Business networks, financing and firm performance in China

Haijian Liang

Doctor of Philosophy

ASTON UNIVERSITY

Oct. 2018

ASTON UNIVERSITY

Business networks, financing and firm performance in China

Haijian Liang, Doctor of Philosophy, Oct. 2018

Summary

This thesis maps out business networks among listed companies in China and investigates their consequences on firms' access to financial resources, profitability and stock return volatility. Using data from China Stock Market & Accounting Research database and Datastream database from 1997 to 2011, this study identifies business networks among listed companies and model their effects using micro econometric modeling approach. The statistics show that the number of firms in business networks is expanding considerably over the years. However, networks do not develop evenly across sectors, and state-owned enterprises play a prominent role. The empirical analysis suggests that firms in business networks have superior access to long-term debts, short-term debts, trade credit and have more efficient working capital management and sufficient cash for investment. The effects of business networks on firms' access to financial resources are mediated by ownership of listed companies and nature of business networks. Furthermore, we find business networks affect firm performance negatively. Evidence suggests firms in business networks experience higher management cost. Ownership networks and collaboration networks, among three types of business networks, show to have significant influence over firms' management cost and performance. Interestingly, concentrated ownership acts as a mediator for network effects. Finally, this study also presents evidence that firms in business networks experience more volatile stock returns. In particular, network structures have significant influence over firm stock return volatility. To conclude, our study shows that business networks may induce both positive and negative effects, which provide insights to firm strategy-making in terms of engaging with business networks to achieve organizational goals.

Keywords: business networks, corporate finance, firm performance, corporate governance, stock return volatility

Contents

Acknowledgements: 7
Chapter 1 Introduction 9
1.1 Motivations 9
1.2 Research questions and objectives 18
1.3 Data and methodology 22
1.4 Preview of findings 24
1.5 Structure of the thesis 26
Chapter 2 Business networks in China 28
2.1 Introduction 28
2.2 A critical review on measuring business networks 33
2.3 Methodology 37
2.3.1 Definition of business networks 38
2.3.2 Data 40
2.3.3 Methodology of network measurement 44
2.4 Results and discussion 48
2.4.1 Whole network analysis 49
2.4.2 Networks composition 51
2.4.3 Individual network features 54
2.4.4 The role of state ownership 58
2.4.5 Discussion 62
2.5 Conclusion 64
Chapter 3 Do business networks help firms to finance? 89
3.1 Introduction 89
3.2 Business networks and the institutional environment in China 93
3.2.1 Business networks in China 93
3.2.2 Institutional environment in China 94
3.3 Literature and hypothesis development 96
3.3.1 Business networks and firms' access to debts 97
3.3.2 Business networks and firms' access to trade credit 100
3.3.3 Business networks and working capital management 102
3.3.4 Business networks and cash sufficiency 104
3.3.5 Business networks and ownership 105
3.3.6 Nature of business networks 106
3.3.7 The effects of network structure 108
3.4 Data and summary statistics 109
3.4.1 Data 109
3.4.2 Summary statistics 110
3.5 Empirical strategy 111
3.6 Results and discussion 114
3.6.1 Business networks and firms' debt financing 114
3.6.2 Business networks and trade credit 117
3.6.3 Business networks and working capital management 120
3.6.4 Business networks and cash sufficiency 122
3.6.5 Business network structure and firms' access to financial resources 124
3.7 Robustness checks and further analysis 124
3.7.1 The effect of business network affiliation on the supply and net position of trade credit 125
3.7.2 Business network affiliation and non-SOEs' short-term leverage 126
3.7.3 Alternative ownership measures 127
3.7.4 Endogenous treatment effects 127
3.7.5 Cross-sectional dependence 130

3.8 Conclusion ... 131
Chapter 4 Managing business networks: the role of concentrated ownership ... 180
4.1 Introduction ... 180
4.2 Background ... 184
4.3 Theory and hypotheses ... 186
4.3.1 Business network and firm performance ... 186
4.3.2 Business network and management cost ... 189
4.3.3 Nature of business networks ... 190
4.3.4 Corporate governance issue-concentrated ownership ... 192
4.3.5 The effects of network structure ... 195
4.4 Data and methodology ... 196
4.4.1 Data ... 196
4.4.2 Model specification ... 197
4.5 Results ... 199
4.5.1 Business network and firm performance ... 199
4.5.2 Business networks and management cost ratio ... 201
4.5.3 The effects of network structure ... 203
4.5.4 Robustness checks ... 204
4.6 Discussion and conclusion ... 206
Chapter 5 Business networks and firm stock return volatility ... 228
5.1 Introduction ... 228
5.2 Literature and hypothesis development ... 233
5.2.1 Related literature ... 233
5.2.2 Hypothesis development ... 236
5.3 Data and methodology ... 241
5.3.1 Data and construction of business networks ... 241
5.3.2 Model and variables ... 242
5.3.3 Descriptive statistics ... 245
5.4 Results ... 246
5.5 Discussion and conclusion ... 252
Chapter 6 Conclusion ... 269
6.1 Summary ... 269
6.2 Contributions ... 272
6.3 Limitations and future studies ... 277
References ... 2811

Table List:

Table 2.1: Percentage of listed companies sampled in each year 67
Table 2.2: Relationships accounted as a related party for listed companies 68
Table 2.3: Whole network features-listed company and related parties 69
Table 2.4: whole network features-listed company only 70
Table 2.5: Listed companies in networks across different controller types 71
Table 2.7: Network size for listed companies across industries 73
Table 2.8: Network size for listed companies across controller types 75
Table 2.9: Centrality of listed companies across controller types 76
Table 2.10: Structural hole of listed companies across controller types 77
Table 2.11: The percentage of listed companies in networks to listed companies in the market for private firms and SOEs in each year 78
Table 2.12: network size for SOE and private firms in each year 79
Table 3.1: Summary statistics of Chapter 3 136
Table 3.2: Univariate tests of Chapter 3 139
Table 3.3: Business networks and firms' access to debts 140
Table 3.4: Business networks and firms' access to trade credit 144
Table 3.5 Business networks and firms' working capital management 146
Table 3.6: Business networks and cash sufficiency 148
Table 3.7: Network structure and firms' access to financial resources 150
Table 3.8: Business networks affiliation and firms' supply of trade credit and net position of trade credit 152
Table 3.9: Further analysis on the role of business networks on non-SOEs' short-term leverage 156
Table 3.10: Business networks and firms' access to financial resources using alternative ownership measure 158
Table 3.11: Endogenous treatment effects correction 170
Table 3.12: Correction for cross-sectional dependence 172
Table 4.1: Descriptive analysis and summary statistics of key variables in Chapter 4 ... 211
Table 4.2: Business networks and firms' profitability 213
Table 4.3: Business networks and firms' management cost 215
Table 4.4: Effects of network structure 217
Table 4.5: Regression results using alternative measures 218
Table 4.6: Correction for cross-sectional dependence 224
Table 5.1: Summary statistics of key variables in Chapter 5 257
Table 5.2: Univariate analysis of Chapter 5 258
Tabel 5.3: Correlation coefficients amongst variables 259
Table 5.4: Business networks and firm return volatility using VOL1 260
Table 5.5: Business networks and firm return volatility using VOL2 261
Table 5.6: Regression results where the dependent variable is VOL3 262
Table 5.7: Business networks and firm return volatility controlling for non-stationary variables 263
Table 5.8: Dynamic GMM estimation results in Chapter 5 264
Table 5.9: Correction for cross-sectional dependence 265

Figure List:

Figure 2.1a: The evolution of business networks.......... 80
Figure 2.1b: The evolution of ownership business networks 81
Figure 2.2a: Listed companies in networks across key industries 82
Figure 2.2b: Listed companies in ownership networks across industries 83
Figure 2.3: Centrality for firms in different industries.......... 84
Figure 2.4: Aggregate constraint for firms in different industries. 86
Figure 2.5: Centralities for SOEs and private firms 87
Figure 5.1: Firm return volatilities during 1997-2011 267

Acknowledgements:

I am extremely grateful to my supervisors, Prof. Jun Du and Dr. Michail Karoglou. Without their inspiration, guidance and support from the beginning to the end of the work; I can rarely develop a comprehensive understanding of this topic and finish the research.

Moreover, thanks for comments from Young Finance Scholars conferences, which help the work to improve. The conference has provided a good communication channel for me to communicate the research to relevant scholars and senior academics. They have provided useful comments to improve the study.

I also offer my thanks to my dearest wife, Zijie Wang, and my son, Minghan Liang. During the research, they stayed with me and supported me in various aspects. Their supports have motivated me to have a sounded researching life.

Finally, I offer my thanks and blessings to all of those who supported me in any method during the completion of the research.

Chapter 1 Introduction

Chapter 1 Introduction

1.1 Motivations

There is an article posted on the Forbes website that discusses the extent of global corporate control. In his post, the author suggests there are 147 companies that control everything (Upbin, 2011). Based on a model of who owns what, the 147 companies control 40% of wealth in a network of 37 million companies and investors worldwide. Coffey (2011) examined the data and further points out that there are four companies that control the 147 companies that own everything. Similar statistics abound. For example, ten multinationals control almost all the world's food brands (Bradford, 2012). It can easily be seen therefore that firm interconnectedness is a common occurrence. As Granovetter (1985) suggests, firms are embedded in concrete, on-going systems of social relations rather than existing as single atoms outside of social contexts.

These impressive figures suggest that firms are enmeshed and linked by complex relationships or networks. Researchers have identified and investigated many such types of business network. For example, North American conglomerates (Davis et al., 1994), Japan's *keiretsus* (Gerlach, 1992), South Korea's *chaebols* (Chang, 2003), supplier networks (Jarillo, 1988), and alliance networks (Gulati, 1998). These types of business networks constitute our global economy.

