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Governmental Venture Capital Firms in China: performance and interaction with private peers

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Abstract

This research combines quantitative and qualitative methods and aims to provide a detailed analysis of the characteristics of governmental venture capital firms (GVCs) in China, their interaction with private venture capital firms (PVCs) through syndication and the methods to improve GVCs' performance.

I first identify the strengths and weaknesses of GVCs in each stage of a VC life cycle and compare them with PVCs. I focus on VC firms' exit performance in their portfolio companies and carry out empirical tests using data on VC investments in China between 1991 and 2010. I find that portfolio companies backed by GVCs are less likely to go public than those backed by PVCs, but they have no statistically significant difference in the likelihood of exiting through merger and acquisition. However, when GVCs invest in their local portfolio companies, the underperformance of these investments exiting through IPOs is moderated. In addition, GVCs show no superior performance in early-stage investments.

I then look at the mixed syndication that involves both GVCs and PVCs. I identify the positive and negative aspects of mixed syndication and find that the portfolio companies backed by mixed syndication are less likely to receive their second round of financing than those backed by syndication solely among PVCs. I present evidence consistent with two possible explanations: (1) PVC-led mixed syndicates select riskier projects to invest in; (2) lead PVCs with an above-average networking position get limited benefits but suffer high coordination costs from mixed syndication.

Lastly, I carry out a case study on Shenzhen Capital Group (SCG), one of the most successful GVCs in China, to explore the methods for improving the performance of GVCs. SCG used to face limited funding resources, less effective compensation schemes and the hurdle of annual assessment by the government as other GVCs did. I document how SCG tackled these problems through its expansion strategy and established a link between SCG's investment performance and future fundraising. In addition, SCG carried out a series of reforms in compensation, decision-making and staff investment, which better aligned the interests of managers and the company. I find that the investments made by SCG after it adopted its new strategy resulted in higher returns than other GVCs. Furthermore, portfolio companies that received investment by SCG or SCG-led syndicates in their first round of VC financing were more likely to achieve successful exits than those portfolio companies backed by other GVCs.

Acknowledgements

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Glossary

VC   venture capital

GVCs   governmental venture capital firms

PVCs   private venture capital firms

SASAC   State-owned Assets Supervision and Administration Commission

SOEs   state-owned enterprises

CSRC   China Securities Regulatory Commission

IPO   initial public offering

M&A   merger and acquisition

LPs   limited partners who commit capital to venture capital funds

GPs   general partners who manage venture capital funds

ChiNext   a NASDAQ-style board in the Shenzhen Stock Exchange

RMB   Ren Min Bi (Chinese Yuan)

SCG   Shenzhen Capital Group

GBFs   Government-backed Funds

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CO-AUTHORS

Name	Nature of Contribution
David Mayes	15%, suggestions on the structure of analysis and revision.

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Name	Signature	Date
Prof David Mayes passed away in Nov 2017, before the paper was accepted by the journal. A memo is attached as required by Graduate School of Study, The University of Auckland		

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My late supervisor Prof David Mayes passed away in Nov 2017. We did not sign the Co-authorship Form for the paper *The performance of governmental venture capital firms: A life cycle perspective and evidence from China*, which was published on Pacific-Basin Finance Journal (Volume 48, April 2018, Pages 162-185), because I did not receive the confirmation of acceptance from the journal until Feb 2018. Therefore, I include a Co-authorship Form without signature with this memo, as required by the School of Graduate Studies, The University of Auckland.

1. Introduction

Venture capital (VC) is often superior to traditional financing options in promoting the development of small and medium enterprises (SMEs) and in facilitating the commercialization of innovations in high-tech entrepreneurial companies. It brings both funding and a variety of value-added services to investees. Furthermore, it takes the form of equity investment rather than debts that need a considerable value of tangible assets as collateral. Chinese economic development is, at least partly, attributed to the growth in SMEs (J. Chen, 2006) and research and development (R&D) (A. G. Hu *et al.*, 2005; Jefferson *et al.*, 2006). Therefore, it is vitally important to pursue sound and effective public policies to support a healthy and active VC market in China.

There is a hot debate on the efficacy of the relevant public policies designed to create an active VC market (Guerini & Quas, 2016; Alperovych *et al.*, 2015; Cumming, 2014; Lerner, 2009). Although China has already become the second largest venture capital market in the world (Ernst & Young, 2014), little research has been done regarding the efficacy of public policies in the context of the Chinese VC market.

The Chinese government, especially the local governments across the country, have set up governmental venture capital firms (GVCs) and adopted a hands-on approach to promoting entrepreneurship. GVCs either invest in portfolio companies by themselves or form syndicates with private venture capital firms (PVCs). The accumulated investment by GVCs reached 7.3 billion USD by the end of 2016, accounting for 17% of the Chinese VC market since the 1990s[1].

China provides an interesting setting for analysing the performance of GVCs and their syndication with PVCs due to a number of features in the governance of GVCs and the special approval mechanism of its domestic stock markets. Firstly, GVCs, defined by their ownership and governance, are regulated in the same way as other state-owned enterprises (SOEs) in China and, therefore, are subject to an annual assessment of their performance and supervision of their operation by the government. Secondly, the administration-based initial public offering (IPO) approval system enables GVCs to have better access to the domestic stock markets than PVCs. This unique institutional background provides a rich context to

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[1] The number is calculated based on the venture capital investments recorded by PEdata, which is a widely-used proprietary database of venture capital investment in China.

measure GVCs' governance, behaviour, strengths and weaknesses, and their interaction with PVCs. However, the extant literature on GVCs and PVCs in China fails to scrutinize the differences in these two types of VC firms in the specific institutional background of China.

Some prior research on GVCs in China relied on the classification of GVCs by the commercial database (PEdata). PEdata is a proprietary database that tracks VC investments in China. It categorises VC firms as "those with a state background" if a VC firm declares that it has connections with the state when answering PEdata's questionnaire. Consequently, VC firms that have only a very small proportion of funding coming from the government may be categorised as VCs with state background by PEdata. The classification by PEdata provides a start-point for me to categorise VC firms as GVCs or PVCs. In my study, GVCs are defined as venture capital firms that have been established by the government, have their main funding resource from the government, and are operated by managers appointed by the government. I manually cross-check the information on VC firms by referring to the official websites of the VC firms and the National Enterprise Credit Information Publicity System, to make sure only VC firms that meet all the three criteria of GVCs are categorised as GVCs.

My thesis investigates the performance of GVCs, their syndication with PVCs, and the ways for improving the performance of GVCs in three separate chapters. I use quantitative analysis as the main methodology and supplement it with the information collected from an online survey, six interviews and my observations. The main measures of the GVCs' performance include their portfolio companies' success in getting listed or being acquired and their temporary success in obtaining subsequent financing. The selection of these measures is not to deny or ignore the potential influence of GVCs on the development of the VC industry and the economy, but to provide an object comparison between GVCs and PVCs. The ultimate purpose of this thesis is to provide policy-makers with a clearer understanding of the performance of GVCs, suggestions on the design of policies that promote the syndication between GVCs and PVCs, and ways for improving the performance of GVCs from a strategic perspective.

The main body of my thesis, which addresses three key research themes, are Chapters Four, Five and Six. These chapters are summarised as follows.

1.1. Chapter Four—the performance of governmental venture capital firms: a life cycle perspective and evidence from China

This chapter compares GVCs and PVCs from the perspective of a VC life cycle. The extant literature emphasises that GVCs fail to motivate their VC managers as effectively as PVCs because GVCs cannot provide competitive compensation schemes (Cumming *et al*. 2017). I take the analysis a step further and point out that the VC life cycle serves as an important incentive for VCs and plays a vital role in aligning the interests of limited partners with those of the general partners. A key difference between GVCs and PVCs is that the former group does not have a link between their investment performance and future fund-raising. Therefore, the overall level of effort by GVCs is expected to be lower than that of PVCs.

According to PEdata, the proportion of early-stage investment in total investment was 32% for GVCs and 38% for PVCs between 1991 and 2010. However, early-stage investment requires VC firms to have better capabilities and more resources to engage with their investees as well as stronger incentives for VC managers to devote time and effort to the investments. Therefore, early-stage investments by GVCs are not expected to outperform early-stage investments by PVCs.

Furthermore, I also take into account the impact of the administrative IPO approval system in China on the performance of GVCs. Although GVCs are expected to perform worse than PVCs, the GVCs' privileged access to domestic stock exchanges may moderate their underperformance when they invest in portfolio companies that are located in the same province as the VC firms.

To test these hypotheses, I construct a dataset of all portfolio companies backed by a sole GVC or sole PVC in their initial round of VC financing between 1991 and 2010. I find that portfolio companies backed by GVCs are less likely to achieve IPOs than those backed by PVCs. However, there is no statistically significant difference in the likelihood of exiting through merger and acquisition (M&A) between these two groups. GVCs do not show any superior capability in screening and nurturing early-stage investment. However, when investing locally, the GVCs' underperformance is moderated. One possible reason is that local governments prioritise the local enterprises that are backed by the local GVCs in getting IPO approvals.

I use three different methods to address potential endogeneity issues that may arise if GVCs and PVCs target different portfolio companies. Firstly, I use the average percentage of

investment by GVCs in a given year across the country as the instrumental variable (Brander *et al*. 2015) for the independent variable "being backed by GVCs". Secondly, I use the propensity score matching method to compare the success rate of portfolio companies with similar characteristics regarding the investment stage, investment amount and location. Thirdly, I take into consideration the unobservable factors that may both affect the probability of being backed by GVCs and the likelihood of achieving successful exits for a portfolio company, using the Heckman treatment effect method. The results of the baseline regressions still hold in the fore-mentioned tests.

In an additional set of analyses, I consider some factors that may drive the original regression results. I replace the dependent variable "successful exits through IPO or M&A" with a dummy variable "whether a portfolio company received further investment after getting its initial round of VC financing" and find the results do not change materially. The results of the baseline regressions are not driven by successful exits through China's new third board, which is regarded as a less liquid stock market. Furthermore, splitting the sample into investments before and after 2006 does not show that GVC underperformance was more prevalent when the Chinese VC industry was more immature. Lastly, adding the ownership of the investees—whether a portfolio company is a state-owned enterprise—into the regression does not change the baseline results.

1.2. Chapter Five—Gain or pain? New evidence on mixed syndication between governmental and private venture capital firms in China

After considering the performance of GVCs when they invest alone, I investigate the performance of mixed syndication, which is defined as syndication that involves both GVCs and PVCs. Mixed syndication is believed to be a more favourable mode of backing entrepreneurs, because it can, on the one hand, overcome the shortcomings of GVCs and, on the other hand, enjoy the favourable public resources brought by GVCs (Cumming *et al.*, 2017).

Although Du (2016) shows that heterogeneity of VC firms in a syndicate leads to a lower success rate for their investees, the literature on mixed syndication has little discussion on the possible coordination cost incurred in the cooperation between GVCs and PVCs. To fill the gap in the literature, I carried out an online survey to ask VC practitioners to share their own experience regarding the costs incurred during their co-investment with GVCs compared to cooperation only among PVCs. The responses from the anonymous venture capitalists

provide a good insight into the costs of mixed syndication. For example, portfolio companies need to provide two different versions of pitching when seeking financing from mixed syndication, because GVCs focus on different aspects from PVCs when making investment decisions. Another example is the uncertainty of mixed syndication investment, caused by the replacement of local officials, a factor which does not affect syndicates among PVCs. I discuss both the positive and negative impacts of mixed syndication on their investees based on the information obtained from the survey and the literature.

I compare the performance of portfolio companies backed by mixed syndication with those backed by syndication only among PVCs. The first measure of performance I use is the same as Chapter Four—the success rate of exits through IPO/M&A. The second measure is the portfolio company's likelihood of obtaining subsequent financing after getting its initial round of VC investment. It is necessary to use the second measure, considering that the IPO approval system in China may bias the performance of mixed syndication. Portfolio companies backed by mixed syndication may outperform those backed by pure PVC syndication because of the GVCs' strength in getting IPO approval for their investees rather than the better screening and value-adding capabilities of mixed syndication.

The empirical results show that when measured by successful exits through IPO/M&A, there are no statistically significant differences between mixed syndication and pure PVC syndication. In contrast, when they are measured by the likelihood of getting subsequent financing, portfolio companies backed by mixed syndication perform worse.

I explore two possible explanations for the underperformance of mixed syndication. Firstly, some mixed syndications led by PVCs have a particular arrangement in that the GVCs, as followers rather than the leaders of a syndicate, only require a fixed rate of return that is similar to government securities. At the same time, the GVCs are not exempt from sharing the losses if the investments fail to generate a positive net return. These specially-designed contracts enable PVCs to enjoy a favourable position regarding the potential returns compared to GVCs. As a result, when PVCs lead the mixed syndicate, they have the motivation to select riskier investment projects to invest in.

A second possible explanation is that the coordination costs of mixed syndication outweigh the benefits that mixed syndication can bring to their investees. I use the networking position of a PVC in the whole VC industry as the proxy for the resources it possesses. The more resources (the higher networking position) a PVC has, the lower the marginal benefit it can

get from its syndication partners. Meanwhile, the coordination cost of mixed syndication increases with the networking position of the lead PVCs, because such PVCs have more established decision-making mechanisms and are, therefore, less adaptable at conflict-solving with their GVCs syndicate partners. The empirical results show that the underperformance of portfolio companies backed by mixed syndication compared to those backed by syndication among PVCs is more profound when the lead PVC has an above-average networking position.

Furthermore, I show that the results are unlikely to be driven by different VCs' preferences for staged financing. Staged financing shortens the length of time between the initial and the subsequent rounds of investments. In the Cox proportional hazard model, a shorter period to subsequent financing means a higher likelihood of getting refinancing. Investments in the early stage, with a smaller amount, or with fewer syndicate partners reflects a relatively higher level of information asymmetry and are, therefore, more likely to be made by VCs using staged financing rather than a lump-sum investment. However, information asymmetry may affect mixed syndication and pure PVC syndication differently. For example, mixed syndication may be more prepared to wait for their portfolio companies to reach a milestone than pure PVC syndication. To test the possible impact of VCs' different preferences for staged financing, I add the interaction terms between these factors relating to the level of information asymmetry and the independent variable "being backed by mixed syndication" in the regression to investigate the different impacts, but do not find any statistically significant results. This suggests that the results obtained from the main regressions are not mainly driven by the different preferences of GVCs and PVCs in staged financing.

1.3. Chapter Six—Improving the performance of governmental venture capital firms: a case study of Shenzhen Capital Group

Based on the discussion of the performance of GVCs in Chapter Four and Chapter Five, Chapter Six throws light on possible ways for improving the performance of GVCs. I investigate the case of Shenzhen Capital Group (SCG), which overcame the challenges for all GVCs by adopting an expansion strategy and a series of reforms involving decision-making and compensation schemes. The analysis follows the framework I use in Chapter Four and emphasises the importance of a continuous VC life cycle in promoting the performance of VC firms. SCG's expansion strategy set up a link between the company's investment performance and its future fundraising. Furthermore, the reformed decision-making

procedure ensured that SCG screened all projects equally and objectively, and the new compensation scheme better aligned the interests of the company and its staff.

Empirical regressions provide evidence that SCG, after adopting its new strategy and reforms, improved its overall return on investments compared to other GVCs. It was better at enhancing its core competency in screening and nurturing its portfolio companies than other GVCs.

1.4. Main contributions

The main contributions of my thesis are as follows.

Firstly, comparing GVCs and PVCs in a VC life cycle framework enables us to better understand the weakness of GVCs in solving agency problems. The case study of SCG provides a realistic example of how GVCs can improve their performances by setting up a link between their investment performance and future fund-raising and by adopting a better-designed compensation scheme.

Secondly, exploring both the positive and negative sides of the cooperation between GVCs and PVCs complements the extant literature on mixed syndication. I point out the importance of using multiple performance measures in the context of the Chinese VC industry and stock markets. I provide new evidence that the performance of portfolio companies backed by mixed syndication is worse than those backed by syndication merely among PVCs when measured by the likelihood of obtaining refinancing.

Thirdly, I also contribute to a growing body of literature on network theory by using the VCs' networks to explain the performance of mixed-syndication. Based on previous research using the networking position to explain VCs' syndication choice and performance, my research utilises network theory in the context of mixed syndication for the first time and provides more evidence for the contingent effects of VC networks on their performance.

The reminder of this thesis is structured as follows. Chapter 2 describes the institutional background. Chapter 3 reviews the literature on GVCs, mixed syndication and GVCs in China. Chapter 4 compares the differences in characteristics and performances between GVCs and PVCs. Chapter 5 focuses on mixed syndication between GVCs and PVCs, and Chapter 6 explores ways for improving the performance of GVCs by referring to the case of Shenzhen Capital Group. Chapter 7 discusses the implications for public policy-makers and practitioners in the VC industry. Chap 8 concludes.

2. Institutional background

This chapter is structured as follows. Firstly, I define GVCs in my research. Secondly, I discuss the Chinese government's three objectives for establishing GVCs and depict the four stages of the regulation and exit environment in the Chinese VC industry. Thirdly, I focus on two unique features of the institutional background to the Chinese VC industry—the supervision mechanism by the government and the administrative approval system for IPOs on the domestic stock exchanges.

2.1. Definition of GVCs

The term GVCs appears in the extant literature with different meanings—government-owned venture capital firms (Bottazzi *et al.*, 2008), public ownership of VC firms (Buzzacchi *et al.*, 2013), governmental venture capital (Alperovych *et al.*, 2015; Colombo *et al.*, 2016) and government-managed venture capital (Grilli & Murtinu, 2014a). I use the term GVCs to refer to government-established, owned and operated VC firms, similar to Guerini & Quas (2016), with the following three features in the context of China.

2.1.1. Definition of GVCs in my study

Firstly, GVCs refer to governmental VC firms rather than governmental VC funds. Mixing up these two terms may cause confusion when analysing the characteristics of GVCs and the effect of government financial support on the VC industry. Governmental VC funds are the funds that come entirely or partly from the government budget but can be operated by any type of VC firm. Some governmental VC funds provide funding support for PVCs and can be regarded as subsidies to PVCs (Grilli & Murtinu, 2014b; Leleux & Surlemont, 2003). Governments only act as the fund resource, while the qualified PVCs selected by the government have operational autonomy in funds management. Typical examples include the Israeli Yozma programme, the U.S. Small Business Innovation Research programme and the New Zealand Seed Investment Fund (Lerner, 2009).

In contrast, governmental VC firms are set up by governments. The governments adopt a "hands-on" (Grilli & Murtinu, 2014b) policy approach, involving themselves intensively in the investment choices and decision-making of the GVCs. This mode is not unique to China. European countries have also set up GVCs that share similar features to GVCs in China.

Secondly, GVCs in China rely on local government budgets[2] as the primary funding resources. The most frequently used name for a GVC is the combination of the province/city name and "high-tech venture capital", which indicates the ownership of the GVCs and implies that they enjoy privileged access to local public resources. Most GVCs have a mandate to make a certain proportion of their investment locally to favour the development of the local economy.

Thirdly, GVCs are operated by managers appointed by governments. Local governments appoint top executives for their GVCs, supervise the management and assess the performance of GVCs through the local State-owned Asset Supervision Commissions (SASAC). From the perspective of ownership and governance, GVCs share the same features as other state-owned enterprises (SOEs) in China.

In contrast, PVCs in China are VC firms set up by individual venture capitalists, private companies, public-listed companies, banks and security companies, research/education agencies, and foreign VC firms. The main funding resources of PVCs are not from the government and the top executives of PVCs are not appointed by the government.

2.1.2. Difference from studies on political ties

The definition of GVCs based on ownership (where the funding sources come from) and governance (how the managers are appointed and how they are supervised) is different from those studies that focus on VC firms with political ties ('GuanXi' in Chinese). Anderson *et al.* (2017) identify a VC firm as one with political ties in any of the following circumstances: being controlled by the government; having a small proportion of its funds from the government; having a manager with former working experience in the government; or the VC firms themselves claiming to have a close relationship with the government. They find that the VCs' political ties increase their investees' rate of successful exit through IPO/M&A.

Similarly, Liu & Chen (2014) find that firms backed by VC firms having a connection with the state are more likely to achieve IPO/M&A. In contrast, N. Jiang & Liu (2014) find that the connection with the state has an insignificant and negligible effect on exit performance when controlling for the investment specializations (in industries and stages) of the VC firms. Both of these two studies use the definition of "connection with the state" by following the categories in PEdata, the main proprietary dataset on VC investments in China. PEdata

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[2] The localities of China are larger than most European countries. For example, the GDP of Guangdong province surpassed that of Australia in 2016, according to www.stats.gov.cn.

categorises VC firms as those with a state background if the VC firms themselves claim to have a state background (i.e. fully/partly owned by the state or having a special connection with the state.)[3].

It is necessary to distinguish the research on the governmental ownership and governance of VC firms from that on VC firms with political ties. Standaert & Manigart (2018) point out that the difference in ownership and governance is one of the most important factors differentiating VC investors. The analysis of VCs' ownership and governance facilitates the comparison between the different features of GVCs and PVCs, for example, funding resources, corporate governances and compensation schemes. In contrast, the analysis of VCs' political ties ignores the different corporate governance of PVCs and GVCs in terms of decision-making and incentive schemes. Furthermore, the relationship between GVCs and their local governments is formed with the establishment of GVCs due to this ownership, while VC firms' political ties with government officials are unstable and hard to measure. In the interview research conducted by Ahlstrom *et al*. (2007), the VC managers reported that the "GuanXi" set up with a particular government official would sometimes end as soon as "he left that office".

2.2. Four stages of the regulatory and exit environment of the Chinese VC industry

The development of the Chinese VC industry can be summarized as happening in four stages. They capture the evolution of the laws and regulations that have created a supportive environment for VCs to flourish, and the development of the domestic stock markets.

Stage One (*from the 1980s to 1998*) features the formation of pioneer GVCs, the absence of regulations and the fledgling domestic stock markets.

The primary considerations of establishing GVCs were threefold: (1) to provide funding resources to high-tech industries, particularly early-stage investment; (2) to reform the mode of governmental support for economic development; and (3) to nurture a healthy VC industry in China.

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[3] The categories provide the basis for starting the classification of GVCs and PVCs for my research, but with many exceptions. For example, Infinity-CSVC was jointly funded by China Development Bank and the Israel government and was operated by Infinity Group. In PEdata, Infinity group is categorised as VC firms with a state-owned background. However, the company should be categorised as a PVC according to the definition of GVCs and PVCs in my study since the funds of this VC firm are managed by professional venture capitalists rather than government-appointed managers.

In the first stage, GVCs in China were established to bridge the gap between the strong funding demands of SMEs in high-tech industries and the limited funding supply from the traditional financial sector (White *et al.*, 2002). Raising loans from the traditional financial institutions had proved extremely difficult for private and high-tech companies, due to their lack of tangible assets and operating track record within their limited history. Furthermore, the banking sector in China was dominated by the four largest state-owned banks, which made it difficult for private companies to obtain credit (Allen *et al.*, 2005). Many GVCs explicitly stated their mandate as, for example, "to catalyse the commercialisation of R&D findings" (by Shanghai Venture Capital Co., Ltd.), "to develop entrepreneurship in high-tech industries" (by Jiangsu High-Tech Investment Group), and "to promote economic restructuring and upgrading" (by Shenzhen Capital Group).

Secondly, both the central and the local governments in China started to explore a top-down reform for stimulating economic growth. The traditional administrative-intensive method of promoting technology development through subsidies allocation had been widely criticised as ineffective and prone to corruption (Science and Technology Commission, PRC, 1984). Furthermore, government subsidies were not nearly enough for converting scientific and technological achievements into industrial and commercial success. Some pioneering government officials[4] learned from the experience of the U.S. and other countries. They wanted the VC industry to be identified as a market-oriented and more effective way to support start-ups and innovation (Cheng, 1999).

Thirdly, GVCs were set up to explore how to promote the development of a healthy VC industry in China. Lerner & Watson (2008) argue that the pioneering VCs in a country play a critical role in forming a virtuous cycle that encourages entrepreneurs, intermediaries such as lawyers and accountants, and institutional investors to become more familiar with and confident in the VC industry. When the Chinese VC industry was still in its infancy, GVCs were established to add market participants as well as funding resources that would help the VC industry in China to reach a sufficient state of development. Without establishing GVCs and stepping into the VC market as funding providers and investors, the Chinese government could not develop the desired perception of the VC industry or accumulate sufficient experience to promote the VC industry effectively.

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[4] The most influential VC industry promoter among Chinese officials is Mr Siwei Cheng, the former vice chairman of the Standing Committee of the Chinese National People's Congress from 1998 to 2008.

In 1985, the term "venture capital" first appeared in the government initiative called *The Resolution of Science and Technology System Reform*. In 1992, the State Council stated in the *Interim Provisions on Several Policies of National High-tech Industrial Development Zone* that a well-prepared high-tech industry development zone could establish venture capital firms on a trial basis. As a result, the venture capital sector began to emerge in the economic development zones in Guangdong, Jiangsu, Shanghai and Beijing. GVCs set up by local authorities dominated the VC market in China before 1996 (M. Liu *et al.*, 2006).

The practices of the venture capital industry in China at this stage were still at the experimental level, without clear and formal regulations from central or local governments. At the same time, the Chinese stock market was in its infancy. Shanghai Stock Exchange and Shenzhen Stock Exchange were set up in 1990. Large state-owned enterprises dominated the main boards and were seldom backed by VCs before going public. The exit channel for venture capital investment was rather limited.

Stage Two (*from 1999 to 2005*) saw both the rapid development of the VC market in China and a better institutional environment being promoted by the government. In 1999, the State Council issued the *Document of establishing Venture Capital Investment Mechanism,* which is regarded as the first formal regulation of the China VC market (White *et al.*, 2002). It was followed by the *Small and Medium-sized Enterprises (SMEs) Promotion Act* in 2002, which offered preferential tax policies for VC firms investing in SMEs.

During this period, more local governments established GVCs by using the funding of their former government subsidies to explore a more market-oriented way of promoting high-tech industries (Lu *et al.*, 2013). Some practitioners who had experience in commercial banks, securities companies or VC firms overseas set up PVCs by themselves. At the same time, some prestigious VC firms in the US also established their offices in China. By the end of 2000, there was increasing participation of both domestic and foreign PVCs in the market. As a consequence, the proportion of investments by GVCs dropped to 53% by the year 2002 and less than half afterwards (Wang, 2005). Figure 2-1 illustrates the overall increase in investment in the Chinese VC market and the change in the proportion of GVCs' investment.

The Chinese government continuously sought to encourage and facilitate exits of venture capital investment through domestic equity markets. Since a high proportion of listed companies on the main boards were large state-owned enterprises, the government established the SME Board in Shenzhen Stock Exchange as a platform for small and

medium-sized enterprises to raise funds. However, the SME Board has very similar listing standards to the main board and only featured a relatively smaller market value of the listed companies (Tan *et al.*, 2013). Thus, the domestic exit channels for Chinese ventures were still limited during this stage.
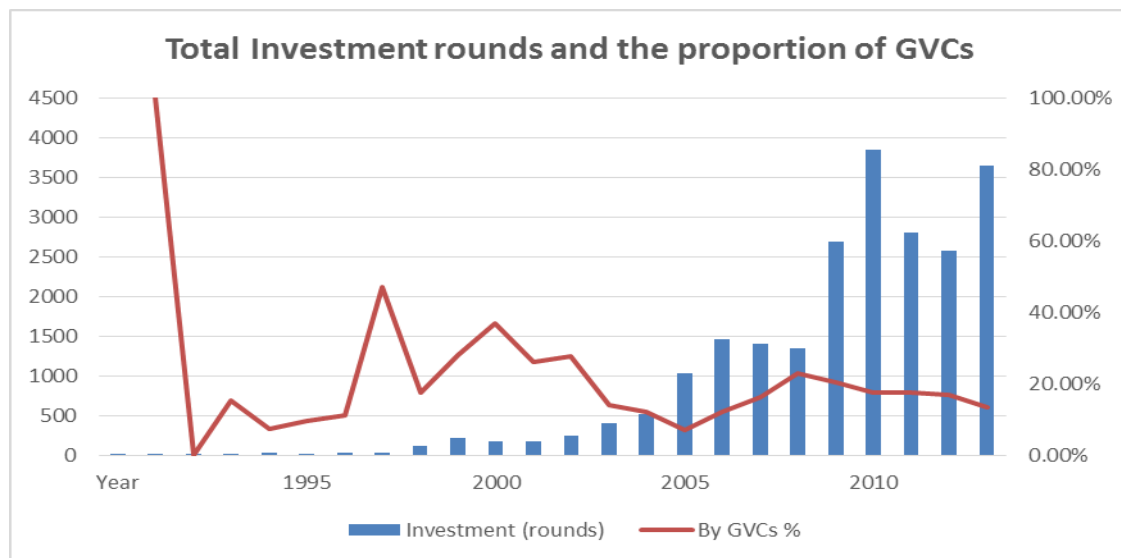
Figure 2-1 Total investment rounds and the proportion of GVCs

Stage Three (from 2006 to 2009) witnessed explosive growth in the VC industry in China and a formal promotion strategy being taken by the government. In 2006, *The Provisional Rules Governing administration of Venture Capital Enterprises* came into effect, which provided the first formal regulation for the establishment and investment of VC firms. Since 2007, investment banks and securities firms have been allowed to make equity investments in pre-IPO companies. As a result, domestic PVCs increased in this period (Tan *et al.*, 2013).

In terms of exit options, the Growth Enterprises Board (ChiNext) was established in 2009 and was known as China's NASDAQ. The purpose of establishing ChiNext was "to provide listed companies with direct access to a large pool of equity investors" and "indirectly support the development of a vibrant VC industry" (J. Zhang *et al.*, 2017). Compared to the main board, ChiNext lowers the listing requirement regarding firm size and profitability but puts emphasis on a higher growth rate for listed companies; therefore, it provides a better platform for SMEs, and growth-oriented and technology-focused private companies to go public. More than half of the companies listed on this board have VC backing (P. Jiang *et al.*, 2014).

Stage Four (from 2010 to now) opened a new phase for the Chinese VC industry. China's VC market was ranked the second largest in the world (Ernst & Young, 2014), after the

development of both VC firms and entrepreneurial enterprises. *The Opinions on Promoting the integration of Science and Finance and Accelerating the Implementation of Independent Innovation Strategy* was issued in 2011, which shows that the government had begun to undertake a more comprehensive analysis of how to promote the whole VC industry.

At the same time, the exit channels for VC investments became more diversified as the National Equities Exchange and Quotations (NEEQ) system came into operation, as it provides another option for entrepreneurial corporations to go public. There has been a dramatic increase in the companies listed on NEEQ. According to PEdata, by the end of 2016 NEEQ has hosted more than 10,000 listed companies, among which more than 30% were backed by VC firms.

2.3. Unique features of GVCs in China

2.3.1. Assessment and supervision by SASAC

In China, SASAC serves as the ultimate holder of state-owned assets on behalf of the state and is responsible for preserving and increasing the value of state-owned assets. Like other SOEs, GVCs are under the supervision of SASAC. The impact of SASAC on the behaviour and performance of GVC is twofold: one is through the annual evaluation on GVCs' performance and the other is through its supervision of the GVCs' investment process.

2.3.1.1. Annual assessment by SASAC

SASAC appoints and removes the top executives of SOEs and annually evaluates their performances. The annual assessment is a complex and comprehensive procedure, which focuses on ROE (return on equity) and is supplemented by total profit and EVA (Economic Value Added). Other "soft" assessment goals are set by SASAC according to the characteristics of each SOE and may include but are not limited to budget management, major projects operation and work safety.

Although the VC industry focuses on long-term equity investments and generally need between three to ten years to generate returns, SASAC undertakes the assessment of GVCs' performance annually as for other SOEs. The hurdle of having to meet this short-term assessment may distort the GVCs' decision over whether (or when) to refinance or end financing of a particular portfolio company.

2.3.1.2. Supervision by SASAC

The ownership and funding resources of GVCs in China determines that SASAC plays an important role in GVCs' initial investment decision-making. SASAC could be regarded as an extra step in a GVCs' operation compared with a PVCs' general practice. What is more, this extra procedure adds uncertainty that is often beyond the control of GVC managers.

For example, if a GVC-backed portfolio company (either being invested in solely by GVCs or by mixed syndication involving GVCs) is undergoing an M&A or an MBO (management buy-out), the approval of SASAC is needed before the GVC can sell its equity in the portfolio company to other buyers. There are two procedures in the approval process (Yang *et al.*, 2011). The first is asset valuation, which is to ensure that the state-owned assets would not be sold at an unreasonably low price. SASAC appoints qualified asset valuation agencies to undertake the task by using stringent valuation procedures and standards. The second procedure is to get SASAC's approval for negotiated transactions. Without this approval, equities held by GVCs must be sold on local equity exchanges (for example, Shanghai United Assets and Equity Exchange and Beijing Equity Exchange) that have been designed for non-public traded companies through an open-bid transaction. In the latter case, more preparation and a longer timeframe are needed. Also, the proposed M&A or MBO will have great uncertainty if the preferred buyer does not win the bid, and the interests of the unexpected buyer may not be aligned with the targeted company and other VC syndicate partners.

To facilitate the equity transactions of portfolio companies held by GVCs, some local governments such as Shanghai and Shenzhen have initiated a number of preferential policies (Shanghai Municipal Development and Reform Commission, 2010; State-owned Assets Supervision and Administration Commission of the Peoples' government of Shenzhen Municipality, 2011). As long as the shares are transferred under the conditions stated explicitly in the *ex ante* investment agreement, the transaction of the shares is exempted from administrative approval. Nevertheless, such provisions were not implemented by any local governments in China until late 2010.

2.3.2. Exit environment for GVCs

2.3.2.1. IPO approval system in China

One distinctive feature of the Chinese stock market is the administration-based system of getting approval for IPOs (J. Zhang *et al.*, 2017), which is different from the registration

system in the U.S. and other developed countries[5]. The IPO administration in China started from the quota allocation system in the early 1990s and changed to an approval-based system later in the early 2000s. Both systems featured massive administrative interference by the government.

Before 2001, the central government allocated each province IPO quotas after intense bargaining between local governments and the central government (Pistor & Xu, 2005). Local governments prioritised companies that they believed were critical to local economic development when granting IPO quotas. The ownership of GVCs enabled their portfolios to enjoy the advantage of obtaining IPO quota compared to their peers backed by PVCs.

After 2001, the quota system was replaced by the administrative approval scheme. However, the government still intervened in the IPO approval process through CSRC by having "soft, qualitative and ambiguous criteria" (Q. Liu *et al.*, 2013) in addition to the clearly outlined standards for listing. As a result, the approval rate of application, the timeframe of getting approval and the screening details still remained unpredictable, and the opportunity of queue-jumping remained.

If a company has the intention of being listed on the domestic stock exchanges in China, it needs to accept IPO "tutorship" provided by investment banks, accountants and lawyers. After the period of tutorship, the company needs to submit an application package to the China Securities Regulatory Commission (CSRC), providing evidence that the firm has met all the criteria required by the CSRC.

The applications are then scrutinised and discussed by the Stock Issuance Verification Committee, which is comprised of internal officers at CSRC and external professionals in investment banks, universities, law firms and accounting firms, etc. All applications form a queue before being discussed by the committee during a formal meeting. The queue of applications is known to be quite long. According to the official website of CSRC, there were 690 firms in the queue in late 2017. The long queue indicates, on the one hand, the great demand of firms seeking public financing, and on the other hand, reflects the fact that CSRC has been following a rather prudential pattern in approving IPO applications.

The priority of being discussed at the committee meeting does not simply follow the order of application. There is an extra procedure called "Feedback and Interaction" before being

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[5] See L. Tian (2011) for a detailed description of the IPO approval system in China.

formally discussed by the Committee. The staff of CSRC provides comments on the application materials and informs the applicants should any further evidence/revision be needed. As a result, there is the possibility for an application to jump the queue (X. Zhang, 2015).

Replacing the administrative approval system with a registration system in IPO has been hotly debated during the last decade. The Chinese government has been continuously moving in this direction albeit with great cautiousness (Shen & Sweeney, 2015). In late 2015, the State Council formally started the reform of the IPO approval system in China (The National People's Congress of the People's Republic of China, 2015). However, a registration system has not been confirmed yet at the time of writing (early 2018).

2.3.2.2. *IPO approval suspensions in China*

In addition to the administrative based IPO approval system in China, another important background to the exit channels for VC investments in China is that CSRC had the discretion to suspend the IPO approval process. During the period of the IPO approval suspensions, no committee meeting was held. As a result, all procedures following the application submission came to a stop. On average, the suspensions lasted for 6 to 15 months[6], during which the exit channel through IPO on the domestic stock exchanges was virtually blocked.

The main purpose of the suspensions was to keep the stability of the stock market albeit with different reasons for each case. Cong *et al.* (2017) provide a full list of the detailed rationales for nine suspensions. The first three and the last three suspensions were caused by the concern that the investors were losing confidence and the stock market was in the doldrums, while other suspensions were related to special reforms that were critical to the stock market or were believed to have a potential impact on stock prices. For example, the fourth suspension paralleled the reform of transferring part of the shares held by SOEs to the National Social Security Fund (the superannuation scheme in China). The fifth suspension was to facilitate the reform of the price inquiry system of IPOs, and the sixth one was to provide a stable environment for the split share structure reform.

The direct impact of the suspensions on VC investment was that companies would seek an overseas listing if they had not submitted the application documents to CSRC. Stock

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[6] According to CSRC, there have been nine mid-term suspensions of IPO administrative approvals in the last two decades on the Chinese stock exchange. The suspensions generally lasted for several months or even longer than a year: 1994.07.21—1994.12.07, 1995.01.19—1995.06.14, 1995.07.05—1996.01.03, 2001.07.31—2001.11.02, 2004.08.26—2005.01.23, 2005.05.25—2006.06.02, 2008.09.16—2009.07.10, 2012.11.16—2014.04.29, 2015.07.09—2015.11.17.

exchanges with proximity to mainland China (e.g. Hong Kong and Singapore) became the most popular alternative exit channels of IPO, together with Nasdaq as the favoured choice for investments in Internet-related industries. Figure 2-2 shows that the periods with high proportion of listing overseas in all IPO cases (shown by the connected line) nearly coincided with the suspensions in the domestic stock exchanges (depicted by the columns). As a result, the suspensions also affected the fundraising preferences (US$ funds or RMB funds) of VCs that were investing in China.
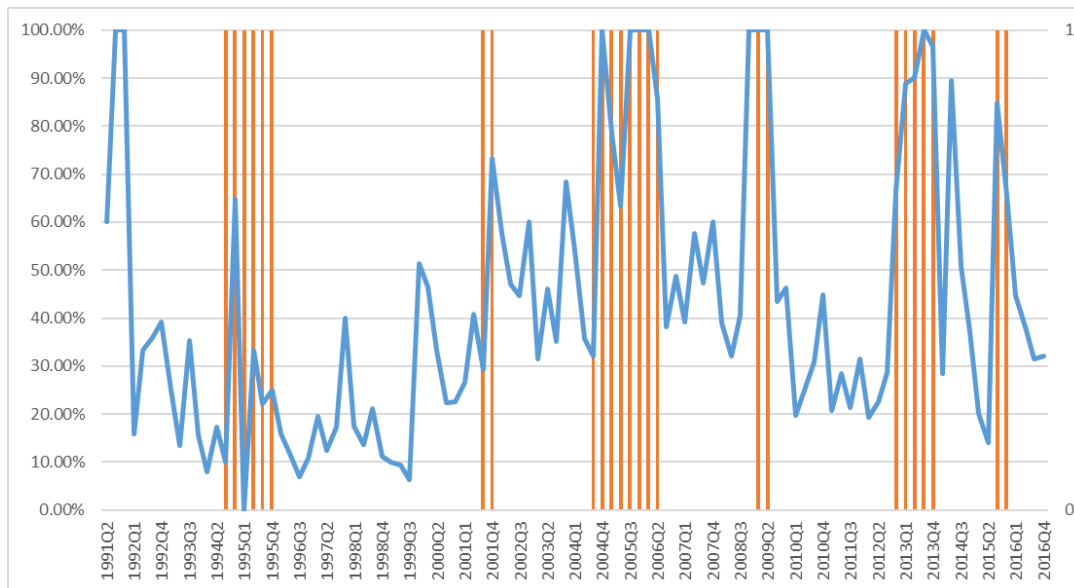
Figure 2-2 Overseas listing proportions and IPO approval suspensions

Data sources: The periods of IPO approval suspensions are compiled by the author according to the official website of China Securities Regulatory Commission: www.csrc.gov.cn. The proportion of IPOs overseas is calculated by the author according to all IPO cases documented by PEdata.

