
Year effect	Y	Y	Y
No. of observations	9,595	9,593	9,595
p-value	0.000	0.000	0.000

\* =  $p < 0.1$ , \*\* =  $p < 0.05$ , \*\*\* =  $p < 0.01$ .

VC = venture capital.

Note: Standard errors in parentheses. The first stage regressions are full estimations with all control variables included, but we do not show them to save space.

Source: Authors' computations.

Krishnan et al. (2011), and may thus help explain the outperformance of VC-backed firms after IPO in the long-term. However, we cannot claim the explanation as conclusive given the nature of the estimates. We suggest that our results can help gain insights into the mechanisms through which VC investment affects long-term firm performance and growth.

## VI. Conclusion

This study examines the effects of VC investment on the post-IPO performance and growth of Chinese entrepreneurial firms. To the best of our knowledge,

this study is the first to provide related evidence in the PRC. Our firm-level panel data analysis finds that VCFs contribute to the long-term performance and growth of entrepreneurial firms post-IPO. Moreover, a significant and positive relationship exists between firm corporate governance and VC investment. However, we do not find that experience and specialization of VCFs matter in terms of their effects on post-IPO performance and growth of entrepreneurial firms in the PRC.

We contribute to the VC investment literature in four aspects. First, following Brav and Gompers (1997) and Krishnan et al. (2011), this study is among the first attempts to link the features of VCFs, corporate governance, and post-IPO performance and growth of VC-backed firms. We gain an insightful understanding of the mechanisms through which VC investments affect the performance and growth of entrepreneurial firms. Second, this study contributes to the existing literature on the effects of diversification on investment performance with the focus on private equity investment. Third, this work is among the first systematic estimations of the contribution of VC investment to entrepreneurial firms post-IPO in the PRC, where capital markets are distinct from those of Western countries (Allen, Qian, and Qian 2005; Wang 2005; Fan, Wong, and Zhang 2007; Kao, Wu, and Yang 2009; Allen et al. 2012; Piotroski and Zhang 2014). Hence, we contribute to the literature on corporate finance in emerging markets by examining the influence of institutions (Hu, Jefferson, and Qian 2005; Jefferson et al. 2006; Cull, Xu, and Zhu 2009).

This research also contributes to policymaking. The PRC has exerted numerous efforts to encourage VC investment with the expectation of stimulating entrepreneurship, especially R&D entrepreneurship activities. However, without a solid empirical evaluation of the effects of VC investment, no foundation exists on which to direct further development of the VC market. This study confirms a positive relationship between VC investment and the long-term performance of VC-backed companies in the PRC. In particular, this work shows the influences of VC investment on the corporate governance of companies. Moreover, by reviewing the development of the VC market in the past 3 decades, this study suggests that the VC market achieved rapid development in the PRC with the relaxation of restrictions on corporate structure and fund-raising of institutional investors over the past few years.

This study clearly has implications for business practitioners. Those operating in this market and those wishing to enter into this market may gain insight into the institutional issues they might encounter as well as the associated opportunities and threats. This study contributes to the business practice of entrepreneurs by showing that VCFs not only provide capital for entrepreneurial firms but also deeply engage in the management of firms and add value to the firms. Moreover, it highlights how different types of VCFs may vary in terms of their effects on entrepreneurial firms.

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\*ADB recognizes "China" as the People's Republic of China.

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## Appendix

Table A.1. VC Investment and Post-IPO Performance and Growth of Firms within 3 Years after IPO

	(1) ROA	(2) ROE	(3) Tobin's Q	(4) G_Emp	(5) G_Sales
<i>VC_Dummy</i>	0.008** (0.003)	0.010* (0.006)	0.405*** (0.138)	0.041*** (0.015)	0.053*** (0.013)
<i>SOE</i>	-0.004** (0.002)	-0.004 (0.004)	0.024 (0.046)	-0.043*** (0.013)	-0.013 (0.012)
<i>Firm Age</i>	-0.001*** (0.000)	-0.002** (0.001)	-0.024*** (0.009)	-0.003** (0.002)	-0.004*** (0.002)
<i>IPO_Age</i>	-0.012*** (0.001)	-0.022*** (0.001)	-0.109*** (0.017)	-0.023*** (0.005)	-0.012*** (0.004)
<i>L_Assets</i>	0.007*** (0.001)	0.033*** (0.005)	-0.589*** (0.039)	0.019*** (0.006)	0.026*** (0.006)
<i>LVRG</i>	-0.014*** (0.002)	-0.052*** (0.011)	-0.078** (0.034)	-0.011* (0.006)	-0.014 (0.011)
<i>ChiNext</i>	0.000 (0.003)	-0.031*** (0.006)	0.026 (0.141)	0.061*** (0.023)	0.011 (0.021)
Constant	0.148*** (0.007)	0.226*** (0.015)	8.372*** (0.232)	0.174 (0.115)	-1.548*** (0.029)
Industry effect	Y	Y	Y	Y	Y
Year effect	Y	Y	Y	Y	Y
No. observations	6,322	6,313	6,284	3,701	6,317
Adj. R-square	0.223	0.209	0.372	0.047	0.048
p-value	0.000	0.000	0.000	0.000	0.000

\* =  $p < 0.1$ , \*\* =  $p < 0.05$ , \*\*\* =  $p < 0.01$ .

IPO = initial public offering, VC = venture capital.

Note: Standard errors in parentheses.

Source: Authors' computations.