Networks are particularly important for firms in emerging economies, such as China, where the institutional environment is relatively weak and the market is imperfect (Achrol & Kotler, 1999; Jia & Wang, 2013). In these environments, transaction costs such as finding cost, negotiation cost, and contracting cost are very high, and business networks can provide a mechanism to reduce transaction costs and their associated uncertainty (Achrol & Kotler, 1999). In networks, members are familiar with each other and exchange favors for the promotion of the organizational purpose (Gu et al., 2008). Through repeated interactions, norms and trust would be established, which govern networked firms' sharing and exchanging of expertise, information, knowledge, and resources. Disputes are resolved using network norms instead of formal laws, which are inefficient in many emerging economies (Jia & Wang 2013). Aside from gaining market-orientated benefits, networks are associated with superior information processing and flexible monitoring (Achrol & Kotler, 1999). Research literature on business groups (e.g. Lamin, 2013; Mahmood et al., 2011) also documents that business units affiliate in groups to pass each other resources and information, especially in emerging economies.

These inter-firm relationships are evident worldwide but are particularly popular in the emerging economies where the need for business networks is greater due to the prevalence of market failure and information problems (Manos et al., 2007). Business networks have been seen to be capable of filling institutional voids (Khanna and Palepu; 1997, 2000). For example, Japanese and Korean business groups are characterized by their superior capability of absorbing new technology, delivering stable financial performance, and achieving international competitiveness (Ma & Lu, 2005). In China, which is an emerging as well as a transition economy, firms extensively form business networks to exchange organizational purpose. China's deeply rooted culture system has fostered a boom in various types of relations that promote the development of business networks (Li, 2013). Evidence suggests that business groups in China have contributed to over 60% of its industrial economic output (Yiu et al., 2005), and Sha & Zeng (2014) indicate that over 50% of listed companies in China are involved in cross share-holding networks.

The prominence of various business networks is an important feature of the global economy (Lechner & Leyronas, 2009), and understanding business networks is key to understanding the global economy. The increasing number of network studies over time (Borgatti & Halgin, 2011) and the application of network linkages (Guler & Guillen, 2010) have outlined the importance of business networks. Firms construct linkages to effectively develop value-adding partnerships (Phusavat et al., 2010). Firms view connections with whom they are networked as being ranked among their own resources. By adopting and managing appropriate network strategies, firms can achieve or sustain competitive advantages (Pablos, 2005). For example, Lenovo has achieved significant success by managing its relationship with its partners and competitors (Shen & Wu, 2004). It has managed to establish marketing channels, gain managerial expertise, access new technological advancements, and obtain advantages in taxes and finance through establishing relationships with partners, universities, and governments respectively. Literature on networks (e.g. Park & Luo, 2001; Lee, Pae & Wong, 2001) has argued that network affiliations are positively related to sales growth, market expansion performance, firm efficiency, and operating performance.

It is important for firms to adopt the appropriate network strategy as network connections are crucial and can even determine the survival and growth of the firm. Goplan et al. (2007) investigate the role of business groups and indicate that the main function of a business group is to support firms in crisis. He et al. (2013) also suggest that firms in business groups in China are less at risk of going bankrupt. Colli et al. (2015) point out that affiliating into business networks is an important force for growth. It is therefore argued that firms with the appropriate network strategy can achieve growth and are less likely to go bankrupt.

Given the importance of business networks for business units, the relationship between business network affiliation and firm performance is widely researched in emerging economies (Lee et al., 2008; Ramaswamy et al., 2012). However, ambiguity exists about the net advantages of business networks since business networks have both bright and dark sides. The existing literature reports mixed findings with regard to performance implications. On the one hand, numerous studies (e.g. Jensen & Schott, 2014; Markoczy et al., 2013; Wang et al., 2015; Guest & Sutherland, 2010) have reported the benefits of joining various business networks. They argue that business networks such as business groups may fill institutional voids that are common in emerging markets, particularly in the transition economies (Guest & Sutherland, 2010). Business networks can enhance firm performance as affiliation allows firms to internalize market transactions to reduce transaction cost, provides superior access to scarce resources, and introduces firms to value-creating relationships (Carney et al., 2009). With more internalized transactions in business groups, the affiliates may be more likely to access raw materials and intermediate goods (Khanna & Rivkin, 2001). By affiliating to business networks, superior access to scarce resources provides for higher combinative potential and increases the ability of firms to respond flexibly and efficiently to market demand (Ahuja et al., 2008).

On the other hand, business networks also involve affiliates in costs that may negatively affect their business performance. Isobe et al. (2006) argue that affiliates may suffer from the liabilities of business groups. For example, a business group's bad reputation is a liability for an affiliate that would otherwise be unaffected, and its performance will therefore be impaired rather than improved. Moreover, even though internal lending among member firms may mitigate the exigencies of the affiliates' cash flow pressures, it is also a primary source of endless "triangle debts" and will overall have an adverse impact on the performance of affiliates (Peng & Luo, 2000). Furthermore, the complexity of the business group's ownership structure poses significant governance challenges, and thus increases management costs for business groups (Gaur & Kumar, 2009).

The extent of the mixed findings on the consequences of business network affiliation presents a valuable opportunity for future research. Given the popularity and importance of business networks, the ambiguity of the consequences of affiliation poses challenges for firms, who must adopt appropriate network strategies. Given the embeddedness of firms in complex network relations (Granovetter, 1985), understanding the impact of business networks is vital for firms. However, the mixed results seen in the research constrain our understanding of the role of business networks and may lead to firms' misusing network strategies, which may negatively impact on firm performance. Therefore, it is of significant importance for academics and firms to have a more reliable and accurate knowledge of the role of business networks. With a more complete understanding of business networks, firms can guide their adoption of network strategies to achieve their organizational goals and gain competitive advantage.

We therefore set out to generate a more reliable and comprehensive understanding of the nature of business networks by clarifying their role and how they work for firms.

First of all, we argue that since business networks are contextually sensitive (Adler & Kwon, 2002), the way in which we define business networks is crucial to determining network effects. The first step in examining networks is for the researcher to define the network by choosing a set of actors and relations. Different definitions of business networks could produce different results and creating a good definition of business networks is key. However, due to data limitation, previous studies have investigated only individual types of firm relationships (Chen & Xie, 2011; Duysters & Lemmens, 2003; Khanna and Rivkin, 2001). Such incomplete definitions of business networks cannot capture a representative network. An increasing number of network studies have explored various inter-firm networks. For example, business groups (e.g. Garney et al., 2009), corporate networks via interlocks (e.g. Ren et al., 2009), cross-shareholding networks (e.g. Li et al., 2014), and alliance networks (e.g. Wu et al., 2010) are all popular networks to study. These definitions either include unnecessary actors or exclude important relations, which constrains our understanding of business networks among firms. We therefore set out to establish a good definition that includes important and popular cross-dimensional relations between firms. To have a more complete definition of business networks, this research uses ‘related relations’ to capture all the important connections between firms, including relations from ownership, relations from collaboration, and relations from key individuals.

Secondly, prior studies were hampered by a lack of sufficient quality data and were thus unable to disclose an overall picture of business networks (Ren et al., 2009; Li et al., 2014). Data limitations meant that previous studies either used a small sample or one specific to a single industry (Wu, 2015; Carney et al., 2009). Most studies investigate networks on the basis of a single year, neglecting the dynamic nature of these networks (e.g. Li et al., 2014; Wang, 2008). In order to capture the configuration of business networks underlying the national economy, a quantitative presentation of business networks and their evolution is needed (Li et al., 2014). Our research constructs business networks via related relations from a database that includes all the listed companies in China over a 15 year period. We outline the features and dynamics of the firms to gain a direct impression of business networks. In this way, a more reliable and accurate understanding of business networks can be generated.

Thirdly, the empirical results of research into the impacts of business networks are mixed and a consensus has not yet been reached about the net effects of business network affiliation (He et al., 2013). It cannot however be assumed by researchers or firms that business networks have only an upside to affiliation (Byun et al., 2013). The negative effects of business networks are increasingly being reported (Gaur & Kumar, 2009; Singh & Gaur, 2011; Byun et al., 2013) leading to the raising of a fundamental question: why and how do business networks survive and continue to grow (Masulis et al., 2011)? Adopting a network strategy imposes significant challenges for firms and it is important to investigate the benefits and expenses of business networks given the changing environment. The current literature has extensively examined the financing advantages of business networks in investigating the role of business networks on firms' debt financing (Byun et al., 2013; Mulyani et al., 2016; Manos et al., 2007; Chakraorty, 2013) and internal capital markets (He et al., 2013; Gopalan et al., 2007; Buchuk et al., 2014). Researchers expected to find that business networks help firms to finance but the empirical results are mixed (Byun et al., 2013; He et al., 2013). Moreover, debt and the internal capital markets are not the only aspects of firm finance. There are other important channels of firm financing such as trade credit and working capital management. It is essential to have a more detailed and accurate knowledge of the role of business networks on firm finance since having sufficient capital is crucial for firms and can even determine their survival (Bridges & Guariglia, 2008; Clarke et al., 2012). With more accurate knowledge of the role of business networks on firm finance, firms can confidently adopt network strategies to help them to obtain finance and achieve their organizational goals. This study expects to generate a more complete and accurate understanding of the role of business networks on firm finance by investigating many aspects of firm finance, constructing more inclusive networks, and using a more reliable sample. In this way we hope to partially answer the question raised above.