2.3.2.3. *Split share structure reform*

When Shanghai Stock Exchange and Shenzhen Stock Exchange—the two main boards in China—were established in 1990, a split share structure was established. Shares were divided into state shares, legal person shares and public shares, with only the last type being allowed to trade freely on the stock market (C. Chen & Shih, 2002). Two-thirds of the shares were non-tradable and were held by central and local governments and state-enterprises (K. Li *et al.*, 2011), while the other one-third of shares were tradable and held by individual and institutional investors. If GVCs invested in a portfolio company with controlling shares or if GVCs invested in a portfolio company that was controlled by other state entities (the central or local governments or state-owned enterprises), then the shares held by GVCs in the portfolio companies were non-tradable on the stock exchanges, although the shares could be

transferred to other investors at a negotiated price with the consent of the CSRC. This implies that GVCs faced more obstacles than PVCs in exiting from their investments even after their portfolio companies successfully went public. In 2005, the Chinese government initiated the reform and completed it by the end of 2007 (K. Li *et al.*, 2011). GVCs benefit from the whole process by having fewer hurdles in getting profit from their listed portfolio companies.

Firstly, I define GVCs in my research. Secondly, I discuss the Chinese government's three objectives for establishing GVCs and depict the four stages of the regulation and exit environment in the Chinese VC industry. Thirdly, I focus on two unique features of the institutional background to the Chinese VC industry—the supervision mechanism by the government and the administrative approval system for IPOs on the domestic stock exchanges.

2.4. Summary of Chapter 2

This chapter defines GVCs in my research and points out the difference from those studies on VC firms with political ties. It is followed by the four stages of the regulation and exit environment in the Chinese VC industry. I then focus on two unique features of the institutional background to the Chinese VC industry—the role of SASAC and the administration-based IPO approval system in China. The institutional background provides a rich context to study the behaviour and performance of GVCs.

3. Literature review

3.1. Weaknesses and strengths of GVCs with international evidence

Cumming *et al.* (2017) summarise three weaknesses of GVCs as follows when explaining why GVCs are expected to perform worse than PVCs.

Firstly, GVCs are established by statute instead of negotiation among contracting parties. Contacts between the limited partners (who provide funding resources but do not participate in the management of VC funds) and the general partners (who manage VC funds) help to mitigate the agency problems in funds management and facilitate the maximisation of returns[7]. However, GVCs do not have effective governance under the statute designed by governments and, therefore, fail to provide efficient performance. Cumming & MacIntosh (2007) explore the establishment of Canadian Labour-Sponsored Investment Funds and provide the evidence.

Secondly, the compensation scheme of GVCs is less efficient than that of PVCs. The former rely on base salary and bonuses, while the latter are motivated by management fees plus carried interests[8] that are directly related to investment performance. As a result, GVCs face greater problems in the retention of talent.

Thirdly, interference by government officials leads to less independence for GVCs in decision-making. The political pressure and other non-financial goals distort the GVCs' ability to invest in the most promising projects regardless of the locations or stages. Cumming & MacIntosh (2007) provide evidence of this in Canada, and Sunley *et al*. (2005) find similar features in UK and Germany.

Cumming *et al.*(2017) point out that GVCs do have strengths from having better access to government contracts and being able to help their portfolio companies to obtain faster regulatory approval when needed. The GVCs' network with government-related suppliers and customers can also benefit their investees.

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[7] For the evidence on the function of the contracts between limited partners and fund managers, see Cumming & Johan (2014) for OECD countries and Gompers & Lerner (2004) for US.

[8] For the evidence on how venture capitalists are motived by their remuneration schemes, see Cumming & Johan (2014) and Gompers & Lerner (2004) for evidence from OECD countries and US respectively.

3.2. Performances of GVCs and PVCs with international evidence

A large body of literature documents the underperformance of GVCs compared to PVCs in getting successful exits, providing value-added activities and bringing social benefits.

3.2.1. Successful exits rate through IPO/M&A

One of the most common metrics for evaluating the performance of VC firms is to look at the success rate of exiting from their portfolio companies. Cumming *et al.* (2017) show that enterprises financed by GVCs underperformed those backed by PVCs on the likelihood of achieving IPO and M&A in European countries. Brander *et al.* (2008) find a similar result for VC investments in Canada.

3.2.2. Value-added activities of GVCs in their portfolio companies

Compared to PVCs, GVCs are reported to be less effective in providing value-added activities to their investees. GVCs are reported to be less active in helping their investees to recruit managers and to raise funds (Bottazzi *et al.*, 2008), and are less valuable in helping their portfolio companies to change management teams, find board members, or find acquirers in a trade sale (Luukkonen *et al.*, 2013). Firms backed by a sole GVC achieved slower growth in sales (Grilli & Murtinu, 2014b) and productivity (Alperovych *et al.*, 2015).

3.2.3. Social benefits brought by GVCs

Since GVCs have multiple goals besides generating financial returns, it is meaningful to look at the performance of GVCs in promoting innovation and boosting employment. Bertoni & Tykvová (2015) find GVC-backed companies underperform those backed by PVCs in innovation measured by patents applications and citations. When measured by employment creation, Standaert & Manigart (2018) find GVCs are less effective than PVCs in promoting the growth of employment for SMEs.

Other researchers investigate the overall effect of GVCs on the whole VC industry and obtain mixed findings. Cumming & MacIntosh (2006) find a "crowding out" effect of GVCs on PVCs in Canada. In contrast, Guerini & Quas (2016) find that the GVC funding in the first round in a portfolio company increases the likelihood that the company will receive PVC investment in later rounds. They argue that GVCs provide the signal to PVCs that the investees are perceived as being able to obtain privileged support from the government, so more PVCs are encouraged to invest.

3.2.4. Endogeneity problem

The endogeneity problem is one of the biggest challenges in the VC literature. The match between portfolio companies and VC firms is never randomly determined. If different VCs intentionally choose different companies to invest in, then the regression results based on the direct comparison of different investees would be biased.

Researchers apply several methods for mitigating the concern of potential endogeneity problems. The first method—propensity score matching—is to ensure that the comparison is only within investees with similar observable characteristics. Dai *et al.* (2012) include the investment stage, industry and country-level control variables to calculate the likelihood (the propensity score) of being backed by a certain VC type for each portfolio company, and then compare the likelihood of achieving IPO/M&A for each subgroup of companies with the nearest propensity scores. A similar method is also employed by many other researchers, for example, Faccio & Hsu (2017), Cumming *et al.*(2017) and Guerini & Quas (2016).

Another effective method is to find a proper instrument variable that is related to the likelihood of being backed by a certain type of VC firm while not being directly related to the performance of the portfolio companies. Brander *et al.* (2015) use the percentage of investments participated in by governmental sponsored VC firms in a country in a given year as the instrumental variable of whether a specific investment is backed by governmental sponsored VC firms. In comparison, Cumming *et al.*(2017) use a bundle of instrumental variables [9] that capture the characteristics of VC firms on an industry-level or a country-level.

Furthermore, some researchers augment the utilisation of instrumental variables by applying the Heckman two-step procedure to take into account endogeneous selection. The inverse Mills ratio is calculated in the first stage regression and is inserted into the second stage regression (the main regression) as an additional regressor. Examples can be found in Chemmanur *et al.*(2011) and X. Tian (2012).

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[9] Cumming et al. (2017) use the following instrumental variables: an industry-level indicator on how important universities are as the sources of external knowledge; an industry-level indicator on the effectiveness of innovation protection mechanism; the percentage of government expenditures in GDP at the country level; the fundraising amount of independent VC firms at the country level; the country-level GDP growth rate and real GDP; and a dummy variable for the investment made after the internet-bubble era.

3.3. Syndication between GVCs and PVCs

3.3.1. Reasons for syndication

Much of the extant literature discusses syndication among venture capital firms. Jääskeläinen (2012) provides a comprehensive literature review on the motivations for VC syndication. The main motivations include enjoying better resources in screening and nurturing portfolio companies, diversifying risk across investments, building up the network with other VCs firms and better managing inter-VC relationships. Jääskeläinen calls for more research on the contingency of syndication, i.e. how the characteristics of VC firms affect their syndication strategies and performances.

3.3.2. Reasons for mixed syndication

In addition to the general benefits of syndication, researchers find mixed syndication particularly appealing. According to Cumming *et al.* (2017), mixed syndication between GVCs and PVCs can offset the shortcomings of GVCs. They argue that because PVCs and GVCs are substitutable for choosing and growing entrepreneurial firms, PVCs in mixed syndication can mitigate the agency problems caused by the inefficient compensation terms and the political pressure on GVCs. Furthermore, mixed syndication can still enjoy the favourable policies and networking from GVCs.

3.3.3. Cost of mixed syndication

To syndicate with other VC firms, the venture capitalists need to balance the costs and benefits of syndication between different VC firms (Verwaal *et al.*, 2010). The size of VCs matters when taking into consideration the cost of syndication. Large VCs enjoy scale advantages by setting up a decision-making system through repetitive and specialised routines. At the same time, large VCs may find it is harder to adjust their decisions on coordination with other VCs. As a result, larger VCs have less motivation to syndicate with others.

The cost of syndication does not only increase with the size of VC firms; it also increases when the syndicate partners are more diversified. Du (2016) argues that co-investing with similar VCs reduces transaction costs due to less information asymmetry among syndication partners. In contrast, syndication between VCs with different characteristics is expected to have higher coordination costs.

3.3.4. Performance of mixed syndication

Empirical research on the performance of mixed syndication supports the favourable views on mixed syndication. Brander *et al.* (2015) found that mixed syndication between GVCs and PVCs leads to higher successful exit through IPO/M&A than pure GVCs or pure PVC investments, using data on 25 countries, including China. However, they compare investment by mixed syndication with both investments by a sole PVC (or a sole GVC) and those by syndication among PVCs (or syndication among GVCs). When they control for the number of investors and the total amount of investments, the outperformance of mixed syndication disappears.

Cumming *et al.* (2017) improve the analysis and control for the number of VC firms that have invested in the portfolio companies by the end of each year (i.e. including all VC firms no matter which rounds of financing they have been involved in with the portfolio company). They use data on seven European countries and find no significant difference between the likelihood of achieving IPO or M&A for companies backed by mixed syndication and those backed by pure PVCs, although the magnitude of the coefficient for mixed syndication is larger than that of pure PVCs investments.

Bertoni & Tykvová(2015) use patents granted and patent citations to measure the impact of mixed syndication on young biotech firms in Europe and find that mixed syndication outperforms pure PVC syndication, suggesting that GVCs serve as an effective complement to PVCs.

However, some researchers find that the positive impact of mixed syndication only occurs under certain conditions. Syndicated investments involving both GVC and PVC are found to have a positive and statistically significant impact on the firms' growth rate, as long as the syndicate is led by PVCs (Grilli & Murtinu, 2014a). Du (2016) provides evidence that the heterogeneity in types among VC firms (private VCs, bank-affiliated VCs, corporate VCs, governmental VCs and angels) in a syndicate leads to a lower likelihood of exit through IPOs or M&A for their portfolio companies.

Similar to the literature on the performance of different types of VC firms, research on VC syndication also seeks to control for potential endogeneity issues. For example, X. Tian (2012) uses the industry concentration index of the lead VC firm in a syndicate as the instrumental variable for being backed by syndication rather than a sole VC firm. He finds

that the more diversified a lead VC's portfolio companies are in different industries, the stronger the lead VC's need to form a syndicate with other peers in a new investment.

3.4. VC firms in China

There is a paucity of literature on the VC industry in China. Due to the unavailability of financial data on private companies in China, most research limits the samples to firms that have successfully got listed on the domestic stock exchanges—the main boards in Shanghai and Shenzhen, SME board and ChiNext. Beladi *et al*. (2017) document that VC firms in China were concentrated in pre-IPO investment and had very limited influence on the sales growth of their investees. They had also given very little help to improve the corporate governance of their portfolio companies. Q.Wang *et al.* (2017) find that VC-backed companies have more independent directors on boards compared to non-VC-backed companies, although the number of independent directors has an insignificant impact on firm performance.

Most researches on the impact of GVCs and PVCs in China also limit their samples to listed companies. Yu *et al.* (2014) use a sample of listed firms on the SME board and ChiNext to investigate the investment behaviour of GVCs compared to PVCs. They find that GVCs are less likely to undertake early-stage investment. However, the reason may lie in the fact that the early-stage investments by GVCs are less likely to achieve an IPO and, therefore, are not included in their sample of listed companies. Q. Wang *et al.*(2018) use a similar sample of companies listed on SME board and ChiNext. They find that companies backed by GVCs are more likely to manage their earnings to improve short-term performance around IPOs. However, they do not control for the characteristics of VC firms that may affect the VC firms' earning management, for example, the reputation or experience of VCs.

Because the financial return on VC investment is exempt from disclosure, it is hard to measure the return performance of GVCs compared to PVCs. To deal with this limitation, Qian & Zhang (2007) hand collected the data for the financial returns on 56 successful exits from portfolio companies between 1999 and 2003 and found that portfolio companies backed by GVCs have a lower annual return rate than those backed by PVCs. However, they fail to take into consideration the impact of investment stage on return. The relatively smaller sample size and the short period of the sample coverage make it hard to generalise from their findings.

All the fore-mentioned research focuses on portfolio companies that have successful exits and therefore, provide only part of the picture in measuring the performance of GVCs and PVCs. They ignore the performance of those portfolio companies that have not achieved successful exit. One exception is Ke & Wang (2017) who use all the portfolio companies backed by VC firms in China as the sample. They define GVCs as VC firms with more than 50% of the funds raised within the first three months since establishment coming from government agencies or government-controlled business enterprises. They find that portfolio companies backed by GVCs are less likely to achieve a successful exit through IPO, M&A or secondary sales and are likely to have a smaller amount of patent application. Furthermore, they find that the GVCs fully financed by the government underperform those GVCs with a small proportion of funding resourced from private entities.

3.5. Summary of Chapter 3

This chapter reviews the literature on the weaknesses and strengths of GVCs, GVCs' performance compared to PVCs on a variety of measures, GVCs' syndication with PVCs, and the empirical findings of GVCs in China. I also throw light on how researchers deal with the typical endogeneity problem in the field of VC studies. The literature review provides the foundation for the three topics I am going to discuss in Chapter 4, Chapter 5 and Chapter 6.

4. The performance of governmental venture capital firms: a life cycle perspective and evidence from China

4.1. Introduction

Recently, there has been growing interest in the role of government in catalysing the development of the venture capital market (Lerner, 2009; Grilli & Murtinu, 2014a; Colombo *et al.*, 2016; Cumming *et al.*, 2017). To bring both funding and players to their domestic venture capital market, many countries have set up GVCs[10]. Given their increasing importance, therefore, the performance of GVCs has been much debated.

Researchers have evaluated the effect of the GVCs that have been established in different countries. Although the Yozma Programme in Israel and SBIC (Small Business Investment Company) in the USA (Gompers & Lerner, 2004; Howell, 2014) are widely recognized as the successful cases of promoting both the local venture capital market and economic development, many efforts by the governments of other countries have turned out to be failures (Lerner, 2009). In European countries (Cumming *et al.*, 2017) and in Canada (Brander *et al.*, 2008), enterprises financed by GVCs underperformed those backed PVCs in their likelihood of getting successful exit through IPOs and M&As. Compared to companies backed by PVCs, those invested in only by GVCs experienced no significant increase in their sales growth (Grilli & Murtinu, 2014a), a statistically significant destruction in productivity three years after the investment (Alperovych *et al.*, 2015), and a relatively smaller increase in patent applications (Brander *et al.*, 2008). As well as the weaker performance of the portfolio companies backed by GVCs, the behaviour of GVCs has also been examined. GVCs are less active than PVCs in helping their portfolio companies to raise further funding and to recruit managers (Bottazzi *et al.*, 2008). As for the impact of GVCs on the local venture capital industry, Cumming & MacIntosh (2006) found a "crowding out" effect of GVCs on PVCs' fund-raising and investment in Canada.

The extant literature identified the main reason for the different performance of portfolio companies backed by GVCs and PVCs as the different characteristics of GVCs and PVCs. The strength of GVCs comes from their close ties with the government, via privileged access to governmental resources. The weaknesses of GVCs include the absence of well-negotiated

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[10] For example, Canada (Cumming & MacIntosh, 2006), Belgium, Finland, France, Germany, Italy, Spain, and the U.K. (Grilli & Murtinu, 2014a), Austria, Denmark, Ireland, Netherland and Sweden (Buzzacchi *et al.*, 2013).

contracts between LPs in VC funds and VC firms, less efficient compensation provisions and less decision-making independence (Cumming *et al.*, 2017).

China has become the second largest VC market (Ernst & Young, 2014) in the world and shares some common practices with European countries regarding establishing GVCs by statute and having a less effective compensation mechanism (Cumming *et al.*, 2017). China provides an interesting and unique context for exploring the performance of GVCs, as the institutional background explained in Chapter 2. For example, GVCs in China are governed as state-owned enterprises, which are assessed annually by the government. In addition, GVCs enjoy privileged access to the domestic stock markets under the administrative system of IPO approval[11] in China.

This chapter scrutinises the differences between GVCs and PVCs in each stage of a venture capital life cycle. The systemic framework enables a more comprehensive comparison in the rich context of the Chinese VC market, based on the widely recognised pros and cons of GVCs in the literature. I suggest that GVCs are expected to underperform PVCs due to agency problems on two levels: (1) on the level of VC firms, the absence of a link between the GVCs' current performance and future fund-raising; (2) on the level of VC managers, the inefficient compensation scheme for venture capitalists in GVCs.

I first investigate the advantages and disadvantages of GVCs in detail, and then empirically test the overall impact of all positive and negative forces on the performance of GVCs. While acknowledging the multiple mandates of GVCs in catalysing technological progress and promoting the prosperity of the VC industry as a whole, this chapter uses portfolio companies' exits through IPO or M&A as the main measure of performance for GVCs and PVCs. The purpose of using this measure is not to ignore other impacts of GVCs on the VC industry and economic/social development, but to explore possible ways for improving the performance of GVCs in future.

Using exiting through IPO/M&A as the measure of performance, the extant literature on the Chinese VC market gets different empirical results when controlling for different factors. Anderson *et al.* (2017) find that the state controlling ownership of VC firms leads to a higher possibility of achieving exit through IPO/M&A, without controlling for the stage of investment nor the expertise of VC firms. In contrast, Ke & Wang (2017) show that portfolio companies invested in by government-controlled VCs underperform those by PVCs in the

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[11] See the previous chapter for a detailed introduction of the IPO approval system in China.

successful rate of exit and patent applications, without considering the experience and expertise of the VCs. When controlling for the industry and stage specialisations of VC firms, Jiang & Liu (2014) find that the government background (voluntarily filed by VCs in PEdata) of VC firms has an insignificant effect on the probability of successful exit from portfolios. However, little has been done in exploring under what specific circumstances (e.g. the stage and the location of investment) GVCs' investees out/underperform PVCs. Therefore, more work is called for in investigating this issue in further detail.

The sample includes the enterprises that received their initial round of investments from the beginning of 1991 to the end of 2010 in China, to leave at least a five-year period for tracking the exiting performance when the data of this chapter was collected at the end of 2015. I found that portfolio companies backed by GVCs are less likely to achieve a successful exit through IPOs compared to those backed by PVCs. However, in the case of local investments when VCs and their portfolio companies are located in the same province, the underperformance of companies backed by GVCs in achieving IPOs is alleviated. In addition, early-stage investments by GVCs do not have a higher chance of achieving a successful exit than those by PVCs. The results are robust to a series of tests when using the possibility of receiving follow-on financing or using successful exits excluding those listed on NEEQ (National Equity Exchange and Quotations, which is regarded as an illiquid market) as the alternative proxies for the performance of portfolio companies.

This chapter proceeds as follows. Section 4.2 compares GVCs and PVCs in the framework of the VC life cycle and develops the hypothesis. Section 4.3 introduces the models and summarises the data. Section 4.4 presents the regression results. Section 4.5 discusses the selection bias problems using three different methods, followed by further robustness checks in Section 4.6. Section 4.7 concludes.

4.2. Comparison of GVCs and PVCs in a VC life cycle

A typical venture capital fund begins its cycle with fund-raising and comes to an end when exiting from its portfolio companies, followed by another round of fund-raising and new investment (Gompers & Lerner, 2004). In this section, I compare the different aspects of GVCs and PVCs at each stage of a venture capital life cycle and discuss how they influence the exit performance of their portfolio companies[12].

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[12] The exit channels (IPO, M&A or liquidation) of the portfolio companies are the most reliable measure of performance available for two reasons. First, the financial data for most private firms in China are not available, which makes it impossible to track the sales/employee

Figure 4-1 shows the characteristics of GVCs compared with PVCs at each stage of a venture capital cycle. This cycle has five main phases: raising funds, accessing potential projects, screening projects, monitoring portfolio companies and providing value-added activities, and exit through IPO, M&A or other less successful channels (even by liquidation). The following discussion evaluates how the advantages and disadvantages of GVCs at each stage influence the performance of their portfolio companies.

Figure 4-1 Differences of GVCs and PVCs in a VC life Cycle
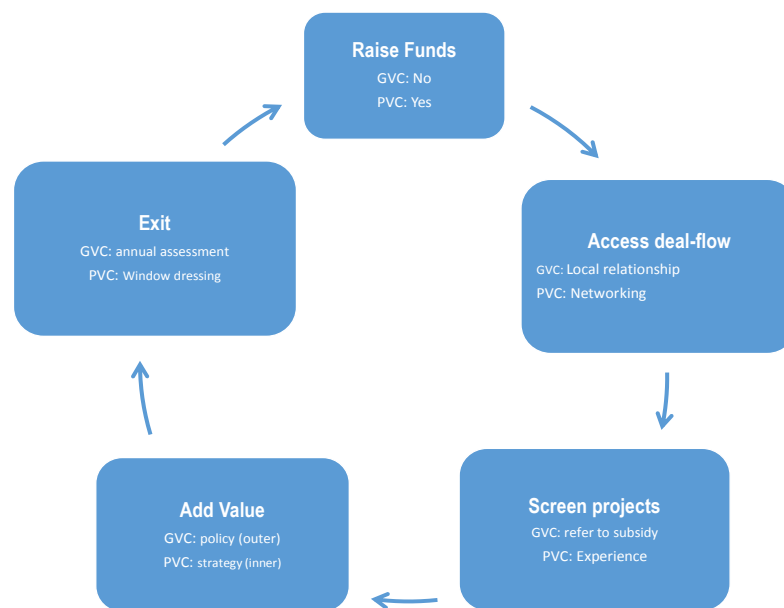
4.2.1. Fund-raising

Fund-raising involves the interaction between investors and venture capitalists. The most significant difference between GVCs and PVCs is that the funds managed by GVCs come from government budgets rather than from limited partners. Previous studies found that government-funded VC firms are less sensitive to the determinants of funding at the macro level, e.g. IPOs in the previous year and other macroeconomic indexes (Jeng & Wells, 2000).

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growth or the ROA of the portfolio companies before and after receiving their VC investments. Secondly, the financial return of VC firms does not have to be disclosed and is private information between the general partners and limited partners involved. Thus, it is hard to gauge the real return of VC funds in China. PEdata does provide the IRR of some investment projects. However, given that the reporting of the return from exit to PEdata is voluntary, the IRR data suffers from a potentially serious self-selection bias.

However, the motivation of different VC firms in fund-raising has not been explored at the micro level.

Investors in VCs (LPs) make their decisions on whether to put their money in a fund, based on the reputation of a VC firm. The reputation refers to the VCs' previous investment performance, especially the successful exit rate from their portfolio companies. LPs can ensure VCs exert the optimal level of effort by compensating VCs according to their investment performance and by making decisions on the subsequent commitment to newly-raised funds contingent on the VCs' realised performance (Gompers & Lerner, 2004).

PVCs in China have similar funding resources to those in developed VC markets. According to the survey done by the China Venture Capital Institute, non-financial companies (including both listed and private companies), wealthy individuals and financial institutions were the main funding resources of PVCs in China between 2003 and 2010 (y. Wang *et al.*, 2012). LPs mainly refer to a PVC's track record before making the commitment decision.

By contrast, the motivation and decisions of local governments on whether to finance a GVC mainly stem from their need for promoting entrepreneurship and local economic development. Sometimes, the decision may also be highly related to some political motivation of showing a positive attitude in promoting high-tech industries. Thus, the financial performance of GVCs becomes less important when local authorities assess whether to provide further funding[13].

4.2.2. Accessing projects

GVCs and PVCs have different channels for accessing potential investment opportunities. PVCs mainly rely on their links with peers through previous investment and syndication (Hochberg *et al.*, 2007), while GVCs have better connections to public institutions and universities (Bertoni & Tykvová, 2015).

Some projects have received government subsidies when they were still in government-established incubators, in which high-tech start-ups enjoy tax benefits, lower office rents,

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[13] For example, the local government of Pudong District of Shanghai decided to provide 100 million RMB capital for both Pudong Science and Technology Investment Co., Ltd. and ZhangJiang VC Investment Co., Ltd, the two local GVCs established by the Pudong government in 1999 and 2000 respectively. The main purpose of further financing the two GVCs by the Pudong government was to "promote the economic development and restructuring in Pudong as a pioneer cluster of high-tech start-ups" (The Government of Pudong District, 2010). Meanwhile, the profitability of these two GVCs was not attractive. According to PEdata, the IPO percentages from investment by Pudong Science and Technology Investment Co., Ltd. (10%) and ZhangJiang VC Investment Co., Ltd (33%) are far below the VC market average level in China (40.63%), and are even lower than the average IPO rate for GVCs (38.83%). Thus the previous performance of these two GVCs were not the incentive for further financing by local government.

better social services and other policy support (Chandra *et al.*, 2007; W. Zhang *et al.*, 2008). The incubators, financially supported by local government, keep a close relationship with local GVCs. Therefore, GVCs have easy access to information about the nature of a project for marketization and further development. Similarly, start-ups nurtured in the incubators have a better knowledge of favourable public policies and are more likely to seek financing from GVCs than those start-ups that have never been financially supported by the government.

Secondly, universities and research institutes are also good sources of new ventures (Ahlstrom *et al.*, 2007; Phan *et al.*, 2005). GVCs have better access to these potential investees because governments allocate R&D subsidies to these institutions and can introduce investment opportunities to their local GVCs as soon as a technological innovation transforms into a marketable product.

Thirdly, with the endorsement of local governments, GVCs are also likely to invest in projects that are immature and risky from the perspective of PVCs. Such projects focus on emerging industries that do not have a secure market prospect due to their high risks. When these high-growth and high-tech enterprises lobby and sell their ideas to government officials, the local authorities will evaluate these projects and recommend some of them to their local GVCs if they believe these projects have potential benefits to the local economy. Although GVCs still need to appraise the investments, support from government officials could be regarded as the necessary endorsement to certify the project. Furthermore, the certification effect may become a signal to PVCs that the project is politically legitimate and therefore qualifies as a recipient for financing (W. Zhang *et al.*, 2008).

4.2.3. Screening projects

GVCs and PVCs' capability of screening projects depends on their venture capitalists. In the 1990s, managers of PVCs in China mainly came from two sources: one was venture capitalists spun off from experienced overseas VC firms and the other was those transferred from securities firms or banks (W. Zhang *et al.*, 2008). They drew on their management and operational expertise in selecting and monitoring portfolio companies. In the case of GVCs, government officials with very limited experience in VC investment (W. Zhang *et al.*, 2008) were directly appointed by the government as the management team and were transformed into venture capitalists overnight. The appointment of management by local authorities means

a less efficient selection of talent for GVCs, compared to the market competition and global perspective used by PVCs in recruiting (Chen & Shen, 2007).

In addition to the talent selection, the decision-making process of GVCs is likely to result in inefficient project-screening. The typical process of an investment by GVCs includes: 1) the management team makes an investment suggestion on a project after due diligence; 2) the board of directors, mainly comprising government officials from different departments, discusses whether to invest; and 3) the investment proposal is approved by the State-owned Asset Evaluation Centre of SASAC as the final decision. Generally, the whole process takes six months, which is much longer than that in PVCs (Chen & Shen, 2007). Some valuable investment opportunities are missed due to the complex approval requirements, which often involve organising meetings of government officials and obtaining administrative approvals several times (Shanghai Pudong Industrial Economy Research Institute, 2011).

However, GVCs have alternative channels for strengthening their screening efficiency. GVCs tend to ask for advices and insights from the government officials and specialists who have participated in evaluating the projects previously when allocating government subsidies. In comparison, PVCs need to spend extra money and time in obtaining similar information.

4.2.4. Monitoring and value-added activities

Although both GVCs and PVCs can add value to their portfolio companies, they differ in the specific benefits they can offer. In general, PVCs tend to underpin the inner structure of a portfolio firm, such as suggesting product and marketing strategies and helping to recruit talent with their expertise developed from previous investments (W. Zhang *et al.*, 2008). For the similar reasons mentioned in the previous section, GVCs are likely to possess less experience and knowledge in monitoring portfolio companies.

However, GVCs do have strength in nurturing their portfolio companies, albeit in a different way. The value-added activities of GVCs mainly focus on empowering their portfolio firms to benefit from favourable local policies (e.g. public procurement). GVCs have preferential access to government resources and are more familiar with the relevant bureaucratic procedures. The managers of GVCs are often consulted in the government policy-making process and, as a result, have their understanding of policies enhanced. Furthermore, the administration-based IPO approval system of the domestic stock market in China means that GVCs have privileged access to IPO approval for their portfolio companies (Guo & Jiang, 2013; L. Tian, 2011).

From the demand side, enterprises with different needs while being developed have different preferences in choosing their desired VC firms. Start-ups that urgently need to recruit professionals or scale up their business may prefer to seek funding from PVCs, while those enterprises that have observed GVCs' privileged access to domestic stock markets may deliberately endeavour to be backed by GVCs.

Since both the internal competitiveness provided by PVCs and the external environment provided by GVCs are crucial to the development of an enterprise, it is hard to evaluate which kind of value-added activities have a greater positive impact on their portfolio companies.

4.2.5. Exit and making profit

Successful exits from portfolio companies either through IPO or M&A are the main channels for VC firms to make a profit. Besides profits, a good exit performance can also build a better reputation and a stronger network position for VC firms. It will ultimately facilitate the fund-raising of a VC firm for a new round of investment.

Besides exiting from portfolio companies through IPO or M&A and making a profit, GVCs in China have a special short-term goal that their PVC peers do not have. GVCs bear the responsibility for maintaining the value and profitability of state-owned assets; they are evaluated every year by SASAC like other state-owned companies. The fact that VC investment generally needs three to five years or even longer to make a profit is ignored. To meet the requirements of SASAC, managers of GVCs may choose either to send their portfolio companies to IPO earlier before they are fully mature or pursue short-term returns by conducting late-stage investment.

It is also common among PVCs to seek exits when the investments are not as profitable as they might be, albeit for another reason. To get a convincing track record to facilitate future fundraising, VC firms (especially young firms) tend to send their portfolio companies to IPO early, known as "window-dressing" (Gompers & Lerner, 2004) even when the profit is still not attractive. However, a PVC's purpose when window-dressing is different from a GVC's, as it is directly related to whether the PVC can successfully raise funds for its future operation.

4.2.6. The link between each cycle

After scrutinising the difference between GVCs and PVCs at each stage of a venture capital life cycle, it is still not clear whether GVCs have a more or less positive impact on the exit performance of their portfolios than PVCs (See Figure 4-2).

Stage	GVCs	PVCs	Impact of GVCs on portfolios' exit compared to PVCs
Deal flow accessing	Fro incubators and research institutions; local government recommendation	Networking (from other VC firms or previous portfolio companies)	Positive/Negative
Screening	Refer to government subsidy assessment records	Experience in VC investment or industry	Positive/Negative
Monitoring	Access to favourable policies	Strategy implementation	Positive/Negative
Exit	Pressure from annual assessment by SASAC	Pursue window-dressing to build track record	Positive/Negative

Figure 4-2 Characteristics of GVCs/PVCs and the impact on portfolio companies' exit

However, from a continuous perspective of a VC life cycle, one fundamental distinction between GVCs and PVCs is the link between current exit performance and future fund-raising (as shown in Figure 4-1). The purpose of a PVC is not only to maximise profits in a finite fund life (which is typically ten years) but also to have a sustainable operation for the indefinite future with continuing cycles. Therefore, performance today is crucial for fundraising tomorrow for those subsequent cycles. Such influences serve as an incentive for VC firms to exert considerable effort in selecting and nurturing their portfolio companies.

By contrast, when the funds operated by GVCs are granted by government statute, GVCs need not compete with other VC firms to raise funds after the maturity of the current funds, which could lead to a lack of incentive for GVCs to exert as much effort as possible in pursuing best performance[14].

4.2.7. The incentive and compensation for venture capitalists

The analysis of a VC life cycle is at the level of VC firms. Nevertheless, there is one factor which may affect venture capitalists' efforts at the individual level. From the perspective of agency theory, the better the interests of the managers/employees of the VC firms and the limited partners are aligned through an efficient compensation scheme, the better the

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[14] One might argue that managers in GVCs may exert a higher effort level in their investment if they are motivated by potential promotion in future. However, the incentive of a political career for individuals is more complex and uncertain than the direct economic performance-based incentive for the organization as a whole.

performance is expected. The compensation mechanism influences the willingness of each venture capitalist to put in an optimal effort at each stage of the VC life cycle. Thus, it is reasonable to augment the analysis of the difference between GVCs and PVCs by including their different compensation practices.

The compensation scheme for GVCs in China offers a lower incentive compared to those for PVCs. The common compensation for managers of PVCs is the management fee plus carry (i.e. 20% of the extra profit), split between the shareholder and employees of the VC management company. However, the principal remuneration for the managers of GVCs is the annual salary plus bonus which means there is a cap on the total income of GVCs' managers[15]. Such an arrangement is similar to the salary of the directors in state-owned enterprises, which ignores the characteristics of the venture capital industry. Therefore, the government is less likely to incentivise the venture capitalists in GVCs in the way that PVCs do. It is hard for GVCs to retain VC talent with experience when facing competition from PVCs.

To summarise the analysis, I expect a lower effort level in GVCs at both the firm level with the lack of a link between current performance and future fundraising, and at the individual level with a less efficient compensation mechanism than in PVCs. A lower effort level in GVCs suggests some underperformance of their portfolio companies. Controlling for the characteristics of VC firms and portfolio companies that can affect their exit performance, the baseline hypothesis is:

Hypothesis 1. *Portfolio companies backed by GVCs are less likely to achieve a successful exit than those backed by PVCs.*

Early-stage investment[16] needs more effort in nurturing the portfolio companies, and a longer period to exit. Although the government policy in China has been directing GVCs to early-stage investments, whether GVCs perform well in early-stage investments remains a concern. Since GVCs are expected to exert a lower level of effort in investment due to the before-mentioned analysis, GVCs are not expected to outperform PVCs in early-stage investment.

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[15] For example, the SASAC of ShenZhen has a regulation that the cap on the annual bonus for the managers of state-owned enterprises is three times their annual salary.

[16] The four categories of investment stages—seed, early, expansion and late stages—are widely adopted by VC dataset (e.g. Venture Economics, Venture Xpert and PEdata). Seed and early are referred as "early-stage investment" while expansion and late stages are quoted as "late-stage investment" in VC literature (Gompers & Lerner, 2004).

Hypothesis 2. *Early-stage investments by GVCs do not have a higher probability of achieving successful exits than those by PVCs.*

GVCs are established to boost local economic development. Due to their privileged access to local resources, especially the advantages of helping their portfolio companies get listed on the stock market, GVCs are expected to do better when conducting local investment.

Hypothesis 3. *When the companies are invested in by local VCs, the underperformance of portfolio companies backed by GVCs in achieving successful exits compared to those backed by PVCs is alleviated.*

4.3.Methods and data

4.3.1. Variables and models

I examine the exit performance of companies backed by GVCs versus those backed by PVCs by the commonly used proxies—successful exits through IPO or M&A (Chen et al., 2010; Ewens & Rhodes-Kropf, 2015; Hochberg *et al.*, 2007; Sorensen, 2007). This practice is common because IPO and M&A are the usual successful exits providing positive returns for VC firms[17]. Another reason is that venture capitalists are typically exempt from filing investment and return details; therefore, the information about the internal return rate (IRR) of investments is usually unavailable.

Following the literature, I control for a range of variables that potentially affect the performance of portfolio companies and categorise them into two groups: the characteristics of VC firms and the features of portfolio companies.

I account for the five characteristics of VC firms in the regression: time-invariant features such as ownership (*GVC*), location (*Local* and *VCcluster*) and time-variant features like *Experience* and *Scale*.

(1) *GVC* indicates whether a portfolio company received its first round of VC investment from a GVC. Referring to the first round of investment a portfolio company receives has been widely used in previous research (Cumming *et al.*, 2017; De Clercq & Dimov, 2008; Sorensen, 2007; Lerner, 1994) and can avoid the problem that decisions on later round investments may be heavily influenced by the first round (Wang & Wang, 2011).

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[17] According to Cumming & MacIntosh (2003), investments exit through IPOs have on average a return of 400%, while those through M&A on average earn 143%.

A venture capital firm is designated as a GVC if it meets the following criteria: (1) the funding resource of the VC firms when established is mainly from local government[18], and the decision on further funding is also dependent upon the government; (2) the VC firms are operated by managers appointed by local government; (3) the VC firms are under the supervision of SASAC. VC firms in China that meet the criteria include those established by:

- Local government
- Bureau of Finance in local government
- Bureau (or Commission) of Science and Technology in local government
- Local State-owned Asset Supervision and Administration Commission
- Asset management companies set up by local SASAC
- City construction and development companies set up by local government (Local Government Financing Vehicles)
- Local Economic Development Zone Management Committees

VC firms that are established by state-owned companies (except those categories mentioned above), state-controlled commercial banks or state universities are not defined as GVCs, because those VC firms need not report directly to SASAC, nor is the further funding decisions made by local government. It is their parent companies (banks or universities) that make the funding decisions based on the previous performance of those VC firms.

(2) *Experience* measures the total rounds of a VC's accumulated investments before the focal deal. More experienced VC firms are more likely to get their portfolio companies listed (Sorensen, 2007) in a mature VC market like the U.S. Gu & Lu (2014) find that the relationship between VC firms' previous experience (investment rounds) and the performance of their portfolios is concave. Therefore, I add a quadratic term of *Experience* in the regression to control for the effect. Some researchers use industry-specific experience (investment made in the same industry as the focal investment) in their research (Bottazzi *et al.*, 2008; De Clercq & Dimov, 2008; Hopp & Lukas, 2014), because they believe industry-specific experience helps VC firms understand their portfolio companies better. I use *Industry Experience* (the number of investment rounds by a VC in the same industry as the focal investment) as an alternative to *Experience* in the regression.

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[18] According to PEdata, VC firms directly established by the central government only take a very small proportion of all GVCs (about 1%). Therefore, the following definition of GVCs focuses on VC firms established by local governments while still ensuring that VC firms established by the central government equivalent are all identified as GVCs in the following analysis.

(3) *Local* shows whether a portfolio company is backed by a VC firm that has its headquarters located in the same province as the portfolio company. Geographic proximity is regarded as an important advantage for VC firms, as it allows them to keep consistent contact in screening and monitoring portfolio companies (Sorenson & Stuart, 2001; Tian, 2011b). Thus, I use *Local* as the proxy for the proximity of VC firms to their portfolios in general and GVCs' privileged access to local resources.

(4) *Scale* sums the value of investments by a VC firms in the past five years before the focal investment. Economies of scale and the decreasing return to scale (Kaplan & Schoar, 2005) may explain the efficiency of the VC firm, thus, affecting the performance of its portfolio companies. Similar to Hochberg *et al.* (2015), I use *Scale* as the proxy for the funds under a VC's management. I also include the quadratic form of *Scale* in the regression to gauge its non-linear impact on the exit performance of the portfolio companies.

(5) *VC Cluster* indicates whether a portfolio company is backed by a VC firm that has its headquarters in Beijing, Shanghai or Guangdong. The three clusters of the VC industry in China account for 42% (722 out of 1710) of the VC firms' head offices in the sample. Furthermore, 58% of first-round individual investments between 1991 and 2010 were made by VC firms located in the three clusters. VC firms tend to locate in cities with intense innovation activities and proven successful VC investments (Chen *et al.*, 2010). The effect of information sharing and more investment opportunities will affect the performance of VC firms positively and, therefore, also that of their portfolio companies.

The control variables of the investees include *Amount* and *Early*.

Amount measures the value amount of the first round of investment for a company. It indicates the valuation of a project and reflects the VCs' risk assessment of the project (Brander *et al.*, 2015). A higher amount may be interpreted as a relatively safer investment that is more likely to have a successful exit.

Early takes the value of 1 if the investment is a Seed or early-stage investment, and 0 if it is an expansion or late-stage investment. Early stage investments are believed to have a higher risk and a lower possibility of going public (Bottazzi *et al.*, 2008; Hochberg *et al.*, 2014; Sorensen, 2007). Due to some missing values for the investment stage in PEdata, I augment the data by comparing the investment date and the establishment date of an enterprise. If the difference is within two years, then I defined it as an "*Early*" stage investment. A similar definition of early-stage investment has also been used previously (Cumming *et al.*, 2017).