Fourthly, since business networks are contextually sensitive (Adler & Kwon, 2002), it is important to consider how institutional factors and the nature of business networks affect the role of business networks. Many studies have investigated the role of state ownership on network effects (e.g. He et al., 2013; Liu et al., 2016), however there remains ambiguity. For example, He et al. (2013) suggest that the internal capital markets are more pronounced among State Owned Enterprises (SOEs) while Liu et al. (2016) claim that the effects of business networks are more pronounced among private firms. The role of ownership in business networks remains an open question, which is a significant lacuna given the importance of state capitalism in China (Lee & Kang, 2012). Thus, it is essential to study the role of ownership on the effects of business networks. When we look at business networks in China, we cannot neglect the role of SOEs since SOEs are often the main players in the market (Lee & Kang, 2012). Indeed, the existence and prominence of SOEs in the market is an important feature of the Chinese economy (Liu et al., 2016). Without considering the role of state ownership on network effects, our understanding may be incomplete and immature. Knowledge about the role of state ownership on network effects helps us to achieve a more reliable and meaningful understanding. We also need to establish whether or not the consequences of business networks are felt more strongly by SOEs. In this study we investigate how network composition and the financing advantages of business networks are mediated by firms' state ownership. In this way we hope to achieve a more complete and reliable understanding of business networks.

Apart from institutional factors that may influence network effects, it is important to investigate the role of how different networks work differently for firms. The nature of business networks matters because different types of business networks can produce different results. For example, Kuo & Wang (2015) indicate that alliance network linkages positively affect financial leverage. However, family firms have been found to be less likely to finance using leverage, which reduces their fixed cash flow commitments and default probabilities (Jensen, 1986; Shleifer & Vishny, 1986; Faccio et al., 2001). Accurate knowledge of how the nature of business networks shapes the role of business networks will help firms to adopt a more precise network strategy enabling them to achieve their organizational goals. Without such knowledge, firms can easily misuse network strategies and therefore be less effective at achieving their goals. Despite the importance of having this knowledge, the literature is relatively blank and, to the best of our understanding, there is no study investigating the role of the nature of business networks. This study constructs ownership networks, collaboration networks, and individual networks in order to examine the impact of the nature of business networks.

Fifthly, as we mentioned above, business network affiliation can be a blessing or a curse for a firm. Even though many studies have investigated the net effects of business networks, the literature's findings, both theoretically and empirically, are mixed concerning the relationship between business networks and financial performance. Indeed, the benefits of business networks can often go unrealized due to various offsetting costs (Claessens et al., 2006; Lee et al., 2008; Carney et al., 2011). It is essential to understand the ultimate effects of business networks, taking the benefits and costs fully into account. This will guide firms when they are adopting network strategies. The current state of ambiguity may lead to confusion for firms and it is necessary to find a new perspective to clarify the effects of business networks. Previous studies heavily focused on institutional aspects with little academic attention being given to the management costs for firms in business networks. This study provides an explanation of how firm performance is influenced by network affiliation using the effects of business networks on firms' management cost. We believe this new approach to be superior as it considers the costs of business networks, thereby providing a more complete and accurate understanding of business networks.

Sixthly, given the importance of business networks on firm performance, it is necessary to understand how firm strategy may also play a part in maximising returns from network affiliation. Many studies have investigated the performance implications of business networks, but there is little research examining the strategies of network affiliates (Carney et al., 2011). Thus, it is unclear whether a firm's strategies can affect the relationship between affiliation and financial performance. We have examined this in the context of firm governance by way of its ownership concentration, with particular regard to how ownership concentration mediating the relationship between network affiliation and firm performance could improve our knowledge about the relationship. With an understanding of how firm strategy can affect network effects, practitioners and academics can figure out ways to adjust the network effects in order to achieve organizational goals.

Seventhly, prior studies have investigated the drivers of stock return volatility in terms of fundamental factors and trading-volume based factors (Zhang et al., 2010). There are no prior attempts to investigate the role of informal contracts, such as business networks, on stock return volatility. Given the importance of the understanding of stock return volatility in emerging economies (Mahender et al., 2014) and the popularity of various business networks in emerging markets (He et al., 2013), it is essential to examine whether there is a link between business network affiliation and stock return volatility. The two most recent financial crises (the Asian financial crisis in 1997 and the more recent global financial crisis in 2008) with their concomitant shockwaves for investors and a higher degree of stock return volatility have prompted research seeking to identify the factors that determine firms' return volatility. By directly linking business network affiliation and firm stock return volatility, this study identifies the role of informal contracts between firms on firm stock return volatility. This knowledge has important implications for firms and policy-makers as both firms and policy-makers are sensitive to stock return volatilities.

Finally, previous studies have extensively investigated the role of business network structure on firm performance (Chen & Xie, 2011; Sha & Zeng, 2014). There has however been little academic focus on the effects of business network structure on stock return volatility. Since different network structures empower firms with different network effects, an understanding of the role of business network structure on firm return volatility is essential in guiding firms' network strategies. Moreover, previous studies have focused on the effects of network position (Chen & Xie, 2011) whereas we need studies that investigate a relatively wide set of network structures to advance our understanding of network structure. This study investigates how firm stock return volatility is affected by network structures using a relatively wide set of network structure measures including network size, network diversity, network position, and network dominator. With this knowledge, we are able to have a more complete understanding of the effects of network structure.

1.2 Research questions and objectives

Given the limitations and gaps mentioned above, this research aims to outline business networks among firms and investigate the consequences of these business networks. As firms are embedded in complex relations which constitute their networks, it is important to have a comprehensive understanding of these business networks. Moreover, it is essential to know the impacts of these business networks for firms. As business networks are particularly prominent in the emerging economies, it is critical to find an explanation for firms' motivations to affiliate into business networks. This study aims to explain firms' network choice by examining the benefits of business networks for firms. After reviewing the benefits, this study further investigates (i) the cost of business networks and (ii) the market response for firms in networks, to generate a complete understanding of the effects of business networks.

This research formulates several research questions to generate a thorough knowledge of business networks and their consequences. (1) What are the features of business networks in China and how they are evolving over time? (2) Do networks help firms to obtain finance? (3) What is the relationship between business network affiliation and firm performance, and how does concentrated ownership affect this relationship? (4) What are the effects of business network affiliation and network structure on firm stock return volatility?

Through these research questions, this research expects to shed light on business networks and their consequences. More specifically, this research attempts to achieve the following objectives.

(1) Identify and disclose important connections among firms to capture the way in which business networks underlie the national economy.

This study sets out to construct business networks that capture only the important relations among firms. We use related relations to define business networks, i.e. relations that either control or significantly influence firms' policy and decision-making (Michele, 2013). We believe that this approach is superior compared with the definitions used in prior studies, such as alliance networks (Gulati, 1998) and business groups (He et al., 2013). Our definition excludes connections that have less significant influence over network members and includes many relations that are widespread in the market. The completeness of this definition provides excellent coverage of ownership relations, collaboration relations, and relations derived from key individuals. The definition is superior at capturing business networks generally in the market.

(2) Outlining and presenting the features of business networks and their dynamics

This study constructs business networks using related relations from 1997 to 2011 to achieve a complete understanding of business networks in the market. We adopt a quantitative method to describe the features of business networks and their dynamics with regard to industry sector and ownership, which is not something that has been previously seen in the literature (Li et al., 2014). Through a systematic descriptive analysis of business networks in China, this research discloses the features of business networks, business network composition, and some individual network features of business networks in China. This study also visualizes business networks and their dynamics to have a more direct understanding by using network analysis software.

(3) Explaining why firms choose to be involved in business networks

This study partially contributes to the question about the prominence of business networks by investigating the effects of business networks on firms' access to financial resources, particularly in an environment of improved institutions and increasingly reported adverse effects (Singh & Gaur, 2009; Byun et al., 2013). Based on the network definitions we constructed, this research investigates the role of business networks in firms' debt financing, access to trade credit, working capital management, and cash sufficiency to provide evidence that firms in business networks gain advantages in financing. It helps to explain the benefits of business networks in the changing environment and helps firms to choose an appropriate network strategy.

(4) Explaining how the financing advantage for firms in business networks is affected by institutional factors and the nature of business networks.

This study further investigates the role of institutional factors and the nature of business networks in the relationship between network affiliation and firms' access to financial resources. This enables us to have a comprehensive understanding of the financing advantages of business networks for affiliated firms. The importance of state capitalism in China and the mixed results of the role of business networks for SOEs motivated a further study that looks at how state ownership affects the role of business networks in firms' access to financial resources. As network effects are contextually sensitive (Adler & Kwon, 2002), the nature of the business network is relevant since different networks may have different network effects. By examining how SOEs and the nature of the business network shape the effects of business networks on firms' access to financial resources, this research generates an improved picture of business networks' financing advantage for firms.

(5) Examining the net effects of business networks on firm performance and explaining how business networks affect firm performance.

To obtain the net effects of business networks, this study investigates the relationship between business networks and firm performance with regard to profitability. Given the mixed results in the literature about the performance implications of network affiliation, the effects of business networks on profitability deserve additional investigation. However, this research goes further by investigating the effects of business network on firm performance with reference to firms' management costs. We are therefore able to explain in more detail how business networks affect firm performance.

(6) Identifying the effects of ownership concentration on the relationship between business networks and firms' management cost as well as firm performance.

This study continues to research the relationship between business networks and firm profitability, and the relationship between business networks and firms' management cost, by examining how concentrated ownership can mediate the effects of business network affiliation on management cost and firm performance. Understanding how ownership concentration helps firms to manage the cost of affiliating to business networks complements our understanding of business networks. It also has strong managerial implications for guiding firms in managing business networks.

(7) Investigating the market response for firms in business networks

To investigate the market response for firms in networks, this study examines the relationship between network affiliation and firms' stock return volatility. As firms are increasingly involved in business networks, they become exposed to other network members and this may affect firms' stock return volatility. Previous research findings in this area have been ambiguous. Given the importance of firm stock return volatility and the prominence of business networks in the emerging economies, research investigating the role of business networks on firm stock return volatility is essential. Moreover, by investigating how network structures affect firm stock return volatility, we can achieve an improved understanding of business networks as well as of stock return volatility. Our research has important implications for firms seeking to attract investors since firms can use our findings to steer their strategy towards their investors' tolerance of risks. An understanding of the relationship between business networks and firm stock return volatility also has strong implications for policy setting.

1.3 Data and methodology

We employ CSMAR (China Stock Market & Accounting Research) database and Datastream database. In this study we use the data to identify business networks, key financial indicators, and stock prices of listed companies in China. The data spans from 1997-2011. In total, five datasets are used, namely: listed company related party information data; listed company related party transaction data; listed company financial indicator data; listed company governance data; and listed company stock price data. The first two datasets are used to construct business networks using related relations. We use the data to generate network information for listed companies, we then merge this data with the remaining three datasets respectively to build the data used in each chapter. Using these data, we have outlined the characteristics and dynamics of business networks in China, and further investigate the consequences of these networks on firms' financing, performance and return volatility.

We use listed company related party information data, listed company related party transaction data and listed company financial indicator data to identify the business networks among listed companies and to outline the networks' characteristics and dynamics. Using several measures developed by previous network studies, we outline characteristics at both network level and firm level. We look at network size, network density, average degree, centrality, and structural holes, and use network analysis software to analyse the networks. We use summary statistics of network variables by industry and ownership type during the period to generate an improved understanding of business networks and their dynamics, which provide the background to the remaining chapters.

Taking this knowledge of business networks and their dynamics in China, we further investigate the impacts of business networks on firms' access to financial resources. By employing listed company related party information data, listed company related party transaction data, and listed company financial indicator data, we can model the effects of business networks on firms' access to debts, trade credit, working capital management, and cash sufficiency using a micro-econometrics modelling approach. The models are estimated using fixed effects, which are widely employed in the literature. To control for potential endogeneity, we control for endogenous treatment effects. For robustness checks, several alternative measures of the dependent variable as well as explanatory variables are used to provide extra comfort for the findings. We also control for cross-sectional dependence to provide confidence that our results are reliable.

After nuancing the benefits of business networks, we further examine the relationship between business networks and firm performance, and investigate how ownership concentration affects this relationship. Using listed company related party information data, listed company related party transaction data, listed company financial indicator data, and listed company governance data, the study models the impacts of business network affiliation on firm performance and firms' management cost. Moreover, by investigating the interaction effects of business networks and concentrated ownership, this work investigates the mediating effects of concentrated ownership on the relationship between business networks and firm performance as well as on firms' management cost. The literature and data structure suggest fixed effects to estimate these models. We also provide extra comfort for the results by using alternative measures of firm performance and ownership concentration and controling for cross-sectional dependence.

Finally, this study investigates the relationship between business networks and firm stock return volatility. Adopting listed company related party information data, listed company related party transaction data, listed company financial indicator data, and listed company stock price data, we model the effects of business networks on firm stock return volatility and estimate them using fixed effects. Three measures of firm stock return volatility are constructed in order to provide confidence in the results. To control for the potential endogeneity problem, dynamic GMM is used to provide additional comfort for the results. We also control for cross-sectional correlations to provide additional confidence for the results.

1.4 Preview of findings

First of all, we constructed business networks via related relations among listed companies in China. We examined the characteristics and dynamics of these business networks. We found that the number of firms in business networks has expanded considerably during the study period. Notably, the development of business networks in China is uneven and is shaped by the development of its economy. Firms in major industries and SOEs are actively involved in the process. Moreover, we provide new insights into the debate of "the state advances and private retreats." Regarding network perspective, we note that SOEs are expanding their influences through network size and network centrality while private firms are relatively stalled or even shrinking.

Based on the network constructed, this research investigated the role of business networks in firms' debt financing, access to trade credit, working capital management, and cash sufficiency. The empirical results suggest that firms in business networks have superior access to long-term debts, short-term debts, and trade credit; they also have more efficient working capital management and sufficient cash for investment. Moreover, we find that the effects of business networks are mediated by institutional factors, the nature of business networks, and network structure. Evidence shows that SOEs in business networks have better access to debts and trade credit while non-SOEs in networks have more efficient working capital management and sufficient cash. Among ownership networks, collaboration networks, and individual networks, individual networks have the largest marginal effects while collaboration networks are less significant in influencing firms' access to financial resources. A central network position and tight network structure are both positively related to firms' access to financial resources.

By investigating the relationship between business networks and firms' management cost as well as firm performance, we find that business networks affiliation is negatively related to firm performance. The empirical analysis suggests that firms in business networks experience higher management cost. Across the three types of business network, ownership networks and collaboration networks are found to have significant influence over firm performance in terms of profitability and firms' management cost. Concentrated ownership is found to significantly affect the relationships between business networks and firms' performance and management cost. Central network position is negatively related to firms' performance and the presence of structural holes is positively related to firms' performance.

Finally, this study inspects the effects of network affiliation and network structure on firm stock return volatility. We find that firms in business networks are more volatile than are free-standing firms. Additionally, the results show that network size and network diversity exhibit an inverted U shape relationship with firm stock return volatility. The central position is positively related to firm stock return volatility while the intermediate position is negatively related to firm stock return volatility. Moreover, we also find that firms in SOE dominated networks are more volatile than those not.

1.5 Structure of the thesis

The thesis reports the characteristics and impacts of business networks using China as the empirical setting. The whole thesis consists of six chapters with the first chapter introducing the motivations for research, the research questions, the methodology and main findings. In the next chapter, we provide an overview of business networks in China to outline the dynamics and features of business networks. This chapter is descriptive in nature to give a background for the empirical studies that follow. The third chapter investigates the role of business network affiliation on firms' access to financial resources. This chapter outlines the potential motivations that prompt firms to participate in networks. The fourth chapter examines profitability, the management costs incurred by firms in business networks, and how concentrated ownership can mediate network effects. The fifth chapter inspects the impacts of business network affiliation and network structure on firm stock return volatility, and the sixth chapter concludes.

Chapter 2 Business networks in China

Chapter 2 Business networks in China

2.1 Introduction

China has achieved rapid economic growth and since 2011 has been ranked second only to the U.S. (Ling & Li, 2012). After it introduced economic reform, its economy started to take off, and according to World Bank figures, its GDP increased to $11.199 trillion in 2016. It is in a special position because it is an emerging as well as a part transition economy (Peng et al., 2008). In 1992 China started its economic reforms at the firm-level and introduced several significant changes, such as transferring state-owned enterprises (SOEs) into private ownership. The aim was to privatize SOEs to maximize profitability, improve efficiency, and increase managers' decision-making autonomy (Chen et al., 2008). However, SOEs maintained ultimate control of the economy. This situation constitutes what the authorities call a socialist-market economy (Lin & Zhu, 2000). The uniqueness of China's economy has attracted ongoing interest into the underlying factors behind its rapid growth.

During China's institutional transition, Chinese business became widely known for its extensive use of guanxi (a Chinese word for connections) and network strategies (Ren et al., 2009). Formally, guanxi refers to the dynamics of personal exchanges inside and outside a social network (Parnell, 2005). It comprises relational connections and links between individuals and groups (Lau & Young, 2013). In this study, we define business networks as inter-firm networks. Business networks in this study is a set of firms connected by a certain types of guanxi. The importance of guanxi for business in the Chinese economy are broadly acknowledged (Li et al., 2008; Li & Zhang, 2007; Lau & Young, 2013). Firms are heavily reliant on guanxi to gain a competitive advantage (Li & Zhang, 2007). The concept is deeply embedded in China's culture and helps firms to mobilize complementary resources by bridging different networks and even potentially negotiating between competing networks (Peng & Luo, 2001). While the current literature heavily focuses on the importance of guanxi, there has been limited academic focus on the mechanics of the underlying configuration of China's network economy (Ren et al., 2009).

As China continues its economic reform, guanxi utilization is increasingly extensive at the firm level, which reflect networks among organizations (Peng & Luo, 2001). The literature mainly discusses guanxi at a personal level (Lau & Young, 2013; Peng & Luo, 2001), disregarding the firm-level guanxi that is crucial to promoting the development of business networks. In this study, business networks are firms with guanxi relationship as guanxi is a broader concept. It consists of various types of relations and links (Lau & Young, 2013). However, firms with guanxi relationship do not necessarily constitute business networks mentioned in this study as we do not take all guanxi relationships to construct business networks in this study. The business network in this study is a narrower concept as it only involves firms and some related relations. We only account for those reliable and stable relations such as parent, subsidiary relations to construct a representative business network. There are studies that define business networks using informal guanxi among firms, such as the CEO's friendship network (El-Khatib et al., 2015). We argue that these informal relationships among firms are less reliable and vulnerable to changes. For example, both a firm's CEO and his/her friends may change at any time. In our study we capture firm-level relationships that are more transparent and contractual (official and verbal), which will be discussed later in the next section. We believe that these relationships are more helpful in constructing business networks and generate reliable understanding of business networks.

As was outlined in the first chapter, the importance of guanxi in China was such that the Chinese economy has been referred to as a relationship economy. China's inter-organization networks are important components that make up the relationship economy. Without a thorough understanding of the configuration of business networks, our understanding of China's economy is incomplete.

Business networks are particularly important for firms in emerging economies such as China's where the institutional environment is relatively weak and the market is imperfect (Achrol & Kotler, 1999; Jia & Wang, 2013). In an underdeveloped market, business networks are associated with superior information processing and flexible monitoring (Achrol & Kotler, 1999), both of which appeal to business units. Business networks help affiliates to reduce transaction costs and peer uncertainty (Achrol & Kotler, 1999). Moreover, as suggested by the resource-dependence theory (Hillman et al., 2009), networked firms tend to release constraints and obtain access to key resources such as expertise, finance, and advice. Establishing relationships with other organizations enables the focal firm to access external resources. Business networking strategies are extensively used by business units to overcome market failure (Leff, 1978). Literature has documented the positive role of business networks in helping firms to gain scarce resources, foster firm growth, and achieve competitive advantage (Li et al., 2008). Many empirical works have demonstrated that network connections increase firm performance in China and other emerging economies (Peng & Luo, 2000; Li et al., 2008). Consequently, it is important for academics and practitioners to have an accurate understanding of business networks within the market, particularly in emerging economies.