Industry and *Year* fixed effects are also included to control for the different risk of projects and the different development levels of the VC industry across industries and investment years. I follow previous studies (Gompers *et al.*, 2008; Gompers *et al.*, 2009) and classify portfolio companies into seven broad categories[19] (Internet and Computers, Communication and Electronics, Biotech and Health Care, Consumer, Industry and Energy, Financial Services, and Others). The classification is consistent with Venture Economics Industry Codes, the most widely used database for the U.S. VC market. I exclude the investments in any specific real estate development projects (rather than investments in real estate development companies) and investments in specific film/television programmes (rather than in companies doing film/television production) from the sample, because the successful exit from such investments cannot be gauged by IPO or M&A[20].

I employ a multinomial logistic regression with the following specification:

$$
\begin{aligned}
Exit_i = \beta_0 &+ \beta_1 GVC_i + \beta_2 Experience_i + \beta_3 Experience_i^2 + \beta_4 Local_i + \beta_5 Scale_i \\
&+ \beta_6 Scale_i^2 + \beta_7 VCcluster_i + \beta_8 Amount_i + \beta_9 Early_i \\
&+ Industry\ fixed\ effects + Year\ fixed\ effects
\end{aligned}
\tag{4-1}
$$

where the dependant variable is a category variable which equals 1 if a portfolio company get listed on the stock market, 2 if the company gets acquired, or 0 otherwise. Interaction terms *Early×GVC* and *Local×GVC* are added in to the baseline regression to test Hypothesis 2 and 3. Table 4-1 presents the definitions of all variables in detail.

Table 4-1 Variable definitions

Category	Variable	Description
Proxy for investment results	*Exit*	A categorical variable that equals 1 if the portfolio company has successfully been listed on stock markets, 2 if it has been acquired through merger & acquisition, and 0 otherwise.
	Further investment	A dummy variable that equals 1 if the portfolio company got subsequent VC financing after receiving its first round of investment.
	Exit excluding NEEQ	A categorical variable that equals 1 if the portfolio company has successfully been listed on stock markets (excluding those getting listed on National Equities Exchange and Quotations), 2 if it has been acquired through merger & acquisition, and 0 otherwise.

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[19] The original industry classification in PEdata contains 233 different industries, some of which are specific (e.g. Integrated circuit) and others are general (e.g. Information Technology).

[20] For example, the investment in a residential project can never be exited through IPO or M&A since the purpose of developing the project is to sell to homebuyers. Similarly, the investment in a specific TV series is to get a return through selling the production to TV stations and websites rather than through IPO or M&A. In contrast, the investments in companies (rather than in a specific project) of real estate and TV/film production industries are kept in the sample.

Characteristics of VC firms	*GVC*	A dummy variable that takes the value 1 if the first round of VC investment in the portfolio company is made by a GVC. Section 2.2 explains the definition of GVCs.
	Experience	The accumulated investment rounds in all industries by a VC firm before it invests in the focal portfolio company. The value used in the regressions is log (1+*Experience*).
	Industry Experience	The accumulated investment rounds in the same industry as the focal investment by a VC firm before it invests in the focal portfolio company. The value used in the regressions is the log value of (1+Industry experience).
	Local	A dummy variable that equals 1 if the headquarter of the VC firm is in the same province as the portfolio company.
	Scale	The total of the investment amount by a VC firm in the last five years prior to the focal investment. The value used in regression is the log value of (1+scale).
	VC cluster	A dummy variable that equals 1 if the headquarter of the VC firm is located in Beijing, Shanghai or Guangzhou—three clusters of the Chinese VC market.
Characteristics of Portfolio companies	*Amount*	Investment amount in millions of US dollars. Investments made in other currencies are converted into US dollars, according to the exchange rate by the end of the investment year. The value used in the regressions is log (1+amount).
	Early	A dummy variable that equals 1 if the portfolio company receives its first round of VC financing in its seed or early stage.
	Industry	A set of mutually exclusive dummy variables that equal 1 if the portfolio company is in one of the following industries: Internet and Computers, Communication and Electronics, Biotech and Health Care, Consumer, Industry and Energy, Financial Services, and Others.
	State_owned	A dummy variable that equals 1 if the portfolio company is fully or partly held by state-owned (or province-/city-/county-owned) enterprises before it receives its initial round of VC financing.
Instrument Variable	*GVC Availability*	The percentage of investment amount made by GVCs in a certain year in the Chinese VC market.

4.3.2. Data and sample

The primary data source for this research is PEdata, a commercial database developed by the Zero2IPO Research Centre, which traces VC investments in China. I augment the database with CSMAR (China Stock Market Accounting Research) to crosscheck the IPO records. In a few rare cases, I refer to the business description from the official websites of the portfolio companies, the main business news websites such as Bloomberg, Morningstar and EastMoney, and cninfo.com[21] to obtain information on the industry, the headquarters location and the investment stage of the portfolio companies if the information is missing in PEdata.

To identify GVCs, I check the detailed description of the VC firms in PEdata and augment the data by cross-checking the official website of each VC firm to ensure a reliable identification, according to the criteria explained in Section 4.3.1.

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[21] The website cninfo.com is the official disclosure website of China Securities Regulatory Commission.

The sample is restricted to portfolio companies that received their first round of VC investment from either GVCs or PVCs between the beginning of 1991 and the end of 2010 in China. According to PEdata, about three-quarters of the companies received their initial round of VC financing from one VC firm rather than from syndicates. Therefore, I simplify the comparison of GVCs and PVCs' performances by focusing on portfolio companies receiving their initial rounds of VC financing from a sole GVC or sole PVC in this chapter and expand my analysis to syndication investment in the next chapter.

Because the boundary between VC firms and private equity firms (PE) is not clear in China (VC firms also engage in late-stage and pre-IPO investment, while PE firms also do early-stage investment) (Gompers *et al.*, 2012), my research adopts a broader definition of VC investment (Wright, 2007), including investments by both VCs and PEs in the sample. Following the general practice in the research on the VC industry that assumes five years for VC-backed enterprises to mature, I drop investments after the end of 2010 from the sample to ensure a meaningful interpretation of the exit from portfolios, using PEdata up to the end of 2015[22] to monitor performance and outcomes of investments made up to the end 2010.

I exclude any investment records with missing identities of VC firms or portfolio companies. I combine the investment records that were made by the same VC firm, on the same date in the same portfolio company, whilst using several funds it managed. In such circumstances, I sum the investment amounts and treat that sum as a single investment.

Sample Criteria	Number of samples left
First round of investments	4,985
Exclude investments by syndicates	3,497
Exclude investments with missing values in investment amount	2,557

I also remove the observations for which the investment amount is missing. Due to the large proportion (nearly 1/3) of missing values of investment amounts in the whole sample, I compare the two groups of samples with and without available investment amount information. I do not find any systematic differences in the two groups of samples with regards to whether a portfolio company is backed by GVCs or PVCs. The regression using the full sample (excluding investment amount from independent variables) does not change the sign and significance of the other coefficients estimated, when compared to the regression using the sample that contains investment amount information (See Appendix 4-A for the

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[22] I obtained the data for this analysis from PEdata at the end of 2015.

regression results excluding the variable *Amount*). I end up with 2,557 VC-backed portfolio companies, of which 428 are backed by GVCs.

Descriptive statistics are set out in Table 4-2. The observational unit is the first round VC investment received by a portfolio company. About one of each six investment is made by GVCs. A third of portfolio firms achieve a successful exit, mostly through IPOs rather than M&A. The exit performance of the other two-thirds of portfolio companies is categorised as unsuccessful ones (shown as "Others", taking 64.22% of all exits), which include liquidation, management-buyout, or no records of exiting at all in the database.

Table 4-2 Descriptive statistics

The table provides descriptive statistics for all the dependent and independent variables that are defined in Table 4-1. For the convenience of interpretation, Experience and Industry Experience are shown in the original number of investment rounds, Scale and Amount are shown in the original value, rather than the value after taking logarithm.

Variable	Mean	Std. Dev.	Min	25 quantiles	Median	75 quantiles	Max	Obs
GVC	0.17	0.37	0	0	0	0	1	2,557
Experience	23.87	42.23	0	1	8	28	310	2,557
Industry Experience	5.65	12.89	0	0	1	6	154	2,557
Local	0.39	0.49	0	0	0	1	1	2,557
Scale (USD, m)	175.01	445.68	0.03	6.78	35.50	155.24	7070.02	2,557
VC Cluster	0.47	0.50	0	0	0	1	1	2,557
Amount (USD, m)	15.16	86.55	0.01	1.22	3.03	8.20	2351.52	2,557
Early	0.33	0.47	0	0	0	1	1	2,557

Exit	Percent	N	Industry	Percent	N
IPO	29.80%	762	Consumer	11.26%	288
M&A	5.98%	153	Financial	3.44%	88
Others	64.22%	1,642	Industry & Energy	23.66%	605
			Internet	19.44%	497
			Medical	10.13%	259
			Telecommunication	17.68%	452
			Other Industries	14.39%	368

On average, portfolio companies are backed by VC firms with about 20 rounds of investment experience (or about 6 rounds of investment in the focal industry). One-third of investments are in the early stage, and nearly 40% of portfolio companies are backed by VC firms with headquarters located in the same city as the portfolio companies. The quantile and median values show that both investment amount and experience (total investment rounds or industry rounds) are highly right-skewed. 75% of investments are less than 8.2 million US dollars and 75% of portfolio companies are backed by VC firms with experience of less than 28 investment rounds (or only 6 rounds in the same industry). The difference between

investing 1 million and 2 million USD in early-stage investment may be quite significant for both VC firms and enterprises, while the difference between 1.001 billion and 1.002 billion in a late stage investment is trivial. The same economic effect applies in cumulative experience. Young VC firms gain more critical experience in their first five investments than well-established VC firms learn in their 101-105th investments. Both the skewness and the non-linear economic impact of experience, scale and investment amount on the successful exit of a portfolio company require a natural logarithmic transformation. Therefore, I follow the common practice in VC literature and use the natural logarithm of the investment amount and the rounds in the following regressions.

Table 4-3 compares the investments by PVCs with those by GVCs regarding investment preferences and performance. Portfolio companies backed by PVCs in their first round investment have a larger investment amount, are more likely to be invested in by PVCs located in Beijing, Shanghai or Guangdong, and are more concentrated in Consumer and Internet industries. In contrast, GVCs tend to invest in the early stage, with a smaller investment amount and a relatively stronger focus on Telecommunication, Industry and Energy, and Medical industries. The stage preference of GVCs is consistent with the central government regulation that GVCs should bridge the gap between the demand for early stage investment and the supply of funds from PVCs. The industry preference of GVCs also reflects the influence of the central government in promoting the development of "Strategic Emerging Industries." According to the *Resolution of Nurturing and Developing Strategic Emerging Industries* (the Stage Council of China, 2010), Strategic Emerging Industries include medical, telecommunication and high-end manufacturing, but exclude the consumer industry.

The fact that GVCs are substantially more likely to invest in local portfolio companies is also consistent with the mandate of most local GVCs—to promote the local VC market and stimulate local economic development. The main purpose of local GVCs is to catalyse the local SMEs and boost local economic development. It is not unusual to find that the provision of governmental funds explicitly requires that a large proportion of the funds should be invested in enterprises that are registered within the provincial (or municipal) administration area.

Portfolio companies backed by PVCs have a higher exit rate than those backed by GVCs. I examine the exit difference between companies backed by GVCs and PVCs in the multivariate regression specified in Equation (4-1) and present the result in the next section.

Table 4-3 Portfolio companies level comparison

This table compares the characteristics of portfolio companies backed by PVCs and GVCs. ***, **, and * indicate that the differences in means are significant at the 1%, 5%, and 10% level, respectively.

	Companies backed by PVCs	Companies backed by GVCs	Difference in Means
Exit _ IPO	0.31	0.26	0.05*
_M&A	0.06	0.04	0.02
Experience	20.08	41.32	-21.24**
Industry Experience	5.06	8.23	-3.17***
Local	0.31	0.79	-0.48***
Scale	188.17	110.35	77.82***
VC Cluster	0.51	0.30	0.21
Amount	17.43	3.93	13.50***
Early Stage	0.32	0.38	-0.06**
Industry Category			
Consumer	0.12	0.06	0.06***
Financial	0.04	0.03	0.01
Industry & Energy	0.22	0.31	-0.09***
Internet	0.21	0.15	0.06***
Medical	0.09	0.14	-0.05***
Telecommunication	0.17	0.21	-0.04**
Other Industries	0.15	0.10	0.05***
N	2,129	428	

4.4.Regressions results

4.4.1. Effect of GVCs on portfolios' exit performance

Table 4-4 shows the impact of GVCs and PVCs on the exit performance of portfolio companies. Columns in odd numbers look at the general experience of VC firms and columns in even numbers control for the industry-specific experience. We start with the baseline regression results[23] in Column (1) and (2) for Panel A that covers IPOs and Panel B covers M&As.

When the outcome equals one (successful exit through IPOs), the coefficients of GVC are negative and statistically significant at the 5% (or 1%) level in all specifications. It suggests that compared to those backed by PVCs, enterprises backed by GVCs are less likely to go public, which supports *Hypothesis 1*. Since the coefficients of nonlinear regressions, especially those with interaction terms, are hard to interpret directly, I calculate the marginal effects of being backed by GVCs and report the results in Table 4-5. In general, portfolio companies backed by GVCs had a 6-percentage-points lower probability in achieving an IPO. In contrast, portfolio companies backed by GVCs show no difference in the likelihood of exiting through M&A.

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[23] I ran Hausman and Suest-based Hausman tests for the IIA assumption (independence of irrelevant alternatives) for the multinomial logistic regressions shown in Table 4-4, finding that the IIA assumption has not been violated.

Table 4-4 Impact of GVCs/PVCs on the exit performance of portfolios companies

This table shows the estimated coefficients of the multinomial logistic regressions using portfolio companies receiving their initial round of VC financing from a sole GVC or a sole PVC between 1991 and 2010 in the Chinese VC market as the sample. The standard errors (in parenthesis) are clustered by the location of portfolio companies. Coefficients significant at the 1%, 5% and 10% level are identified by ***, **, and *.

	Expected sign	(1)	(2)	(3)	(4)	(5)	(6)
Panel A *Exit*=1 (IPO)							
GVC	-	-0.34**	-0.36**	-0.41**	-0.45***	-0.86***	-0.89***
		(0.15)	(0.15)	(0.17)	(0.17)	(0.33)	(0.32)
GVC×Early	-			0.30	0.34		
				(0.29)	(0.29)		
GVC×Local	+					0.67*	0.68*
						(0.36)	(0.36)
Experience	-	-0.16		-0.17		-0.20*	
		(0.11)		(0.11)		(0.12)	
Experience^2	+	0.03		0.03		0.04	
		(0.02)		(0.02)		(0.02)	
Industry Experience	-		-0.16		-0.16		-0.18
			(0.13)		(0.13)		(0.13)
Industry Experience^2	+		0.07*		0.07*		0.08*
			(0.04)		(0.04)		(0.04)
Local	+	0.01	-0.01	0.01	-0.01	-0.06	-0.08
		(0.11)	(0.11)	(0.11)	(0.11)	(0.12)	(0.12)
Scale	-	-0.33***	-0.39***	-0.33***	-0.39***	-0.32***	-0.39***
		(0.12)	(0.10)	(0.12)	(0.10)	(0.12)	(0.10)
Scale^2	+	0.02	0.02*	0.02	0.02*	0.02	0.02*
		(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
VCcluster	+	-0.13	-0.13	-0.13	-0.13	-0.12	-0.12
		(0.10)	(0.10)	(0.10)	(0.10)	(0.10)	(0.10)
Amount	+	0.02	0.06	0.02	0.06	0.02	0.06
		(0.07)	(0.06)	(0.07)	(0.06)	(0.07)	(0.06)
Early	-	-1.23***	-1.23***	-1.28***	-1.30***	-1.22***	-1.23***
		(0.12)	(0.12)	(0.14)	(0.14)	(0.12)	(0.12)
Panel B *Exit*=2 (M&A)							
GVC	-	-0.29	-0.29	0.14	0.12	0.14	0.01
		(0.29)	(0.29)	(0.35)	(0.34)	(0.47)	(0.46)
GVC×Early	-			-1.01*	-0.97*		
				(0.56)	(0.56)		
GVC×Local	+					-0.62	-0.45
						(0.59)	(0.57)
Experience	-	0.38*		0.40*		0.42*	
		(0.23)		(0.23)		(0.23)	
Experience^2	+	-0.06		-0.07*		-0.07	
		(0.04)		(0.04)		(0.05)	
Industry Experience	-		0.11		0.12		0.12
			(0.23)		(0.23)		(0.23)
Industry Experience^2	+		-0.03		-0.04		-0.03
			(0.06)		(0.06)		(0.06)
Local	+	-0.18	-0.15	-0.17	-0.14	-0.11	-0.10
		(0.21)	(0.20)	(0.21)	(0.20)	(0.22)	(0.22)
Scale	-	-0.31	-0.16	-0.30	-0.15	-0.32	-0.15
		(0.21)	(0.19)	(0.21)	(0.19)	(0.21)	(0.19)
Scale^2	+	0.03	0.01	0.03	0.01	0.03	0.01
		(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
VCcluster	+	0.17	0.17	0.15	0.15	0.15	0.15
		(0.19)	(0.19)	(0.19)	(0.19)	(0.19)	(0.19)
Amount	+	0.09	0.06	0.09	0.06	0.09	0.06
		(0.12)	(0.11)	(0.12)	(0.11)	(0.12)	(0.11)
Early	-	0.18	0.19	0.31	0.32	0.19	0.20
		(0.19)	(0.19)	(0.20)	(0.20)	(0.19)	(0.19)
Industry fixed effect		Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effect		Yes	Yes	Yes	Yes	Yes	Yes
N		2,557	2,557	2,557	2,557	2,557	2,557

One concern I address is that GVCs may be able to achieve M&A easily by selling their portfolio companies to state-owned enterprises (SOEs)24. Thus, companies that might be unsalable in the normal market can be sold to a local SOE, if the SOE is pressured or obliged to purchase. Among 153 M&A deals, 22 deals were made by SOEs as the acquirers. GVCs only accounted for 6% of the SOEs acquisition. This proportion is much lower than GVCs involvement in non-SOEs acquisition (11%). It indicates that GVCs do not show any advantages in selling their portfolio companies to SOEs.

Table 4-5 Marginal effects of being backed by GVCs

The table reports the marginal effects of achieving successful exit for portfolio companies being backed by GVCs compared to those by PVCs. Multinomial logistic regressions (shown in Table 4-4) are run before calculating the marginal effects. Column (1) and (2) compare the marginal effects of being backed by GVCs on achieving an IPO, while Column (3) and (4) look at the marginal effects on exiting successfully through M&A. In Panel A, marginal effects are calculated by taking the value of *GVC* as one and zero respectively and taking the mean values of all other explanatory variables. In Panel B (Panel C), all independent variables except *GVC* and *Early* (*Local*) take the mean values. The columns with odd numbers use the regression results when controlling for the number of the overall accumulated rounds, while the columns with even numbers control for the industry-specific experience. Values significant at the 1%, 5% and 10% level are identified by ***，**, and *.

	(1)	(2)	(3)	(4)
	Marginal effect on IPO		Marginal effect on M&A	
Panel A: Baseline regression				
GVCs vs PVCs	-0.06**	-0.06**	-0.01	-0.01
	(0.03)	(0.03)	(0.01)	(0.01)
Panel B: with *GVC*×*Early*				
When *Early*=1	-0.01	0.01	-0.05**	-0.05**
(GVCs vs PVCs)	(0.03)	(0.03)	(0.02)	(0.02)
When *Early*=0	-0.08***	-0.09***	0.01	0.01
(GVCs vs PVCs)	(0.03)	(0.03)	(0.02)	(0.02)
Panel C: with *GVC*×*Local*				
When *Local* =1	0.03	0.03	-0.02	-0.02
(GVCs vs PVCs)	(0.03)	(0.03)	(0.02)	(0.02)
When *Local* =0	-0.14***	-0.14***	0.02	0.01
(GVCs vs PVCs)	(0.04)	(0.04)	(0.03)	(0.03)

4.4.2. Effect of GVCs on early-stage investment

In the baseline regressions, the coefficient estimates of *Early* are negative and statistically significant at the 1% level when the exit channel is through IPO. It means that early-stage investment involves a higher risk level and finds it hard to achieve the ultimate success of going public. However, there is no significant relationship between the stage of investment and the likelihood of exiting through M&A in the baseline regression.

In order to explore the performance of portfolio companies backed by GVCs in different stage of investment, the interaction term of *Early* and *GVC* is added in the baseline

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24 I identify the ownership of the mergers according to their ultimate controlling shareholders (Fan *et al.*, 2013). If the ultimate shareholder of a merger is the central State-owned Asset Supervision and Administration Commission or a local equivalent, then it is defined as an SOE.

regressions. The results are listed in Column (3) and (4) of Table 4-4. The coefficient estimates of the interaction terms are not statistically significant regarding the result of IPO, but are significantly negatively related to the propensity of exiting through M&A. Although GVCs tend to do early-stage investment to meet their mandates in promoting entrepreneurship (as shown in Table 4-3), the regression results imply that GVCs do not have advantages in selecting and nurturing early stage investments compared to PVCs, keeping the other factors constant. Furthermore, GVCs have more disadvantages when they are helping start-ups to find a good acquirer for early-stage investment. When *Early*=1, as shown in Table 4-5, the marginal effect of being backed by GVCs on the likelihood of achieving M&A is 5-percentage-points lower than that of being backed by PVCs. The results support *Hypothesis 2* that early-stage investments by GVCs do not have a higher probability of achieving a successful exit.

4.4.3. Effect of GVCs on local investment

The interaction term between *GVC* and *Local* is added in the baseline regressions to investigate the performance of GVCs when investing locally and non-locally. The coefficient of the interaction term is positive and statistically significant at the 10% level as shown in Column (5) and (6) of Table 4-4 where the successful exit is gauged by IPO.

According to the marginal effects presented in Table 4-5, the portfolio companies backed by non-local GVCs have a 14-percentage-points lower probability of achieving an IPO than those backed by non-local PVCs. However, if the deal is a local investment, those backed GVCs show no difference in the rate of going public from those backed by local PVCs.

The results support *Hypothesis 3* that the underperformance of being backed by GVCs is offset by the local effect. When PVCs are located in the same city as their focal portfolio company, the main advantage of PVCs is the lower cost of monitoring the company when taking a proactive involvement by constantly supervising their portfolios (W. Zhang *et al.*, 2008). In comparison, when GVCs invest in enterprises located in the same province, the GVCs have full access to local governmental resources, in addition to the proximity effect of monitoring their portfolio companies. The result is consistent with the fact that under the administrative IPO approval system (Guo & Jiang, 2013; L. Tian, 2011), companies backed by GVCs are more likely to obtain approval and go public.

It is worth mentioning that the advantage of local GVCs is limited to obtaining IPO opportunities. The interaction term of *Local* and *GVC* is not statistically significant when the

dependent variable equals 2 (exit through M&A). Thus, there is no evidence to show that local GVCs possess any advantage when helping their portfolios find good acquirers as a successful exit alternative.

4.5. Endogeneity problems

Potential selection bias is a major concern in corporate finance research. In the present case, the main concern is that the lower success in achieving an IPO by GVCs-backed portfolio companies may be caused by the fact that companies with a lower possibility of a successful exit tend to be invested in by GVCs. If GVCs deliberately choose to invest in those enterprises that may find it harder to succeed, then the results shown in Table 4-4 may be driven by selection bias. I mitigate the concern by focusing on the bias caused by observable factors and unobservable factors in the following analysis.

4.5.1. Instrumental variable

The typical solution to selection bias is to find an effective instrumental variable (IV hereafter) which is related to the potentially endogenous variable (whether a portfolio company is backed by GVCs) but is unrelated to the exit performance (whether it gets an IPO or M&A). The average level of a parameter in a certain market is not directly related to the performance of each individual project and therefore is regarded as exogenous. This choice of instrumental variable has been widely used in previous VC research (Bottazzi *et al.*, 2008; Chemmanur *et al.*, 2011).

I use the "*Availability of GVCs*" in a certain year in China as the IV of the dummy variable *GVC*. *Availability of GVCs* is defined as the percentage of the investment amount made by GVCs in total VC investment in each year, representing how likely it was that a portfolio company would be invested in by GVCs in that year. The higher the proportion, the more likely a portfolio company was invested in by a GVC. However, the numbers of GVCs available in the whole Chinese VC market in a specific year is expected to have no causal relationship with the probability of a portfolio firm achieving a successful exit. The investment amount of the focal portfolio company backed by GVCs is excluded from both the numerator and denominator of the percentage, to avoid endogeneity problems with the IV.

In the "first stage" regression, I estimate a logistic regression and explore the likelihood of being backed by GVCs, using *GVC availability* as the instrumental variable and including all other explanatory variables of the baseline regressions. Column (1) and Column (2) of Panel

A of Table 4-6 controls for the general investment experience/industry-specific experience of VC firms. Panel A shows that *GVC availability* is positively and statistically significantly related to whether a portfolio is backed by GVCs. The value of F-test on whether the coefficient of *GVC availability* equals zero is about 25, implying that the regression does not suffer from the weak instrument problem.

After estimating the possibility of being backed by a GVC, I insert the error terms from the first stage regression as an additional regressor in the main multinomial logistic regressions, following the control function method since the potential endogenous variable is binary and the outcome model is nonlinear. A similar application can be found in Lewbel *et al.* (2012). Results shown in Pane B Table 4-6 are consistent with those in Table 4-4 and provide more evidence to support the three hypotheses. GVC-backed portfolios are less likely to achieve an IPO, but the underperformance is moderated when the investments are made by local GVCs. In addition, early-stage investments by GVCs do not show any advantages over those backed by PVCs in achieving successful exit.

Table 4-6 Instrumental variable

This table reports the results of two-stage regressions using *GVC Availability* as the instrumental variable for the potentially endogenous variable *GVC*. The error term estimated from the first stage shown in Panel A is inserted into the multinomial logistic regressions in the second stage shown in Panel B. Column (1) to (3) in Panel B use the error terms obtained from Column (1) Panel A, controlling for the general investment experience of VCs. Similarly, Column (4) to (6) in Panel B use the error terms obtained from Column (2) Panel B, controlling for the industry-specific investment experience of VCs. Standard errors (in parenthesis) are clustered by the location of portfolio companies. Values significant at the 1%, 5% and 10% level are identified by ***，**，and *.

Panel A: First Stage	(1) GVC	(2) GVC
GVC availability	7.32***	7.45**
	(1.67)	(1.49)
Experience	-0.02	
	(0.30)	
Experience²	0.22***	
	(0.07)	
Industry Experience		0.58***
		(0.14)
Industry Experience²		-0.01
		(0.06)
Local	2.63***	2.50***
	(0.61)	(0.57)
Scale	0.25	0.23
	(0.33)	(0.23)
Scale²	-0.09*	-0.01
	(0.05)	(0.03)
VCcluster	-1.73***	-1.53***
	(0.45)	(0.43)
Amount	-0.35***	-0.59***
	(0.13)	(0.11)
Early	-0.08	-0.08
	(0.18)	(0.14)
Industry fixed effect	Yes	Yes
Year fixed effect	Yes	Yes
N	2,557	2,557

Panel B: Second Stage	(1)	(2)	(3)	(4)	(5)	(6)

	(1)	(2)	(3)	(4)	(5)	(6)
Exit=1 (IPO)						
GVC	-0.79*	-0.84*	-1.48***	-0.97*	-1.04**	-1.82***
	(0.44)	(0.44)	(0.56)	(0.49)	(0.50)	(0.62)
GVC×Early		0.28			0.33	
		(0.29)			(0.29)	
GVC×Local			0.73**			0.81**
			(0.37)			(0.36)
Experience	-0.17	-0.17	-0.21*			
	(0.11)	(0.11)	(0.12)			
Experience^2	0.04	0.04	0.05**			
	(0.03)	(0.02)	(0.03)			
Industry Experience				-0.13	-0.14	-0.15
				(0.13)	(0.13)	(0.13)
Industry Experience^2				0.07*	0.07**	0.08**
				(0.04)	(0.04)	(0.04)
Local	0.13	0.13	0.09	0.17	0.17	0.14
	(0.16)	(0.16)	(0.16)	(0.17)	(0.17)	(0.17)
Scale	-0.32***	-0.32***	-0.31**	-0.37***	-0.38***	-0.37***
	(0.12)	(0.12)	(0.12)	(0.11)	(0.11)	(0.11)
Scale^2	0.02	0.02	0.02	0.02*	0.02*	0.02*
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
VCcluster	-0.20*	-0.19	-0.20*	-0.22*	-0.21*	-0.24*
	(0.12)	(0.12)	(0.12)	(0.12)	(0.12)	(0.12)
Amount	0.01	0.01	0.01	0.03	0.04	0.02
	(0.07)	(0.07)	(0.07)	(0.06)	(0.06)	(0.06)
Early	-1.23***	-1.28***	-1.22***	-1.23***	-1.30***	-1.23***
	(0.12)	(0.14)	(0.12)	(0.12)	(0.14)	(0.12)
Exit=2 (M&A)						
GVC	0.80	1.14	1.49	0.48	0.87	1.09
	(0.78)	(0.80)	(0.94)	(0.89)	(0.91)	(1.08)
GVC×Early		-0.97*			-0.97*	
		(0.56)			(0.56)	
GVC×Local			-0.79			-0.61
			(0.59)			(0.59)
Experience	0.39*	0.41*	0.44*			
	(0.23)	(0.23)	(0.23)			
Experience^2	-0.08*	-0.09**	-0.10**			
	(0.05)	(0.05)	(0.05)			
Industry Experience				0.09	0.09	0.09
				(0.23)	(0.23)	(0.23)
Industry Experience^2				-0.03	-0.04	-0.04
				(0.06)	(0.06)	(0.06)
Local	-0.47	-0.44	-0.42	-0.35	-0.34	-0.33
	(0.29)	(0.29)	(0.29)	(0.31)	(0.31)	(0.31)
Scale	-0.32	-0.31	-0.33	-0.18	-0.17	-0.18
	(0.21)	(0.21)	(0.21)	(0.19)	(0.19)	(0.19)
Scale^2	0.03	0.03	0.03	0.02	0.02	0.02
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
VCcluster	0.31	0.28	0.31	0.27	0.25	0.27
	(0.21)	(0.21)	(0.21)	(0.22)	(0.22)	(0.22)
Amount	0.11	0.10	0.11	0.09	0.09	0.10
	(0.12)	(0.12)	(0.12)	(0.11)	(0.11)	(0.11)
Early	0.18	0.31	0.19	0.19	0.32	0.20
	(0.19)	(0.20)	(0.19)	(0.19)	(0.20)	(0.20)
Industry fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
N	2,557	2,557	2,557	2,557	2,557	2,557

4.5.2. Observable factors

Whereas the documented difference in exit performance between GVC-backed and PVC-backed portfolio companies appears to be due to the PVCs' ability to screen and nurture start-ups better, the baseline results could be driven by other potential explanations. One possible explanation is that GVCs and PVCs might invest in different types of firms.

To mitigate this concern, I employ propensity score matching (PSM) to explore the potential endogeneity problem due to the observable characteristics of companies receiving VC financing. Although the information on portfolio companies is only limited to the

investment stage (*Early*), the amount received in the initial round of financing (*Amount*) and location (*VCcluster*), it still enables me to eliminate the differences between those being backed by GVCs and those by PVCs to some extent.

I run a probit regression with the dummy variable *GVC* as the dependent variable to calculate each portfolio company's probability (the propensity score) of being backed by GVCs. To eliminate the concern that there may be a nonlinear relationship between the investment amount and the possibility of being backed by GVCs, I include the quadratic form of *Amount* in the probit regression. To investigate the different impact of VC firms when investing locally and outside of their headquarters, I first match firms receiving financing from local GVCs with those being backed by local PVCs. For the second group, I match firms funded by non-local GVCs with those by non-local PVCs. The results of matching regressions are shown in Panel A of Table 4-7.

Table 4-7 Propensity score matching

Panel A shows the results of regressions in calculating the propensity scores of being backed by GVCs. Each investment by GVCs is matched with an investment by PVCs with the nearest propensity score within the same industry and investment year. The number of matched nearest neighbours is decided based on the balancing criteria after matching. Panel B reports the average treatment effect of being backed by GVCs in achieving successful exits through IPOs, compared to being backed by PVCs. The optimal calliper is selected as 0.2 times of the standard error of the propensity score. Standard errors (in parenthesis) of the treatment effects are calculated using bootstrap for 1000 times. Panel C shows the balancing checks after matching. Values significant at the 1%, 5% and 10% level are identified by ***, **, and *.

Panel A Dependent variable: *GVC*	(1) *Local* = 1	(2) *Local* = 0
VC Cluster	-1.85***	0.60**
	(0.15)	(0.25)
Amount	-0.48**	-0.44
	(0.19)	(0.36)
Amount^2	0.05	-0.02
	(0.04)	(0.09)
Early	-0.04	-0.17
	(0.16)	(0.24)
Constant	0.72***	-2.27***
	(0.20)	(0.39)
N	994	1,560

Panel B	*Local* =1		*Local* =0	
Average treatment effect on achieving IPO	Match with 2 nearest neighbours	Match with 2 nearest neighbours within caliper	Match with 5 nearest neighbours	Match with 5 nearest neighbours within caliper
Treated group (*GVC*=1)	0.37	0.38	0.28	0.25
Matched group (*GVC*=0)	0.48	0.45	0.42	0.46
Difference	-0.11*	-0.07	-0.14**	-0.20**
	(0.05)	(0.06)	(0.07)	(0.08)
N of treated group on support	336	241	92	79

Panel C	*Local* =1			*Local* =0		
Balance after matching	Treated Group	Control Group	*p value of* t-Test	Treated Group	Treated Group	*p value of* t-Test
VC Cluster	0.28	0.28	0.98	0.39	0.39	0.93
Amount	1.01	1.02	0.84	1.37	1.53	0.24
Amount^2	1.41	1.46	0.81	2.58	3.21	0.31
Early Stage	0.37	0.38	0.79	0.27	0.24	0.67

Since there are many more portfolio companies being backed by PVCs than being backed by GVCs, I match each investment by GVCs with investments by PVCs with the closest propensity scores within the same industry and at the same investment year. I select the exact number of matching neighbours to maximise the balancing of observable characteristics of portfolio firms after matching. The purpose of matching within the same industry and year is to ensure that it is possible for a portfolio company in a specific industry to be invested in by either a GVC or PVC in a certain year. If the year and industry requirements are removed, the comparison between two portfolios with very similar propensity scores but in a different year (or industry) is not reasonable in practice.

I depict the average probabilities of achieving an IPO of the treated group (backed by GVCs) and the matched group (backed by PVCs) in Panel B of Table 4-7, using different matching methods with and without calliper (the maximum difference between the propensity score of the treated and the matched group). I follow Austin (2011) to use the optimal callipers of width equal to 0.2 times the standard deviation of the propensity score and report the results of matching with/without callipers. Consistent with the marginal effects shown in Table 4-5, companies backed by GVCs are less likely to achieve successful exits through IPOs than those by PVCs, especially when the VC firms are not located in the same province as the portfolio companies.

Panel C lists the mean of observable characteristics of firms after matching. There are no statistically significant differences between the matching variables. The overall balancing index shows that the matching meets the criteria[25] of balancing.

Although I cannot rule out the possibility that the regression results are driven by a selection effect, the findings from PSM suggest that the difference in successful exits through IPOs between the firms backed by GVCs and those by PVCs is more likely to be due to a treatment effect, i.e. whether a company is invested in by GVCs or PVCs.

4.5.3. Unobservable factors

The matching methods employed above are based on observable factors. Another concern about the potential endogeneity problem is that there may be some unobservable characteristics of the portfolio companies, which may include the quality of a project, the potential risk of a project and even the capability of the entrepreneurs. These unobservable

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[25] The values of Rubins' B (the absolute standardized difference of the means of the linear index of the propensity score in the treated and matched group) are within 25 and the values of Rubin's R (the ratio of treated to matched variances of the propensity score index) are between 0.5 and 2. See Rubin (2001) for a detailed description.

factors may both affect the company's choice of being backed by GVCs or PVCs and the company's ability to achieve an IPO. I develop the following equation in estimating the likelihood of being backed by GVCs for each portfolio company:

$$GVC_i = \gamma' Z_i + \varepsilon_i \tag{4-2}$$

where ε is the unobservable factors that are known by the portfolio firms themselves, but are not revealed by the VC firms. Z_i is a set of observable variables which affect the possibility of being backed by GVCs. In the main regression:

$$IPO_i = GVC_i + \beta X_i + \mu_i \tag{4-3}$$

μ is the unobservable factors which affect the IPO propensity of a portfolio company. If the unobservable factors μ simultaneously drive the possibility of investment by a GVC, then ε is correlated with μ, i.e. the baseline regression results would be biased.

Here, I employ the Heckman treatment effect method (Heckman, 1990) to address the problem. In the first step, *GVC* is run upon a set of variables that may affect the probability of portfolio companies being backed by GVCs. I estimate a probit model to explore the likelihood of being backed by GVCs, using *GVC availability* as an additional explanatory variable in the treatment function. Panel A of Table 4-8 shows that *GVC availability* is positively and statistically significantly related to whether a portfolio is backed by GVCs.

After the first stage regression, an Inverse Mills Ratio type of control factor (λ) is calculated using the algorithm $\lambda = \phi(\gamma Z_i)/\Phi(\gamma Z_i)$ when $GVC = 1$, and $\lambda = -\phi(\gamma Z_i)/(1 - \Phi(\gamma Z_i))$ when $GVC = 0$ (Schenone, 2004). ϕ is the normal distribution density of the estimated value of being backed by GVC (i.e. γZ_i), and Φ is the normal distribution of the estimated value of being backed by GVC.

In the second step, λ is added into the regression with other observable control variables. Now the equation can be estimated consistently using multinomial logistic regressions. Since both the outcome variable *IPO* and the endogenous variable *GVC* are binary, it is practical to use the feature of bivariate probit model to run the regression without bias[26]. The results are reported in Panel B of Table 4-8. The results remain qualitatively the same as the baseline regressions shown in Table 4-4. Being backed by GVCs is negatively correlated with the

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[26] See (Wooldridge, 2010, page 596-598) for a detailed discussion of "using the bivariate probit log-likelihood function for endogenous explanatory variables".

likelihood of achieving exits through IPO, while local investments moderate the

underperformance of GVCs.

Table 4-8 Heckman treatment effect

This table reports the results of regressions using the method of Heckman two-step treatment effect. The first step (Panel A) estimates the likelihood of being backed by GVCs using a probit regression. The value of λ (Inverse Mills ratio type control variable) is added in the second step as shown in Panel B, using dummy variable *IPO/M&A* as the dependent variable. ρ refers to the correlation coefficient between the error terms of the first and the second step. Values significant at the 1%, 5% and 10% level are identified by ***, **, and *.

Panel A Treatment regression				GVC		
GVC availability				7.45***		
				(1.67)		
Industry Experience				0.58***		
				(0.14)		
Industry Experience²				-0.01		
				(0.06)		
Local				2.50***		
				(0.57)		
Scale				0.23		
				(0.23)		
Scale²				-0.01		
				(0.03)		
VCcluster				-1.53***		
				(0.43)		
Amount				-0.59***		
				(0.11)		
Early				-0.08		
				(0.14)		
Industry fixed effect				Yes		
Year fixed effect				Yes		
N				2,557		

Panel B	(1)	(2)	(3)	(4)	(5)	(6)
Outcome regression	*Exit*=1 (IPO)			*Exit*=2 (M&A)		
GVC	-0.36**	-0.44**	-0.96***	-0.31	-0.08	0.11
	(0.15)	(0.18)	(0.32)	(0.29)	(0.36)	(0.46)
GVC× Early		0.30			-0.62	
		(0.33)			(0.61)	
GVC× Local			0.88**			-0.79
			(0.37)			(0.60)
Industry Experience	-0.19	-0.18	-0.18	0.29	0.25	0.24
	(0.16)	(0.16)	(0.16)	(0.29)	(0.29)	(0.29)
Industry Experience²	0.07*	0.07*	0.08***	-0.03	-0.03	-0.04
	(0.04)	(0.04)	(0.04)	(0.06)	(0.06)	(0.06)
Local	-0.11	-0.09	-0.50	0.55	0.47	1.10
	(0.40)	(0.40)	(0.43)	(0.75)	(0.76)	(0.80)
Scale	-0.40***	-0.40***	-0.39***	-0.09	-0.10	-0.13
	(0.11)	(0.11)	(0.11)	(0.20)	(0.20)	(0.20)
Scale²	0.02*	0.02*	0.02*	0.01	0.01	0.01
	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)
VC cluster	-0.07	-0.07	-0.13	-0.27	-0.22	-0.16
	(0.26)	(0.26)	(0.27)	(0.49)	(0.49)	(0.51)
Amount	0.09	0.08	0.06	-0.12	-0.08	-0.06
	(0.11)	(0.11)	(0.12)	(0.21)	(0.21)	(0.21)
Early	-1.13***	-1.23***	-1.24***	0.16	-0.29	0.18
	(0.12)	(0.28)	(0.12)	(0.19)	(0.46)	(0.19)
Industry fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
N	2,557	2,557	2,557	2,557	2,557	2,557

4.6. Robustness check

Although exiting through IPO/M&A is the most widely used proxy for the performance of good VC investments, there are potential problems. Leleux & Surlemont (2003) reveal that being backed by GVCs is interpreted by other VC firms as signalling the government's support and the public value of the project. If GVCs want to nurture seed and early-stage investment, and then attract PVCs to follow up the investment in later rounds, the certification effect of GVCs can still be regarded as a successful government policy. In addition, not all IPOs can be regarded as ultimately successful exits, because some boards (for example, National Equities Exchange and Quotations) in Chinese stock markets are highly illiquid. Getting listed on such an illiquid board provides a much lower return to VC firms compared to exiting through the main boards (e.g. Shanghai Stock Exchange). Thus, I use several tests to check the robustness of the previous regression results.

4.6.1. Further investment

Staged financing is one of the most important features of the VC industry. Subsequent investments are regarded as a symbol of the healthy development of the portfolio companies, especially for early-stage investments. A larger number of financing rounds is found to be positively related to the entrepreneurial firms' propensity to go public (X. Tian, 2011). Thus, I use further investments as a proxy for successful investments.

Previous empirical research in the context of European countries shows that GVCs are less likely to help their portfolio companies obtain additional financing (Bottazzi *et al.*, 2008). I test for a similar effect by constructing a dummy variable *Further Financing*, which equals 1 if a portfolio company gets its second round of VC financing.

I focus on the subsample in which the portfolio companies have achieved no successful exit. The independent variables are the same as in the baseline regressions. The results are shown in Panel A of Table 4-9. The result is consistent with the baseline regression. In all specifications, the coefficients of *GVC* are negative and are statistically significant at least at the 10% level. In the specification of Column (2) and Column (5), the interaction term of *Early* and *GVC* is negative and but not statistically significant. However, the marginal effects of being backed by GVCs compared to being backed by PVCs (Panel B of Table 4-9) show that the underperformance of GVCs is more significant when the investment is in the early stage. This provides further supportive evidence for Hypothesis 2. From the perspective of getting further financing for their portfolio companies, GVCs perform even worse than PVCs.

The interaction terms of *GVC* and *Local* have positive coefficients in Column (3) and Column (6) but with quite small magnitudes. The marginal effects in Panel B of Table 4-9 show that portfolio companies backed by GVCs underperform those backed by PVCs, regardless of whether the investment is made locally or outside of the headquarters of the VC firms. The results provide further evidence that the benefit brought by GVCs in China is limited to access to IPO rather than providing other value-adding activities to improve the core competitiveness of their investees.

Table 4-9 Impact of GVCs and PVCs on obtaining further financing

The table reports the estimated coefficients of the logistic regressions using the sub-sample of first round investments in portfolio companies that did not achieve successful exits through IPO/M&A. The dependent variable is the dummy variable *further financing*. Standard errors (in parenthesis) are clustered by the location of portfolio companies. Values significant at the 1%, 5% and 10% level are identified by ***, **, and *.

Panel A	(1)	(2)	(3)	(4)	(5)	(6)
GVC	-0.49***	-0.39*	-0.54*	-0.48***	-0.38*	-0.52*
	(0.17)	(0.22)	(0.31)	(0.17)	(0.22)	(0.30)
GVC× Early		-0.22			-0.22	
		(0.31)			(0.31)	
GVC× Local			0.08			0.05
			(0.37)			(0.34)
Experience	-0.13	-0.12	-0.14			
	(0.14)	(0.14)	(0.14)			
Experience^2	0.03	0.02	0.03			
	(0.03)	(0.03)	(0.03)			
Industry Experience				-0.25*	-0.25*	-0.25*
				(0.15)	(0.15)	(0.15)
Industry Experience^2				0.07	0.06	0.07*
				(0.04)	(0.04)	(0.04)
Scale	0.25*	0.25*	0.25*	0.26**	0.26**	0.26**
	(0.14)	(0.14)	(0.14)	(0.12)	(0.13)	(0.12)
Scale^2	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Amount	-0.07	-0.07	-0.07	-0.08	-0.08	-0.08
	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)
Early	0.44***	0.48***	0.44***	0.44***		0.44***
	(0.12)	(0.13)	(0.12)	(0.12)		(0.12)
Local	0.10	0.10	0.09	0.10	0.10	
	(0.13)	(0.13)	(0.14)	(0.13)	(0.13)	
VC cluster	0.61***	0.61***	0.61***	0.62***	0.61***	0.62***
	(0.12)	(0.12)	(0.12)	(0.12)	(0.12)	(0.12)
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
N	1,642	1,642	1,642	1,642	1,642	1,642
Panel B	Control for general experience			Control for industry-specific experience		
GVCs vs PVCs	-0.10***			-0.10***		
	(0.04)			(0.03)		
With *GVC×Early*						
When *Early*=1	-0.13***			-0.13***		
(GVCs vs PVCs)	(0.05)			(0.05)		
When *Early*=0	-0.07*			-0.07*		
(GVCs vs PVCs)	(0.04)			(0.04)		
With *GVC×Local*						
When *Local* =1	-0.09**			-0.09**		
(GVCs vs PVCs)	(0.04)			(0.04)		
When *Local* =0	-0.10*			-0.10		
(GVCs vs PVCs)	(0.05)			(0.05)		

4.6.2. NEEQ effect

Launched in late 2012 as an over-the-counter (OTC) exchange and known as the "new third board" in China, NEEQ (National Equity Exchange and Quotations) provides another option for entrepreneurial corporations to go public. By the end of 2015, NEEQ had hosted 5129 listings (Shi, 2016). The requirement for listing on NEEQ is relatively easier compared to the main boards (Shanghai and Shenzhen exchanges), Shenzhen Small and Medium Enterprise Board and ChiNext (Shenzhen's Nasdaq-style start-up board). The listed companies on NEEQ are supposed to transfer to major exchanges when they meet higher requirements (e.g. profitability).

However, the trading on NEEQ is still limited to qualified institutional investors. Moreover, the lack of market makers and lack of a clear upgrade path to major exchanges led to illiquidity on NEEQ (J. Li, 2015). Of the 5129 listed companies at NEEQ by the end of 2015, nearly half had no trading in their shares (Shi, 2016). Some researchers claim that sending portfolio companies to registration at NEEQ should not be regarded as an ultimately successful exit for VC firms.

Table 4-10 Comparison of portfolio companies being listed on NEEQ with those on other exchanges

The table compares the means of characteristics for portfolio companies listed on NEEQ (National Equities Exchange and Quotations) with those on other stock exchanges. Differences significant at the 1%, 5% and 10% level are identified by **, *, and +.

	Listed on NEEQ	Listed on other Exchanges	p value of Differences
GVC	0.22	0.13	0.01***
Experience	1.69	1.84	0.31
Industry Experience	0.82	0.93	0.30
Local	0.58	0.34	0.00***
Scale	2.68	3.25	0.00***
VC cluster	0.39	0.41	0.58
Amount	1.09	1.72	0.00***
Early	0.23	0.17	0.09*
Industry category			
Telecommunication	0.17	0.17	0.93
Consumer	0.06	0.12	0.06*
Financial	0	0.02	0.09*
Industry & Energy	0.32	0.30	0.57
Internet	0.19	0.13	0.09*
Medical	0.09	0.09	0.92
Other Industries	0.17	0.17	0.96
N	135	627	

Among the 762 successful exits through IPO in the sample, 135 are through NEEQ. I compare the characteristics of the portfolio companies (and their VC firms) which are listed on NEEQ and other exchanges. The t-tests (Table 4-10) show that portfolio companies listed on NEEQ are more likely to be backed by GVCs. Moreover, NEEQ tends to provide a platform for early-stage investments with smaller investment value. Portfolio companies exiting through listing on NEEQ are more likely to be backed by local VCs.

Due to the difference between firms listed on NEEQ and other exchanges, it is meaningful to investigate whether the lower possibility of enterprises backed by GVCs going public is caused by their different preference for exiting through NEEQ. I use *Exit excluding NEEQ* (a category variable equals one if the portfolio company goes public on the stock exchanges except NEEQ, equals two if exit through M&A, and zero otherwise) as the dependent variable and run the regressions similar to the baseline regression.

Table 4-11 shows the results. All coefficients estimated are qualitatively the same as the baseline regressions. The underperformance of firms backed by GVCs in achieving IPOs is more statistically significant (at the 1% level). The moderate underperformance of local investments on achieving IPOs and the magnified underperformance of early-stage investment in achieving M&A by GVCs-backed firms are also found when eliminating listings on NEEQ from exit through IPO.

Table 4-11 Impact of GVCs and PVCs on exit excluding on NEEQ

This table shows the results of multinomial logistic regressions using the dependent variable *Exit* that is different from that in Table 4-4. *Exit* equals one if the portfolio companies have achieved IPOs (excluding those getting listed on National Equities Exchange and Quotations) and equals two if the companies achieved an M&A, and zero otherwise. Standard errors (in parenthesis) are clustered by the location of portfolio companies. Values significant at 1%, 5% and 10% are identified by **, *, and $^{+}$.

	(1)	(2)	(3)	(4)	(5)	(6)
Exit=1 (IPO except on NEEQ)						
GVC	-0.42**	-0.44***	-0.47**	-0.51***	-1.02***	-1.05***
	(0.17)	(0.16)	(0.19)	(0.19)	(0.37)	(0.36)
GVC $\times$ Early			0.23	0.28		
			(0.33)	(0.33)		
GVC $\times$ Local					0.78*	0.79*
					(0.41)	(0.40)
Experience	-0.12		-0.13		-0.17	
	(0.12)		(0.12)		(0.12)	
Experience^2	0.03		0.03		0.04*	
	(0.03)		(0.03)		(0.02)	
Industry Experience		-0.09		-0.09		-0.12
		(0.14)		(0.14)		(0.14)
Industry Experience^2		0.07*		0.07*		0.08**
		(0.04)		(0.04)		(0.04)
Local	-0.16	-0.17	-0.16	-0.17	-0.24*	-0.25*
	(0.12)	(0.12)	(0.12)	(0.12)	(0.13)	(0.13)
Scale	-0.22*	-0.27**	-0.22*	-0.28**	-0.21	-0.27**
	(0.13)	(0.11)	(0.13)	(0.11)	(0.13)	(0.11)
Scale^2	0.01	0.01	0.01	0.01	0.01	0.01

	(1)	(2)	(3)	(4)	(5)	(6)
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
VC cluster	-0.11	-0.11	-0.11	-0.11	-0.10	-0.10
	(0.11)	(0.11)	(0.11)	(0.11)	(0.11)	(0.11)
Amount	0.14**	0.18***	0.14**	0.18***	0.14**	0.18***
	(0.07)	(0.06)	(0.07)	(0.06)	(0.07)	(0.06)
Early	-1.25***	-1.25***	-1.29***	-1.30***	-1.24**	-1.25***
	(0.13)	(0.13)	(0.15)	(0.15)	(0.13)	(0.13)
Exit=2 (M&A)						
GVC	-0.29	-0.29	0.15	0.12	0.15	0.02
	(0.29)	(0.29)	(0.35)	(0.34)	(0.47)	(0.46)
GVC × Early			-1.03*	-1.00*		
			(0.56)	(0.55)		
GVC × Local					-0.64	-0.46
					(0.58)	(0.57)
Experience	0.41*		0.43*		0.45*	
	(0.23)		(0.23)		(0.23)	
Experience²	-0.07		-0.08*		-0.08*	
	(0.04)		(0.04)		(0.05)	
Industry Experience		0.14		0.14		0.15
		(0.23)		(0.23)		(0.23)
Industry Experience²		-0.03		-0.04		-0.04
		(0.06)		(0.06)		(0.06)
Local	-0.21	-0.19	-0.21	-0.18	-0.14	-0.13
	(0.21)	(0.20)	(0.20)	(0.20)	(0.21)	(0.21)
Scale	-0.27	-0.10	-0.26	-0.08	-0.27	-0.10
	(0.21)	(0.19)	(0.21)	(0.19)	(0.21)	(0.18)
Scale²	0.02	0.01	0.02	0.01	0.02	0.01
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
VC cluster	0.17	0.18	0.16	0.16	0.15	0.16
	(0.19)	(0.19)	(0.19)	(0.19)	(0.19)	(0.19)
Amount	0.12	0.09	0.12	0.09	0.12	0.09
	(0.12)	(0.11)	(0.12)	(0.11)	(0.12)	(0.11)
Early	0.24	0.25	0.37*	0.38*	0.25	0.26
	(0.19)	(0.19)	(0.20)	(0.20)	(0.19)	(0.19)
Industry fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
N	2,557	2,557	2,557	2,557	2,557	2,557

In Appendix 4-B, I report a multinomial logistic regression distinguishing exit channels through IPO (exit=1), M&A (exit=2) and NEEQ (exit=3). The results are similar to Table 4-11 when eliminating NEEQ from the successful exits. The underperformance of GVCs is only found in exiting through IPOs but not in getting listed on NEEQ.

4.6.3. Strategic industries

The underperformance of portfolio companies backed by GVCs may be caused by the mandate of GVCs to promote the development of "Strategic Emerging Industries"[27], which are regarded as industries with higher risk and uncertainty. The broader categories of industries in the main regression cannot capture the diversified risk of specific industry categories. For example, in the "Industry and Energy" category, *New Energy and Advanced Equipment Manufacturing* belong to Strategic Emerging Industry, but *Mining* does not.

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[27] As early as 1999, *Document of Establishing Venture Capital Investment Mechanism* issued by the State Council of China emphasised that VC firms should focus on high-tech industries. In 2016, State Initiative of Developing Strategic Emerging Industries,13th Five-year Plan (2016-2020) reemphasises the scope of strategic emerging industries which includes Next generation of information and communication technology, Advanced equipment manufacturing, New materials, Biotechnology, Alternative fuel vehicles, New energy, Energy conservation and Environmental protection, and Digital & Creative industry.

To deal with this potential bias, I partition the investments into Strategic Industry and non-Strategic Industry according to their specific industry category recorded in PEdata. The industry fixed effect is replaced by a dummy variable *Strategic Industry* in the regression. 77% of GVCs' investments are in strategic industries while this proportion for PVCs is 64%. The t-test shows that the difference is statistically significant at the 1% level. However, when I include the dummy variable *Strategic Industry* and its interaction term with *GVC* in the regressions, none of the coefficients related to *Strategic Industry* is statistically significant (Appendix 4-C shows the results). One possibility is that even the specific industry categories cannot fully capture the heterogeneity of each portfolio company within the industry.

I also tried the propensity score matching method to test the results using partition of strategic industries. When each investment in strategic industry/non-strategic industry by GVCs is matched with an investment by PVCs within the same year and in the same strategic industry category, no statistically significant differences are found in the marginal effects of being backed by GVCs (see results shown in Panel B of Appendix 4-C).

4.6.4. State-owned investees

Another concern over the results obtained from the baseline regressions is whether the ownership of the investees explains the success rate of exit. Is the underperformance of GVC-backed portfolio companies in achieving IPOs mainly because GVCs are more likely to invest in state-owned enterprises that are less likely to get listed? I collect data on the ownership of portfolio companies to address this concern.

It is quite challenging to collect reliable data on the ownership of portfolio companies because they are private firms when receiving their initial round of VC financing. I refer to several different data sources to conquer this challenge. I check National Enterprise Credit Information Publicity System and trace back to the earliest annual report disclosed to find the information on shareholding. If a portfolio company becomes publicly traded later on, I refer to its IPO prospectus to find relevant information. I also rely on the official website of each portfolio company to get detailed information about its ownership.

Panel A of Table 4-12 shows the means of explanatory variables for state-owned and non-state-owned enterprises. State-owned enterprises are more likely to be backed by GVCs, by VCs with less experience and smaller scale, and are less likely to locate in the three VC clusters in China. The two groups show no statistically significant differences in the stage of investment and the likelihood of being backed by local VCs.

To investigate the different impacts of being backed by GVCs on state-owned and non-state-owned enterprises, I split the sample into two groups and run logit regressions to test their probabilities in achieving IPO/M&A. These results shown in Panel B of Table 4-12 suggest that enterprises backed by GVCs underperform those by PVCs in achieving IPOs in both groups. The result mitigates the concern that GVCs underperformance shown in the baseline regression is mainly due to the GVCs' investments in state-own enterprises.

Table 4-12 Proportion of investments in state-owned enterprises

This table compares the characteristics of state-owned and non-state-owned enterprises as investees and shows the results of multinomial logistic regressions when splitting sample into two groups: state-owned and non-state-owned investees. Values significant at the 1%, 5% and 10% level are identified by ***, **, and *.

Panel A	State-owned investees	Non-State-owned investees	P value of difference
GVC	0.26	0.15	0.00***
Experience	1.62	2.24	0.00***
Scale	3.26	3.59	0.00***
Local	0.42	0.38	0.19
Early	0.37	0.33	0.17
VC cluster	0.36	0.49	0.00***
Amount	1.97	1.59	0.00***
N	317	2,240	

Panel B	(1) IPO	(2) M&A	(3) IPO	(4) M&A
	State-owned investees		Non-State-owned investees	
GVC	-0.80*	2.32*	-0.31*	-0.41
	(0.48)	(1.40)	(0.17)	(0.33)
Experience	0.76*	1.53*	-0.26**	0.28
	(0.39)	(0.86)	(0.12)	(0.24)
Experience^2	-0.14	-0.14	0.04	-0.06
	(0.10)	(0.19)	(0.03)	(0.05)
Scale	-1.17***	-1.35	-0.20	-0.32
	(0.34)	(1.08)	(0.13)	(0.22)
Scale^2	0.08**	0.05	0.01	0.04*
	(0.03)	(0.11)	(0.02)	(0.03)
Local	-0.62	-3.21**	0.10	-0.08
	(0.41)	(1.54)	(0.12)	(0.21)
Early	-0.66*	0.85	-1.32***	0.14
	(0.37)	(0.87)	(0.13)	(0.20)
VC cluster	-0.48	0.01	-0.12	0.21
	(0.36)	(0.84)	(0.11)	(0.20)
Amount	0.26	1.15**	-0.00	0.00
	(0.20)	(0.48)	(0.07)	(0.13)
Industry fixed effect	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes
N		317		2,240

4.6.5. Earlier years, harder years?

There is another alternative explanation for the relatively worse exit performance by GVCs than PVCs. When GVCs were established to catalyse the fledgeling VC industry in China, it could have been harder for industry players to get a promising return. Therefore, the lower possibility of exiting through IPO or M&A backed by GVCs could have been due to the immature industry environment and more challenges in finding competitive projects.

Table 4-13 Being backed by GVCs before and after 2006

This table reports the regression results of the multinomial logistic regressions when splitting samples into the investments before and after 2006. Column (1) to (3) in Panel A use the subsample of investments before 2006, while Column (4) to (6) use investments after 2006. Panel B compares the marginal effects of being backed by GVCs on achieving an IPO/M&A. Values significant at the 1%, 5% and 10% level are identified by ***，**, and *.

Panel A	(1)	(2)	(3)	(4)	(5)	(6)
	Before 2006			2006 afterwards		
Exit=1 (IPO)						
GVC	-0.10	-0.18	-0.53	-0.32*	-0.35*	-0.77*
	(0.27)	(0.35)	(0.71)	(0.19)	(0.20)	(0.38)
GVC × Early		0.17			0.22	
		(0.46)			(0.42)	
GVC × Local			0.50			0.60
			(0.76)			(0.42)
Experience	-0.58**	-0.59**	-0.59**	-0.07	-0.07	-0.11
	(0.24)	(0.24)	(0.24)	(0.14)	(0.14)	(0.14)
Experience^2	0.20***	0.20***	0.20***	-0.01	-0.01	0.01
	(0.06)	(0.06)	(0.06)	(0.03)	(0.03)	(0.03)
Scale	-0.79***	-0.78***	-0.78***	-0.34**	-0.34**	-0.33**
	(0.26)	(0.26)	(0.26)	(0.14)	(0.14)	(0.14)
Scale^2	0.06*	0.06*	0.06*	0.03*	0.03*	0.03*
	(0.04)	(0.04)	(0.04)	(0.02)	(0.02)	(0.02)
Local	-0.10	-0.09	-0.14	0.07	0.07	0.01
	(0.23)	(0.23)	(0.25)	(0.13)	(0.13)	(0.14)
VC cluster	-0.20	-0.20	-0.20	-0.14	-0.14	-0.13
	(0.20)	(0.20)	(0.20)	(0.12)	(0.12)	(0.12)
Amount	0.50***	0.50***	0.50***	-0.10	-0.10	-0.10
	(0.16)	(0.16)	(0.16)	(0.08)	(0.08)	(0.08)
Early	-0.77***	-0.81***	-0.76***	-1.50***	-1.53***	-1.51***
	(0.20)	(0.24)	(0.20)	(0.16)	(0.18)	(0.16)
Exit=2 (M&A)						
GVC	-1.42**	-0.67	1.11	0.15	0.36	0.16
	(0.72)	(0.96)	(0.90)	(0.33)	(0.39)	(0.58)
GVC × Early		-1.39			-0.57	
		(1.37)			(0.62)	
GVC × Local			-3.91***			-0.01
			(1.44)			(0.69)
Experience	0.84	0.81	0.96*	0.37	0.38	0.37
	(0.56)	(0.56)	(0.58)	(0.25)	(0.25)	(0.26)
Experience^2	-0.03	-0.03	-0.04	-0.09*	-0.09*	-0.09*
	(0.11)	(0.11)	(0.11)	(0.05)	(0.05)	(0.05)
Scale	-0.97*	-0.96*	-1.09*	-0.37	-0.36	-0.37
	(0.54)	(0.54)	(0.56)	(0.23)	(0.24)	(0.23)
Scale^2	0.12	0.11	0.13	0.04	0.04	0.04
	(0.08)	(0.08)	(0.08)	(0.03)	(0.03)	(0.03)
Local	-0.01	-0.04	0.32	-0.21	-0.20	-0.21
	(0.46)	(0.46)	(0.46)	(0.24)	(0.24)	(0.25)
VC cluster	0.72	0.71	0.74	0.02	0.01	0.02
	(0.48)	(0.48)	(0.49)	(0.22)	(0.22)	(0.22)
Amount	-0.08	-0.07	-0.03	0.10	0.10	0.10
	(0.32)	(0.33)	(0.32)	(0.13)	(0.13)	(0.13)
Early	0.24	0.41	0.13	0.07	0.15	0.06
	(0.44)	(0.48)	(0.45)	(0.22)	(0.23)	(0.22)
Industry fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
N	620	620	620	1,937	1,937	1,937

Panel B: Marginal effects	Before 2006		After 2006	
GVCs vs PVCs	(1) Marginal effect on IPO	(2) Marginal effect on M&A	(3) Marginal effect on IPO	(4) Marginal effect on M&A
Baseline regressions	-0.01	-0.05***	-0.06*	0.01
	(0.05)	(0.02)	(0.03)	(0.02)
(with *GVC×Early*)				
When *Early*=1	0.02	-0.08***	-0.01	0.01
	(0.06)	(0.03)	(0.04)	(0.02)
When *Early*=0	-0.03	-0.01	-0.08**	0.02
	(0.08)	(0.02)	(0.04)	(0.04)
(with *GVC×Local*)				
When *Local* =1	0.02	-0.08***	-0.03	0.01
	(0.06)	(0.02)	(0.04)	(0.02)
When *Local*=0	-0.12	0.10	-0.13**	0.01
	(0.11)	(0.09)	(0.05)	(0.04)
N	620		1,937	

To test this alternative explanation, I partition the samples into two groups according to the first-round investment year of each portfolio company. The total investment amount in the Chinese VC industry reached 10 billion US dollars for the first time in 2006 and remained high thereafter. In addition, the *Limited Partnership Law* and *The Provisional Rules Governing Administration of Venture Capital Enterprises* came into effect, which was essential for the healthy development of the VC industry in China. Furthermore, as discussed in Chapter 2 Institutional Background, the split share structure reform completed in 2006 enables GVCs to get a return from their listed portfolio companies more easily. Therefore, 2006 is regarded as the cut-off year, and portfolio companies that received their initial round of investment before 2006 are denoted by "early years".

Before 2006, 23% of first-round investments were by GVCs. In contrast, GVCs only took up 15% after this date. This reflects the fact that more PVCs were established when the Chinese VC market became mature. The total of first-round investment deals after 2006 (1,937 deals till the end of 2010) was also much larger than before (620 deals).

Table 4-13 shows the regression results (Panel A) and the marginal effects (Panel B) of being backed by GVCs compared to by PVCs. The underperformance of GVCs in helping their investees achieve IPOs could only be observed after 2006, especially when they invested in non-local portfolio companies. Therefore, the overall underperformance of GVCs between 1991 to 2010 is not driven by "earlier and harder years". What is worth mentioning is that GVCs significantly underperformed PVCs before 2006 in helping their local or early stage portfolio companies find an acquirer, as shown the negative and statistically significant coefficient of the interaction term of *GVC×Local*. However, this disadvantage disappears afterwards.

4.7. Conclusion

Prior research shows portfolio companies backed by GVCs and PVCs have different exit performances. However, there is a lack of systematic analysis of what leads to this different performance. This chapter compares the characteristics of GVCs and PVCs at each stage of a VC life cycle. I point out that the link between VC firms' current performance and future fundraising serves as an incentive for VCs, but the impact of the link has been ignored in the literature. GVCs are expected to underperform PVCs due to the agency problems at the level of VC firms (because there is no link between GVCs' current performance and future fundraising), and an inefficient compensation scheme at the level of VC managers.

Using data on VC investment from 1991 to 2010 in the Chinese VC market, the empirical results show that companies backed by GVCs in their first round of VC financing are less likely to go public, compared to those backed by PVCs. The underperformance of GVCs is partially offset by their ability to access favourable local public resources, especially IPO approval when investing locally. Furthermore, there is no evidence to show that GVCs have any advantage in selecting or nurturing early-stage investment, despite the fact that GVCs have made more early-stage investments than PVCs. The results are robust to a number of checks.

Appendix 4-A Regression results of Table 4-4 when not controlling for investment amount

This table shows the estimated coefficients of the multinomial logistic regressions shown in Table 4-4 using portfolio companies receiving their initial round of VC financing from a sole GVC or a sole PVC between 1991 and 2010 in the Chinese VC market as the sample. The difference between this table and Table 4-4 is that regressions shown in this table do not include investment amount (*Amount*) in the control variables. As a result, the sample size increase from 2,557 in Table 4-4 to 3,497 in this table. The regression results remain qualitatively the same as Table 4-4. The standard errors (in parenthesis) are clustered by the location of portfolio companies. Coefficients significant at the 1%, 5% and 10% level are identified by ***, **, and *.

	(1)	(2)	(3)	(4)	(5)	(6)
Exit=1 (IPO)						
GVC	-0.231$^+$	-0.279*	-0.242	-0.295$^+$	-0.695*	-0.708*
	(0.135)	(0.132)	(0.155)	(0.152)	(0.288)	(0.279)
GVC×Early			0.063	0.079		
			(0.266)	(0.265)		
GVC×Local					0.601$^+$	0.565$^+$
					(0.321)	(0.314)
Experience	-0.471**		-0.472**		-0.508**	
	(0.098)		(0.098)		(0.100)	
Experience^2	0.057**		0.058**		0.069**	
	(0.021)		(0.021)		(0.022)	
Industry Experience		-0.452**		-0.453**		-0.470**
		(0.111)		(0.111)		(0.111)
Industry Experience^2		0.094**		0.095**		0.105**
		(0.031)		(0.032)		(0.032)
Local	0.005	-0.026	0.006	-0.026	-0.063	-0.092
	(0.102)	(0.102)	(0.102)	(0.102)	(0.109)	(0.109)
Scale	-0.061	-0.179*	-0.061	-0.179*	-0.055	-0.181*
	(0.095)	(0.088)	(0.095)	(0.088)	(0.095)	(0.088)
Scale^2	0.003	0.010	0.003	0.010	0.001	0.010
	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)
VCcluster	-0.189*	-0.205*	-0.189*	-0.205*	-0.183$^+$	-0.196*
	(0.095)	(0.094)	(0.095)	(0.094)	(0.095)	(0.094)
Early	-1.163**	-1.188**	-1.174**	-1.202**	-1.163**	-1.188**
	(0.110)	(0.109)	(0.120)	(0.120)	(0.110)	(0.109)
Exit=2 (M&A)						
GVC	-0.342	-0.340	0.001	-0.020	-0.096	-0.136
	(0.235)	(0.232)	(0.298)	(0.292)	(0.406)	(0.392)
GVC×Early			-0.728$^+$	-0.697		
			(0.438)	(0.437)		
GVC×Local					-0.349	-0.296
					(0.490)	(0.479)
Experience	-0.019		-0.002		-0.004	
	(0.183)		(0.183)		(0.184)	
Experience^2	0.001		-0.005		-0.003	
	(0.035)		(0.035)		(0.036)	
Industry Experience		-0.166		-0.162		-0.165
		(0.179)		(0.179)		(0.179)
Industry Experience^2		0.044		0.039		0.043
		(0.046)		(0.046)		(0.046)
Local	-0.080	-0.083	-0.073	-0.075	-0.042	-0.051
	(0.166)	(0.165)	(0.166)	(0.165)	(0.175)	(0.174)
Scale	0.097	0.126	0.098	0.129	0.096	0.128
	(0.163)	(0.152)	(0.163)	(0.152)	(0.163)	(0.152)
Scale^2	-0.011	-0.015	-0.010	-0.015	-0.011	-0.016
	(0.020)	(0.019)	(0.020)	(0.019)	(0.020)	(0.019)
VCcluster	0.164	0.170	0.152	0.156	0.156	0.162
	(0.161)	(0.161)	(0.162)	(0.161)	(0.162)	(0.162)
Early	0.233	0.233	0.331*	0.326$^+$	0.237	0.236
	(0.156)	(0.156)	(0.167)	(0.167)	(0.157)	(0.156)
Industry fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
N	3,497	3,497	3,497	3,497	3,497	3,497

Appendix 4-B Exit channels distinguishing among IPO, M&A and NEEQ

This table shows the results of the multinomial logistic regressions when distinguishing among different exit channels: IPOs (exit=1), M&A (exit=2), and NEEQ (exit=3). The regression results remain qualitatively the same as Table 4-4. The standard errors (in parenthesis) are clustered by the location of portfolio companies. Coefficients significant at the 1%, 5% and 10% level are identified by ***, **, and *.

	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Exit=1 (IPO)						
GVC	-0.424*	-0.453**	-0.485*	-0.526**	-1.040**	-1.066**
	(0.168)	(0.165)	(0.191)	(0.189)	(0.373)	(0.364)
GVC×Early			0.238	0.291		
			(0.334)	(0.334)		
GVC×Local					0.791+	0.800*
					(0.412)	(0.405)
Experience	-0.149		-0.154		-0.195	
	(0.122)		(0.122)		(0.124)	
Experience^2	0.032		0.034		0.046+	
	(0.025)		(0.025)		(0.026)	
Industry Experience		-0.118		-0.121		-0.144
		(0.137)		(0.137)		(0.138)
Industry Experience^2		0.072+		0.075+		0.086*
		(0.038)		(0.039)		(0.039)
Local	-0.112	-0.125	-0.110	-0.123	-0.192	-0.209
	(0.123)	(0.122)	(0.123)	(0.122)	(0.130)	(0.130)
Scale	-0.282*	-0.351**	-0.283*	-0.352**	-0.272*	-0.349**
	(0.127)	(0.113)	(0.127)	(0.113)	(0.128)	(0.113)
Scale^2	0.014	0.016	0.014	0.016	0.012	0.016
	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)
VCcluster	-0.122	-0.122	-0.120	-0.118	-0.113	-0.109
	(0.110)	(0.110)	(0.110)	(0.110)	(0.110)	(0.110)
Amount	0.109	0.150*	0.110	0.151*	0.109	0.146*
	(0.071)	(0.064)	(0.071)	(0.064)	(0.071)	(0.064)
Early	-1.321**	-1.326**	-1.362**	-1.376**	-1.316**	-1.323**
	(0.135)	(0.135)	(0.148)	(0.148)	(0.135)	(0.135)
Panel B: Exit=2 (M&A)						
GVC	-0.296	-0.297	0.138	0.112	0.136	0.006
	(0.291)	(0.286)	(0.350)	(0.342)	(0.474)	(0.459)
GVC×Early			-1.024+	-0.988+		
			(0.556)	(0.556)		
GVC×Local					-0.627	-0.454
Experience	0.385+		0.403+		0.421+	
	(0.228)		(0.227)		(0.231)	
Experience^2	-0.064		-0.073+		-0.074	
	(0.044)		(0.044)		(0.045)	
Industry Experience		0.113		0.117		0.121
		(0.228)		(0.228)		(0.228)
Industry Experience^2		-0.028		-0.037		-0.032
		(0.060)		(0.061)		(0.061)
Local	-0.177	-0.153	-0.171	-0.142	-0.106	-0.099
	(0.205)	(0.204)	(0.205)	(0.203)	(0.215)	(0.215)
Scale	-0.312	-0.154	-0.302	-0.145	-0.316	-0.151
	(0.210)	(0.186)	(0.210)	(0.186)	(0.210)	(0.187)
Scale^2	0.027	0.014	0.028	0.014	0.029	0.013
	(0.023)	(0.022)	(0.023)	(0.022)	(0.023)	(0.022)
VCcluster	0.164	0.169	0.146	0.149	0.144	0.153
	(0.189)	(0.189)	(0.190)	(0.189)	(0.190)	(0.190)
Amount	0.095	0.060	0.091	0.060	0.095	0.062
	(0.116)	(0.107)	(0.117)	(0.107)	(0.116)	(0.107)
Early	0.180	0.191	0.312	0.317	0.187	0.197
	(0.191)	(0.191)	(0.204)	(0.204)	(0.192)	(0.192)
Panel C: Exit=3 (NEEQ)						
GVC	-0.058	-0.054	-0.188	-0.181	-0.192	-0.109
	(0.266)	(0.262)	(0.307)	(0.302)	(0.608)	(0.583)
GVC×Early			0.474	0.456		
			(0.508)	(0.508)		
GVC×Local					0.182	0.089
					(0.653)	(0.635)
Experience	-0.367		-0.369		-0.380	
	(0.235)		(0.235)		(0.241)	

Experience^2	0.047		0.050		0.051	
	(0.051)		(0.051)		(0.054)	
Industry Experience		-0.427		-0.424		-0.428
		(0.267)		(0.267)		(0.269)
Industry Experience^2		0.075		0.079		0.075
		(0.078)		(0.078)		(0.079)
Local	0.495*	0.488*	0.501*	0.493*	0.469*	0.471*
	(0.215)	(0.215)	(0.216)	(0.216)	(0.228)	(0.228)
Scale	-0.268	-0.396+	-0.284	-0.409+	-0.266	-0.397+
	(0.248)	(0.210)	(0.249)	(0.211)	(0.248)	(0.210)
Scale^2	0.023	0.038	0.023	0.039	0.022	0.038
	(0.035)	(0.030)	(0.035)	(0.030)	(0.035)	(0.030)
VCcluster	-0.163	-0.160	-0.148	-0.145	-0.157	-0.155
	(0.211)	(0.210)	(0.212)	(0.211)	(0.212)	(0.210)
Amount	-0.657**	-0.626**	-0.650**	-0.621**	-0.657**	-0.626**
	(0.167)	(0.158)	(0.167)	(0.158)	(0.167)	(0.158)
Early	-0.918**	-0.926**	-1.043**	-1.045**	-0.918**	-0.927**
	(0.237)	(0.236)	(0.276)	(0.275)	(0.237)	(0.237)
N	2,557	2,557	2,557	2,557	2,557	2,557

Appendix 4-C Regression results when controlling for Strategic Industry

This table shows the results of the multinomial logistic regressions when controlling for the strategic industry. The standard errors (in parenthesis) are clustered by the location of portfolio companies. Coefficients significant at the 1%, 5% and 10% level are identified by ***, **, and *.

Panel A	(1)	(2)	(3)	(4)
Exit=1				
GVC	-0.288+	-0.231	-0.312*	-0.249
	(0.149)	(0.266)	(0.146)	(0.261)
GVC×Strategic Industry		-0.077		-0.085
		(0.296)		(0.295)
Strategic Industry	-0.001	0.009	-0.025	-0.014
	(0.102)	(0.109)	(0.104)	(0.111)
Experience	-0.144	-0.143		
	(0.112)	(0.113)		
Experience^2	0.024	0.024		
	(0.023)	(0.023)		
Industry Experience			-0.085	-0.085
			(0.126)	(0.126)
Industry Experience^2			0.048	0.048
			(0.035)	(0.035)
Local	-0.025	-0.025	-0.037	-0.037
	(0.112)	(0.112)	(0.111)	(0.111)
Scale	-0.328**	-0.328**	-0.404**	-0.404**
	(0.116)	(0.116)	(0.103)	(0.103)
Scale^2	0.021	0.021	0.023+	0.023+
	(0.013)	(0.013)	(0.013)	(0.013)
VCcluster	-0.207*	-0.207*	-0.215*	-0.215*
	(0.099)	(0.099)	(0.099)	(0.099)
Amount	0.015	0.015	0.060	0.060
	(0.066)	(0.066)	(0.059)	(0.059)
Early	-1.270**	-1.270**	-1.280**	-1.281**
	(0.121)	(0.121)	(0.121)	(0.121)
Exit=2				
GVC	-0.324	-0.476	-0.332	-0.476
	(0.289)	(0.638)	(0.284)	(0.638)
GVC×Strategic Industry		0.184		0.216
		(0.685)		(0.682)
Strategic Industry	0.173	0.157	0.151	0.130
	(0.201)	(0.212)	(0.205)	(0.215)
Experience	0.391+	0.389+		
	(0.227)	(0.227)		
Experience^2	-0.064	-0.064		
	(0.044)	(0.044)		
Industry Experience			0.130	0.130
			(0.226)	(0.226)
Industry Experience^2			-0.019	-0.019
			(0.060)	(0.060)
Local	-0.173	-0.173	-0.148	-0.149
	(0.206)	(0.206)	(0.204)	(0.204)
Scale	-0.315	-0.316	-0.172	-0.172
	(0.210)	(0.210)	(0.187)	(0.187)
Scale^2	0.028	0.028	0.014	0.014
	(0.023)	(0.023)	(0.022)	(0.022)
VCcluster	0.238	0.237	0.239	0.238
	(0.184)	(0.184)	(0.184)	(0.184)
Amount	0.066	0.066	0.047	0.046
	(0.116)	(0.116)	(0.107)	(0.107)
Early	0.253	0.254	0.256	0.256
	(0.187)	(0.187)	(0.188)	(0.188)
Industry fixed effect	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes
N	2,557	2,557	2,557	2,557

Panel B: Treatment effect after matching on Strategic industry

	Strategic Industry =1	Strategic Industry =0
GVC vs PVC	-0.058	-0.117
t-test value	(-1.19)	(-1.49)

5. Gain or pain? New evidence on mixed syndication between governmental and private venture capital firms in China

5.1. Introduction

Syndication, which involves two or more venture capital (VC, hereafter) firms in a particular round of financing in a portfolio company, is a common phenomenon in the VC industry. It enables VC firms to spread their risk over a wider range of projects and facilitates the financing of larger projects by bringing a group of VC firms together. Governments have increasingly set up their own VC firms (GVCs) in the hope of improving the flow of innovation and entrepreneurial ideas into successful ventures (Lerner, 2009). Besides investing alone, GVCs also syndicate with private VC firms (PVCs). According to Cumming *et al.* (2017), mixed syndication involving both GVCs and PVCs is expected to perform better than just syndication among PVCs, because mixed syndication enjoys the benefits of favourable policies from the government and can also overcome the inefficiency issues of GVCs.

This chapter investigates the performance of mixed syndication in the context of China, the second largest VC market in the world (Ernst & Young, 2014). It is important to evaluate the performance of mixed syndication not only because it involves a substantial amount of taxpayers' money[28], but also because of the potential implications for policy-makers in designing schemes to promote entrepreneurship.

The difference between mixed syndication and pure PVC syndication (i.e. syndication that only involves PVCs) is the focus of this chapter. The literature emphasises the positive influence of mixed syndication (Cumming *et al.*, 2017), but has done little work on the possible costs incurred in the co-investment between GVCs and PVCs. I seek to bridge two gaps in the VC literature as discussed below.

I first discuss the possible cost of mixed syndication compared to the most common type of VC syndication—only among PVCs[29]. Since literature is scarce on the negative side of mixed syndication, I collected the opinions of venture capitalists through an online survey. The

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[28] According to PEdata, more than 60 billion US dollars was invested by GVCs between 1991 and 2011, half of which was through mixed syndication.