It isn’t just the business units that have embraced business networks. Since 1987, the state has signaled its favor for various business networks such as business groups (Carney et al., 2009). In 1991, the national trail group was established to share resources and protect them from competition (Nolan, 2001). Business networks have assisted in the development of the national economy and have significantly contributed to it. Sha & Zeng (2014) suggests that over 50% of China’s listed companies are involved in cross-shareholding networks. Yiu et al. (2005) find that business groups have contributed over 60% of the nation’s industrial output. Many studies have indicated the prominence and significance of business networks (Peng & Heath, 1996; Peng & Luo, 2000; Park & Luo, 2001). Understanding China’s business networks aids knowledge of the country’s economy and its capitalism (Ren et al., 2009; Aguilera, 1998). Thereby, it is necessary to study business networks to have a better understanding of the country’s economic achievement.

Given the importance and popularity of business networks in the practice of business in China and other emerging economies, a thorough understanding of them is crucial. Even though there are many studies investigating business networks in China, there are knowledge gaps and limitations which may impede our understanding of business networks. First, previous studies have used relatively vague definitions of business networks, which limits our understanding of the configuration of such networks in the economy. Business groups (e.g.

Carney et al., 2009), collaboration networks (Wu et al., 2010), interlock directorship networks (e.g. Ren et al., 2009), trading networks (Cohen-Cole et al. 2014) are popular networks studied in the literature. However, the definitions of each of these business networks have limitations. The studies are either concerned with very narrow types of relationships, or they investigate weak connections. The limited definitions fail to generate a representative sample of business networks in the market. Further, the results generated may be less than reliable as network effects are contextual sensitive (Adler & Kwon, 2002). A broad definition that incorporates critical and popular connections between firms is necessary for a reliable understanding of the configuration of business networks. We expect to contribute to the literature by proposing a new approach to constructing business networks, which is to define business networks using related relations. A related party is an agent that controls or significantly influences the listed company's policy and decision-making (Michele, 2013). Our definition of business networks provides us with a more representative sample and consequently helps to generate a complete and reliable understanding of business networks.

Additionally, due to data limitation, it is arguable whether the findings about business networks are reliable. The emerging literature about China's business networks largely relied on the examination of individual network structures in a cross-sectional setting (e.g. Chen et al., 2011; Sha et al., 2014) while failing to comment on the dynamics of business networks. Thus, a study that explores the whole network structure over a period of years is necessary to enhance the understanding of the network economy and its evolution. Burt (2002) suggests that 90% of the relationships between counterparties disappear in a year. As business networks evolve all the time, trying to understand them statically leads to incomplete or even biased findings. Therefore, it is important to study them dynamically by using panel data to investigate them. In this study, we construct business networks from 1997 to 2011, and analyze the dynamics of business networks; this gives us a thorough understanding of business networks in China. Our grasp of the features and dynamics of business networks in China also potentially contributes to the relatively under-studied area of business networks generally, including the causes of and motivations for joining in this type of networking activity (Lockett et al., 2012).

Moreover, prior studies (e.g. Wu & Lou, 2010; Schilling & Phelps, 2007) primarily rely on samples that are either relatively small or are limited to specific industries. Thus, the knowledge generated may be less representative. Consequently, a complete understanding of inter-organizational networks among Chinese firms at the national level is needed (Ren et al., 2009). Firms do not all network in the same way; some may remain largely isolated, others may cluster in separate alliances or the network may have a core-periphery structure. Understanding the structure of the firms' networks is of particular importance for policymaking (Vitali et al., 2011). Narrow data limits the general applicability of our understanding since business networks are contextually sensitive (Adler & Kwon, 2002). In this study, we use 15 years of panel data for companies listed on the Shanghai and Shenzhen Stock Exchanges to investigate business networks in China.

Lastly, even though the prominent role of SOEs in China has been highlighted extensively (He et al., 2013; Ma et al., 2006), there is no prior study that analyzes state capitalism in China from a network perspective. Given the prominence and importance of business networks in China (He et al., 2013; Singh & Gaur, 2009; Carney et al., 2009) and state capitalism (Lee & Kang, 2012), it is crucial to look at the role and dynamics of SOEs in business networks. By comparing the roles of SOEs with those of private firms in business networks, we can gain an improved understanding of state capitalism in China. Since state capitalism is an important feature of China's economy, this study helps to generate an improved understanding of China's economic achievement.

In this chapter, we are going to construct listed company networks using related relations in China, and investigate the features and dynamics of these networks. Using data from 1997 to 2011, we expect to reveal the configuration of business networks in China and shed light on its state capitalism. By describing business networks at the individual and network levels, we are able to generate a thorough understanding of the characteristics and dynamics of business networks. This knowledge gives us a degree of background information, and contributes to an understanding of the impact of business networks on the economy and elsewhere, which will be examined in the following chapters.

In order to systematically understand business networks in China, we first provide a critical review on the measurement of business networks, and outline the possible limitations of prior studies. This is followed by the presentation of the methodology used in this study. Next, we present our findings and discussion. Finally, the conclusion and research limitation are presented to shed light on avenues for future research on business networks in China.

2.2 A critical review on measuring business networks

To know what a business network is, we need to first know what a network is. A network consists of a set of actors, and the relationships that link them (Borgatti & Halgin, 2011). Depending on the definition of relationships, researchers can investigate different types of networks. For example, social networks refer to networks connected through social relations that include social obligations, kinship obligations, or a past relationship with social entities (Granovetter, 1985). The researcher must therefore start by defining the network to be studied by choosing a set of actors and relations (Borgatti & Halgin, 2011). In this study, we describe business networks as inter-firm networks.

In general, there are two categories of relations: state relationships and event relationships (Borgatti & Halgin, 2011). State relationships have continuity over time and an open-ended persistence (Borgatti & Halgin, 2011). Kinship relations and role-based relations are examples of state relationships. In contrast, event relationships have a discrete and transitory nature and we can enumerate them over periods of time (Borgatti & Halgin, 2011). Examples of event relationships are transactions and e-mail exchanges. Event relationships are widely researched since the data are easy to collect. As technology advances, the study of state relations has increased.

Since firms in the market operate in complex business relationships, there are many types of business networks among firms, which vary depending on the definition of relations. An increasing number of networks studies have explored various inter-firm networks, such as business groups (e.g. Garney et al., 2009), corporate networks via interlocks (e.g. Ren et al., 2009), cross-shareholding networks (e.g. Li et al., 2014), and alliance networks (e.g. Wu et al., 2010). In this section, we are going to briefly discuss some of the most studied networks and outline the strengths and weaknesses of their definitions.

Business groups refer to “a set of firms which, though legally independent, are bound together by a constellation of formal and informal ties and are accustomed to taking coordinated action” (Khanna and Rivkin, 2001). Business groups are widely investigated, particularly in emerging economies where they have a prominent role in filling institutional voids (Khanna and Palepu; 1997, 2000). However, this definition may vary in different contexts. Business group studies in China usually take the definition issued by the National Statistics Bureau of China: namely, a set of legally independent firms that are partly or wholly owned by a parent firm or registered as affiliates of that parent firm (Lee et al., 2012). Using different definitions of business groups causes problems when comparing results across countries. Clearly firms in business groups as defined in China connect through ownership. Resource and information sharing are effective and efficient in these networks since ownership ensures if not direct control then at least significant influence. However, this business group definition naturally excludes many relations that also have significant influence, for example, partnership relations. The definition is limited to a sole type of relationship, which is ownership, and means that the research findings may not be transferable to other more generalized types of business networks.

Listed company cross-shareholding networks are networks of listed companies connected by holding shares in each other’s companies (Sha & Zeng, 2014; Li et al., 2014). In this definition, listed companies create stock-holding links to other listed companies. However, the definition is weak because it also includes listed companies that are linked through owning only a tiny number of shares of the other listed companies. Without significant ownership, the listed company cannot have significant influence over the connected listed company. The definition therefore may include many superfluous actors and relations with highly inefficient information or resource sharing, or mobilization. Study of these actors and relations is meaningless since they have little influence over each other. Moreover, as the definition is associated with ownership, it naturally excludes more meaningful connections that fall short of ownership. By and large, this definition of business networks may include some weak connections and exclude more relevant and widespread connections, which will bias our understanding of business networks in general.

Listed company interlock directorship networks are defined as those listed companies that share at least one board-level director (Chen & Xie, 2011, Li, 2012). It is a commonly seen network, defined via key individuals. In listed companies issuing A shares in China in 2007, over 84% of them had interlocking directors constituting corporate networks (Lu et al., 2009). Another form of business networks is the CEO network. These are networks of firms with connected CEOs (El-Khatib et al., 2015). This is a particularly weak form of connection since the key individual may leave the firm at any time and may in any case be less than influential within the organization. For example, the press and public criticize some independent directors of listed companies in China for not actively working in the company and merely taking up a seat on the board (Chen et al., 2011). They may not therefore effectively link firms together. The grouping is theoretically useful in that it captures many firms in networks; however it can have little practical impact if the many alleged connections do not actually have a significant influence on each other. Further, since only key individuals come under the CEO umbrella, the definition excludes many important relationships between firms and this may constrain our understanding of business networks in general.

Trading networks are defined as companies linked by at least one shared transaction (Cohen-Cole et al., 2014). These transactional networks are a form of event relationship. Networks defined through trading can capture many actors, generating a whole picture of business networks. However, as transactions are discrete, these relationships are not stable. Consequently, it is less likely that all the firms in these networks have significant influence over each other.