[29] According to PEdata, pure PVC syndication made ¾ of the syndication investments in the initial round of financing in portfolio companies between 1991 and 2011, while syndication among GVCs took less than 5% of syndication investments during the same period. The remaining syndication investment is by mixed syndication.

anonymous informants who responded to the survey provide insights into the costs of mixed syndication in China.

However, merely using IPOs to measure the performance of mixed syndication as researchers have done in the literature has a potential pitfall in the context of the Chinese stock market. The administrative approval system for IPOs makes it hard to separate the selecting and nurturing capability of mixed syndication from the influence of GVCs' privileged access to IPO approvals on domestic stock markets. Therefore, I adopt two measures—the likelihood of achieving IPO/M&A and the probability of obtaining subsequent financing—to compare the performance of mixed syndication with pure PVC syndication. Using data on companies that received their initial VC investment between 1995 and 2011, I find that firms invested in by mixed syndication in China are less likely to get subsequent round of financing compared to those backed by pure PVC syndication. This finding suggests that the negative impact of mixed syndication outweighs the positive effects.

The baseline empirical result leads to the next question: what are the mechanisms through which mixed syndication underperforms pure PVC syndication in China? When I partition the mixed syndicates into GVC- and PVC-led ones, it appears that the underperformance of mixed syndication mainly stems from the syndicates led by PVCs. I suggest one institutional reason in that PVC-led mixed syndicates may choose riskier projects due to the special return arrangement between the lead PVCs and the participating GVCs.

Another reason why mixed syndication might lead to a lower likelihood of obtaining subsequent financing is that benefits from the complementary resources of syndicate partners are offset by the cost of coordination among the partners of mixed syndication. I find that the underperformance of PVC-led mixed syndication is contingent on the lead PVC's networking position—a proxy for the resources a VC firm can leverage. The regression results provide evidence that the more resources a PVC can leverage, the fewer gains it can obtain from its GVCs syndicate partners compared to syndication with other PVCs, and the more likely it is to suffer from the costs of resolving conflicts in cooperation.

I apply two methods to address the empirical challenges of potential endogeneity. Firstly, I use whether the investments are made in the domestic currency "RMB" as an instrumental variable for a start-ups' probability of being backed by mixed syndication. Secondly, I adopt propensity score matching to ensure that only portfolio companies with similar observable characteristics are compared across groups.

One alternative mechanism that may drive the empirical findings is that the level of information asymmetry may affect mixed syndication's and pure PVC syndication's choices on staged financing differently. Robustness checks, however, show that the factors reflecting the level of information asymmetry (e.g. stage and amount of investment) do not show different patterns of influence for mixed syndication and pure PVC syndication.

The rest of the chapter is organised as follows. Section 5.2 discusses the literature and develops the hypotheses. Section 5.3 introduces the empirical methods, describes the data and provides basic summary statistics. Section 5.4 contains the main empirical results and Section 5.5 provides robustness tests. Section 5.6 concludes.

5.2. Related literature, institutional background and hypotheses

De Maeseneire & Van Halder (2010) provide a comprehensive overview of the benefit/cost of VC syndication. However, little research has been undertaken on how different types of VC firms contribute to costs and benefits in syndication, especially the cost due to different ownership—whether they are GVCs or PVCs. This section starts with a brief review of the positive side of mixed syndication, then focuses on the negative side of mixed syndication compared to pure PVC syndication, especially in the context of the Chinese VC market.

5.2.1. Positive side of mixed syndication

VC syndication benefits from crosschecking in the initial screening process and the addition of complementary value-adding skills (Brander *et al.*, 2002), especially when there is a gap in the knowledge of the VC firm leading the syndicate (De Clercq & Dimov, 2004). The main advantage of mixed syndication, according to Cumming et al. (2017), is that it can offset the shortcomings of GVCs and benefit from the aforementioned gains of syndication. Mixed syndication also has a certification effect by providing a signal that the investees are perceived as being able to obtain privileged support from the government, so that more PVCs are encouraged to invest in certain industries/geographic areas (Guerini & Quas, 2016; Minola *et al.*, 2017). In China, mixed syndication also enjoys privileged access to domestic stock markets, as explained in the institutional background chapter.

5.2.2. Negative side of mixed syndication

Syndication requires effective coordination among participants for the benefits to be realised. However, VC syndication increases the likelihood of conflicts (Bruining *et al.*,

2005) and can result in associated costs due to the opportunistic behaviour of syndicate partners (Dimov & Milanov, 2010).

Du (2016) finds that the heterogeneity among VC firms brings more communication costs than benefits to syndication investment. Since the literature on the cost of mixed syndication is scant, I attempted to gain more information from venture capitalists before conducting empirical analysis. A request for information from PVCs was placed on the Zhihu platform[30] in November 2016. The question posted was, "In your experience of syndication with governmental VC firms, what extra cost have you encountered compared to syndication with other private VC firms?" The responses were anonymous (see Appendix 5-A for the details of the responses). The following analysis is based on the literature as well as these anonymous responses.

Compared to pure PVC syndication, mixed syndication has three potential sources of extra coordination costs due to: (1) the different project-screening criteria of GVCs and PVCs; (2) the interference of government officials, and (3) specifically in China, the extra investment/exit procedures required by SASAC (the State-owned Assets Supervision and Administration Committee).

5.2.2.1. *Different project-screening criteria*

GVCs have an obligation to stimulate local industry and economic development (Bertoni & Tykvová 2015) and, as a result, focus on different aspects and have different criteria when screening potential deals compared to PVCs (Minola *et al.*, 2017). Furthermore, the techniques GVCs employ in project-screening (e.g. the portfolio companies' records in government subsidies applications or governmental incubators) are different from PVCs, as discussed in Chapter 4.

According to the online responses, portfolio companies often find that they need to prepare a tailored proposal to cater for GVCs and relevant government officials. In mixed syndication investment, the cooperating PVCs need to "be super patient", as noted by one respondent, in achieving a consensus with their GVCs syndicate partners. This indicates a longer decision-making time for mixed syndication.

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[30] See Appendix 5-A for a detailed introduction to the platform and academic works using Zhihu as the information source.

5.2.2.2. The impact of government officials

Researchers believe that one of the major weaknesses for GVCs is their lack of independence in decision-making. The head of local governments, together with officials of public divisions (such as local Commission of Science and Technology, Development and Reform Commission, Economic Commission), may interfere with the decision-making of GVCs.

Some government officials regard GVCs as stepping stones for their career paths and require the collaborative PVCs to spend "a considerable amount of money" (mentioned by one anonymous respondent) on public relations events. In contrast, VCs in pure PVC syndication are not under the pressure of government officials when managing their funds.

In addition, the replacement of government officials increases costs for mixed syndication. The re-evaluation required by newly appointed officials may result in longer lasting and greater uncertainties for the GVCs and PVCs in mixed syndication to reach a consensus on critical issues like refinancing and exiting. In contrast, the replacement of government officials does not have a direct impact on syndication that is solely among PVCs. It is simply an extra layer that increases the uncertainty for mixed syndication but not for pure PVC syndication.

5.2.2.3. The Role of SASAC

SASAC is responsible for the annual assessment and supervision of GVCs and other state-owned enterprises. The annual assessment, which ignores the characteristics of the VC industry, may distort the GVCs' decision over the refinancing/divestment in a particular portfolio company. Therefore, GVCs may have different goals from their PVC partners in mixed syndication. The supervision by SASAC creates an extra procedure for the GVCs' initial investment decision-making process right through to exit (as discussed in the chapter on institutional background), and also gives rise to a longer decision-making process for mixed syndications.

The relative performance of mixed syndication compared with pure PVC syndication is ultimately an empirical question. I first test the null hypothesis using the traditional measure of VC performance—whether the investment has successfully exited through IPO or M&A:

Hypothesis 1a*: Portfolio companies backed by mixed syndication and those by pure PVC syndication show no difference in the likelihood of achieving IPO/M&A.*

However, only using IPO/M&A to measure the performance of VC financing may not be enough to investigate the effect of mixed syndication on portfolio companies. The administration-based IPO system in China means that government authorities retain substantial discretionary power in approving IPO applications (Guo & Jiang, 2013; Tian, 2011a). As a result, the final IPO outcome is not simply based on the development and prospects of the entrepreneurial companies but is also heavily affected by its VCs' capability of getting IPO approvals.

Therefore, I use another measure of performance—whether the initial round of VC investment has obtained subsequent financing after the initial round. Venture capitalists re-evaluate their portfolio companies periodically to decide on whether or not to provide follow-on funding (Gompers, 1995). Obtaining subsequent financing is an important milestone for investees (Hochberg *et al.*, 2007) and a convincing sign for resolution of uncertainty (Giot & Schwienbacher, 2007). Using the alternative measure, I test a similar null hypothesis as follows:

Hypothesis 1b*: Portfolio companies backed by mixed syndication and those backed by pure PVC syndication show no difference in their likelihood of obtaining subsequent financing.*

5.2.3. Other factors that may affect the performance of mixed syndication

Measuring the performance of mixed syndication is not the only goal of this research. Some natural questions following Hypothesis 1 are (1) which subgroup causes outperformance (or underperformance) of mixed syndication; and (2) what are the possible factors that lead to the performance. In this section, I discuss two possible mechanisms to explain the performance of mixed syndication.

5.2.3.1. Mixed syndication led by GVCs or PVCs

The lead VC firm in a syndicate plays a primary role in screening, structuring and monitoring the investees (Wright & Lockett, 2002). Vanacker *et al.* (2014) document the GVCs' underperformance in helping firms to obtain follow-on rounds of financing. Furthermore, Grilli & Murtinu (2014a) find that mixed syndication has a positive and statistically significant impact on firm growth only when PVCs lead the syndicates. These findings suggest that if GVCs lead a mixed syndication, the syndication should underperform those led by PVCs.

On the other hand, however, the participation of GVCs in a PVC-led syndicate may "distort private markets by offering finance which does not fully reflect the appropriate risk

premium" (Murray, 2007). Some GVCs, as required by local governments, join mixed syndication as followers and only require a fixed rate of return (X. Hu & Chen, 2012) to promote local VC industry and entrepreneurship. The special arrangement limits a GVC's right to share the profit when the return is higher than a pre-set level, but does not exempt the GVC's obligation to share the loss. PVCs obtain the call options to purchase the equities held by GVCs in the future at a pre-set price (the original price of equity when the GVC invested plus the annual fixed rate of return that is as low as government securities). As a result, the lead PVCs in a mixed syndication may choose riskier projects to invest in.

In contrast, in a GVC-led mixed syndication, PVCs are invited to provide a second opinion on screening or provide more diversified value-added activities. It is difficult to believe that getting additional opinions and resources from PVCs will lead to GVCs investing in riskier deals. In addition, from the perspective of the participating syndicate partners, PVCs will only join in a syndicate led by GVCs when the PVCs perceive the project to be of high quality.

As there are both pros and cons in mixed syndication led by GVCs and PVCs, I make the following null hypothesis:

Hypothesis 2*: Portfolio companies backed by GVC-led or PVC-led mixed syndications show no difference in performance compared to those backed by pure PVC syndications.*

5.2.3.2.   *Complementary resources and coordination cost*

The impact of mixed syndication may be affected by the status of the lead VC in a syndicate. The more resources a VC firm has for screening and nurturing its portfolio companies, the less likely it will benefit from the extra resources provided by its syndicate partners, and the higher the coordination cost it is likely to have in resolving potential conflicts with its syndicate partners. In contrast, VC firms with fewer resources can adapt more efficiently to unexpected future contingencies in syndication investment (Verwaal *et al.*, 2010).

I use the firm's networking position to measure the resources a VC firm can leverage. Networking position refers to a VC's relative connectedness with peers through prior joint syndication (Hochberg *et al.*, 2007). Syndication facilitates the sharing of resources among VCs, so a high networking position indicates the greater benefits—both knowledge and potential deal flows—a VC can obtain from its peers. In addition, syndication is more

efficient than a single VC in improving the portfolio companies' value (Tian, 2012), so a high networking position indicates that a VC has accumulated more resources through syndication.

I investigate the impacts of the lead VC's networking position in mixed syndication with the following null hypothesis:

Hypothesis 3: *The networking position of lead VCs does not have a different impact on the performance of portfolio companies backed by mixed syndication and pure PVC syndication.*

5.3. Model and data

5.3.1. Model of IPO/M&A and subsequent financing

Since detailed financial data on VCs' exit are not available, I use a logit model to test *Hypothesis 1a*:

$$IPO/M\&A = \alpha + \sum_{i=1}^{5} \beta_i VCType_i + Controls \qquad (5\text{-}1)$$

where *IPO/M&A* has the value 1 in the event of a successful exit and zero otherwise. *VCType* refers to five categories of VC financing (GVC alone, PVC alone, pure GVC syndicate, pure PVC syndicate, and mixed syndicate). *Controls* includes a set of control variables that explain the chance of success, as discussed later.

Similarly, a logit regression is used to measure the performance of investment using whether a company has obtained subsequent financing as the dependent variable to test Hypothesis 1b:

$$Subsequent\ Financing = \alpha + \sum_{i=1}^{5} \beta_i VCType_i + Controls \qquad (5\text{-}2)$$

where *Subsequent financing* is a dummy equalling 1 if the portfolio companies survive to the next round and obtain follow-on financing after its initial round of VC investment, or achieve successful exit directly after its first round of VC financing.

However, the logit model does not take into account the probability of getting subsequent financing after 2016 (five years after 2011)—the end year of the data period for this chapter. Therefore, I use a Cox proportional hazard model where *Subsequent financing* is the duration from a portfolio company's initial VC financing date to the refinancing date, or to the date of IPO/M&A if it has successfully exited after its initial VC financing without necessarily having a follow-on round of financing. The proportional hazard can be written as

$$h(t|x_j) = h_0(t) \exp(x_j \boldsymbol{\beta}_x)$$ **(5-3)**

h_0 is the baseline group's "hazard" of obtaining subsequent financing at any given time t once they have received the initial round of VC financing. I set the portfolio companies backed by a sole PVC in the first round financing as the baseline group since it is the most common case for investees (shown in Table 5-1). The estimated β coefficient can be interpreted as the probability that a portfolio company backed by other types of VCs in getting subsequent financing on a given date t, compared to the baseline group. I use the proportional hazard model as an alternative regression to test Hypothesis 1b. For Hypothesis 2, I use the same aforementioned models by splitting the sample of mixed syndication into GVC-led ones and PVC-led ones.

To test Hypothesis 3, I expand Equation (5-2) to consider whether a higher networking position matters.

$$Subsequent\ financing = \alpha + \sum_i^n \beta_i VCType_i + \theta_i HighNetwork_i \\ + \sum_i^n \gamma_i VCType_i * HighNetwork_i + Controls$$ **(5-4)**

The coefficient of interest is γ_i, the interaction term between the VC Type and the dummy variable *HighNetwork*, which takes the value of 1 if the lead VC firm of a syndicate has an above-average networking position in a given year.

5.3.2. Data sources and sample

The data in this study comprises information on VC firms, portfolio companies, and the investment environment. The primary data source is PEdata. China Stock Market Accounting Research (CSMAR) is used as the supplementary data source to cross-check the IPO records in PEdata. To augment the identification of the lead VC in syndicates, I also refer to National Enterprises Credit Information Publicity System (NECIPS), an official online platform operated by the State Administration for Industry and Commerce.

The sample includes portfolio companies that received their initial round of VC financing between 1995 and the end of 2011 in China. Beginning from 1995[31] facilitates the calculation of networking positions on a five-year rolling basis. Truncating in 2011 gives all investments

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[31] The earliest investment record in PEdata is in 1990.

at least five years to achieve exits or obtain subsequent financing by the end of 2016 when I collected the data.

From an initial base of 18,805 investments[32], the sample falls to 17,782 after eliminating investments where either the portfolio companies or the VC firms could not be identified. I also exclude 961 private investments in public equity (PIPE) and private placements by publicly-listed firms, 422 investments in film and TV series production projects, and 223 real estate development investments from the analysis because successful exit from such investments cannot be gauged by IPO, M&A or subsequent financing, as explained in Section 4.3.1. I integrate the investments made by the same VC firm on the same date into the same portfolio company but using different funds under management as one investment. This procedure removes a further 1,027 investments, which would otherwise be double counted. I treat investments in the same portfolio company by different VC firms within a month as being part of the same syndication to allow for the different preference of syndicate partners in reporting the date of investment[33].

In total, I identify 15,149 investments in 5,230 distinct portfolio companies that received their first rounds of VC financing between 1995 and 2011. The observations in the regressions are in the form of a cross-section of the 5,230 portfolio companies. Thus in controlling for the characteristics of the investments, I focus on the initial round of VC investment in each portfolio company and then use the remaining investments records to track whether or not the investees have obtained subsequent financing or successful exits.

5.3.3. Identifying VC Types

All investments are classified into five categories: being invested in by a single GVC, a single PVC, mixed syndication of GVCs and PVCs, pure GVC syndication, and pure PVC syndication. Following the previous chapters, VC firms are classified as GVCs if they are established by the government, with the main funding resource coming from the government and the CEO and directors appointed by the government [34].

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[32] Investments refer to the pairs of VC firms and portfolio companies in a specific round of financing. For example, VC A invested in company X on 01/03/2002 as the initial round of financing to X, and two years later A and B co-invested in X. In this case, there are three investments identified: A→X in the first round, A→X and B→X in the second round.

[33] For example, some VC firms report the investment date as the signing date (or closing date) of the term sheet, while others report the exact date of transferring funds to their portfolio companies' account.

[34] To ensure a reliable classification, I cross-check the information on VC firms by referring to the official websites of the VC firms and local SASACs across provinces, municipality cities and sub-cities. From a total of 474 VC firms categorised by PEdata as "with state background", 254 are identified as GVCs after cross-checking.

I adopt a strategy similar to Dai *et al*. (2012) in identifying the lead VC firms of a syndicate as those with the largest investment amount in the initial round of financing in portfolio companies. When the exact investment amount of each syndicate partner is not available in PEdata, I refer to the shareholding information in the annual reports of firms in NECIPS. If there are multiple VC firms leading the syndicate, i.e. two or more VC firms having equal amounts of investment in the portfolio company's initial VC financing, I regard the VC firm with the longest investment presence in the portfolio company as the lead VC.

Table 5-1 presents the distribution of portfolio companies backed by different types of VC financing. Three-quarters of the portfolio companies got their initial VC financing from one VC firm, while the other quarter received syndicated investment. There are three times as many firms backed by pure PVC syndication as those backed by mixed syndication.

Table 5-1 Distribution of portfolio companies backed by different types of VC financing

This table shows the number and proportion of portfolio companies backed by different VC firms in the sample. Portfolio companies are categorised as *GVC* if they obtain their first-round VC financing from a GVC (defined as VC firms established by the government in China, operated by the managers appointed by the government, and having their funding resources from the government), and as *PVC* if from a PVC. Similarly, *GVC syn* represents a portfolio company being backed by a syndicate among GVCs, and *PVC syn* refers to the syndication only including PVCs. Syndication investment is defined as *Mixed syn* if the first round of investment in a portfolio company involves both GVCs and PVCs.

Investment Type	Observation	Proportion
GVC	623	11.91%
PVC	3,259	62.31%
GVC syn	55	1.05%
PVC syn	1,004	19.20%
Mixed syn	289	5.52%
G-led mixed	157	3.00%
P-led mixed	132	2.52%
Total	5,230	100%

5.3.4. Control variables

According to the VC literature, I include three sets of control variables related to the VC firms' characteristics, the portfolio firms' characteristics and the investment environment that might affect the relative performance of different forms of VC finance. (See Appendix 5-B for the detailed descriptions and definitions of all variables.)

At the same time, PEdata has a lot of missing data that recognises whether a VC firm has a state background. For example, Qingdao S&T Venture Capital Co., Ltd. was founded in 2000 by Qingdao government with 100% funding from the government budget and has been supervised by Qingdao SASAC. After checking all possible VC firms which may meet the criteria of GVCs, I identified another 80 firms as GVCs. Among all the 334 identified GVCs established before 2011, 147 GVCs have provided the initial round of financing to the portfolio companies in the sample. In comparison, 2,411 PVCs during the same period have been involved in the initial round of financing in the portfolio companies in the sample.

5.3.4.1. *Characteristics of VC firms*

Experience: Investment experience in general or in a certain industry may increase a VC firm's capability to screen and monitor start-ups (Gompers & Lerner, 2004; Sorensen, 2007). I use three proxies for the experience a VC firm has accumulated before it makes the focal investment: (1) its total number of investment rounds in general; (2) its relative experience compared to the average level of all VC firms in the year of making the focal investment; and (3) its total number of investment rounds in the same industry as the focal investment. I also include the quadratic term of *Experience* in the regression to control for the possible concave effect of a VC's experience on the performance of its portfolio companies (Gu & Lu, 2014).

Reputation: The success of VC firms in the past is likely to be an indicator of the success rate in the future (Tian & Wang, 2014). *Reputation* measures a VC's successful exits through IPO&M&A scaled by its total number of portfolio companies before making the focal investment.

Scale: The amount of funds under management by a VC firm should act as an indicator of the quality of the firm in terms of the financial resources it can put into new or subsequent investments and hence increase the chance of success (Kaplan & Schoar, 2005). It also allows for possible economies of scale, which may lead to better performance. A quadratic term of *Scale* is also included, as the marginal benefit of economies of scale may be decreasing when funds under management reach a certain level.

Network: Portfolio companies backed by better-networked VCs are more likely to achieve refinancing and a successful exit (Hochberg *et al.*, 2007). The network position of a VC firm is measured by its connectedness with other VC firms over the five years prior to the focal investment (Dimov & Milanov, 2010; Hochberg *et al.*, 2007). If any two VC firms have invested together in the same portfolio company in the same round, the value of these two VC firms in the networking matrix is 1, otherwise 0.

Following Hochberg *et al.*(2007), I distinguish between the link with an influential VC and the link with a relatively isolated VC in the whole network. I use Bonacich's *c(β)* beta-centrality (Bonacich, 1987)[35] rather than the eigenvalue centrality score, because when there

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[35] Appendix 5-C provides a detailed explanation of Bonacich's *c(β)* beta-centrality.

are two or more components in the whole network, the eigenvalue centrality of the nodes in different components is not comparable (Bonacich, 2007)[36].

Syndicate partners: The number of syndicate partners may have both a positive and negative impact on the investment. A company is more likely to succeed if it is backed by a number of VCs with more complementary resources to leverage and a wider network to rely on (Brander *et al.*, 2002; Giot & Schwienbacher, 2007). On the other hand, coordination, frictions and opportunistic behaviour among syndicate partners induce higher costs (De Maeseneire & Van Halder, 2010; Wright & Lockett, 2003) and, as a result, inefficient performance.

For all these control variables, if the first round investment in a portfolio company is made by a syndicate, only the characteristics of the lead VC firm are controlled for, because the lead VC in a syndicate is most likely to become the board members of the portfolio companies and be extensively involved in value-adding activities (Nahata, 2008)[37].

5.3.4.2.   *Characteristics of portfolio companies*

Amount: The extent of the first round investment could be interpreted as a sign of the level of confidence in the investment. A larger amount indicates a less risky project (Chemmanur & Tian, 2011), and therefore could increase the chance of getting subsequent financing.

Local: If the portfolio company and the VC are in the same region, the VC should to be better informed of the investment, and monitoring the portfolio company will be more convenient (Sorenson & Stuart, 2001).

Early: Early stage investment in a project is usually perceived as riskier than investment in expansion and late stages (Sorensen, 2007) and is hence less likely to get refinancing or successful exit. The dummy variable *Early* equals 1 if the investment is a seed or early-stage investment classified by PEdata[38], and 0 if it is classified as expansion or late-stage investments.

Industry: Risks are different in industries facing rapid technical change from those that are relatively stable. Industry fixed effects are included in the regressions to control for the

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[36] Appendix 5-D provides a comparison of *c(β)* and eigenvector centrality score, using the network of VC firms in China from 1996 to 2000 as an example.

[37] I also tried to control for the characteristics of all syndication partners according to their proportion of investment in the initial VC financing in a startup, and found that all the results of the regressions remain qualitatively the same.

[38] PEdata categorises investments into seed, early-stage, expansion and late-stage investments, following the similar practices of well-recognised databases (e.g. VentureXpert and Venture Economics).

special characteristics of any particular industry. There are 29 two-digit industry categories in PEdata. To make the analysis comparable to the existing literature, I map these industries into the industry classification used in the Venture Economics[39] database as the following general categories: Biotech and Health Care, Business Service, Consumer Related, Electronics, Financial Services, Industry and Energy, Media and Entertainment, Software and Internet, Telecommunication and Others.

Table 5-2 sets out the distribution of investment industries. Companies in *Industry and Energy* and *Software and Internet* dominate VC investments in China, followed by those in *Consumer Related* and *Electronics*.

Table 5-2 Distribution of investment industries

This table shows the industry distribution of portfolio companies backed by different types of VCs in the sample.

Industry	GVC	PVC	GVC syn	PVC syn	Mixed syn	Total
Biotech and Health Care	92	262	0	69	23	446
Business Service	12	88	1	31	8	140
Consumer Related	44	428	3	149	30	654
Electronics	107	291	9	115	43	565
Financial Services	14	182	0	28	4	228
Industry and Energy	240	920	32	333	135	1,660
Media and Entertainment	13	101	0	34	5	153
Software and Internet	80	877	9	218	29	1,213
Telecommunication	16	79	1	23	10	129
Others	5	31	0	4	2	42
Total	623	3,259	55	1,004	289	5,230

5.3.4.3. *Investment environment*

Market: An increase in the total capital inflow into the VC market may lead to more intensive competition among VC firms, described as "money chasing deals" (Gompers & Lerner, 2000). If the desired deals are limited, then marginal quality deals may obtain financing (Y. Li, 2008). When there are more deals made in a certain period, the average quality of investments is expected to be lower than average (Nahata, 2008; Puri & Zarutskie, 2012). Therefore, the total capital inflow reflects the competitive pressure to do VC deals.

PEdata suffers a severe missing data problem in terms of the gross magnitude of annual VC funds inflows, particularly in the early years. Therefore, I use the sum of all VC investments in a given year to capture the competitive pressure of venture deals. A larger amount implies greater competition among VC funds in accessing and screening deals, potentially lower

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[39] Venture Economics is the most frequently used database in VC empirical research and it mainly covers VC investment in USA.

quality in the chosen projects, and thus, a lower chance of getting refinancing or exits through IPO/M&A.

PE ratio: The stock market climate affects both the demand and supply of VC funds. On the demand side, prosperity on the stock exchange stimulates entrepreneurial activity (Hochberg *et al.*, 2010) and leads to higher demand for VC investment. On the supply side, a stock market boom increases the willingness and capability of limited partners to contribute to VC funds and, as a result, increases the supply of VC investment (Cumming & MacIntosh, 2006). Whether the VC market in a certain period turns out to be "money chasing deals" or "deals chasing money" depends on the forces of both the demand and supply sides of VC funds. Since VCs adjust their behaviour according to the realised performance of the stock market, I use the averaged Shanghai Stock Exchange Composite Index[40] in the year prior to the focal investment to control for the effect of the stock market on the VC industry.

5.3.5. Descriptive statistics

The descriptive statistics are set out in Table 5-3. About 41% of portfolio companies achieved successful exits through IPO/M&A. Nearly 60% of portfolio companies received refinancing or achieved their IPO/M&A directly after receiving their initial VC financing. On average, it took two and a half years (932 days) for a portfolio company to receive refinancing or exit through IPO/M&A directly after the initial round of financing. Because VC funds generally have a lifespan of 10 years to invest in and exit from their portfolio companies[41], all portfolio firms eventually exit by being written off or sold to their management. However, in PEdata most investments that get no refinancing or successful exits do not have a record of being written off or otherwise disposed of. In that case, similar to X. Tian (2011), I regard the investment in a portfolio company as being written off if the company did not receive any subsequent round of investment within 10 years after its first round of investment.

Table 5-3 Descriptive Statistics

This table provides the descriptive statistics for the dependent and independent variable in my regressions. Panel A looks at all samples used in the baseline regressions. The numbers in Panel A are in their original value without taking natural log for the convenience of interpretation. Panel B compares the difference in means between portfolio companies being backed by GVC-led and PVC-led mixed syndication with those by pure

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[40] Shanghai Stock Exchange Composite Index is a capitalisation-weighted index with the base period as 19 Dec 1990, and the base value as 100.

[41] Although China did not confirm the validity of limited partnership until 2007, funds managed by GVCs in practice still have an implicit limited lifespan. Since the mayors generally have a maximum tenure of 10 years (as regulated by the central government), whenever there is a replacement of the local governors, the new mayors often push their local GVCs to review all the investments and try their best to exit from those "living dead" if the investment was made a long time ago.

PVC syndication. *and ** indicate the difference between *Mixed syn* (*G-led mixed or P-led mixed*) and *PVC syn* is statistically significant at 5% and 1% level, respectively.

Panel A	Observation	Mean	Std. Dev.	Min	Max
IPO/M&A	5,230	0.41	0.49	0	1
Subsequent financing	5,230	0.59	0.49	0	1
_Duration (days, get refinancing or IPO/M&A)	3,060	932.18	725.69	10	3648
_Duration (days, get no refinancing nor IPO/M&A)	2,170	2699.55	655.88	92	3652.5
Experience$_1$ (rounds)	5,230	38.17	65.47	0	395
Experience$_2$ (%, of the most experienced at a year)	5,230	9.91	168.38	-100	971.30
Experience$_3$ (rounds)	5,230	8.94	21.15	0	235
Scale (USD, million)	5,230	217.57	458.88	0.01	7504.24
Reputation (%)	5,230	8.61	11.17	0	100
Network	5,230	0.14	0.23	0	1
Amount (USD, million)	5,230	16.50	116.00	0.01	4866.68
Early	5,230	0.30	0.46	0	1
Local	5,230	0.42	0.49	0	1
Syn Partner	5,230	1.41	0.87	1	14
Market (USD, million)	5,230	22159.30	12288.75	535.5933	38619.82
PE Ratio	5,230	28.18	10.17	18.49	53.97

Panel B	*PVC syn*	*Mixed syn*	*G-led mixed*	*P-led mixed*
IPO/M&A	0.54	0.58	0.61	0.55
Subsequent financing	0.73	0.66*	0.74	0.58**
Experience$_3$	1.29	1.62**	2.20**	0.94**
Scale	4.08	4.05	4.56**	3.4**
Reputation	0.10	0.10	1.11	0.07*
Network	0.15	0.21**	0.31**	0.09**
Amount	2.33	1.98**	1.97**	1.98**
Early	0.20	0.17	0.17	0.17
Local	0.25	0.45**	0.38**	0.52**
Syn Partner	2.51	2.93**	2.80**	3.10**
Market	9.82	9.71*	9.71	9.71
PE ratio	27.70	28.62	29.20	27.94
N	1,004	289	157	132

The raw values rather than the log transformation of *Experience, Scale, Amount* and *Market* used in the regressions are shown for the explanatory variables. On average, VC firms have a general (or industry-specific) experience of 38 (or 10) rounds of VC financing before conducting the focal investment. The general experience (industry-specific experience) of VC firms ranged, however, from none to 395 (235) rounds. The mean value of the first round investment in a portfolio company is about 16.50 million (USD), and the average scale of funds under management by VCs is 217.57 million (USD). VC firms have, on average, 8.6% of their previous investments successfully exited through IPOs (as shown by Reputation) before making the focal investment. About 1/3 of investments are in the early stage, and more than 40% are backed by local VC firms. Generally, the portfolio companies are backed by 1.4 VC firms in their first round of VC financing. The largest syndicate includes 14 VC firms.

Panel B of Table 5-3 lists the differences in means of the main variables between portfolio companies backed by mixed syndication and those by pure private syndication since the comparison between these two categories is the focus of this study. Companies invested in by mixed syndication are less likely to obtain subsequent financing. Regarding the characteristics of the lead VCs, those in mixed syndication have more experience and higher networking positions. At the same time, mixed syndication tends to have more syndication investors and is more likely to invest in local deals, while the two types of syndication show no statistically significant difference in the investment stage.

The correlation matrix of the independent variables is set out in Table 5-4. Since the values of differently defined *Experience* are highly correlated, the correlation matrix only includes the industry experience of VC firms as the main proxy for a VC's experience for brevity. The value of variance inflation factor (VIF) is well below the threshold of 5 (Belsley *et al.*, 2004) and thus, no severe multicollinearity problem is identified.

Table 5-4 Correlation matrix of independent variables

This table shows the correlation matrix and the variance inflation factors (VIF) of the independent variables in this research. * indicates statistical significance at the 5% level. See Appendix 5-B for the detailed definition of all variables.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	VIF
(1) Experience$_3$	1										2.26
(2) Scale	0.61*	1									3.32
(3) Reputation	0.22*	0.38*	1								1.18
(4) Network	0.61*	0.54*	0.19*	1							1.90
(5) Amount	0.03*	0.52*	0.23*	0.06*	1						1.98
(6) Early	0.03*	-0.19*	-0.17*	0.03*	-0.31*	1					1.15
(7) Local	-0.06*	-0.23*	-0.13*	-0.10*	-0.27*	0.12*	1				1.10
(8) Syn Partner	0.02	0.07*	0.07*	0.06*	0.28*	-0.12*	-0.06*	1			1.13
(9) Market	0.22*	0.29*	0.11*	0.01	0.14*	-0.14*	-0.05*	0.03*	1		1.70
(10) PE ratio	-0.13*	-0.16*	-0.07*	-0.04*	-0.04*	0.03*	0.04*	-0.01	-0.57*	1	1.50

5.4. Empirical results

In this section, I begin by examining the different performances of firms backed by different types of VCs using two different measures of performance: (1) successful exit through IPO or M&A, and (2) successfully getting subsequent financing. Then, I explore the reasons for the different performance.

5.4.1. Exit performance

To provide a direct comparison with the existing literature, I estimate Equation (5-1) in logistic regressions with the most widely used measure of the success for VC investment, namely the exit of the portfolio companies through IPO or M&A.

Table 5-5 presents the coefficient estimates using the dummy variable *IPO/M&A* as the dependent variable. The baseline category is firms backed by a sole PVC. The negative and statistically significant coefficient of *GVC* indicates that compared to companies backed by a sole PVC, those backed by a sole GVC in their first round of VC financing have a much lower likelihood of achieving IPO/M&A.

In the scenario of syndication (*GVC syn*, *PVC syn* and *Mixed syn*), the results are consistent with the literature, that portfolio companies backed by syndication have a higher success rate in achieving exit through IPO/M&A than companies backed by one VC firm (Brander *et al.*, 2002). The results of Wald tests (as displayed in Appendix 5-E Table 5-11) show that there are no statistically significant differences between the estimated coefficients of *Mixed syn* and *PVC syn*. Therefore, *Hypothesis 1a* cannot be rejected.

Both *Experience* and *Scale* show a reverse U-shape correlation with exit performance, i.e. the possibility of successful exit through IPO/M&A will not increase until the accumulated investment rounds and funds under management by a VC firm reach a certain level. The positive and significant coefficient of *Reputation* indicates that the better investment performance of a VC firm in the past persists in the future. *Early*-stage investment is harder to exit, but investments where the VC firm and the portfolio company both come from the same region (*Local*) do show a higher success rate. Larger capital inflow into the *Market* and bull stock market performance (measured by a higher *P/E ratio*) lead to less successful exits for portfolio companies that received their initial round of VC financing in that given year.

Surprisingly, the networking position (*Network*) of a VC firm does not significantly alter its portfolio companies' exit rate when other factors are controlled for. This is not in line with the networking literature, which finds that investments by better-connected VC firms outperform those by less-connected ones in terms of achieving a successful exit (Hochberg *et al.*, 2007; Nahata, 2008; Bellavitis *et al.*, 2016). One possible explanation is that the IPO administrative approval system in China distorts the impact of the VC firms' network position on their portfolio companies' exit performance. Zhang *et al.* (2017) pointed out that, in a mature stock market, well-connected VC investors endorse the quality of their portfolio companies and can mitigate the information asymmetry between entrepreneurs and investors in the public market. In an emerging market such as China, however, the interference of government authorities in the stock market distorts the role of VC firms and leads to different empirical findings when they are compared to mature stock markets.

Table 5-5 Logit regression analysis on the exit performance of portfolio companies

This table reports the results of logistic regressions when having *IPO/M&A* as the dependent variable. Standard errors (in parentheses) are clustered by the location of the portfolio companies. *, **, and *** indicate that the coefficient is statistically significant at the 10%, 5% and 1% level, respectively.

Baseline group: PVC	Expected sign	(1)	(2)	(3)	(4)	(5)
GVC	-	-0.43***	-0.46***	-0.45***	-0.44***	-0.44***
		(0.11)	(0.11)	(0.11)	(0.10)	(0.10)
GVC syn	+	0.59**	0.58*	0.58*	0.56*	0.56*
		(0.290)	(0.30)	(0.30)	(0.31)	(0.31)
PVC syn	+	0.56***	0.56***	0.55***	0.55***	0.55***
		(0.11)	(0.10)	(0.11)	(0.11)	(0.10)
Mixed syn	+	0.54***	0.54***	0.54***	0.54***	0.54***
		(0.16)	(0.15)	(0.16)	(0.16)	(0.16)
$Experience_1$	-	-0.30***				
		(0.08)				
$Experience_1^2$	+	0.03**				
		(0.01)				
$Experience_2$	-		-0.09			
			(0.08)			
$Experience_2^2$	+		0.02			
			(0.01)			
$Experience_3$	-			-0.19**	-0.22***	-0.22***
				(0.08)	(0.08)	(0.08)
$Experience_3^2$	+			0.03**	0.04**	0.04**
				(0.02)	(0.02)	(0.02)
Reputation	+				1.17***	1.167***
					(0.29)	(0.29)
Network	+					-0.02
						(0.22)
Scale	-	-0.20***	-0.38***	-0.34***	-0.35***	-0.35***
		(0.06)	(0.05)	(0.05)	(0.05)	(0.06)
$Scale^2$	+	0.02**	0.03***	0.03***	0.03***	0.03***
		(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Amount	+	-0.03	0.03	0.02	0.02	0.02
		(0.06)	(0.05)	(0.05)	(0.05)	(0.05)
Early	-	-0.82***	-0.85***	-0.83***	-0.81***	-0.81***
		(0.07)	(0.07)	(0.07)	(0.07)	(0.07)
Local	+	0.16*	0.15*	0.15*	0.16*	0.16*
		(0.09)	(0.09)	(0.09)	(0.09)	(0.09)
Syn Partner	+/-	0.08*	0.07	0.07	0.07	0.07
		(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
Market	-	-0.78*	-0.73*	-0.72*	-0.64	-0.64
		(0.43)	(0.42)	(0.42)	(0.43)	(0.43)
PE ratio	+/-	-0.18*	-0.17*	-0.17*	-0.15	-0.15
		(0.09)	(0.09)	(0.09)	(0.09)	(0.10)
Industry fixed effect		Yes	Yes	Yes	Yes	Yes
Year fixed effect		Yes	Yes	Yes	Yes	Yes
N		5,230	5,230	5,230	5,230	5,230

5.4.2. Refinancing performance

To get around the distortion that may be occurring in the results using IPO/M&A as the measure of performance, I consider "the likelihood of obtaining subsequent financing" as an alternative measure of success as set out in Equation (5-2) and (5-3).

Table 5-6 Likelihood of obtaining subsequent financing

The dependent variables in the specifications shown in Column (1)-(3) and (5)-(7) are the duration from a portfolio company's initial round to its second round of VC financing (or to the date of IPO/M&A if the portfolio company has achieved successful exit directly after its initial round of financing), using Cox proportional hazard model. If a portfolio company did not receive refinancing or exit, the duration equals to the difference between 2016/12/31 and the date of the initial round of financing for the portfolio company. Estimated coefficients rather than hazard ratios are presented for the convenience of interpretation. Column (4) and Column (8) show the coefficient estimates of logistic regression when having the dummy variable *Subsequent financing* as the dependent variable. Standard errors (in parentheses) are clustered by the location of the portfolio companies. *, **, and *** indicate that the coefficient is statistically significant at the 10%, 5% and 1% level, respectively.