Production facilitators such as suppliers, distributors, and other institutions form production networks (Wu et al., 2015). A typical example of a production network is a supply network formed via integrated supply and production systems (Bezuidenhout et al., 2012).

These networks capture relations in the production process and assist our understanding of production. However, it excludes relations outside of production, and includes many insignificant relations. For example, a firm that is party to a joint venture may be excluded from its collaborator's network because it does not participate in the firm's production system. Such networks are beneficial to the understanding of production but are less effective at capturing business networks in general. An understanding generated from production networks may be less reliable or even biased when applied to general business networks because of the contextual nature of network effects (Adler & Kwon, 2002).

Alliance networks are established through strategic alliances, which is a commonplace type of connection among firms in practice (Wu et al., 2010). As firms form and maintain partnerships with each other, they weave a network of relationships (Schilling & Phelps, 2007). This is one of the most studied forms of network, and captures widely seen relationships between firms. However, even this is an imperfect definition since it may include many weak relations as alliances, including many informal connections (Wu et al., 2010). The understanding of business networks generated from alliance networks is not sufficient.

The definition of business networks varies significantly. Previous definitions either include unnecessary actors or exclude important relations; both constrain our understanding of business networks in general. Such weak or incomplete definitions of relations hamper research. We need a new definition of business networks; one that will ensure effective and efficient resource mobilization and information sharing and will capture business networks in general. It needs to capture all important relations as well as relations across different dimensions.

An additional issue for previous studies is the constraint in measuring business networks due to data limitation. Many studies use surveys and interviews (e.g. Lee & Jin, 2009; Wu, 2015) to identify the origins of business networks and the implications of these networks. The sample size tends to be small, around 300 firms, and the use of seven-point Likert scales carries a high degree of dependence on interviewees' personal feelings. These shortcomings would constrain the ability of such network studies to reveal the underlying picture of China's business networks (Ren et al., 2009). Additionally, prior studies normally investigate business networks in China in specific sectors, such as the manufacturing industry (e.g. Wu, 2015; Carney et al., 2009). As network effects are heavily reliant on the contextual environment (Adler & Kwon, 2002), it is debatable whether these studies can be representative.

Apart from the data used, previous studies researching business networks use either surveys or reported data to assess the firms' network affiliation status. For example, business group affiliation information provided by He et al. (2013) and Singh & Gaur (2009) come directly from the China Securities Regulatory Commission and PROWESS databases respectively. Since each database has its own definition of network affiliation status, this is reflected in the two studies. While He et al. (2013) use the same definitions as Lee et al. (2012), Singh & Gaur (2009) adopt the definition described by Khanna & Rivkin (2001). The use of different definitions challenges the comparability of the results.

Furthermore, most studies investigate networks over a period of one year so they fail to comment on the dynamics of these networks (e.g. Li et al., 2014; Wang, 2008). As we mentioned above, business networks are evolving all the time. Attempting to understand business networks without taking into account their dynamics may not provide a sufficient and reliable understanding. It is therefore essential to have panel data to study the dynamics of these networks. Some studies (e.g. Li et al., 2014; He et al., 2013) used panel data to explore the characteristics of China's business networks but, due to the availability of the data, they only can observe networks over a period of around six years and most of the studies' data have an endpoint of 2007, which makes the studies relatively old.

In summary, business networks studied in the literature have certain limitations that call for an improved definition and network construction. In order to capture the configuration of business networks, a quantitative presentation of business networks is necessary (Li et al., 2014). It is important to have a dynamic understanding of business networks that takes their evolution into account.

2.3 Methodology

2.3.1 Definition of business networks

As we discussed above, the definitions of business networks used in prior studies are insufficiently strong or complete for us to have a thorough understanding of business networks in the market. It is essential to have a more generalized definition that covers all important and popular connections and enables us to capture firms and relations. A good definition of business networks should, first of all, include all important relations and exclude those connections that can have little influence on their counterparts. Strengthening the definition enables us to establish business networks that consist of network members who have significant influence over each other, ensuring that information and resources flow efficiently and effectively. Additionally, the definition should incorporate relations from different dimensions. The definition should include various types of relations that are seen in practice in the market. An understanding of the topic that has been generated in this way will have general applicability.

In order to fill the gap in the literature, this study proposes a new approach to defining business networks, which is to construct business networks using related relations. As defined by Michele (2013), a related party is an agent that controls or significantly influences the listed company's policy and decision-making. We argue that the firms who participate in the business networks that have been formed by related parties experience more effective and efficient resource mobilization and information-sharing when compared with the firms in other networks and those firms that do not participate in any networks. This is because the definition of a related party is associated with either control or significant influence. Related parties and related relations are defined as important actors and relations for listed companies. Our definition by its nature excludes actors and relations that carry little influence, such as companies with very few shares in listed companies. Moreover, related relations includes relations of varying types, the only criteria being that they are associated with control or significant influence. Unlike previous studies that only captured some relationships such as alliances, this definition includes many relationships that are widely seen in the market such as ownership relations, collaboration relations, etc. We argue that defining business networks via related relations captures various important connections in the market that are a good miniature of business networks at national level. Investigating business networks via related relations gives a more complete and accurate understanding of the national economy.

Moreover, when we examine the literature on business networks we see a focus on various relations. With regard to the state relationships investigated by scholars, there are three broad types of business networks. These are ownership networks, collaboration networks and individual networks. Ownership networks are firms connected by sharing the same ownership, and include business group and listed company cross-shareholding networks. These networks are widely studied in the literature (Lee et al., 2012; Garney et al., 2009; Khanna and Rivkin, 2001; Sha & Zeng, 2014; Li et al., 2014). Collaboration networks are firms linked by collaborations, for instance, alliance networks. These networks widely exist in the market and are very common forms of business network. Individual networks are firms networked through key individuals, for example, interlock directorship networks. These three broad networks are widely seen in the market. However, prior studies mainly examine only one type of business network without comparing it to the others, and nowhere in the literature are the differences between these networks explored. In this study we examine these three types of business network in order to have a better idea about business networks in China, and most particularly about how the networks are different from each other. In this research, we also define ownership networks, collaboration networks and individual networks to capture the effects of the nature of business networks.

As our definition includes many relations that have already been investigated, it leads to greater comparability. Relations can be categorized into one of 3 broad types enabling us to compare the results generated across different types of networks. For example, we can compare the results of our collaboration networks to those obtained for the alliances studied in previous research. Using a complete range of relations heightens the potential comparability of our results.

Related parties of listed companies are often seen in research on listed company related party transactions (e.g. Cheung et al., 2009; Chen et al., 2009). These transactions are widely observed and studied. However, to the best of our knowledge, there is no prior study investigating business networks formed through related parties. By examining related parties through the lens of a network perspective, an improved understanding of the connections between listed companies can be generated. We argue that defining business networks via related relations contributes to a more in-depth understanding of business networks in general.

2.3.2 Data

The study focuses on networks among listed companies in China for three main reasons. First, listed companies are big enterprises that have a considerable amount of capital. They are important and large players in the market. As at 2013, there were 2490 listed companies in the market, with a capitalized market value of around 23 trillion RMB (SHSE and SZSE, 2013). As China places strict requirements on corporations who want to be listed (CSRS, 1999), all listed companies in the market are large enterprises with superior profitability. According to the Forbes ranking of the top 2000 companies in the world, China's top 10 firms are all listed companies (Forbes, 2014). Thus, understanding the networks among listed companies helps significantly to generate an understanding of networks in the whole economy. Second, previous studies have focused mostly on interlock directorship networks and cross-shareholding networks of listed companies (Chen & Xie, 2011; Sha & Zeng, 2014). There are many hidden connections among listed companies that have not previously been studied. Research that discloses these connections and generates a complete picture of business networks among listed companies would be invaluable. Finally, listed companies are required to publish their financial performances and regularly disclose related parties to the public. Data are reliable and easy to access through open channels, for example from the official website of two stock exchanges in China. In this section, we present the source and structure of our data.

In this study, three main datasets are employed to identify network connections among listed companies and their basic information over the period spanning from 1997-2011 in China. The datasets are listed company related party information data, listed company related party transaction data, and listed company financial performance data. The first two datasets are mainly used to identify network connections among listed companies, and the third one provides more information on listed companies, including firm ownership. The three datasets employed in this study are all extracted from the CSMAR (China Stock Market & Accounting Research) database issued by GTA (Guo Tai An) Technology LTD. It is a reliable and widely used database for research on China listed companies (e.g. Chen et al., 2009; Cheung et al., 2009; Li et al., 2014; He et al., 2013). These datasets provide superior coverage for listed companies in the market, which varies from 90% to 100%. Table 2.1 provides a summary of the coverage of these datasets in each year. The population of listed companies is well captured in these datasets. In total, there are 2482 listed companies caught in the data. The data shows that the number of listed companies in China increased considerably from 618 in 1997 to 2346 in 2011.

<Table 2.1 inserted here>

The unique feature of these data is the availability of relations between the listed company and its related parties. The dataset of listed company related party information provides relationships between listed companies and their related parties. A related party is an agent that controls or significantly influences the listed company's policy and decision-making (Michele, 2013). Overall, there are 11 types of relations between the listed company and related parties classified as related relations. As suggested by the definition of a related party, these 11 types of relations all associate with control or significantly influence over each other. They include parent relationship, subsidiary relationship, sister-company relationship, investor imposing joint control, investor imposing significant influence, associate company, joint venture company, key individual related to the investor, key individual related to the manager, enterprise significantly influenced by the key individual and other related relation. These 11 types of relations can be divided into relations with control and relations associate with significant influence. Clearly, top 4 relations connect companies via control as major ownership empower control over each other. The rest relations associate with significant influence either through minor but significant portion of ownership or influences firms' decision making from various aspects. Either control or significant influence enable companies connected effectively and efficiently sharing resources and information, which contribute to a network-affiliated advantage.