Baseline group: PVC	(1) Cox	(2) Cox	(3) Cox	(4) Logistic	(5) Cox	(6) Cox	(7) Cox	(8) Logistic
GVC	-0.46***	-0.45***	-0.47***	-0.65***	-0.46***	-0.45***	-0.47***	-0.65***
	(0.07)	(0.07)	(0.07)	(0.10)	(0.07)	(0.07)	(0.07)	(0.10)
$GVC\ syn$	-0.20	-0.18	-0.21	-0.13	-0.19	-0.18	-0.21	-0.14
	(0.25)	(0.26)	(0.25)	(0.35)	(0.25)	(0.26)	(0.25)	(0.34)
$PVC\ syn$	0.33***	0.33***	0.32***	0.58***	0.32***	0.32***	0.32***	0.56***
	(0.06)	(0.06)	(0.06)	(0.10)	(0.06)	(0.06)	(0.06)	(0.11)
$Mixed\ syn$	0.13	0.14	0.11	0.19				
	(0.10)	(0.11)	(0.10)	(0.16)				
$G\text{-}led\ mixed$					0.32***	0.34***	0.29***	0.56***
					(0.08)	(0.09)	(0.09)	(0.19)
$P\text{-}led\ mixed$					-0.12	-0.13	-0.14	-0.27
					(0.17)	(0.17)	(0.17)	(0.22)
$Experience_1$	-0.05				-0.04			
	(0.05)				(0.05)			
$Experience_1^2$	-0.00				-0.01			
	(0.01)				(0.01)			
$Experience_2$		-0.11**				-0.12***		
		(0.04)				(0.05)		
$Experience_2^2$		0.01*				0.01*		
		(0.01)				(0.01)		
$Experience_3$			-0.07	-0.14			-0.08	-0.14
			(0.06)	(0.10)			(0.06)	(0.09)
$Experience_3^2$			0.01	0.02			0.01	0.01
			(0.01)	(0.02)			(0.01)	(0.02)
$Reputation$	0.74***	0.68***	0.69***	0.90***	0.72***	0.67***	0.68***	0.89***
	(0.19)	(0.19)	(0.19)	(0.30)	(0.19)	(0.19)	(0.19)	(0.30)
$Network$	0.55***	0.70***	0.46***	0.65***	0.55***	0.73***	0.44***	0.62***
	(0.14)	(0.18)	(0.12)	(0.20)	(0.14)	(0.19)	(0.13)	(0.21)
$Scale$	-0.07	-0.11***	-0.09**	-0.21***	-0.07	-0.11***	-0.09**	-0.21***
	(0.05)	(0.03)	(0.04)	(0.07)	(0.05)	(0.03)	(0.04)	(0.07)
$Scale^2$	0.00	0.01	0.00	0.01	0.00	0.01*	0.00	0.01
	(0.01)	(0.00)	(0.01)	(0.01)	(0.01)	(0.00)	(0.01)	(0.01)
$Amount$	-0.03	-0.02	-0.01	-0.04	-0.04	-0.03	-0.02	-0.04
	(0.03)	(0.02)	(0.02)	(0.04)	(0.03)	(0.02)	(0.02)	(0.04)
$Early$	-0.06	-0.07	-0.06	-0.18*	-0.06	-0.07	-0.06	-0.18*
	(0.08)	(0.08)	(0.08)	(0.11)	(0.08)	(0.08)	(0.08)	(0.11)
$Local$	0.07*	0.07	0.07*	0.12**	0.07*	0.07	0.07*	0.13**
	(0.04)	(0.04)	(0.04)	(0.06)	(0.04)	(0.04)	(0.04)	(0.05)
$Syn\ Partner$	0.05	0.04	0.05	0.10**	0.05*	0.05*	0.05*	0.11***
	(0.03)	(0.03)	(0.03)	(0.04)	(0.03)	(0.03)	(0.03)	(0.04)
$Market$	-0.41*	-0.43**	-0.40*	-0.89***	-0.42*	-0.44**	-0.41*	-0.89***
	(0.21)	(0.22)	(0.21)	(0.32)	(0.22)	(0.22)	(0.21)	(0.32)
$PE\ ratio$	-0.10**	-0.10**	-0.09**	-0.19***	-0.10**	-0.10**	-0.09**	-0.19***
	(0.05)	(0.05)	(0.04)	(0.07)	(0.05)	(0.05)	(0.04)	(0.07)
Industry fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	5,230	5,230	5,230	5,230	5,230	5,230	5,230	5,230

The coefficients estimated of the duration analysis (Cox proportional hazard model) are reported in Columns (1)-(3) in Table 5-6. A positive coefficient means that an increase in the value of an independent variable is positively related to the possibility of subsequent financing. The results of the logistic regression are displayed in Column (4). Note that although the magnitudes of the estimated coefficients in the Cox proportional hazard model and the logistic model are not comparable, the sign and the significance remain qualitatively the same, which indicates that the results are robust.

Portfolio companies backed by pure PVC syndication performed best. The results of Wald tests[42] show that the coefficient estimates of mixed syndication and those of pure PVC syndication are different and statistically significant at the 5% level in all specifications in Column (1) to (4). Therefore, *Hypothesis 1b* is rejected. Those backed by mixed syndication are less likely to obtain refinancing or exit through IPO or M&A directly after the first round of VC financing than those backed by pure PVC syndicates.

Another interesting change in the results compared to those when measuring performance by *IPO/M&A* is that the higher the networking position a VC firm has, the more likely its portfolio company is to achieve refinancing. This result is consistent with the VC networking literature (Hochberg *et al.*, 2007) and, to some extent, supports the choice of using the subsequent financing to measure a VC's performance in China.

5.4.3. The importance of the lead VC firms

The foregoing analysis shows that in China mixed syndication-backed firms are less likely to obtain subsequent financing than those backed by pure PVC syndication. I delve deeper into the issue by exploring whether it matters if a PVC or a GVC leads the mixed syndication.

I divide the mixed syndication investments into those led by GVCs and by PVCs, and re-estimate the models. The results are shown in Columns (5) to (8) of Table 5-6. Compared to the baseline group (being backed by a sole PVC), the coefficients of *P-led Mixed* are statistically insignificant. In contrast to the reported inefficiency of GVC-led mixed syndication in European countries (Grilli & Murtinu, 2014a), the likelihood of getting subsequent financing for portfolio companies backed by GVC-led mixed syndicates is 1.372 times greater[43] than the baseline group—investments by a sole PVC. Again, Wald tests

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[42] The results of Walt test are shown in Appendix 5-E Table 5-12.

[43] This number is obtained from the odd ratio of being backed by GVC-led mixed syndication, compared to the base group—being backed by one PVC. Using the coefficient obtained in Column 5 Table 5-6, the odd ratio equals $e^{0.316} = 1.372$. The direct interpretation is that the

suggest that the differences between the coefficients of GVC-led and PVC-led mixed syndication are statistically significant at the 1% level. Consequently, null *Hypothesis 2* is rejected.

As discussed in Section 2, one possible explanation for the underperformance of PVC-led mixed syndication is the higher risk of deals selected by the lead PVCs that are incentivised by the "call options" from their special arrangements with the participating GVCs. However, since I do not have access to the detailed agreements between syndicate investors, I cannot identify which syndicates include such kind of different return terms. As a result, I can only suggest that the underperformance of PVC-led mixed syndications could be partially attributed to their riskier inclination in deal selection.

5.4.4. The impact of networking position

Another possible explanation for the underperformance of mixed syndication measured by the likelihood of getting subsequent financing is that mixed syndication suffers from a higher coordination cost but a relatively lower benefit. I, therefore, also explore the impact of the networking linkages of the lead VC firm in mixed syndication on their portfolio companies. Because the focus is to compare the performance of mixed syndication with pure PVC syndication, I only include the samples of portfolio companies backed by GVC-led mixed syndication, PVC-led mixed syndication and pure PVC syndication in the following regressions using Equation (5-4).

Columns (1) and (2) Table 5-7 show that the duration analysis and the logistic regression yield similar results when including the interaction terms of high networking position and VC types in the regressions. Investments by PVC-led mixed syndication have a lower success rate in obtaining a further round of VC investment, compared to pure PVC syndication—the baseline group. The underperformance is magnified when the comparison is between syndicates lead by PVCs with a high networking position. Therefore, *Hypothesis 3* is rejected. In contrast, this magnification effect is not found when comparing GVC-led mixed syndication with pure PVC syndication.

Since it is hard to directly interpret the coefficients for nonlinear models with interaction terms, the hazard ratios in duration analysis (or odd ratio in the case of logit regression) of

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odds of achieving refinancing backed by GVC-led mixed syndication is about 1.372 times greater for the portfolio companies than for those backed by a PVC.

Table 5-7 Effect of networking position on mixed syndication led by different VC firms

The sample is limited to mixed syndication and pure PVC syndication. The dependent variable in Column (1) is the duration of a portfolio company's initial round to its second round of VC financing (or to its date of IPO/M&A if it achieved successful exit directly after the initial round of financing). Column (2) and (3) show the coefficient estimates of the logistic regressions, using the dummy variables *Subsequent financing* and *IPO/M&A* as the dependent variables. Standard errors (in parentheses) are clustered by the location of the portfolio companies. *, **, and *** indicate that the coefficient is statistically significant at the 10%, 5% and 1% level, respectively. Panel A reports the estimated coefficients and Panel B reports the odd ratios of marginal effects.

Panel A Baseline Group: *PVC syn*	(1)Cox *Duration*	(2) Logit *Subsequent financing*	(3) Logit *IPO/M&A*
G-led mixed	0.17	0.69***	0.72***
	(0.13)	(0.23)	(0.27)
G-led mixed × High network	0.26	0.49	0.60*
	(0.17)	(0.35)	(0.36)
P-led mixed	-0.31*	-0.53*	-0.13
	(0.16)	(0.31)	(0.32)
P-led mixed × High network	-0.99***	-1.48***	-0.81*
	(0.33)	(0.41)	(0.49)
High network	0.16	0.29	-0.12
	(0.13)	(0.21)	(0.22)
$Experience_3$	-0.03	-0.05	0.13
	(0.08)	(0.13)	(0.11)
$Experience_3^2$	-0.01	-0.02	-0.06*
	(0.02)	(0.03)	(0.03)
Reputation	0.89***	1.59***	1.02***
	(0.26)	(0.39)	(0.35)
Scale	-0.02	-0.15	-0.55***
	(0.08)	(0.16)	(0.15)
$Scale^2$	-0.01	-0.00	0.05***
	(0.01)	(0.02)	(0.01)
Amount	0.01	0.04	0.11
	(0.03)	(0.07)	(0.07)
Early	-0.01	-0.24	-1.06***
	(0.10)	(0.18)	(0.17)
Local	0.14**	0.30*	0.44***
	(0.07)	(0.17)	(0.12)
Syn Partner	0.03	0.05	0.05
	(0.03)	(0.04)	(0.05)
Market	-0.05	-0.20	-0.62
	(0.30)	(0.56)	(0.63)
PE ratio	0.01	-0.03	-0.19
	(0.06)	(0.14)	(0.18)
Industry fixed effect	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes
N	1,293	1,293	1,293
Panel B:Odd ratio	(1) Cox	(2) Logit	(3) Logit
When *High network* = 1			
G-led Mixed	1.10	1.12	1.59
	(0.19)	(0.34)	(0.55)
P-led Mixed	0.49***	0.29***	0.51
	(0.12)	(0.10)	(0.28)
When *High network* = 0			
G-led Mixed	0.96	1.16	1.36
	(0.12)	(0.28)	(0.28)
P-led Mixed	**0.65***	**0.45***	0.77
	(0.09)	(0.11)	(0.24)

getting refinance are shown in Panel B of Table 5-7. A ratio that is larger/smaller than 1 means more/less likely to obtain refinancing (or to achieve IPO/M&A in Column (3)) than the base group—pure PVC syndication. For example, when the lead VC has a networking position below average, for every 100 companies being backed by pure PVC syndication

achieving refinancing or exit through IPO/M&A after the first round of financing, one can only expect to find 65 companies being backed by PVC-led mixed syndication got the same performance. In contrast, this number decreases to 45 when the lead VC has a relatively high networking position.

The results imply that, for well-connected PVCs, syndicating with GVCs generates less success compared to syndicating with other PVCs. The more resources a PVC has (e.g. product market share through government procurement contracts, familiarity with the IPO process, etc.), the less likely it can benefit from its GVC partners in mixed syndication. Meanwhile, well-connected PVCs tend to have more established procedures in decision-making and are less flexible in dealing with conflicts with their GVC syndication partners. In comparison, less connected PVCs with quite limited resources to leverage can expect to benefit more from their GVCs collaborators. At the same time, fledgeling PVCs are expected to be more adaptable in adjusting their decision-making process when interacting with their GVCs syndication partners.

5.5. Endogeneity and robustness tests

The mutual choice between companies and VC firms is never a random process. Therefore, the results obtained from the previous section may suffer potential endogeneity problems. I use the instrumental variable method and propensity score matching method to mitigate this concern.

5.5.1. Instrumental variable

Omitted factors in the main regressions may affect the type of syndication so that, to some extent, the syndication type is endogenous in the model. I, therefore, need an instrumental variable for explaining the syndication type in order to remove this source of bias in the regression.

The dataset makes the list of possible instruments very short. One I can utilise is the currency of the investment. PVCs in China can raise both RMB and foreign currency funds from limited partners, while GVCs mainly manage RMB funds. If an investment is in foreign currencies, it is less likely to be backed by GVCs. Similarly, its chance of being backed by mixed syndication is also lower.

The fundamental question for entrepreneurs when choosing to raise funds in either foreign or domestic currency is actually to decide on where to list the company later on. For example,

returnee entrepreneurs (with the experience of studying and/or working overseas) generally choose to incorporate a holding company overseas before registering their start-ups in China[44]. When seeking outside resources to finance their start-ups, those entrepreneurs prefer to choose VC firms managing USD funds (or HK dollar, etc.). Similarly, companies established by non-returnee entrepreneurs may also prefer to get investment in foreign currencies if they believe it is easier for some certain industries (e.g. internet-related companies) to get listed overseas. The literature provides evidence that exits channels are pre-planned (Bertoni & Groh, 2014; Cumming & Johan, 2008) before seeking for VC financing. This indicates that a portfolio company decides on the preferred currency in advance and then selects its VC investors. My discussion with venture capitalists also supports this argument[45].

I limit the sample to the portfolio companies backed by PVC-led mixed syndication and pure PVC syndication[46]. The coefficient estimates of the standard two-stage IV regression are presented in Table 5-8. The first stage regression looks at the probability of being backed by mixed syndication, including all explanatory variables in the baseline regressions and the instrumental variable *RMB*. The positive sign of RMB indicates that when an investment is in the domestic currency, it is more likely to be backed by mixed syndication. The coefficient of *RMB* is statistically significant at the 1% level. F-test of H_0 that the coefficient of *RMB* equals zero yields the value of 17.41, mitigating the concern of a weak instrument.

Using the control function approach[47] (Wooldridge, 2010, p. 586), the error terms obtained from the first stage (i.e. the difference between the predicted possibilities of being backed by mixed syndication and the realised choices, using the estimates shown in Column (2) Table 5-8) is inserted into the second stage regression as an additional regressor. The outcome results are qualitatively the same as the results shown in Column (1) Table 5-7. Companies backed by PVC-led mixed syndicates have a lower success rate in achieving refinancing compared to those backed by pure PVC syndication. The underperformance is magnified when the comparison is between syndicates led by PVCs with a high networking position.

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[44] See Zhang & Wang (2014) for a detailed description of using VIE (Variable Interest Entity) structure by off-shore VCs to invest in Chinese companies.

[45] The choice of investment currency for the portfolio companies still may suffer from potential selection bias. Therefore, I interpret the result with caution.

[46] The regressions using subsamples only contain GVC-led mixed syndication and pure PVC syndication do not find a statistically significant impact of the lead VCs' networking position on the performance of their portfolio companies. The results are shown in the Appendix 5-E Table 5-15.

[47] Wooldridge (2010, p.589) provides a detailed explanation for why inserting the error terms obtained from the first stage into the second stage regression as an additional regressor works better than including the fitted value obtain from the first stage, in the context nonlinear models.

Table 5-8 Duration analysis using investment currency as instrument variable

This table shows the regression results using investment currency *RMB* as the instrumental variable. The sample includes portfolio companies backed by PVC-led mixed syndication and pure PVC syndication. The first stage is logistic regression with the dummy variable *Mixed syndication* as the dependent variable. The error terms obtained from the first stage are inserted in the second stage models as an additional regressor. Standard errors (in parentheses) are clustered by the location of the portfolio companies. *, **, and *** indicate that the coefficient is statistically significant at the 10%, 5% and 1% level, respectively.

	(1)	(2)	(3)	(4)
	First stage	Second stage		
	Back by mixed syn	*Duration*	*Subsequent financing*	*IPO/M&A*
RMB	0.85***			
	(0.20)			
P-led mixed		-1.65**	-2.61*	1.04
		(0.74)	(1.36)	(0.83)
P-led mixed × High network		-0.39*	-0.52	-0.28
		(0.23)	(0.34)	(0.44)
High network	-0.60	0.13	0.24	-0.15
	(1.17)	(0.11)	(0.19)	(0.20)
Experience$_3$	-0.16	0.02	-0.07	0.10
	(0.29)	(0.08)	(0.12)	(0.12)
Experience$_3^2$	-0.07	-0.03	-0.03	-0.03
	(0.10)	(0.02)	(0.03)	(0.03)
Scale	0.20	-0.02	-0.11	-0.61***
	(0.24)	(0.08)	(0.15)	(0.16)
Scale^2	0.00	-0.00	-0.00	0.05***
	(0.02)	(0.01)	(0.02)	(0.02)
Reputation	-1.46	0.83***	1.67***	1.46***
	(1.01)	(0.26)	(0.44)	(0.37)
Amount	-0.63***	-0.05	-0.06	0.16
	(0.10)	(0.06)	(0.12)	(0.10)
Early	-0.07	0.11	-0.03	-1.02***
	(0.40)	(0.08)	(0.13)	(0.15)
Local	1.07***	0.34***	0.62***	0.24*
	(0.30)	(0.10)	(0.20)	(0.13)
Syn Partner	0.68***	0.12**	0.50**	-0.03
	(0.10)	(0.06)	(0.09)	(0.07)
Market	-0.41***	-0.05	-0.09	-0.22**
	(0.11)	(0.05)	(0.11)	(0.09)
PE ratio	-0.01	-0.00	-0.00	-0.02***
	(0.01)	(0.00)	(0.01)	(0.01)
Industry fixed effect	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes
N	1,136	1,136	1,136	1,136

5.5.2. Propensity score matching

If mixed syndicates deliberately choose portfolio companies that are different from those invested in by pure PVC syndication, then the regression results would be biased. I use the propensity score matching method to get around this problem. The propensity score is calculated using a logit regression to estimate the probability of being backed by mixed syndicates for portfolio companies. The independent variables include a set of observable characteristics of portfolio companies such as the amount, stage, location and industry of the investments.

I consider two matches. In the first group, I match each GVC-led syndicate investment with a pure PVC syndicate investment with the nearest propensity score (a 1:1 match without replacement). For the second group, I match each PVC-led syndicate investment with pure PVC syndicate investments using the same procedure. In each subsample, mixed syndication is the treated group, while pure PVC syndication is the control group. Matching is only conducted within the same investment year to ensure a meaningful comparison. After matching, I identify a control group with minimal differences in observable characteristics compared to the treated group.

Table 5-9 Propensity score matching

This table shows the differences in the probability of getting refinancing using the propensity score matching method. Matching is conducted within the same investment year, using probit regression with being backed by mixed syndication as the dependent variable and the amount, stage, same location with VCs and industry dummies of the investment as control variables. Each mixed syndication investment is matched with a pure PVC syndication investment without replacement. Panel A shows the differences in means of the possibility of getting refinancing for the treated and control groups. Panel B checks the balancing after matching. Standard errors (in parentheses) are obtained using bootstrap for 1000 times. *, **, and *** indicate that the coefficient is statistically significant at the 10%, 5% and 1% level, respectively.

Panel A: PSM regression results

Difference of getting refinancing	Mixed syndication	Pure PVC syndication	Mean Diff.
	GVC-led mixed syn		
All treated and controlled sample	0.78	0.74	0.04
Only samples with high network	0.74	0.68	0.06
Only samples with low network	0.83	0.77	0.06
	PVC-led mixed syn		
All treated and controlled sample	0.58	0.79	-0.21**
Only samples with high network	0.35	0.70	-0.35**
Only samples with low network	0.65	0.83	-0.18*

Panel B: Balancing check of portfolio companies after matching

Variable	PVC-led Mixed syndication	Pure PVC syndication	Mean Diff.
Amount	2.10	2.13	-0.32
Early	0.13	0.17	-0.04
Local	0.57	0.54	0.04
Industry category			
Biotech and Healthcare	0.08	0.07	0.02
Business Service	0.03	0.03	0.00
Consumer Related	0.13	0.10	0.03
Electronics	0.16	0.15	0.01
Financial Services	0	0	0
Industry and Energy	0.49	0.44	0.06
Media and Entertainment	0.01	0.03	-0.02
Software and Internet	0.07	0.16	-0.08*
Telecommunication	0.02	0.03	-0.01
Others	0	0	0

Panel A of Table 5-9 shows the probabilities of getting subsequent financing for different portfolio companies backed by mixed syndication compared to those by pure PVC syndication after matching. The results correspond to the findings in Table 5-7. PVC-led mixed syndication underperformed pure PVC syndication, especially when the lead VC firms

have a higher networking position. In contrast, there is no similar trend found when comparing GVC-led mixed syndication with matched pure PVC syndication.

Panel B of Table 5-9 reports the balancing tests after matching. There are no significant differences between the treated and controlled groups, except for the industry distribution in *Software* with means different at the 10% confidence level.

5.5.3. Preferences for staged financing

In the main regressions, a longer duration between the initial and the second round of financing is interpreted as a lower likelihood of getting subsequent financing. Nevertheless, an alternative interpretation is that a longer duration indicates a VC firm's less preferences for staged financing.

Staged financing is the "stepwise disbursement of capital" from VC firms to portfolio companies (X. Tian, 2011). When VCs suffer from information asymmetry and high monitoring costs, they use staged financing more frequently (B. Liu & Tian, 2016; X. Tian, 2011). The choice of staged financing by mixed syndication and pure PVC syndication may be affected by the level of information asymmetry they have. Because GVCs have the mandate of filling the financing gap in early-stage investments and high-tech industries, mixed syndication may be more tolerant to failure and more patient than pure PVC syndication when the projects suffer from severe information asymmetry. When the information asymmetry problem is not severe, the patterns of choosing staged financing for mixed syndications and pure PVC syndications may be similar.

I use the following model to investigate the possible different preferences for staged financing for firms backed by different types of VCs:

$$Duration\ to\ Subsequent\ Financing$$
$$= \alpha + \beta Mixed\ syn \times information\ asymmetry + Controls \tag{5-5}$$

where *information asymmetry* of investment is measured by the following proxies.

Early: Early-stage investment has more uncertainties in development and exits. VCs use staged financing to mitigate the higher risk and the potential problems caused by information asymmetry in early-stage investment (Gompers, 1995; Hopp & Rieder, 2011).

Amount: Similarly, a smaller amount of investment at the first round reflects the higher uncertainty level of the project. X. Tian (2011) finds that a smaller amount in the initial round

of investment is positively correlated with a larger number of total financing rounds (i.e. shorter duration between each round of financing) for the portfolio companies.

Syn partner: A larger number of syndicate partners in the first round of financing reflects a possible higher information asymmetry that makes VCs want to share the risk with other collaborators (Landström, 2004; Lerner, 1994). As shown by Y. Li (2008), a larger syndication size accelerates the arrival of subsequent financing.

I insert the interaction term of *mixed syn* and the three proxies (*Early*, *Amount,* and *Syn partner*) for the level of information asymmetry in the regressions. If the coefficient of the interaction term is significant, it suggests that when the project suffers from severe information asymmetry, mixed syndication and pure PVC syndication have different preferences for staged financing. In addition, I consider one characteristic of VC firms that may also affect their preferences for staged financing.

Reputation: Staged financing enables VCs to mitigate the risk of being held up by entrepreneurs (Neher, 1999). VCs with a good track record enjoy a more favourable position when negotiating terms with entrepreneurs, so they are more likely to use staged financing to safeguard the VCs' interests. If mixed syndication is less aggressive in negotiation with their investees than pure PVC syndication is, then the reputation of VCs (the success rate of sending their portfolio companies to get listed) may affect the choice of staged financing for mixed syndications and pure PVC syndications in different ways.

Panel A of Table 5-10 reports the estimation results when including the interaction terms in different specifications. The samples are limited to mixed syndication and pure PVC syndication.

None of the coefficients of the interaction terms is statistically significant at the 10% level, except for that of *G-led mixed ×Early*. The result suggests that when GVCs lead mixed syndication in early-stage investment, they are more patient and allow a longer period for their portfolio companies to get subsequent financing than pure PVC syndication. However, since the coefficient of *G-led mixed* in the first specification is not significant, I calculate the overall marginal effects of being backed by GVC-led mixed syndication when the investment is in the early/late stage and do not find any statistically significant differences from the baseline group—pure PVC syndication. The results are shown in Panel B of Table 5-10.

Table 5-10 Duration analysis controlling for VC firms' preferences of staged financing

Panel A shows the regression results of duration analysis when adding interaction terms to investigate the effect of VC firms' preferences of staged financing. The samples are limited to portfolio companies backed by pure PVC syndication and mixed syndication. The regressions in all specifications are Cox proportional hazard models. Panel B shows the marginal effects of being backed by GVC-led mixed syndication vs. pure PVC syndication when including the interaction term *G-led mixed × Early* in the regression. Standard errors (in parentheses) are clustered by the location of the portfolio companies. *, **, and *** indicate that the coefficient is statistically significant at the 10%, 5% and 1% level, respectively.

| Panel A | (1) | (2) | (3) | (4) |
Base Group: *PVC syn*	Duration	Duration	Duration	Duration
G-led mixed	0.15	-0.17	-0.01	-0.12
	(0.12)	(0.23)	(0.18)	(0.28)
P-led mixed	-0.40***	-0.47*	-0.46***	-0.46
	(0.14)	(0.26)	(0.16)	(0.29)
G-led mixed × Early	-0.83***			
	(0.31)			
P-led mixed × Early	-0.56			
	(0.36)			
G-led mixed × Amount		0.09		
		(0.10)		
P-led mixed × Amount		-0.01		
		(0.11)		
G-led mixed × Reputation			0.15	
			(1.24)	
P-led mixed × Reputation			-0.31	
			(1.20)	
G-led mixed × Syn Partner				0.05
				(0.09)
P-led mixed × Syn Partner				-0.01
				(0.09)
Early	0.14	-0.01	-0.01	-0.01
	(0.11)	(0.10)	(0.10)	(0.10)
Experience$_3$	-0.02	-0.02	-0.02	-0.02
	(0.09)	(0.09)	(0.09)	(0.09)
Experience$_3^2$	-0.01	-0.01	-0.01	-0.01
	(0.02)	(0.02)	(0.02)	(0.02)
Scale	-0.01	-0.02	-0.02	-0.02
	(0.09)	(0.09)	(0.09)	(0.09)
Scale^2	-0.01	-0.01	-0.01	-0.01
	(0.01)	(0.01)	(0.01)	(0.01)
Reputation	0.86***	0.88***	0.88***	0.88***
	(0.29)	(0.29)	(0.30)	(0.29)
Network	0.20	0.30	0.30	0.32
	(0.24)	(0.23)	(0.23)	(0.23)
Amount	-0.01	-0.01	-0.00	-0.00
	(0.04)	(0.05)	(0.04)	(0.04)
Local	0.17**	0.16**	0.16**	0.16**
	(0.08)	(0.08)	(0.08)	(0.08)
Syn partner	0.04	0.04	0.04	0.04
	(0.04)	(0.04)	(0.04)	(0.04)
Market	-0.14	-0.13	-0.12	-0.12
	(0.33)	(0.33)	(0.33)	(0.33)
PE ratio	0.00	-0.00	0.00	0.00
	(0.08)	(0.08)	(0.08)	(0.08)
Industry fixed effect	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes
N	1,293	1,293	1,293	1,293
Panel B:Marginal effects on obtaining subsequent financing			When *Early=1*	When *Early=0*
G-led Mixed			-0.15	0.04
			(0.76)	(0.22)

Taken together, these four factors relating to VC firms' preferences for staged financing do not provide an additional explanation for the relative success of portfolio companies

according to the types of VC firms that back them. Although VC firms' different preferences for staged financing cannot be fully ruled out as an alternative explanation, the robustness check shows that this is not a main factor that drives the main regression results.

5.5.4.   Other robustness checks

I use a competing risk model that is similar to Buzzacchi *et al.*(2013) to treat achieving exits through IPO/M&A as a competing event to obtaining refinancing after the initial round of financing. Regression results (shown in Appendix 5-E Table 5-13) remain qualitatively the same as Table 5-7. Furthermore, I also try the multinomial regression where the dependent variable equals 1 if the portfolio companies get refinancing but have no ultimate exits through IPO/M&A, equals 2 if the companies have achieved IPO/M&A, and 0 otherwise. The results (shown in Appendix 5E Table 5-14) are also consistent with those shown in Table 5-7.

5.6. Conclusion

This chapter discusses the benefits and costs of mixed syndication and investigates its relative performance compared to the most common type of syndication—pure PVC syndication. Using data on 5,230 portfolio companies that received their first-round investment between 1995 and 2011, I find that portfolio companies backed by mixed syndication and pure PVC syndication have no statistically significant difference in their likelihood of achieving successful exits through IPO/M&As. However, mixed syndication underperforms pure PVC syndication when being measured by the likelihood of obtaining subsequent financing for their portfolio companies.

This chapter contributes to research on the Chinese VC market by pointing out that it is necessary to measure performance by both the success rate of IPO/M&A and getting refinancing, when taking into consideration GVCs' privileged access to IPO approval in China. The Chinese government has set out to reform the administrative approval-based IPO system and move it towards a registration-based system. Under a more market-oriented regime, GVCs are expected to lose their privileged access to IPO approval gradually. Looking at the performance measured by refinancing helps policy-makers to understand the competitiveness of GVCs (except their advantages in getting IPO approval in the old system) and improve the performance of GVCs in future.

Another contribution of this chapter is to the growing body of literature on the impact of networking on VC investment. When lead VCs in syndicates hold a high networking

position, the increased coordination cost of mixed syndication may outweigh the supplementary resources brought by other syndication partners. The empirical results show that the underperformance of PVC-led mixed syndication—relative to pure PVC syndication—is more pronounced when the lead PVC has an above-average networking position.

Appendix 5-A: Online responses received on Zhihu

In November 2016, I made a request on "Zhihu", a professional forum for practitioners in different industries, asking for the opinions of VC managers on the cost incurred in mixed syndication. Established in 2010, Zhihu was oriented as a Q&A network community for practitioners in the IT industry. With the rapid expansion of registered users to 60 million (Ye, 2016), Zhihu has become a knowledge and experience-sharing platform of high-quality user-generated answers in most professional industries (Shao & Wang, 2017) featuring a high proportion of entrepreneurs and intellectuals (Wong, 2014). Academic research using Zhihu as the data source includes Driessen (2016) in migration research, Liu & Wang (2016) in social media research, and Shao & Wang (2017) in political research.

Zhihu was chosen as the platform to collect practitioners' opinion for two reasons. First, the discussion on the cost incurred in cooperation with GVCs is, to some extent, a sensitive topic. Some venture capitalists might want to avoid revealing their true experiences publicly if they are concerned that their written answers might have a negative impact on their opportunities for obtaining government support in the future. The voluntary real name authentication requirement by Zhihu could reduce this concern to some extent. Secondly, the vast amount of registered users including entrepreneurs and venture capitalists on Zhihu ensures that the question will obtain responses from a variety of practitioners.

The question posted was "According to your experience in the syndication with governmental venture capital firms, what extra cost have you ever encountered compared to pure private VC syndication?" I summarise the responses below. Although it is quite hard to judge whether these opinions of the anonymous informants represent the general idea of venture capitalists that have mixed syndication experience in China, their opinions do provide suggestions about the possible cost incurred in mixed syndication.

1. Extra financial advisory fee. When the government evaluates a project, they have different requirements the format and focuses compared to PVCs. In most cases, you need to pay an extra financial advisory fee to tailor the proposal to cater for government officials.

2. Extra public relation expense. Government officials sometimes have unrealistic expectations of a project that their local GVCs have invested in. They think they are more influential than the most prestigious private venture capitalists in certain industries, and they hope their projects will create magic in the business model.

However, they seldom take into consideration the expense of public relations. They want their project to attract more attention, but at the same time, they are super cautious in taking more unusual and cutting-edge ideas. As a result, a large amount of money is spent on purchasing "fake hits" if it is an internet related project. Sometimes, an even larger amount of money is needed if the public relations activities involve inviting celebrities to hype the projects.

3. Government officials hold the view that PVCs should be super-patient when waiting for them on decision-making, while PVCs should be super-efficient when taking steps to continue their cooperation with GVCs.

   Government officials need a greater sense of security from their cooperating PVCs. PVCs need to have enough funds in reserve if a government officer gets promoted or is appointed to another position in a different city because the government officer expects to have reliable investment and unquestioned support from the PVCs if the PVCs still want to maintain the relationship and get further cooperation with this officer. Making capital calls (drawing down the commitments of limited partners when general partners encounter investment opportunities) cannot meet the needs of the cooperative GVCs when money is needed to do unexpected public relation activities. As a result, PVCs reserve a certain proportion of called funds to meet unforeseen events like the promotion or relocation of the related government officials.

4. Some GVCs follow the model of industry funds in managing venture capital funds. A new trend is that some GVCs have begun to adopt a "co-GP" mode, which means there is more than one VC firm taking the role of general managers. However, in practice, some GVCs are only "a nominal GP" rather than taking any real responsibilities. The management burden is on the cooperating PVCs, but the management fee is shared between GVCs and PVCs.

5. I have cooperated with some GVCs, some of which are very good. Nevertheless, the main potential problem lies in their different decision-making mechanisms and the source of capital from PVCs. They may have more trouble in making decisions efficiently—longer time frames and repeated processes. Also, there are more administrative requirements when the investment gets an exit. I have experienced such circumstance when our company has cooperated with GVCs.

6. The cost depends on the purpose of a governmental investment. Some investment by GVCs is only a political grandstanding for the benefit of some government officials' personal promotion in the short-term. For example, in order to show the local

government's support for the "Torch Plan" (an initiative to promote high-tech industries by the central government), some GVCs made investments without really caring about the quality of the project being invested in. If PVCs are involved in such circumstances, they should be particularly cautious and protect their own interests.

7. Some GVCs have insufficient specialised knowledge in certain industries and therefore rely on social benefit rather than the economic benefit of a project to make investment decisions. PVCs are learning to alleviate the risk associated with cooperation with GVCs. For example, our company is managing a fund through the establishment of a VC company as the general partner and an asset management company to ensure stable revenue obtained from the management fees.

Appendix 5-B: Description of variables

| Variable	Description	Value Transformed
VC Type	A category variable that identifies the type of VC firms the portfolio company being backed by in the first round investment. GVC—backed by one GVC	
	PVC—being backed by one PVC	
	GVC syn—backed by syndicate solely involving GVCs	
	PVC syn—backed by syndicate solely involving PVCs	
	Mixed syn—backed by syndicate involving both GVCs and PVCs	
	G-led mixed—backed by mixed syndicate led by GVCs	
	P-led mixed—backed by mixed syndicate led by PVCs	
Performance of Portfolio Companies		
IPO/M&A	A dummy variable that takes the value one if the portfolio company has successfully been listed on the stock market (IPO) or has been acquired through mergers and acquisitions (M&A), and 0 otherwise.	
Subsequent financing	A dummy variable that takes the value one if the portfolio company has survived to the next round to obtain follow-on financing or achieve successful exit through IPO/M&A directly after its initial round of financing.	
Duration	Count of days between the first and the second round investment/IPO or M&A (whichever is earlier) of a portfolio company. If the focal portfolio company gets neither refinancing nor exiting through IPO/M&A within 10 years, the investment is regarded as write-offs.	
VC Firms Characteristics		
Experience	1. Accumulated investment rounds by the (lead) VC firm before the calendar year of the focal investment.	1. $\text{Log}(1 + Experience_{i,t})$
	2. The percentage difference between the accumulated investment rounds by the (lead) VC firm till the calendar year of the focal investment and the average accumulated investment rounds of all VC firms till that year.	2. $\dfrac{Experience_{i,t} - \overline{Experience_t}}{\overline{Experience_t}}$
	3. Accumulated investment rounds by the (lead) VC firm before the focal investment in the same industry.	3. $\text{Log}(1 + Experience_{i,k,t})$
Scale	Accumulated investment amount by the focal (lead) VC firm in the past five years till the calendar year of the focal investment as a proxy for amounts under management.	$\log\left(1 + \sum_{h=1}^{5} Investment_{i,t-h}\right)$
Reputation	The ratio of successful exit through IPO by the (lead) VC firm till the calendar year of the focal investment.	$\dfrac{\sum_{h=1}^{t} IPO_{i,t-h}}{\sum_{h=1}^{t} Investment_{i,t-h}}$
Network	The Bonacich c(β) centrality score of the (lead) VC firm, calculated on its previous syndication experience with other VC firms five years prior to the calendar year of the focal investment. The highest score of each year is scaled to 1.	$c_{it}(\alpha, \beta) = \sum_{j=k}^{n} (\alpha + \beta c_{kt}) R_{ikt}$
Network Variance	The variance of VC firms' network positions within a syndicate.	$\sum (Network_i - \overline{network})^2$
High Network	A dummy variable that equals one if the Bonacich c(β) centrality score of the (lead) VC firm is above the median level of all VC firms in the same investment year.	
Portfolio companies Characteristics		

Amount	Investment amount (USD, Million) in a given financing round. Investments made in other currencies are converted into USD according to the exchange rate by the end of the investment year.	$\log(1 + Amount)$
Early	A dummy variable that equals one if the first round VC investment a portfolio company receives is in seed or early-stage investment (as identified in PEdata), and 0 otherwise.	
Local	A dummy variable that equals one if the headquarters of the (lead) VC firm is in the same province as the portfolio company.	
Syn Partner	The number of syndication partners in the focal investment.	
Industry	Seven industry categories include Communication and Electronics, Internet and Computer, Financial Services, Consumer, Industry and Energy, Medical and Health, and Other Industries.	
RMB	A dummy variable that equals one if the investment is in the Chinese domestic currency and 0 otherwise.	
Cluster	A dummy variable that equals one if the portfolio company is located in Beijing, Shanghai, or Guangdong, the three concentration areas of VC activities in China.	
Investment Environment		
Market	A measure of the level of competition among VC firms in a given year. It equals to total investment amounts by all VC firms in the Chinese VC market in the prior year (t-1) of the focal investment.	$log\left(1 + \sum_{i} Amount_{t-1}\right)$
PE Ratio	A measure of the stock market hotness. It equals to the average P/E ratio of Shanghai Stock Exchange in the prior year (t-1) of the focal investment.	

Appendix 5-C: Bonacich Centrality Score

$$c_i(\alpha, \beta) = \sum_j (\alpha + \beta c_j) R_{ij} \qquad \text{(5-6)}$$

$c_i(\alpha, \beta)$ denotes the Bonacich Centrality score of a VC firm i, α reflects the length of vector $c_i(\alpha, \beta)$, while β reflects the degree to which the VC firm i's status is a function of the statuses of those to which i is connected (Bonacich, 1987). R is an adjacency matrix with elements R_{ij} reflecting the tie between any pair of VC firms in the network. R_{ij} equals one if VC firms i and j have ever co-invested in the same portfolio company, and zero otherwise. R is symmetric in this case because the ties between VC firms are treated as undirected. If A leads the investment in a syndicate with B, then A is linked with B and B is linked with A as well.

Take a network including five VC firms as an example. These five VC firms have a syndication experience (A with B and C, C with D, and D with E) between 1991 and 1995. The accumulated network graph of the VC market in 1996 is illustrated in Figure 5-1.
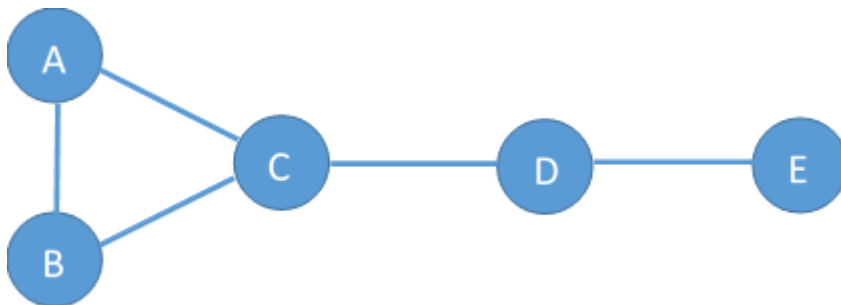
Figure 5-1 Network graph of five VC firms

Figure 5-2 shows the corresponding adjacent matrix R.

$$
\begin{array}{c}
\begin{array}{ccccc} A & B & C & D & E \\ \downarrow & \downarrow & \downarrow & \downarrow & \downarrow \end{array} \\
\begin{array}{c} A \rightarrow \\ B \rightarrow \\ C \rightarrow \\ D \rightarrow \\ E \rightarrow \end{array}
\begin{pmatrix}
0 & 1 & 1 & 0 & 0 \\
1 & 0 & 1 & 0 & 0 \\
1 & 1 & 0 & 1 & 0 \\
0 & 0 & 1 & 0 & 1 \\
0 & 0 & 0 & 1 & 0
\end{pmatrix}
\end{array}
$$

Figure 5-2 Network matrix of five VC firms

R^2 represents the possible paths by which one VC firm can reach another VC firm by "walking two steps"— through the introduction of their mutual friends.

$$
\begin{pmatrix}
0 & 1 & 1 & 0 & 0 \\
1 & 0 & 1 & 0 & 0 \\
1 & 1 & 0 & 1 & 0 \\
0 & 0 & 1 & 0 & 1 \\
0 & 0 & 0 & 1 & 0
\end{pmatrix}
\times
\begin{pmatrix}
0 & 1 & 1 & 0 & 0 \\
1 & 0 & 1 & 0 & 0 \\
1 & 1 & 0 & 1 & 0 \\
0 & 0 & 1 & 0 & 1 \\
0 & 0 & 0 & 1 & 0
\end{pmatrix}
=
\begin{pmatrix}
2 & 1 & 1 & 1 & 0 \\
1 & 2 & 1 & 1 & 0 \\
1 & 1 & 3 & 0 & 1 \\
1 & 1 & 0 & 2 & 0 \\
0 & 0 & 1 & 0 & 1
\end{pmatrix}
$$

For example, Row 3 Column 5 represents that VC firm C has one path to reach VC firm E by "walking two steps", which is through the intermediation of VC firm D. Similarly, R^n represents the possible paths one VC firm can reach another VC firm by "walking n steps".