This classification method of relations is consistent with China Accounting Standards for Business Enterprises Rule 36 - "related party disclosure." As long as a listed company has a relationship with another entity that belongs to one of the relationships outlined below, the listed company should report it in their annual reports. It is a legal requirement for listed companies to report their related parties, which provides a valuable opportunity to study relations among listed companies. Table 2.2 below presents the explanation of the 11 relationships between listed companies and their related parties.

<Table 2.2 inserted here>

As the table suggests, the 11 kinds of relationships are associated with a level of ownership that can directly impose control over listed companies or they have significant influence to the extent that it indirectly affects listed companies' operating and decision-making. Where the parties in such a relationship maintain associations that are strong enough to allow them to influence each other, this contributes to the establishment of network connections. As the related parties of listed companies can influence or even determine listed companies' decision making, the relations classified as 'related' are all important relations. The definition de facto excludes those relations that have little impact on each other. By broadening the definition in this way, we take into account many previously disregarded important actors. Moreover, by incorporating the many various definitions of business networks, our construction of business networks is more likely to be able to be generalized and the findings are closer to the truth. The relations we examine are all commonly seen relations among firms; this makes our definition more complete and closer to reality. The inclusion of relations from different dimensions also helps us to have a more generalized understanding.

The 11 types of relations can be further divided into three groups. As we mentioned above, state ties can be broadly grouped into ownership ties, collaboration ties, and individual ties. As these relations have continuity over time, we call them state ties. In order to test the effects of these ties on different networks, they are classified as ownership networks, collaboration networks and individual networks. Clearly, relations 1 to 5 are essentially the same, being derived from ownership. These relations can link companies together as they share a degree of ownership that ensures they have control or significant influence over each other. These relations can be further divided into ownership with control, and ownership with significant influence. Clearly, the top 4 relations are ownership with control, while relation 5 is ownership with significant influence. Relation 6 and relation 7 are relations derived from collaborations, and connect firms through their significant influence over each other. Relation 8 to relation 10 are relations from key individuals. These key individuals link firms and exercise significant influence over them. The definition of our business networks naturally includes many connections from different dimensions, which is superior to those used in the previous studies mentioned above.

The dataset of listed company related party information offers rich information about connections among listed companies and related parties. However, it does not provide complete relations. We therefore employ a listed company related party transaction dataset to supplement our first data set. This enables us to obtain comprehensive connections among these companies. This second dataset records all related party transactions between listed companies and their related parties since 1997. While these two datasets provide valuable information for network construction, they do not contain information on listed company ownership. Therefore, we further adopted listed company financial indicator data, which contains firms' basic information as well as their financial information. Firms' ownership information is based on the ultimate controller type and is classified into SOEs, private firms, foreign firms, collectivist firms, and others. Utilizing this dataset contributes to an improved understanding about listed company related party networks, and the role of state capitalism in an examination of network development.

Utilizing these data, we can construct connections among listed companies via their related parties. In the next section, we introduce the procedures of constructing business networks and outline the network measures used in this study.

2.3.3 Methodology of network measurement

Once we obtained relatively complete data about the relationships between listed companies and their related parties, the next step was to construct the listed company related party networks, and compute relevant network measures to identify features of such networks. First, all relationship data about listed companies and their related parties (which defines the counterparties of a relationship and the relationship between said counterparties) are transferred into network data in order to be read in network analysis software. Network data defines nodes and lines in a network. In network data, the names of listed companies and related parties are coded using numbers. After the data are prepared, Pajek software is used to construct the networks. Pajek is network analysis software that is widely used in constructing and computing network coefficients. Once network data is input, the software automatically recognizes connections and establishes networks. Networks data are input yearly to generate the whole network of listed companies and their related parties in each year. In this way, we generate 15 years' whole networks about listed companies and their related parties.

In order to have a more direct understanding of listed companies, the next step is to simplify the network generated above into networks that show connections solely among listed companies. The rationale for this is as follows. First, the focus of this study is listed companies, being enterprises with a significant amount of capital in the market. All listed companies have capitalized 2.654 trillion yuan (SHSE & SZSE). Listed companies provide a good miniature of China's national economy, to which they are important contributors. In 2010, the value of listed companies accounts more than 6% of GDP in China. Secondly, listed companies come from different sectors and provide a better picture of firms in China than can be seen in earlier studies that focused mostly on the manufacturing sector (Wu, 2015). Furthermore, listed companies include firms with different control structures, including SOEs, private firms, collectively owned firms, foreign firms, and so on. From an examination of data on the structure of control, we see that SOEs are major players, while the other firms are important contributors. This is consistent with China’s economic system. Moreover, listed companies have firms of different sizes. In 2004, the Second Board in Shenzhen Stock Exchange was opened up for SMEs (small and medium enterprises). So listed companies are divided into large firms in the main board and SMEs in the Second Board. SMEs have contributed over 40% of capital in Shenzhen Stock Exchange (SZSE).

Additionally, listed companies are required to publish their information regularly to the public. In our study we need accurate and reliable data (including corporate governance and financial data) and listed companies therefore make good candidates. Since non-listed companies are not required to publish their financial information, data are not available for these firms.

Finally, we have a precedent for simplifying business networks since this was also done in Chen & Xie (2011), Li et al. (2014).

By excluding non-listed related parties, we obtain a more direct and clear picture about networks among listed companies. In this step, all indirect connections between listed companies via related parties that are non-listed are replaced by direct connections. For example, A and B are listed companies while C is a non-listed related party. If we find that A connects to C and B connects to C, we can remove C from the picture and replace the link with “A directly links to B”. By doing so, our networks contain only listed companies in China. Moreover, in order to generate accurate connections among listed companies, we use the number of lines between a specific pair of listed companies to get a sense of the number of channels through which these two listed companies are connected. For example, if listed companies E and F both have common third parties G and H as their non-listed related parties, there would be two lines between these two listed companies to reflect that there are two potential channels that can connect them. This consideration of the number of lines that exist between each pair of listed companies contributes to a more accurate computation of network parameters.

The identification of ownership networks, collaboration networks and individual networks follows the same procedures as for the general networks. Previous studies used reported affiliation or survey affiliation (Singh & Gaur, 2009; Manos et al., 2007; He et al., 2013). We, on the other hand, adopt network perspectives to construct business networks among listed companies and we identify their network affiliation status through the network established. We believe that this method is more objective and leads to findings that can be generalized, making it superior to the methods used previously.

Once we have constructed the business networks, the next step is to compute key network measures to capture the network's features. Our first measure, network size, refers to the number of members of a network (Nooy et al., 2005). Firms in big networks encounter more resources, which can enhance corporate performance (Soh, 2010; Liao & Welsch, 2005). We compute two levels of network size. The first is the number of whole networks per year, and the second is the number of components per whole network. A component is a sub-network in which all members can reach each other through certain paths. As each whole network is composed of many sub-networks, it is essential to identify the size of each sub-network for a comprehensive understanding of the composition of the whole network and the features of individual networks. Since individual networks are the main theme of our study we next compute companies' network positions based on the individual networks that listed companies engage in.

Centrality is a measure of the virtual position of an individual network member in their networks. There are several measures of network position and centrality is one of the most used ones to capture how central a firm is in its networks. Degree centrality and betweenness centrality are widely used in prior studies (Chen & Xie, 2011). We calculate these centralities using the following equations:

(1) Degree centrality

$$DC_i = \sum_j l_{ij},$$

where l_{ij} means a connection from firm i to firm j.

(2) Betweenness centrality

$$BC_i = \sum_j \sum_k \frac{g_{jk}(i)}{g_{jk}},$$

where g_{jk} means the number of shortest paths from firm j to firm k; $g_{jk}(i)$ refers to the number of shortest paths from firm j to firm k through firm i.

Degree centrality is defined as the number of direct contacts that a firm has in the network (Wang et al., 2014). Uzzi (1997) suggests that the number of connections that a node has made determines the information and resources that are available to use, filter, or recombine, which in turn increase the potential for extracting value from the network.

Betweenness centrality, another much used centrality measure, refers to the overall control that a firm has over the paths of other firms (Nooy et al., 2005). Freeman (1979) suggests that companies can influence the network by controlling or distorting the information flow and that this is another form of central positioning. Maintaining a central network position brings a listed company greater access to resources and information (Ahuja, 2000). Evidence suggests that listed companies that occupy central network positions achieve better firm performance (Chen & Xie, 2011). Both of the two measures are calculated using Pajek software.

Furthermore, we employ structural holes to measure the tightness of such networks. According to Burt's (1992) structural holes theory of social capital, actors' ego networks with more structural holes can receive more non-redundant information, which in turn provides the focal actor with superior capability for performing better. A structural hole is a feature of ego networks and an ego network is the cloud of nodes surrounding a given node, along with all the ties among them. Structural holes measure the freedom of association within networks using aggregated constraints of individual nodes in a network. It is argued that the higher the number of aggregated constraints, the less opportunity there is to broker (Nooy et al., 2005).

(3) Aggregate constraint

$$AC_i = \sum_j (P_{ij} + \sum_q P_{iq}P_{qi})^2,$$

where P_{ij} means the proportional strength of the tie from firm i to firm j.

The aggregated constraint is used to measure an individual's structural holes in a network, the higher the aggregate constraint, the less freedom for the individual to withdraw from existing ties and explore structural holes (Nooy et al., 2005).

Regarding cohesion of networks, density, average degree, and component analysis are useful tools for understanding the features of the whole network. Macro patterns of a network play a significant role in understanding network effects (Jackson, 2014).