Based on the meaning of R^n explained above, the mathematic interpretation of $c(\alpha, \beta)$ is more straightforward. $c(\alpha, \beta)$ could be regarded as the sum of the centrality score of directly and indirectly connected peers to the VC firm under discussion, "when β is less in absolute value than the reciprocal of the largest eigenvalue of R" (Bonacich, 1987).

$$C^\beta(R) = \alpha R \mathbf{1} + \beta\, R\, a\mathbf{1} + \beta^2 R^2 a\mathbf{1} + \cdots \tag{5-7}$$

where $\mathbf{1}$ is an identity matrix.

At the very beginning, each VC firm in the network is assigned a base value $\alpha R \mathbf{1}$ as its centrality score, where $\alpha > 0$ and R denotes the count of direct links—the degree—of each VC firm with peers through direct syndication experience. Then, the centrality scores of its direct neighbour, those peers that can be reached by a VC firm by "moving one step" are added into the equation, where the weight put on each direct neighbour's centrality score is β. The larger the β coefficient, the higher weight put on the indirect resources a VC firm can leverage from its direct or indirect syndicate peers. Similarly, the sum of the centrality scores of the neighbours' neighbours— those peers a VC firm need to "move two steps to reach"—is added, but with an even smaller weight β^2 because the weight is inversely related to its distances to the VC firm under discussion (Jackson, 2008). The adding process continues until all existing VC firms in the network are included. As a result, $c(\beta)$ represents the total resources a VC firm can leverage directly and indirectly.

To rewrite Equation (5-6) in matrix notation,

$$C(\alpha, \beta) = \alpha(I - \beta R)^{-1} R \mathbf{1} \tag{5-8}$$

when the value of β does not exceed the reciprocal of the eigenvalue of matrix R, Equation (5-7) = Equation (5-8). For detailed proof, see Ferrar (1951, page 168-169). Following previous researchers who set the β coefficient as three-quarters of the reciprocal of the largest eigenvalue (Sorenson & Stuart, 2001; Zhang et al., 2016), I also tried one-quarter and one-half as alternatives without finding any material changes in the results.

Appendix 5-D: Eigenvector centrality and Bonacich c(β) centrality

The eigenvector centrality score is defined as

$$C_i = \alpha \sum_j g_{ij} C_j \tag{5-9}$$

C_i, the centrality score of a VC firm i, is dependent on the centrality scores of all its neighbours C_j, where g_{ij}=1 if VC firms i and j have previous syndication investment experience with each other, and zero otherwise. If C_i and C_j are denoted by the vector C, and $\sum_j g_{ij}$ is denoted by the adjacent matrix R_{ij} mentioned above, then the equation could be rearranged as

$$C = \alpha R_{ij} C \tag{5-10}$$

It is like the eigenvalue and eigenvector of matrix R, where C is the eigenvector, and the reciprocal of α is the associated eigenvalue. And, since C is a self-referential concept, there are many possible solutions. What I need to get is the largest non-negative eigenvalue (according to Perron-Frobenius Theorem), and its corresponding eigenvector (a $1 \times n$ matrix if there are n VC firms in total in the whole VC network) represents the centrality score of each VC firm.

Figure 5-3 illustrates the network of VC firms in China from 1996-2000 as an example. Most VC firms are inter-connected in the largest component, while nine small components exist in the whole network as well. If I calculate the eigenvector centrality of VC firms in the network, it will be described as its own eigenvector in each component. But $c(\beta)$ takes into account the centrality position of each node in each component as a whole (Bonacich, 2007). For example, $c(\beta)$ of VC98 is smaller than VC93, because VC93 is connected to a VC firm (VC53) that is better connected than VC87, which is the direct and the only connection VC98 has. Although VC98 and VC93 are in different components in the whole network, I can still compare their networking position value using $c(\beta)$. But if I use the eigenvalue centrality score to gauge the centrality of VC98 (9.104) and VC93 (0.003), it will misinterpret how well connected each VC firm is in the whole network. As the magnitude of $c(\beta)$ grows over time with the evolution of the VC industry in China, $c(\beta)$ is scaled by the highest score in the respective investment years to ensure the networking position of VC firms are comparable across years.
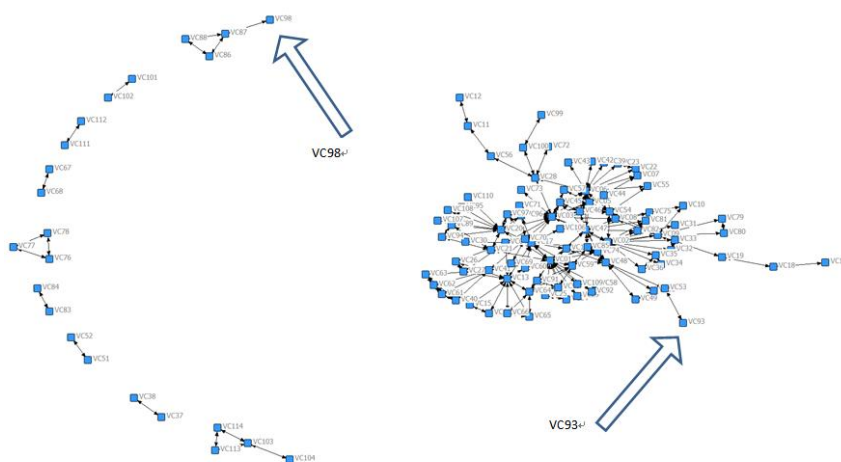

Figure 5-3 The network of VC firms in China between 1996 and 2000

There are 114 active VC firms, which are denoted by nodes with an identity number. A link between two nodes represents a realised syndication investment between two VC firms. Ucinet is used in generating the network graph with the data for all VC investments in China between 1996 and 2000 as recorded in PEdata.

Appendix 5-E Tables of additional tests and regressions

Table 5-11 Wald test of coefficients in Table 5-5

H_0: *mixed syn=PVC syn*	(1)	(2)	(3)	(4)	(5)
x^2	0.02	0.01	0.00	0.00	0.00
p value	0.896	0.924	0.947	0.967	0.968

Table 5-12 Wald test of coefficients in Table 5-6

H_0: *mixed syn=PVC syn*	(1)	(2)	(3)	(4)
x^2	4.93	4.10	5.35	5.79
p value	0.026	0.042	0.020	0.016
H_0: *P-led mixed=PVC syn*	(5)	(6)	(7)	(8)
x^2	8.57	8.64	8.66	13.33
p value	0.00	0.000	0.000	0.000
H_0: *G-led mixed=PVC syn*	(5)	(6)	(7)	(8)
x^2	0.00	0.06	0.09	0.00
p value	0.975	0.802	0.766	0.992

Table 5-13 Competing risk model of Table 5-7

The following regression uses the competing risk model rather than the simple Cox analysis in analysing the duration to the next round of financing. Achieving IPO/M&A directly after the first round of financing is treated as a competing event to obtaining refinancing.

Baseline Group:PVC syn	Duration
G-led mixed	-0.006
	(0.168)
G-led mixed × High network	-0.049
	(0.254)
P-led mixed	-0.418*
	(0.184)
P-led mixed × High network	-0.660+
	(0.377)
High network	0.233+
	(0.131)
Experience$_3$	0.047
	(0.110)
Experience$_3^2$	-0.004
	(0.026)
Reputation	0.387
	(0.333)
Scale	0.003
	(0.108)
Scale^2	-0.011
	(0.013)
Amount	-0.057
	(0.056)
Early	0.304**
	(0.113)
Local	0.186*
	(0.094)
Syn Partner	-0.007
	(0.050)
Market	0.227
	(0.421)
PE ratio	0.062
	(0.101)
Industry fixed effect	Yes
Year fixed effect	Yes
N	1293

Table 5-14 Multinomial regression of Table 5-7

The following regression uses the Multinomial regression rather than Cox analysis in analysing the possibility of surviving to the next round to either achieve an exit through IPO/M&A directly (the dependent variable equals 2) or obtain refinancing (the dependent variable equals 1) after the initial round of financing.

	Outcome 1:Refinancing	Outcome 2:IPO/M&A
G-led mixed	-0.446	0.158
	(0.472)	(0.221)
G-led mixed $\times$ High network	-0.144	0.409
	(0.558)	(0.361)
P-led mixed	-1.703**	-0.621*
	(0.381)	(0.282)
P-led mixed $\times$ High network	-1.019^{+}	-1.007*
	(0.604)	(0.477)
High network	0.503^{+}	0.019
	(0.293)	(0.252)
Experience$_3$	-0.278	0.038
	(0.200)	(0.131)
Experience$_3^2$	0.034	-0.046
	(0.041)	(0.039)
Reputation	1.383*	1.444**
	(0.636)	(0.398)
Scale	0.567**	-0.345*
	(0.204)	(0.162)
Scale^2	-0.075**	0.023
	(0.023)	(0.016)
Amount	-0.193^{+}	0.035
	(0.108)	(0.084)
Early	0.645**	-0.775**
	(0.132)	(0.171)
Local	-0.054	0.426**
	(0.256)	(0.160)
Syn Partner	0.036	0.076^{+}
	(0.066)	(0.039)
Market	0.559	-0.427
	(0.801)	(0.629)
PE ratio	0.242	-0.104
	(0.188)	(0.165)
Constant	-12.489	7.923
	(12.541)	(10.264)
Industry fixed effect	Yes	Yes
Year fixed effect	Yes	Yes
N	1,293	1,293

Table 5-15 Duration analysis using investment currency as instrumental variable

Only include GVC-led mixed syndication and pure PVC syndication in the sample.

	(1) First stage	(2)	(3)	(4)
			Second stage	
		Duration	Surviving	IPO/M&A
RMB	2.148**			
	(0.697)			
G-led mixed		-0.145	0.085	0.799
		(0.605)	(0.831)	(0.734)
G-led mixed × High network		0.109	-0.003	0.011
		(0.215)	(0.270)	(0.247)
High network	2.433**	0.123	0.241	-0.140
	(0.601)	(0.111)	(0.205)	(0.203)
$Experience_3$	0.317	0.023	-0.005	0.239*
	(0.277)	(0.098)	(0.139)	(0.120)
$Experience_3^2$	0.093	-0.015	-0.031	-0.091**
	(0.063)	(0.027)	(0.034)	(0.028)
Scale	0.384	-0.006	-0.069	-0.562**
	(0.418)	(0.074)	(0.130)	(0.128)
$Scale^2$	-0.070	-0.007	-0.008	0.051**
	(0.046)	(0.010)	(0.014)	(0.013)
Reputation	-0.555	0.932**	1.895**	1.066**
	(1.041)	(0.244)	(0.424)	(0.396)
Amount	-0.371	-0.006	-0.007	0.158
	(0.259)	(0.050)	(0.081)	(0.108)
Early	0.124	0.073	-0.070	-0.995**
	(0.329)	(0.082)	(0.156)	(0.157)
Local	0.414+	0.139**	0.276+	0.374**
	(0.250)	(0.051)	(0.149)	(0.128)
Syn Partner	0.366**	0.047	0.088	0.048
	(0.090)	(0.053)	(0.061)	(0.056)
Market	-0.484**	-0.007	0.030	-0.088
	(0.149)	(0.072)	(0.110)	(0.110)
PE ratio	0.019+	-0.004	-0.007	-0.021**
	(0.010)	(0.005)	(0.009)	(0.006)
Constant	-1.694		0.833	2.101*
	(1.399)		(1.287)	(0.903)
Industry fixed effect	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes
N	1,161	1,161	1,161	1,161

6. Improving the performance of governmental venture capital firms: a case study of Shenzhen Capital Group

6.1. Introduction

In Chapter 4, I investigated the differences between GVCs (governmental venture capital firms) and PVCs (private venture capital firms). I proposed that the underperformance of GVCs relative to PVCs is mainly due to agency problems at two levels: (1) at the VC firm level, where there is no link between the GVCs' current investment performance and future fund-raising, and (2) at the staff level, where the compensation scheme of GVCs is less effective.

The case of Shenzhen Capital Group (SCG, hereafter) provides a quasi-experiment to investigate the impact of improved governance in GVCs on their performance. SCG, as other GVCs, used to rely on the local government as its main funding resource. However, SCG adopted an expansion strategy in 2006 and established many Government-backed Funds (GBFs, hereafter) in cooperation with local governments outside Shenzhen. The new strategy created a link between SCG's current investment performance and its future fundraising because SCG's track record served as an important factor in convincing other local governments to cooperate with SCG. In addition, SCG carried out a series of reforms in staff compensation, which better aligned the interest of employees with the company.

In a case study of Harvard Business School by Gompers *et al.*(2012), SCG is described as the pioneer of GBFs in China. They attribute SCG's success to its large scale of funds under management. My research aims to provide a more comprehensive overview of changes in SCG and, more importantly, to throw light on the impact of these changes on SCG's return of investments and its capability of selecting and nurturing portfolio companies compared to other GVCs.

I conducted six face-to-face interviews with managers of SCG to obtain insights into the changes in strategies and governance at SCG. I was present at an Investment Committee meeting of the company to obtain details of the decision-making procedures of SCG. Appendix 6-A provides details of the interviews and my personal observations at the meeting. The most important thing unearthed from the interview and the observation is the whole picture of what happened in SCG around 2006. News reports and research articles, including the case study published in the Harvard University Case Study, only focus on the expansion itself and contribute the success of SCG to the economies of scale and the special design of

the GBFs. In contrast, information collected from the interview and observation enables me to provide a comprehensive explanation for the success of SCGs. My interview questions covered different aspects of change in SCG, some aspect even has not been considered by their staff as a factor that may affect their performance (e.g. the link between its performance and fundraising). The information collected confirms that SCG benefits from its expansion strategy through economies of scale and the link between SCG's current investment and its future fundraising. In addition, SCG's reforms in compensation, decision-making and staff investments also improve its governance.

I use data on investments by all GVCs in China between 1999 (when SCG was established) and 2010 to compare the performance of investments by SCG with those by other GVCs before and after SCG's expansion strategy. Firstly, I compare the return on investments and find that SCG had a higher rate of success in early stage investment than other GVCs after it adopted the expansion strategy. For late-stage investment, SCG does not show any difference from other GVCs pre and post its reform. Secondly, I compare SCG's capability in selecting and nurturing enterprises with other GVCs and find that the portfolio companies backed by SCG are more likely to achieve successful exits through IPO or M&A than those backed by other GVCs after 2006.

This chapter is structured as follows: Section 6-2 reviews the background of SCG and the challenges faced by SCG and other GVCs before 2006. Section 6-3 investigates SCG's expansion strategy and other reforms in the governance of the company and develops hypotheses. Section 6-4 introduces the model and the data. Section 6-5 shows the empirical results and Section 6-6 concludes.

6.2. Background and challenges to SCG

6.2.1. Establishment of SCG and its features as a GVC

SCG was established in 1999 by the Shenzhen Municipality Government, with equity of 500 million RMB from the local government and another 200 million RMB from six local state-owned enterprises as initial backers (Breznitz & Murphree, 2011). SCG is notable in part for being the first GVC in Shenzhen (which is the pioneer of reform in China), but particularly for its strategy of actively raising funds outside of its original city and its success in achieving IPOs for its portfolio companies. With the original intention of promoting the development of the local VC industry, SCG was one of the earliest GVCs in China and has been ranked as the top VC in China by Chinaventure.cn from 2008 to 2012.

SCG is a good case to find out how to improve the performance of GVCs because the company meets all the three criteria of being a GVC both before and after its reform in 2006:

(1) Its main funding resource is from the local government of Shenzhen;

(2) Its chair of the board and CEO are appointed by the local government; and

(3) It is under the supervision of the local SASAC like other local SOEs.

Although SCG has been consistently adding private enterprises as its shareholders, it is still a SOE, because "the government is the de facto owner, and they choose managers to run the firm" (Allen *et al.*, 2005). Table 6-1 provides the information on the shareholding of SCG since its establishment. Shenzhen Municipality Government's direct holding in SCG had been less than 50% since 2002. However, because some of the main shareholders of SCG are 100% owned or controlled by Shenzhen Municipality Government, the percentage of shares held by the local government directly and indirectly in SCG has always been above 50%. In other words, the local government has remained the actual controlling shareholder of SCG. The local government appoints the Board Chair and the CEO for SCG, and the local SASAC supervises and assesses the operation of the company. According to SASAC (2016), the newest definition of SOEs includes those enterprises in which the direct holding of the government or government-control enterprises is lower than 50%, the state—as the biggest shareholders—can materially control the enterprise's decisions through the shareholder agreement, board of directors or other agreements. From this perspective, the Shenzhen Municipality Government has remained the biggest shareholder of SCG and met the criteria mentioned above.

6.2.2. Challenges to SCG before 2006

When being appointed as president of SCG in 2005 by the local SASAC, Mr Haitao Jin faced growing concern about limited funding resources and highly illiquid exit channels. At that time, the biggest issue SCG faced was that it mainly relied on its shareholders' equity for investment. Moreover, the investments of SCG in its portfolio companies were highly illiquid before the split-share structure reform in 2005 and were hard to sell even after the portfolio companies were floated on the stock markets (refer to Chapter 2 for more information on the institutional background). Under such circumstances, it was quite challenging for SCG to meet SASAC's annual assessment, which is focused on the annual return of equity rather than a performance measure that is aligned to the life cycle of VC funds.

Table 6-1 Evolution of shareholding of Shenzhen Capital Group (1999-2010)

The shareholding information shown in this table is compiled by the author according to the website of State-owned Assets Supervision and Administration Commission of the People's Government of Shenzhen Municipality (http://www.szgzw.gov.cn/szgq/) and the annual reports of the companies included in the table.
*SASAC Shenzhen is the actual controller of the company.

Name of Shareholder (Unit: RMB, 0000) / DD/MM/YYYY	25/08 1999	03/08 2001	08/11 2002	20/12 2002	11/07 2005	16/03 2006	07/04 2008	14/08 2009	25/06 2010	Shares by SASAC
SASAC of Shenzhen municipality government	50000	83000	78200	53962	58112	58112	58112	58112	70525.75	**100%**
Shenzhen Investment Holdings Co., Ltd							32000	32000	32000	**100%**
Shenzhen Airport Corporation	3000	32000	32000	32000	32000	32000				**100%**
Shenzhen Yuanzhi Investment Co., Ltd										**100%**
Shenzhen Yixin Investment Co., Ltd			4800	4800	4800	4800	4800	4800	8284	**100%**
Shenzhen Yantian Port Group Co., Ltd		5000	5000	5000	5000	5000	5000	5000	5837.5	**100%**
Shenzhen Futian Investment Co., Ltd		5238	5238	5238	5238	5238	5238	5238	6115.37	**100%**
Shenzhen Public Transportation Group Co.,Ltd	2000	4150	4150	4150						**55%**
Shenzhen Energy Corperation	3000	4350	4350	4350	4350	4350	4350	4350	5078.63	**48.09%***
Shenzhen Expressway Co.,Ltd**	5000	5000	5000	5000	5000	5000	5000	5000	5837.5	**43.7%***
Shenzhen Shenbao Industry Co., Ltd	3500									**22%***
Guangshen Railway Co., Ltd	3000	3000	3000	3000	3000	3000	3000	3000	3502.5	
Zhong Xing ZTE	500	500	500	500	500	500	500	500	583.75	
Shanghai Dazhong Utility Group		2762	2762	32000	32000	32000	32000	32000	34847.5	
Shanghai Dazhong Enterprise Management Co., Ltd		5000	5000							
Guangdong Electric Power Development Co., Ltd		5000	5000	5000	5000	5000	5000	5000	9187.5	
Longxin Group Co., Ltd		5000	5000	5000	5000	5000	5000			
Hanhua Bonding Company Group Co., Ltd								5000	5000	
Shenzhen Liye Group Co., Ltd									11583.2	
Shenzhen Xinghe Real Estate Development Co., Ltd									40167.5	
Fujian Septwolves Group Co., Ltd									11583.2	
Sum of Share Value	70000	160000	160000	160000	160000	160000	160000	160000	250133.9	
Percentage of shares held by SASAC Shenzhen directly and indirectly	**95.00%**	**86.71%**	**86.71%**	**71.56%**	**71.56%**	**71.56%**	**71.56%**	**71.56%**	**53.44%**	

The challenges faced by SCG were similar to other GVCs at that time. With the funds granted by government statute, GVCs did not have to compete with other VC firms to raise funds. The decision of local governments on whether to continue or expand financing a GVC is mainly affected by the need for promoting the local economy and venture industry, rather than by the performance of the GVC. Without the motivation of future fund-raising, the managers of GVCs may not exert much effort (Cumming *et al.*, 2017; Leleux & Surlemont, 2003).

The GVCs' compensation scheme makes it more difficult to motivate the managers in GVCs. The common practice at PVCs (Zider, 1998) is to have an annual management fee (2-3% of committed capital) and carried interest or "carry" (20% of the profit that is higher than a pre-agreed return rate). According to WallStreetOasis.com[48], junior staff (like analysts and associates) in PVCs do not receive carry as part of their income, but senior management (like vice presidents, managing directors and general partners) have a large proportion of their compensation on "carry" that can be as high as three to nine times their base salaries. The compensation system that emphasises "carry" plays a critical role in aligning the interests of venture capitalists and limited partners (Sahlman, 1990), because "venture capitalists have incentives to engage in activities that increase the value of the carried interest, which is precisely what benefits the limited partners."

In contrast, compensation for the managers of GVCs is limited to annual salary plus bonus, just like managers of other SOEs. Furthermore, local SASACs put a cap on the total income of general managers in SOEs. For example, Shenzhen SASAC requires that the annual bonus for general managers in SOEs shall not exceed three times their base salary—about USD 40,000 per year.

A lack of independence in decision-making is another concern for GVCs (Cumming *et al.*, 2017). The influence of local governments on GVCs' decision making is mainly through their appointed managers. GVCs often make investment decisions that are not only based on the quality of the projects but are also under political pressure from government officials.

Despite these challenges, many opportunities for SCG and other GVCs existed before 2006. Firstly, the split-share structure reform (non-tradable state-owned shares in state-owned public companies becoming tradable in the secondary stock market) in China started in mid-2005. It enabled GVCs to get a considerable return if they had accumulated investments in

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[48] WallStreetOasis.com is a popular forum for investment bankers, venture capitalists and other professionals in finance.

the preceding years. Secondly, there was a strong demand by the Chinese central government to establish a NASDAQ-style board to facilitate the financing of high-tech and small enterprises. The central government had already chosen Shenzhen as the location of the new board (currently known as "ChiNext"), and the only decision pending was to choose the best timing. The expectation of the forthcoming new board provided VC firms, especially those in Shenzhen, with the incentive to screen and nurture more potential ventures to get listed on ChiNext. Thirdly, the central government initiated support for developing Government-backed Funds (GBFs) and carried out *Interim Regulation on Venture Capital Firms* at the end of 2005. SCG responded to these challenges and opportunities by making a series of reforms, which had a profound impact on the company's performance.

6.3. SCG's new strategy and reforms

6.3.1. Expansion strategy

SCG's most influential action was to expand outside of Shenzhen and cooperate with other local governments to establish GBFs. Interviewees mentioned the factors that led to the cooperation between SCG and local governments on both the demand and supply side. On the demand side, local governments had a strong intention to change the traditional way of allocating subsidies to a more market-oriented style in order to boost innovation and economic development. On the supply side, SCG's track record, together with its expertise in managing governmental VC funds, secured its cooperation with the local governments.

As the pioneer of establishing GBFs, SCG adopted a three-pillar structure in funding its GBFs. Local government, SCG, and other local SOEs or private companies contributed 1/3 of the funds respectively. SCG managed the GBFs as the general partner, while the local government and the other enterprises acted as the limited partners. A larger proportion of commitment by general partners is crucial for first time fundraising to establish credibility (Lerner & Hardymon, 2002). Compared to the general practice at PVCs that general partners contribute only 1% of committed capital (Sahlman, 1990), the much higher proportion of contribution by SCG as the fund manager (1/3 of the committed capital) ensured a better alignment of interests for SCG and the local governments.

Additionally, the funds from the local governments adopted a practice similar to preferred stocks, i.e. the local governments only asked for a fixed return (similar to the interest rate of government securities) when the funds invested generated a positive cash flow, and they had a prior claim on the fund's assets if it were liquidated. This arrangement ensured a relatively

low risk for local state-owned assets in GBFs and increased the local governments' willingness to cooperate with SCG.

Following the adoption of its expansion, SCG established 40 GBFs with local governments around the country from 2006 to 2010. As mentioned by the interviewees, SCG benefits from economies of scale in fundraising through local government, local SOEs and private enterprises. SCG leveraged its investment team better in screening, monitoring and value-adding activities. SCG also obtained better access to a broader range of local resources across the country, and more potential deal flows compared to how it was before adopting the expansion strategy. By managing a larger amount of funds, SCG can better meet the demand for subsequent financing for its portfolio companies. Also, by having invested in a variety of portfolio companies in different stages and industries, SCG can more easily decide when to sell and how much to sell its investments in the secondary stock market to meet the annual profit goal set by SASAC. Table 6-2 summarises the benefits of SCG's expansion strategy.

By adopting the expansion strategy, SCG, in fact, established a link between its current performance and its future fund-raising. As all interviewees mentioned, setting up the link is not a deliberate reform but a direct result of the new strategy. The VC life cycle (as discussed in Chapter 4) indicates that the cycle of funds comes to an end when a VC firm exits from its portfolio companies and repeats from a new round of fund-raising. Therefore, performance today is crucial for fundraising tomorrow, as this influence serves as an incentive for VC firms to exert optimal effort in selecting and nurturing their portfolio companies. Figure 6-1 and Figure 6-2 compare SCG before and after its expansion strategy in 2006. A fundamental distinction is that after adopting the new strategy, a link between its investment performance and future fund-raising was set up and SCG overcame one of the biggest obstacles to GVCs in solving agency problems.
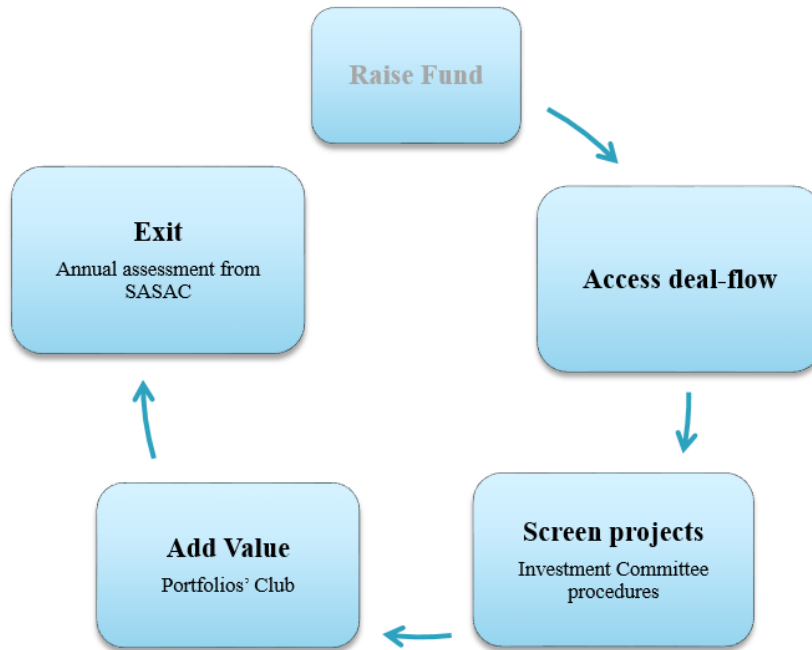
Figure 6-1 SCG before its expansion strategy
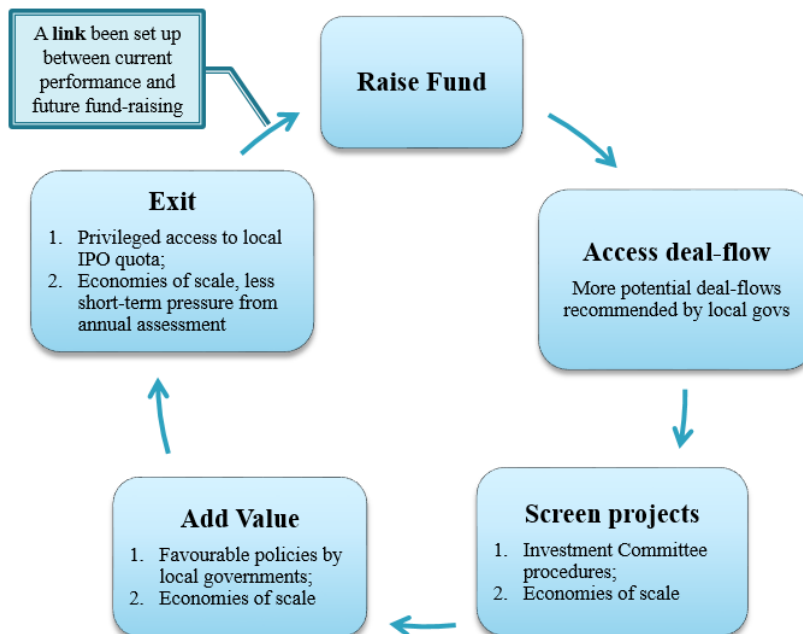
Figure 6-2 SCG after its expansion strategy

6.3.2. Reforms of SCG

SCG's expansion strategy coincided with some other reforms, which also had a profound impact on the company. Firstly, SCG improved the procedure of project screening and decision-making to make sure all potential deal flows are screened following the same procedure. This reform mitigates the political pressure on SCG's decision-making. Secondly, to provide better incentives to its employees, SCG adopted a carry-like bonus and required investment teams to invest at least 1% of the total investment in their portfolio companies in order to align the interests of the staff and the company. Thirdly, all the staff of SCG are entitled to follow the investment made by the company and invest up to 15% of the total investment by the company in any project.

Table 6-2 lists the new strategies and reforms taken by SCG since 2006 and the main benefits of these reforms. Appendix 6-1 and Appendix 6-2 provide details on different aspects of the reforms mentioned by the interviewees and the procedures of decision-making by the Investment Committee.

Table 6-2 Strategies and reforms by Shenzhen Capital Group in 2006

| Strategy and reforms	Description	Benefits
Expansion Strategy	• Set up Government-backed Funds with local governments outside of Shenzhen. • SCG, local government and other investors (local public or private companies) contribute 1/3 of a fund respectively, and SCG manages the funds as the general partner. • Convince local governments by SCG's track records of previous investments and successful exits.	• Broaden its channels of fundraising and deal flows. • Gain access to more favourable local resources. • Develop more insights into industries and better leverage its research team and risk control team, etc. • Meet the demand of its portfolio companies for subsequent financing and meet the annual profit goals set by SASAC more easily. • Set up a link between its current performance and future fund-raising.
Decision making procedure	• Investments that are less than $80 million RMB can be approved by the Investment Committee if more than 2/3 members agree. • The Board Chair and the CEO have the same weight of vote as other members. • The voting process is undertaken after meeting anonymously online, following the rule of one man one vote with the power of veto granted to the CEO and the Board Chair.	• Screen all projects following the same procedure to be fair and transparent. • Ensure that only projects meeting the criteria for investment are selected. • Show a real attempt to be independent of political pressure to vote anonymously after the Investment Committee meeting.
Remuneration	• 8% of annual profit as a bonus to the whole company.	• Align the interests of management and shareholders.

Plan	• 2% of investment profit as a carry-like bonus to the investment team. • 1% compulsory follow-up investment by the investment team. • Voluntary follow-up investment by all staff. • The CEO and the Board Chair can pool their bonus in the portfolio companies of SCG as their own investment.	• Align the interests of the investment teams and the management. • Avoid the cap on the remuneration for managers of state-owned enterprises required by SASAC

6.3.3. Impact of new strategies and reforms on performance

The expansion strategy resulted in a historically high number of portfolio companies and IPOs for SCG. Before 2006, SCG ranked second among the main GVCs in China based on the number of portfolio companies and IPOs (see Figure 6-3). By the end of 2010, SCG had become the largest and the most successful GVC in China, with the number of portfolio companies and successful exits through IPO being more than twice as many as the second-placed GVC (see Figure 6-4).
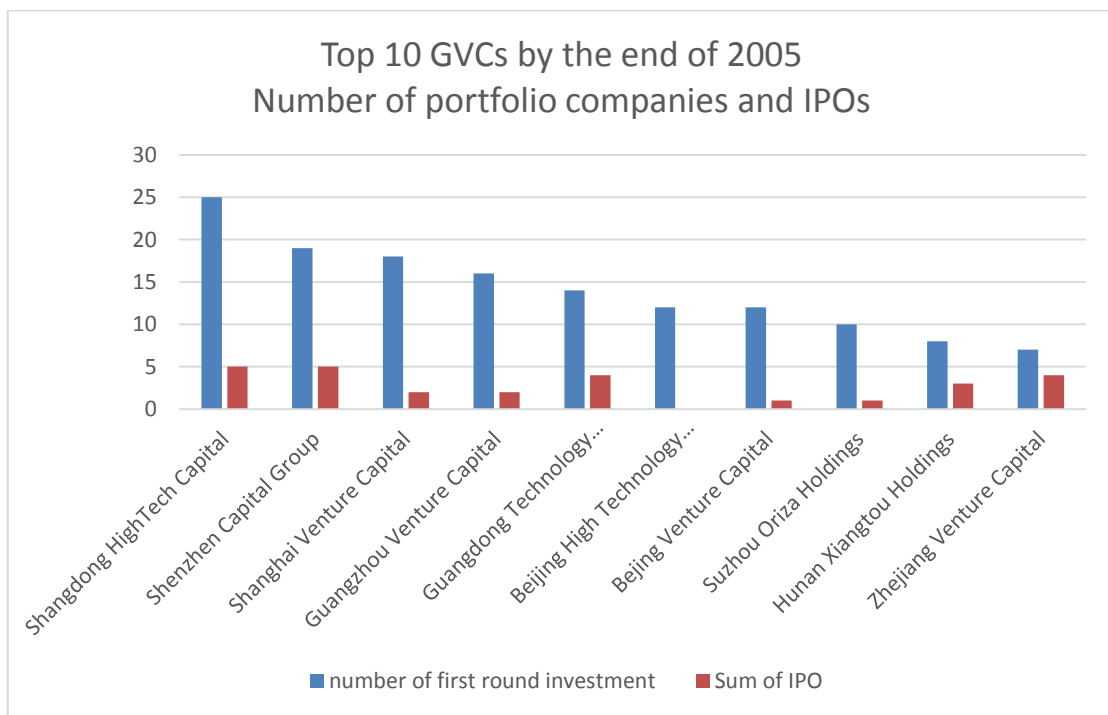
Figure 6-3 Top 10 GVCs by 2005 in China
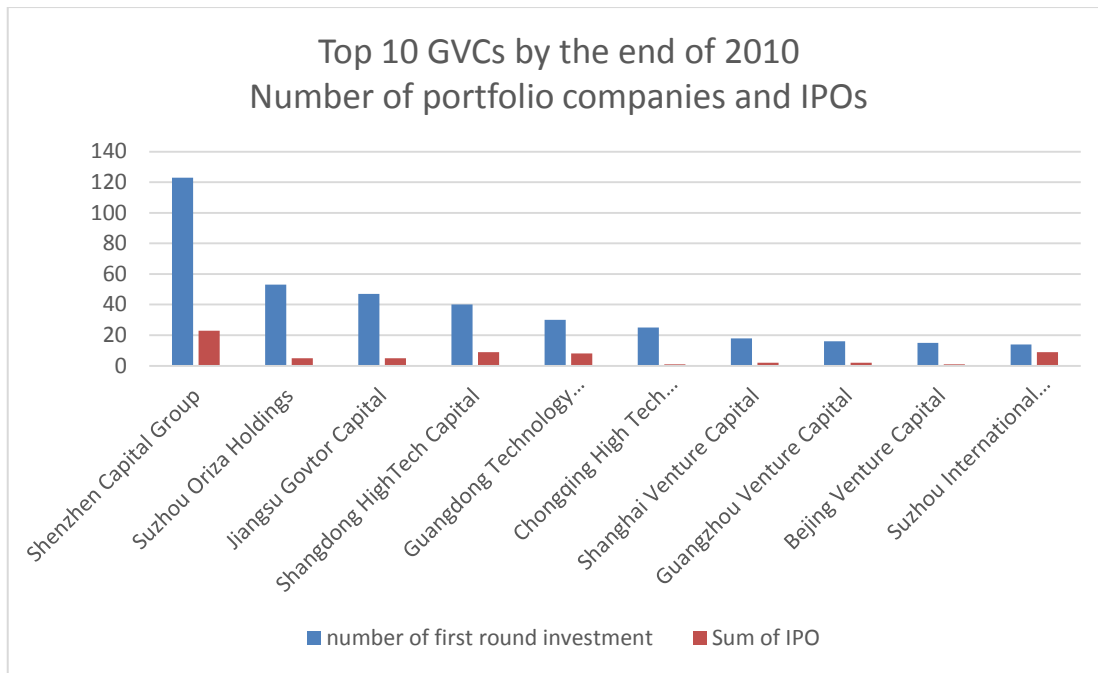
Figure 6-4 Top 10 GVCs by 2010 in China

However, is the increase in successful exits of SCG driven by its increased cases of investments or its improved efficiency in investing? One objective measure of performance is the return on investment. If the expansion strategy and other reforms have improved the performance of SCG, it should have a higher return from its investments than other GVCs.

Hypothesis 1: Investments made by SCG have a higher return than those by other GVCs in the period after SCG adopted its expansion strategy in 2006.

A stricter measure of performance is a VC's capability of screening and nurturing portfolio companies. In the scenario of syndication, the lead VC firm of the syndicate plays a vital role in screening and providing value-added activities to the investee. In the scenario of staged financing, VC firms that invest in the first round play an essential role in recognising the potential of start-ups and providing certification for the portfolio company to other VCs that may join in the later rounds of financing. Therefore, the success of a portfolio company, to a certain extent, reflects the capability of its dominant VC firm—the one that leads the investment in the initial round of VC financing.

SCG's expansion strategy and reforms have had an impact on its core competency, not only through economies of scale but also through better-aligned interests and less distortion from political pressure. Therefore, SCG is expected to outperform other GVCs after 2006 using the stricter performance measure for VC firms.

Hypothesis 2: Portfolio companies that receive their initial round of VC financing from SCG or SCG-led syndicates are more likely to achieve successful exits through IPO or M&A than those backed by other GVCs after 2006.

6.4. Model and Data

6.4.1. Models and samples of two performance measures

6.4.1.1. For Hypothesis 1

The preferred measure to compare the return on investment is to look at the financial return (e.g. internal return rate). However, it is hard to collect data on exact returns since the VC industry is exempt from disclosing detailed information on their investments. VC firms voluntarily disclose their performance, which leads to the potential bias that we can only observe successful exits with a high return rate.

An alternative way to measure return on investment is to look at the successful exits of investments through IPO/M&A, because the information about IPO/M&A is public and reliable. Cochrane (2005) finds that late-stage investment is "steadily less risky" with smaller "mean returns, alphas and betas". Therefore, it is meaningful to compare SCG's and other GVCs' success rates with early and late stage investments in separate models.

$$IPO/M\&A_i = \alpha + \beta_1 SCG_i + \beta_2 Post + \beta_3 SCG_i \times Post_i \qquad \textbf{(6-1)}$$

Equation (6-1) looks at all early (late) stage investments by SCG or other GVCs, where the dummy variable *SCG* indicates whether an investment *i* was made by SCG, and another dummy variable *Post* indicates whether the investment was made after 2006. The dependent variable *IPO/M&A* equals one if the investment has achieved a successful exit through IPO or M&A. SCG's early stage investments are compared to the early-stage investments made by other GVCs in one regression, while another regression compares the performance of late-stage investments. The unit of observation is the unique pair of VC firms and their investees which forms when a VC firm invests in a portfolio company, no matter in which round and no matter through sole investment or syndication. If a VC firm has invested in several rounds of financing in a portfolio company, only the first time the VC firm gets involved is included in the sample. One portfolio company may appear several times in the regression if it has

been invested in by several VC firms[49]. There are 1,212 investments in total, among which 436 are early-stage investments, and 776 are late-stage ones.

The reason for not including control variables in Equation (6-1) is that I compare the return on early-stage investments by SCG with all early-stage investments by other GVCs, and late-stage investments by SCG with those late-stage investments by other GVCs. It does not matter what characteristics the VCs had when they made the investment, and it does not matter whether they did it alone or through syndication, because a VC firm can get some return from its investment as long as its investment gets a successful exit.

Furthermore, it is not possible to control for a variety of VC characteristics in Equation (6-1). One portfolio company is likely to be invested in by several VCs (either through syndication in the same round or through receiving financing from different VCs in different rounds). In both cases, the characteristics of the VCs are different, but they are making an investment in the same portfolio companies. For example, VC A and VC B co-invested in Company X in the first round, and VC C invested in Company X in the second round, and later on, Company X got listed on the stock market. In Equation (6-1), it only matters that an investment by VC A, an investment by VC B and an investment by VC C all succeeded. However, it is not feasible to control the characteristics of VC A when I use its investment in Company X as one observation, and control the characteristics of VC B (C) when having VC B (C)—Company X as a second (third) observation, because the success of a portfolio company is affected by all VC firms involved.

6.4.1.2. For hypothesis 2

The sample in Equation (6-1) enables us to get a first expression of the overall performance of all the investments by SCG compared to other GVCs. However, does SCG achieve the performance by doing more investments as co-investors (which need less time engaged and not necessarily high capability in screening and nurturing portfolio companies) rather than the lead VC or chose to do follow-on round investments rather than searching and screening projects and leading the first round of investment. I, therefore, use the following equation to further investigate the core competency of SCG compared to other GVCs.

$$IPO/M\&A_i = \alpha + \beta_1 SCG_i + \beta_2 Post_i + \beta_3 SCG_i \times Post_i + Controls_i \qquad \textbf{(6-2)}$$

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49 For example, if VC A and VC B invest in Company X in the same round, each pair of a VC firm and the portfolio company forms an observation (VC A—Company X, VC B—Company X).

Equation (6-2) looks similar to Equation (6-1) but has different samples. In Equation (6-2), each portfolio company is a unit of observation and appears only once in the regression. During the sample period, 598 portfolio companies received their initial round of VC financing from a sole GVC or a syndicate among GVCs. *SCG* indicates whether a portfolio company received its initial round of VC financing from SCG or a syndicate led by SCG. *Post* indicates whether the first round of VC investment that a portfolio company got was after 2006. *Control* includes a bundle of control variables that represent the characteristics of the investment and the VC firm that is leading the first round of financing in the portfolio company i.

Equation (6-2) measures the likelihood of achieving successful exits through IPO or M&A for a portfolio company when it is backed by a certain VC firm in its first round of VC financing. In other words, it investigates the capability of a VC firm in selecting and nurturing its portfolio companies after controlling for the following observable factors that may affect the success rate of the investment.

6.4.2. Control variables

Equation (6-2) measures the performance of VC firms by their capability of screening and nurturing their investees to achieve successful exits. I control for the characteristics of VC firms and portfolio companies as follows.

6.4.2.1. *VC firms' characteristics*

Scale equals the total value of investments by a VC firm in the five years prior to the focal investment[50], as the proxy for funds under the management of the VC firm. Gompers *et al.* (2012) attribute the success of SCG to the expanding size of its funds under management. To control for the possible concave relationship between the VC firms' experience and the performance of their portfolios (Gu & Lu, 2014), I also add the quadratic term of *Scale* in the regression.

Industry Experience counts the accumulated investment rounds done by a VC firm in the same industry as the focal investment. Researchers find that a better understanding of a specific industry enables VC firms to develop their portfolio companies more successfully (Bottazzi *et al.*, 2008; De Clercq & Dimov, 2008; Hopp & Lukas, 2014). I also add the

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[50] PEdata has a large number of missing values for funds raised each year. Many VC firms made investments without any records of fundraising in the sub-data source of funds in PEdata. Thus, it is less reliable to use the sum of total funds raised by a VC firm as the proxy for its funds under management.

quadratic term of *Industry Experience* in the regression to control for the possible concave relationship between the VCs' experience and their portfolio companies' success.

   Local indicates whether a GVC's headquarters is located in the same province as its portfolio company. Geographic proximity is regarded as an advantage for VC firms as it keeps consistent contact with their investees, allows them to screen and monitor their investments (Sorenson & Stuart, 2001; X. Tian, 2011) and is an important signal of privileged access to local public resources for GVCs. When SCG adopted its expansion strategy in 2006 and set up GBFs with other local governments, it acquired new local resources in a wider range of geographic areas. Thus, I adjust the value of *Local* to one if the investments were made by SCG outside of Shenzhen but in those areas where they had established GBFs with the local government to control for SCG's newly acquired local advantages.

   Syndicate indicates a portfolio company that receives its initial round of investment from a syndicate rather than a sole VC firm. Syndicate-backed firms are more likely to achieve a successful exit (X. Tian, 2012) than those backed by a sole VC.

6.4.2.2.   Portfolio companies' characteristics

   Amount measures the value of the first round of investment in millions of US dollars that a portfolio company receives. The amount of the first-round investment is an indicator of the valuation of the project and reflects the risk assessment of the project by venture capitalists (Brander *et al.*, 2015). The higher the investment amount is, the lower the implied risk is associated with the project.

Table 6-3 Definition of variables

Variable	Description
IPOorM&A	A dummy variable that equals 1 if the investment/portfolio company has achieved successful exits through IPO or M&A.
SCG	A dummy variable that indicates an investment is made by SCG, or a portfolio company's first round of VC financing is undertaken (or led) by SCG.
Post	A dummy variable that equals one if an investment is made after 2006 (in 2007 or later), or the first round of VC financing for a portfolio company is made after 2006; the dummy variable equals zero if an investment is made after 2006 (in 2005 or earlier).
Scale	The total of the investment amounts by a VC firm in the last five years prior to the focal investment. Proxy for funds under management for a VC firm. In the case of syndication, it equals to the lead VC firm's scale. The value used in the regressions is log (1+ *Scale*).
Industry Experience	The accumulated investment rounds in the focal industry done by a VC firm

	before it invests in the focal portfolio company. In the case of syndication, it equals to the lead VC firm's industry experience. The value used in the regressions is log (1+ *Industry Experience*).
Local	A dummy variable that equals 1 if the headquarters of a VC firm is in the same province as the portfolio company. In the case of syndication, it equals one if the headquarter of the lead VC firm is in the same province as the portfolio company. If the investment was made by a government-backed fund (GBF) established by SCG and other local government outside of Shenzhen, the value of *Local* is adjusted to one to reflect SCG's acquired local advantages.
Syndication	A dummy variable indicates two or more than two VC firms undertake the first round of VC financing for a portfolio company.
Amount	Investment amount for the first round of VC financing in a portfolio company in millions of US dollars. In the case of syndication, it equals the sum of investment amount of all syndication partners in the focal portfolio company. The value used in the regressions is log (1+*Amount*).
Early	A dummy variable that equals 1 if the first round VC investment in the portfolio company is in seed or early stage.
Cluster	A dummy variable that equals 1 if the portfolio company is in Shanghai, Beijing or Guangdong—three clusters of VC investment in China.
Year	A set of mutually exclusive dummy variables that equal one if the first round of investment in the portfolio company is in the year 1990 to 2010.
Industry	A set of mutually exclusive dummy variables that equal one if the portfolio company is in one of the following industries: Internet and Computers, Communication and Electronics, Biotech and Health Care, Consumer, Industry and Energy, Financial Services, and Others.

Early indicates whether the initial round of VC financing that a portfolio company receives is in the seed or early stage. Early-stage investment is believed to have a higher risk, and hence, a lower possibility of going public (Bottazzi *et al.*, 2008; Hochberg *et al.*, 2014; Sorensen, 2007). For the missing values of the investment stage in PEdata, I augment the data by comparing the investment date and the establishment date of an enterprise. If the difference is within two years, then I define it as an early stage investment. A similar definition of early-stage investment is also used by Cumming *et al.*(2017).

Cluster indicates whether a portfolio company is in Beijing, Shanghai or Guangdong—the three clusters of VC investments in China with the advantages of accessing IPO opportunities (Pan *et al.*, 2016). Furthermore, companies located in the three clusters also enjoy an information-sharing effect and therefore, are expected to perform better.

Industry and *Year* fixed effects are included in Equation (6-2) to capture the different levels of risk associated with different industries and investment in different years.

Table 6-3 summarises the definitions of all variables.

6.4.3. Data and descriptive statistics

I get data on VC investments from PEdata and augment the database with CSMAR (China Stock Market Accounting Research) to crosscheck the IPO records.

The sample in Equation (6-1) includes all investments made by GVCs between 1999 (when SCG was founded) and the end of year 2010, which leaves at least five years to achieve exits by the end of 2015 when the data for this chapter was collected. I drop investments made in 2006 to have a clear contrast before and after SCG carried out its expansion strategy.

Table 6-4 Descriptive statistics

This table reports the descriptive statistics of the variables. Panel A reports the number of investments by SCG and other GVCs both in initial and subsequent rounds before and after 2006. The numbers in Column "Exit" count the successful exits of the investments through IPO or M&A. Panel B compares the characteristics of portfolio companies that received their initial round of VC financing from SCG or SCG-led syndicates with those by other GVCs.

Panel A	**Early-stage** Investment					**Late-stage** Investment				
Year	SCG	Exits	Other 58 GVCs	Exit	Diff	SCG	Exit	Other 60 GVCs	Exit	Diff
1999	0	0	19	8		1	0	5	3	
2000	4	1	32	14		5	2	25	13	
2001	5	3	31	15		5	3	19	13	
2002	4	2	23	4		4	3	12	4	
2003	1	1	39	9		1	1	27	6	
2004	3	0	29	9		1	0	18	7	
2005	1	0	34	11		3	1	24	11	
% of successful exits *Before 2006*		39%		34%	5%		50%		44%	6%
2007	6	2	37	7		26	17	70	38	
2008	10	2	34	9		41	25	90	41	
2009	5	2	38	13		47	16	108	51	
2010	9	6	72	18		68	26	176	78	
% of successful exits *After 2006*		40%		26%	14%		46%		47%	-1%

Panel B: portfolio companies	SCG	Other GVCs	Difference
IPOorMA	0.39	0.38	0.01
Portfolio companies characteristics			
Early	0.16	0.37	-0.21***
Amount	1.57	1.26	0.32***
Cluster	0.53	0.24	0.28***
VC characteristics			
Scale	5.31	3.16	2.15***
Industry Experience	2.91	1.23	1.68***
Local	0.53	0.90	-0.37***
Syndication	0.40	0.29	0.11***

Panel A of Table 6-4 lists the early and late stage investments by SCG and other GVCs before and after 2006. With only a small proportion of investments in early-stage projects, both SCG and other GVCs saw a dramatic increase in late-stage investment after 2006, especially for SCG.

Panel B of Table 6-4 compares portfolio companies backed by SCG and other GVCs in their initial round of VC financing. The portfolio companies in the two groups show no significant difference in the likelihood of achieving IPO or M&A. However, SCG did invest in different companies compared to other GVCs. SCG had less early-stage investment and was more likely to choose portfolio companies located in Beijing, Shanghai or Guangdong to invest in. The investment amount for SCG was also larger than other GVCs. SCG also showed different characteristics from other GVCs. It had more funds under management, thanks to its expansion strategy and having more experience than other GVCs. However, SCG' investments were less likely to be limited to the location of its headquarter and other provinces where SCG had set up GBFs with the local governments. Furthermore, SCG was more likely to engage in syndication investment than other GVCs.

6.5. Regression results

6.5.1. Return of investments

I first compare the return on investment for SCG and other GVCs before and after 2006 when SCG undertook its expansion strategy and a series of reforms. I run two logistic regressions using early-stage and late-stage investments as the samples respectively in the specification of Equation (6-1). The regression results are reported in Table 6-5.

Column (1) and (2) report the return on early and late stage investments respectively. In early-stage investment, the estimated coefficients of *SCG* and the interaction term of *SCG×Post* are positive but statistically insignificant. By comparison, for late-stage investment, the coefficients of *SCG* and *SCG×Post* are of the opposite signs.

Since the magnitude and the sign of interaction terms in non-linear models cannot be interpreted directly (Ai & Norton, 2003), Panel B reports the marginal effects of being an investment by SCG versus other GVCs on the probability of achieving a successful exit through IPO or M&A. We can see that SCG showed no outperformance in early-stage investment before 2006. However, after SCG adopted its expansion strategy and carried out a series of reforms, its early stage investments were more likely to have successful exits—the

proxy for a higher rate of return. In contrast, SCG shows no difference from other GVCs in return on late-stage investment before or after 2006.

Table 6-5 Return of all investments for SCG and other GVCs

Panel A reports the results of the logistic regressions for all investments by SCG and other GVCs. The sample in Column (1) includes early-stage investments, while Column (2) includes late stage investments. The dependent variable is the dummy variable *IPOorM&A* that indicates whether the investment has achieved successful exit through IPO or M&A. Panel B calculates the marginal effect of being an investment made by SCG compared to by other GVCs on the probability of achieving a successful exit. Values significant at the 1%, 5% and 10% level are denoted by ***, **, and *. Standard errors are reported in parentheses and are clustered by the location of VC firms.

Panel A: logistic regressions	(1) Early-stage investment	(2) Late-stage investment
SCG	0.22	0.25
	(0.18)	(0.21)
Post	-0.38	0.12
	(0.35)	(0.20)
SCG×Post	0.42	-0.28
	(0.35)	(0.20)
Year fixed effect	Yes	Yes
Industry fixed effect	Yes	Yes
N	436	776
Panel B: Marginal effects of investment by SCG	(1) Early-stage investment	(2) Late-stage investment
Before 2006	0.05	0.06
	(0.04)	(0.05)
After 2006	0.14***	-0.01
	(0.05)	(0.03)

The results of the marginal effects[51] support Hypothesis 1 that SCG had a higher investment return on early-stage investment than other GVCs after 2006, while estimated coefficients suggest that there is no difference between the return on investment for SCG and other GVCs either before or after 2006.

6.5.2. Capability of screening and nurturing portfolio companies

I then compare SCG and other GVCs by looking at their capability of screening and nurturing portfolio companies before and after 2006. The sample is limited to portfolio companies that received their first round of VC financing from a GVC or a syndicate led by a GVC. I run the regression as the specification shown in Equation (6-2) and report the results in Panel A of Table 6-6.

Table 6-6 Capability of screening and nurturing portfolio companies

Panel A presents the logistic regression results with using whether the portfolio company has achieved a successful exit through IPO or M&A as the dependent variable. Panel B lists the marginal effect of being backed by SCG versus being backed by other GVCs on achieving successful exit before and after 2006.Values significant at the 1%, 5%, and 10% level are identified by ***, ** and *. Standard errors are reported in parentheses and are clustered by the location of VC firms.

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[51] Although the marginal effect of being an early-stage investment by SCG is statistically significant at the 1% level, the coefficient of the interaction term SCG×Post is statistically insignificant. I interpret the result with caution (Greene, 2009).

Panel A	Expected sign	(1)	(2)
SCG	+	0.25	0.01
		(0.22)	(0.28)
Post		-0.21	-0.57
		(0.18)	(0.39)
SCG × Post	+	0.67***	0.87***
		(0.24)	(0.29)
Scale	+	-0.28	-0.33
		(0.21)	(0.25)
Scale^2	-	-0.01	0.02
		(0.03)	(0.02)
Industry Experience	+	0.58***	0.53**
		(0.22)	(0.23)
Industry Experience^2	-	-0.16**	-0.18**
		(0.06)	(0.07)
Local	+	0.89***	0.99***
		(0.25)	(0.27)
Syndication	+	1.04***	0.92***
		(0.16)	(0.16)
Amount	+	0.21	0.22*
		(0.14)	(0.12)
Early	-	-0.82***	-0.85***
		(0.27)	(0.27)
Cluster	+	0.04	0.08
		(0.19)	(0.18)
Year fixed effect		No	Yes
Industry fixed effect		No	Yes
N		598	598
Panel B: Marginal effects of being backed by SCG vs by other GVCs on achieving successful exits		Without year and industry fixed effects	With year and industry fixed effects
Before 2006		0.05	0.01
		(0.05)	(0.05)
After 2006		0.19***	0.17***
		(0.04)	(0.04)

    Column (1) and (2) of Panel A report the results when controlling for the characteristics of the investment (*Amount, Early*) and the VC firm that led the investment (*Industry Experience, Scale, Local and Syndication*), without and with year and industry fixed effects respectively. The marginal effects of being backed by SCG versus being backed by other GVCs before and after 2006 are listed in Panel B of Table 6-6. Portfolio companies backed by SCG are more likely to achieve a successful exit through IPO or M&A than those backed by other GVCs. Therefore the regression results support Hypothesis 2. However, SCG's outperformance in screening and nurturing investees can only be observed after its expansion strategy. Before 2006, portfolio companies backed by SCG show no statistical difference in the success rate of achieving IPO or M&A.

    The estimated coefficients of other control variables are as expected. The industry experience of VC firms shows a concave relationship with the success rate of their portfolio companies, which implies that VC firms benefit a lot from the experience obtained from their first investments in a certain industry, but the positive effect disappears when a VC firm's accumulated experience in that industry reaches a certain level. Early-stage investment is

harder to get successful exits. Being backed by local GVCs and being backed by syndication enable portfolio companies to have a higher success rate.

The results provide evidence that besides the benefits that SCG's expansion strategy has brought to the company (including an increase in funds under management, more accumulated experience in a variety of industries, more opportunities of syndication with other VCs, and convenient access to local resources in more geographic areas), SCG's capability of screening and nurturing portfolio companies has also been improved compared to other GVCs. One possible explanation is that the expansion strategy linking SCG's investment performance and fund-raising has created effective incentives. Furthermore, a fairer decision-making process and a better remuneration scheme might also have helped to improve the core competency of SCG.

6.5.3. Alternative explanations

In 2010, SCG expanded its equity from 1.6 billion RMB to 2.5 billion RMB by introducing three private shareholders. Is the outperformance of SCG caused by the private shareholders that may (1) change the incentive mechanism of the company and, (2) help SCG to expand the network for accessing deals and nurturing portfolio companies?

The answer lies in the ultimate purpose of adding these three private shareholders. The main reason, as explained by the interviewees, is to bypass the policy restriction of the central government. In 2009, the State Council passed *Implementation of transferring part of state-owned shares in the domestic stock markets to enrich social security funds*. The purpose was to add funding resources to the national pension funds. Under this regulation, state-controlled enterprises that are listed on the domestic stock market should transfer 10% of the total value raised from their IPOs to the national pension funds. Obviously, the transfer will affect the financial return of GVCs if a portfolio company's controlling shareholder is a state-owned enterprise.

To circumvent the restriction caused by this regulation, some GVCs sought a way to reduce the percentage of shares directly held by their local governments (Feng, 2017). In mid-2010, SCG had Liye, Xinghe, and Septwolves as its new shareholders and, as a result, the percentage of shares directly held by Shenzhen local government through its controlling enterprises decreased to 49%. By having the three new shareholders, SCG was exempt from transferring its equities to the national funds.

However, as mentioned in Section 2, the Shenzhen local government's total shares in SCG through direct and indirect controlling enterprises were 53.44% after introducing the three new private shareholders. The CEO and Board Chair were still appointed by the local government, and the local SASAC continued to supervise and assess the performance of SCG. The additional private shareholders did not change the fact of SCG being a GVC.

Apart from the effect of circumventing the statutory hurdle of transferring equities to national pension funds, the interviewees confirmed that the new private shareholders had little impact on the incentive mechanism and the networking development of SCG. The compensation scheme of SCG was clarified in 2006 and has not been materially revised since. The new private shareholders had no experience in venture capital investment[52] and had barely been involved in introducing potential deals or nurturing portfolio companies for SCG. I cannot entirely rule out the impact of the new private shareholders on the performance of SCG, despite the evidence provided by the interviewees not identifying the private shareholders as one explanation for SCG's outperformance after 2006 compared to other GVCs.

6.6. Conclusion

This chapter explores the possible ways to improve the performance of GVCs by analysing the case of SCG. Specifically, I investigate the impact of SCG's expansion strategy, which the company carried out in 2006, on its performance. I use the data collected from interviews and direct observation, and the database PEdata to do both qualitative and quantitative analysis. Information collected from the interviews and the observation confirms that SCG's expansion strategy has enabled the company to benefit from economies of scale and brought a change to the company's VC life cycle by setting up a link between its current investment performance and future fund-raising. A series of reforms in SCG that paralleled its expansion strategy has also enhanced the governance of the company.

Using two measures to compare the performance of SCG with other GVCs before and after its expansion strategy, I find that:

(1) When taking into consideration all investments made by SCG and other GVCs, SCG outperformed in early-stage investment after carrying out its expansion strategy;

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[52] Liye and Xinghe are real estate development companies and Septwolves is a company with its main business in garment production and sales.

(2) When looking at the capability of VC firms in screening and nurturing investees, portfolio companies backed by SCG or by SCG-led syndicates are more likely to achieve successful exits than other GVCs. I obtain the results by controlling for the observed changes in SCGs—more accumulated experience, economies of scale, expanded networking and more local favourable resources—due to its expansion strategy. Therefore, the link set up between SCG' performance and fund-raising, its improved decision-making process and a better-designed remuneration scheme provide a possible explanation for the success of SCG.

This research has important implication for policymakers. To mitigate the agency issues of GVCs and achieve better corporate governance and better-aligned interests between shareholders and employees, I suggest two possible methods to improve the performance of GVCs. At the level of VC firms, empowering local GVCs to raise funds is an effective solution to overcoming the low incentive obstacle of GVCs. At the level of individual venture capitalists, a performance-based compensation plan for retaining talents in the VC industry is essential.

Appendix 6-A: Summary of Interviews

I conducted the interviews with ethics approval (Ref. 016603) granted by The University of Auckland. The main purpose of the interviews is to understand the mechanism that led to the success of SCG after it adopted a strategic reform in 2006.

In the week of 20 to 24 June 2016, I interviewed six managers who held senior positions at SCG. Five of them are the directors of different departments (Risk-control, Fund management, Investment, Research Centre and Investment Committee), and the other one is the head of Shanghai branch office. All interviewees joined SCG before 2006 and have worked at SCG ever since. Therefore, they are in good position to talk about the strategy taken by SCG since 2006.

The interviews were conducted at the premises of SCG's headquarters in Shenzhen, except for one at SCG's branch office in Shanghai. On average, each interview lasted for about one hour. No interview was recorded as requested by the interviewees.

Interview questions were structured around the following four aspects:

- The motivation of SCG's expansion strategy since 2006

- The main strength SCG relied on to successfully get cooperation with other local governments

- Other factors besides its expansion strategy that contribute to the success of SCG, and

- Their opinions on the connection between investment performance and future fundraising.

The interviews were carried out by asking interviewees several semi-structured questions. Semi-structured interviews are widely used in research on the venture capital industry (Kalidas *et al.*, 2014; Pukthuanthong & Walker, 2007; Avnimelech *et al.*, 2007) to obtain practitioners' insights into various factors that affect the behaviour and performance of the VC industry. The semi-structured interviews were open to any issues raised by the interviewees and were focused on different aspects according to the position of the interviewees in the company. The information provided by previous interviewees was presented to later interviewees for validation.

Since all the participants preferred not to have a recording of the interviews, I summarised the interviews based on the notes taken during the interviews. To avoid ambiguity, I asked

follow-up questions via emails to confirm the exact interpretation. The final step was to contact the interviewees to validate my final summary of their own discussions.

The content of the interviews is summarised as follows. The duplicated or very similar opinions of different interviewees are presented as one item.

Question 1: What is SCG's motivation for adopting the expanding strategy since 2006?

- To achieve economies of scale through raising funds from other local governments. We used to invest using SCG's corporate equity only, most of those investments failed to generate profit and suffered from a very low level of liquidity. Since 2006, the typical structure of the funds SCG raised was 1/3 from other local government, 1/3 from private investors (mainly well-known local enterprises with a close tie with the local governments), and 1/3 from SCG's own capital.

- SCG had successfully exited from some portfolios due to the split-share structure reform since 2005 (when the untradable shares became tradable). The expansion strategy since 2006 is to strengthen our confidence in investing.

- To access more potential projects outside of Shenzhen.

- To benefit from the favourable conditions in the investment contracts if some local governments waive their claim on the extra return on investment.

- To leverage the opportunity of the ChiNext (the second board, like NASDAQ), which would be released on ShenZhen Stock Exchange after 2006.

- To follow the policy of the central government to promote government-backed funds (GBFs).

- To follow SCG's four principles which were explicitly stated when SCG was established in 1999: governmental guidance, market-oriented operation, following market discipline, and learning from international conventions.

- To follow the spirit of ShenZhen Municipal Government—*Exploring and Reforming*.

Question 2: What is the main strength of SCG in successfully getting cooperation with other local governments?

- SCG's governmental background. Other local governments thought SCG was more reliable than private VC firms in the 2000s.

- SCG's variety of investments and its convincing track record of successful exits from previous investments. The local governments also cared about how an industry is developed for the local economy and what kind of "superstar" companies SCG had nurtured. The "superstar" companies are not necessarily public companies listed on stock market. Those showing a significant impact on the industry with a high growth rate or possessing high-end patents in a specific high-tech field are all convincing evidence as SCG's capability of selecting and nurturing portfolio companies.

- SCG's reliable and high-quality management team and market-oriented management mechanism.

- The mandates of the GBFs explicitly stated that a certain proportion of the funds raised should be invested locally. Therefore, the local government hoped to see potential growth in GDP, tax contributions, employment and the overall competitiveness from the local investments made by the new funds.

- SCG's high proportion of commitment in the GBFs. As both the limited partner and the general partner (acting as the fund management team), SCG contributed a 1/3 of the commitment in the newly established GBFs. In contrast, the common practice in the VC industry is that general partners only invest 1% of in the funds under their management, whilst 99% is contributed by limited partners. The local governments— as the limited partners who provide part of the commitment—regarded this arrangement as a more effective way for aligning the interests of the general partners and limited partners.

- Local governments desired to change how they support the development of the local economy, from an administration-based mechanism to a more market-oriented way. The cooperation with SCG provided the local governments with a good alternative in the transition. By investing one dollar in GBFs, local governments can leverage another two dollars to support the local industry and economic growth.

- As the earliest and the only GVC that adopted the expansion strategy to established GBFs with local governments in 2006, SCG had almost no competition from other GVCs until late 2009.

Question 3: Are there any other factors contributing to the success of SCG besides its expansion strategy?

(1) The incentive mechanism

- A market-oriented mechanism of recruitment (only Board Chair and the CEO are appointed by the government).

- 2% of the return on investment that exceeds the pre-set goal is allocated to the team members as a bonus, after subtracting the fund cost (6% annually), the cost incurred in investment (e.g. the cost of due diligence, monitoring and nurturing activities, etc.), and the net loss in previous projects made by the investment team members. This policy was carried out in 2006 after Mr HaiTao Jin became the Board Chair of SCG.

- 8% of annual profit is allocated as a bonus to the whole company. The allocation is according to the job level of the staff. It is not directly related to the performance of any specific investment team.

- A binding policy that the management team must put in money of their own that is equivalent to 1% of the total investment amount in their portfolio companies. The policy was also adopted in 2006.

- The follow-up investment mechanism for all employees. All SCG's employees are entitled to follow the investment made by the company. SCG set up a cap (15%) on the percentage of the employees' share in the total investment. The employees can voluntarily decide which project to invest in and how much to invest in. The investment by SCG's employees follows the rule of "same share, same interest" and the employees are fully responsible for their personal investments.

(2) The investment decision-making mechanism

- The Investment Committee of SCG exercises full discretion on investments smaller than 80 million RMB (approximate 12 million USD). Investment exceeding this bar should be referred to the board of directors. Projects that are more than 5% of its overall managed funds should be referred to the general meeting of shareholders.

- The Investment Committee consists of 11 members including the Board Chair, the CEO, all vice presidents, the directors of the main departments and the head of the main divisions in different areas. All staff of the company can sit in on the Investment Committee meeting to get information on proposed projects.

- The Board Chair and the CEO have the power of veto (to unilaterally stop an official action) over the project under discussion. But for approving a project, the Board Chair

and the CEO have the same weight of vote as other investment committee members (one person one vote). This is to ensure that the decision-making process is not driven by any specific person regardless of his/her administrative level in the company. This also serves as a mechanism to ensure that any projects recommended by government officials will be evaluated following the same procedure as other projects.

- The Investment Committee meeting ensures fairness and standardization, albeit dampening its efficiency to some extent. The decision on all projects, including those undertaken by divisions in different geographic areas, must be made by the Investment Committee that is located in the ShenZhen headquarters. Generally, it takes 3-4 months from the first due diligence to the final investment decision.

(3) The role of local SASAC (State-owned Asset Supervisory and Administration Commission)

- Like other SOEs, SCG is under the supervision of the local SASAC. SCG's financial performance—the annual profit rate—is the most important aspect of its annual assessment that is carried out by the local SASAC. Since the company holds a variety of portfolios at different investment stages, SCG can decide when to sell the shares it holds in the secondary share market to meet the annual profit rate goal set by SASAC.

- The annual assessment by SASAC does not force SCG to pursue short-term profit returns by sacrificing the long-term returns because the company has large-scale funds under management and can easily meet the annual goal of ROE by selling a small proportion of the shares at the best timing.

- Since its establishment in 1999, SCG had an agreement with its shareholders that the company has discretion on allocating 8% of the annual profit to its employees as a bonus. The allocation of the bonus follows the hierarchy in SCG. If the bonus that the Board Chair and the CEO receive exceeds the cap on the bonus the directors and managers of state-owned enterprises may get, the Board Chair and the CEO of SCG may pool the extra bonus in SCG's portfolio companies as their personal investment. This arrangement enables the Board Chair and the CEO of SCG to be motivated without breaking the regulations of the SASAC on the remuneration of state-owned enterprises.

- SCG hopes that, in future, the annual assessment by SASAC can be replaced by a long-term assessment (e.g. the tenure assessment of the director and CEO) to reflect

the characteristics of the VC industry and to enable SCG to focus on long-term goals better.

(4) Network set up by SCG

- SCG organizes an Investment Entrepreneurs Club twice a year. The company invites its portfolio companies, upstream and downstream companies in the industry chain, banks, officials from the local government and the stock supervision committee to a variety of club activities. The platform provides a good networking opportunity for their portfolio companies to set up a close tie with their potential partners and as a result, contributes to the success of SCG.

Question 4: Do you agree that one of the main factors driving the success of SCG is the link set up between its current performance and future fundraising?

- When cooperating with other local governments to establish GBFs, SCG focused on providing convincing track records to the local government. Once the local government agrees on a commitment, SCG relies on the impact of the local government to raise the other 1/3 of commitment from local state-owned or private companies.

- Setting up the link is not the motivation of SCG's expansion strategy. However, it did create a link between current performance and future fundraising in practice.

- Other GVCs do not have the pressure of raising funds, and they have no links between investment performance and personal compensation either.

Appendix 6-B: Summary of observation

On 22 June 2016, with the consent of the Investment Committee of SCG, I sat in on the Investment Committee meeting and observed the whole process of how they evaluated a proposed project and how they made an investment decision. The following summary of SCG's decision-making mechanism, especially the procedures of the Investment Committee meeting, is based on the information collected through both interviews and observation.

Firstly, only projects with a two-thirds majority of votes by the Investment Committee can get approval. The Investment Committee of the company has eleven members: the president, general manager, assistant general managers, directors of main departments, and head of subsidiaries in different areas. All staff of the company can sit in on the Investment Committee meeting to get information about the projects under discussion.

Secondly, although the president and the general manager are appointed by the local SASAC, they have the same voting power as other Investment Committee members—*one man one vote*. This arrangement is to ensure that the decision-making process is not driven by any specific person regardless of his administrative position in SCG. It also serves as a mechanism to ensure that any projects recommended by government officials will be evaluated following the same procedure as other projects. The only substantial additional right of the president and the general manager is their power of veto (disagreement on the project under discussion). Projects that are not beneficial to the local economy can be eliminated from the potential portfolios.

Thirdly, the Investment Committee exercises considerable discretion in decision-making. According to the regulations of the company, investments of less than 80 million RMB (about 13 million USD) are based on the voting results of the Investment Committee. Larger investments are referred to the Board of Directors for a decision. If the value of an investment is larger than 5% of SCG's total assets (by the end of the preceding year), a general meeting of shareholders will be called. In practice, most investments are within the remit of the Investment Committee.

Fourthly, the procedure (listed below) followed by the Investment Committee ensures a comprehensive evaluation of the project under discussion.

1) Independence declaration by the investment team.
2) Investment proposal and due diligence report by the investment team.
3) Legal, financial and risk reports by the Risk Management Committee.

4) Industry analysis reports by the Research Centre.

5) Q&A between the Investment Committee and the investment team.

6) Discussion among Investment Committee members.

7) Q&A between the Investment Committee and the investee company.

8) Summary.

9) **After the meeting,** 11 members of the Investment Committee vote anonymously and provide detailed comments on the project under discussion. This process is carried out on the company's computer system without disclosing the choice of other committee members. This arrangement is to avoid that the opinions of the Board Chair and the CEO affecting the choice of their subordinates when voting openly by a show of hands.

The procedure applies to all projects of the company. Government-recommended projects, similar to other projects, are therefore evaluated equally and transparently. One interviewee mentioned, "the projects recommended by local governments are a treasure rather than a burden for us, as long as every project is, by all means, evaluated by our company. The close ties of those projects with local governments are sometimes strong evidence of a promising future."

7. Policy implications and discussions

This chapter discusses the implications for policy-making based on the analysis and results of Chapters 4 to 6. I also discuss the new challenges for GVCs and the possible direction for future study in Sections 7.5 and Section 7.6.

The Chinese central government and some local governments have now begun to consider how to improve the performance of GVCs. In late 2016, the Chinese State Council initiated the *Opinions on promoting the sustainable and sound development of the venture capital industry* and pointed out the directions of future reforms:

- For funding resources, both governmental and private entities are encouraged to invest in the VC industry. In addition to publicly listed companies, state-owned enterprises, universities, insurance companies and wealthy individuals are also encouraged to become new funding resources for the VC industry.

- For the healthy development of GVCs, better compensation schemes should be designed to improve the performance of GVCs.

- For the regulation of GVCs, SASAC should work towards a new supervisory and assessment mechanism, which can "promote entrepreneurship and tolerate failure", as stated in the initiative.

- For cooperation between GVCs and PVCs, the state will conduct an overall and scientific evaluation of the return and performance of government funding.

- For the role of governments, the state will encourage local governments to establish government-guided funds and select qualified VC firms to operate the funds.

My study provides both evidence to support these reforms and suggestions on designing new policies.

7.1. Multiple funding resources

The analysis of the VC life cycle suggests that when there is no link between the current investment performance and the probability of future fund-raising for GVCs, there could be a lack of incentive for GVCs to exert as much effort as possible in pursuing best performance. The case study of SCG provides additional evidence that once the link is established, the performance of GVCs improves.

In order to better motivate their local GVCs, local governments should empower GVCs by giving them the right to proactively raise funds from diversified resources. Established GVCs

should be able to raise funds from the cities and provinces where the local governments have not established their local GVCs. Private enterprises can become the potential additional funding resource for GVCs, should GVCs be able to demonstrate a convincing track record that matches their private peers.

7.2. Effective compensation scheme

Reforms to the compensation scheme for managers of GVCs are also necessary. Compared with the annual base salaries and bonuses (generally with a cap on bonuses that is three times the base salaries) for managers in GVCs, the bonuses linked to the carried interest adopted by PVCs better reflect the characteristics of the VC industry and more effectively align the interests of VC managers and investors. Shenzhen Capital Group provides a good example of how GVCs utilised carry-like bonuses to motivate their staff.

7.3. Assessment by SASAC

As discussed in Chapter 2, Chapter 4 and Chapter 6, the annual assessment by SASAC emphasises the short-term performance of GVCs. Some large and successful GVCs such as SCG can mitigate the negative effect of annual assessment to some extent when they have a sufficiently large portfolio that contains companies in different stages and get cash flow from exit through IPOs or M&A every year. However, evaluating the performance of GVCs annually like other SOEs may not be consistent with maximising long-term returns in the venture capital industry.

For local SASACs, the reform in the evaluation of performance for GVCs can supplement the annual assessment with other more effective methods. Since 2015, the SASAC in Shenzhen started combining annual assessment with the tenure assessment of CEOs. Shenzhen SASAC emphasised that the tenure assessments of CEOs in SOEs "should have different goals in different industries" (State-owned Assets Supervision and Administration Commission of Shenzhen Municipal, 2015). As a supplementary measure to the annual assessment, tenure assessment takes place every three or four years according to the tenure of the CEOs of SOEs. The new policy aims to put higher weight on long-term performance and better reflects the characteristics of the VC industry.

7.4. Co-investment strategies

As shown in Chapter 5, the benefits of mixed syndication may be offset by the costs of coordination between GVCs and PVCs. If governments aim to promote cooperation between

GVCs and PVCs, mixed syndication between GVCs and those PVCs with below-average networking positions should be encouraged. For well-connect PVCs, the benefit from syndicating with GVCs may be limited, while the coordination cost may be substantial.

The implication for practitioners is that PVCs should evaluate their own networking positions and their potential syndication partners before seeking cooperation, especially when syndicating with GVCs. Otherwise, the added marginal benefit from the mixed syndication may be offset by the substantial communication and cooperation costs incurred.

7.5. New era of IPO approval system and new challenge to GVCs

The empirical results of Chapter Four and Chapter Five show that better access to IPO approvals in domestic stock markets for GVCs has an important impact on the exit performance of their portfolio companies through IPOs. However, this advantage for GVCs is diminishing. Replacing the administrative approval system with a registration system for IPOs has been a hot debate since the last decade. The Chinese government has been continuously working towards this direction albeit with great cautiousness (Shen & Sweeney, 2015). In late 2015, the Congress empowered the State Council to revise the relevant regulations during the reform of the IPO system in China. However, changes to the registration system had not been confirmed by the end of this study.

GVCs should be aware of the potential change in the IPO approval system in China and the possible impact on GVCs' performance. Improving GVCs' core competency rather than relying on their privileged access to domestic stock markets has become a critical issue for GVCs. Comparing the exit performance through IPOs for GVCs' investments before and after the reform of the IPO approval system in China may be a future research direction.

7.6. LPs or GPs? The future direction of research

When the VC industry in China was still immature in the 1990s, GVCs were set up, and governments stepped into the VC industry both as the funding providers (limited partners or LPs) and the funds' managers (general partners or GPs). However, as the Chinese VC industry has developed and become the second largest in the world since 2014, both the central and local governments in China have begun to reconsider the role of government in the VC industry.

Before 2009, some Government-guided Venture Capital Funds (GVCFs) were set up on a trial basis, in which governments acted as LPs rather than being directly involved in setting

up GVCs and overseeing the investment decision-making. The GVCFs adopted the form of Fund of Funds (FOFs) and were operated in a more market-oriented way (J. Chen, 2010).

GVCFs entered into a stage of formal development when the State Council passed *Guidance on establishing and operating government-guided venture capital funds* in 2009. According to PEdata, GVCFs did not become widely spread across China until 2014. The evaluation of GVCFs will become another research direction when the performance of GVCFs unfolds in the future.

8. Conclusion

This thesis investigates the performance of GVCs in China and their co-investment with PVCs and explores the ways for improving the performance of GVCs based on a case study of SCG.

The empirical results show that portfolio companies that received their first round of VC investment from GVCs are less likely to achieve successful exits through IPOs than those portfolio companies backed by PVCs. When investing locally, however, GVCs show no statistically significant difference from PVCs in the likelihood of exiting from their portfolio companies through IPOs. In addition, early-stage investments by GVCs do not perform better than those by PVCs.

The study of mixed syndication between GVCs and PVCs shows that portfolio companies backed by mixed syndication are less likely to get their second round of VC financing that those portfolio companies that are backed by syndication solely among PVCs. When I separate mixed syndication into those led by GVCs and those led by PVCs, I find that only the portfolio companies backed by PVC-led mixed syndication have a lower probability of getting the second round of financing than those backed by syndication solely among PVCs. In addition, for syndications led by PVCs with above-average networking positions, mixed syndication performed worse than pure PVCs syndication in helping their portfolio companies get a second round of financing.

The case study of SCG shows that the investments made by SCG after adopting its expansion strategy and carrying out a series of reforms in compensation and decision-making have a higher return than other GVCs. Furthermore, portfolio companies backed by SCG in their initial round of financing are more likely to go public than the portfolio companies backed by other GVCs in their first round of VC financing.

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