(4) Network density

$$\mathrm{ND} = \frac{2L}{g(g-1)},$$

where L refers to the number of lines in a network; g means the number of actors in a network.

(5) Average degree

$$\mathrm{AD} = {\sum_i \sum_j X_{ij}}/{g},$$

where X_{ij} is a connection from firm i to firm j; g is the number of actors in a network.

Network density is critical in determining the diffusion of network effects. The density of a network is the number of lines expressed as a proportion of the maximum possible number of lines (Nooy et al., 2005). However, as density is inversely related to network size, it is not feasible to compare density measures across networks of different sizes. To do this, we use average degree whereby we measure network cohesion as compared between networks of different sizes (Nooy et al., 2005). Denser networks in terms of average contacts per node can produce more extensive diffusion. Moreover, component analysis could provide an understanding of the distribution of individual sub-networks in the whole network, which can enhance knowledge about the entire network.

2.4 Results and discussion

In this section, results are reported in 4 sections and followed by a discussion section. Firstly, a whole network analysis is presented to provide an overview of business networks. It is followed by network composition analysis, showing what kinds of firms are more likely to be networked. After that, an individual network analysis is presented, which outlines firm-level network characteristics. The next section discusses the role of state ownership to provide an in-depth analysis of China's state capitalism. Finally, a discussion section is presented.

2.4.1 Whole network analysis

We have two layers of whole networks. One layer contains networks consisting of all listed companies and non-listed related parties, and the other one is limited to networks of listed companies only. The first layer of the whole network provides some insights about network evolution. The second layer of the whole network gives a more direct understanding of network connections among listed companies. However, as we do not have data for non-listed counterparts, the main focus of this study is the second layer of networks. In this section, both layers of the whole network are presented and analyzed through a consideration of certain network features.

Table 2.3 below shows the characteristics of the whole network consisting of listed companies and their related parties. Clearly, network size increased significantly during the research period: from 4,922 in 1997 to 45,747 in 2011. In terms of density, which represents the proportion of actual links in a network to the number of possible connections in the network, it was 0.00035 in 1997 and 0.000043 in 2011. However, it is meaningless to compare these figures as network size increased significantly during the period. Another density measure, average degree, suggests that the average connections per node stably increased from 1.75 in 1997 to 1.99 in 2011. Members of a denser network are likely to have more contacts than those in a low-density network. Thus, information and resources are expected to flow more freely among members in denser networks (Scott, 1992). The component distribution of the whole network suggests that listed companies and their related parties became increasingly involved in multiple sub-networks. The number of components and the size of the largest component increased significantly during the period. Generally, the whole network of listed companies and related parties starts out sparse and grows increasingly denser during the period.

<Table 2.3 inserted here>

Table 2.4 presents network features of the whole network of only listed companies. In table 2.4 we report network characteristics based on ownership connections as well as general connections. Panel A gives the whole network features based on all related relations and Panel B illustrates network features based on ownership relations. The whole network of listed companies shows similar characteristics to the whole network that included non-listed companies. Network size, density, and the number of sub-networks increased significantly over the years. The whole networks of listed companies are less complicated than the whole network of listed companies and unlisted related parties since the former is a sub-network of the latter.

<Table 2.4 inserted here>

Tables suggest that the majority of listed companies start out isolated in the network as the density and average degree are very small. During the study period, links between listed companies are increasing as more and more listed companies participate in networks. On average each listed company had about 0.04 connections in 1997, and the average degree rose to 0.71 in 2011. The density was 0.00006 in 1997 and 0.0003 in 2011. This suggests that the network is relatively sparse and that only 0.03% of possible links were active among listed companies. In terms of networks connected by ownership, the trend is similar to the general network development. However, it exhibits some uniqueness. It suggests that ownership networks have a smaller size and more components during their development. Sometimes, it even shows adverse development when compared with the development of general networks.

For example, the average degree of networks experienced a drop within ownership networks while there was an increase in the general networks' cohesion.

It is interesting that even though China is famous for its guanxi economy, network connections among listed companies are relatively sparse. Even though China is believed to be a guanxi-oriented society, this does not necessarily imply a densely connected business network. In our study, we find only one large component (namely, densely-linked guanxi interfirm networks). This finding is consistent with Ren et al. (2009) who investigate listed companies' interlock relationships in China. As firms are related either through control or significant influence, expanding networks among listed companies may weaken market competition. A single developing giant component in the network further suggests that control through networks is increasingly concentrated. Moreover, the definition of networks matters, since different definitions may exhibit different networks features.

2.4.2 Networks composition

After gaining insights about networks among listed companies in China, we look further at the composition of these networks. In this section, we only investigate firms with connections to other listed companies since isolated listed companies are less attractive in the network perspective. In this section, we analyze the coverage of listed companies by their connections with others, and the distribution of these firms in terms of industry and ownership. We report both general networks and ownership networks.

First of all, it is worth noting that the listed company related party network expands and grows increasingly complicated during the period observed. Figure 2.1 presents the evolution of business networks and ownership networks during the period. In 1997, 22 out of 618 listed companies were involved in related party networks. We treat listed companies as being in a network if it connects to at least one another listed company rather than standing isolated in the whole network. These 22 listed companies form 10 individual networks, with the largest component consisting of 4 listed firms. During the period, more listed companies became involved in such networks. In 2005, there were 425 listed companies forming 148 individual networks. In 2011, there were 884 listed companies in networks, which accounts for about 38% of listed companies in the market. In total there were 189 individual networks in 2011. Notably, listed companies are increasingly related, and the largest sub-network in 2010 consists of 312 listed companies that account for 13% of population listed companies.

Regarding ownership networks, it suggests that connections among listed companies are increasing. The connections of ownership are less frequent than those in the general network as we dropped many connections that are not derived from ownership. Looking at the components of ownership networks, it is clear that the individual component size tends to be small and that the number of components is greater than those in the general network.

<Figure 2.1 inserted here>

Moreover, looking at firms in networks across sectors, we find that listed companies in Manufacturing, Real Estate, and the Wholesale & Retailing sectors are more likely to participate in related party networks. Figure 2.2[1] outlines the distribution of listed companies in related party networks across different industries, and the intensity of listed companies in networks in key industries. Both general networks and ownership networks exhibit the same characteristics. As the coverage of listed company related party network is expanding, listed companies in various industries are increasingly involved in networks. When the intensity[2] of listed companies in different industries is considered, the statistics show that listed companies in the Energy, Financial and Utility sectors are mostly involved in related party networks. Many industries are more intensively involved in these networks. In 2011 for example, over 50% of listed companies in the following sectors were involved in related party networks: the Electricity, heat, gas and water production and supply industry; Accommodation and catering services; and the Financial sectors. These findings are similar to those seen in studies that investigate listed company interlocking directorates networks (Ren et al., 2009).

[1] The data for figure 2 are given in Appendix 1 in case of information needed.
[2] For interest, the table is in appendix 2

<Figure 2.2 inserted here>

Furthermore, considering the ultimate controller types of listed companies, it is suggested that state capitalism dominates these networks since SOEs are main players in these networks. Table 2.5 shows the distribution of listed companies in related party networks across different ownership. Panel A reports the results for general networks and panel B shows the results for ownership networks. Clearly, SOEs are the majority player in these networks. Over 60% of listed companies in related party networks are SOEs, followed by private firms which account for around 20%. Among all listed companies, foreign-owned listed companies are least likely to participate in these networks. They account for only around 1% of all listed companies in general networks. In terms of ownership networks, we find similar characteristics.

<Table 2.5 inserted here>

By investigating listed companies' industry and ownership structure, we have generated an improved picture of listed company related party networks. Even though China is famous for its guanxi economy, formalized network connections among listed companies are relatively sparse (Ren et al., 2009). The development of inter-organizational networks among listed companies is unequal and varies according to the industry and ownership of the listed company. Generally, listed companies in certain industries are more likely to participate in networks. Given China is a socialist country, it is not surprising that SOEs are major players in these networks. The findings of network composition provide evidence for the argument that the government is responsible for the formation of business networks in most cases (Lee, 2006). In emerging economies where the institutional environment is imperfect, governments often intervene in the market. A consideration of the role of the state is crucial. According to Lee (2006), business networks are organizational devices for economic catch-up. Our findings on the composition of business networks in China have supported this view. In order to further exploit the features of these networks, individual networks are studied to understand listed companies' position in networks and other network structures.

2.4.3 Individual network features

Hundreds of sub-networks of different sizes constitute the whole network of listed companies. Listed companies are positioned in these networks differently. Some listed companies occupy central positions and some of them are on the periphery. Some listed companies are associated with a more closed ego-network structure while some others are not. In this section, we investigate individual listed company related party networks and examine network size, position and degree of closedness.

Table 2.6 gives the statistics of network variables. The statistics show that on average there are 30% of listed companies affiliated into business networks via related relations. The coverage found is less than was found by prior studies (e.g. Sha & Zeng, 2014). We argue that this is due to the nature of our business networks. The definition of our networks has excluded connections that only have little influence and this is the rational result. Moreover, we compute the coverage of ownership networks, collaboration networks, and individual networks. Our research indicates that the main component of related relations is ownership relations. We also tabulate key network measures of ownership networks. The mean value of network size is 11 – meaning that there are 11 firms on average in each network. However, there is a lot of variation, suggesting that the development of business networks in China is uneven. Regarding network size for firms in ownership networks, the mean value is 2.6 with a standard deviation of 7.1, which suggests that ownership networks are on average smaller than general networks. It also hints that different networks may precipitate different network effects.

<Table 2.6 inserted here>

Network size here is the number of listed companies in an individual component. Evidence shows that resource availability is increased as network size grows (Greve & Salaff, 2003).

Participating in large networks may hence enhance firms' performance. Network size of listed companies varies significantly in terms of industry and ownership. Table 2.7 summarizes network size for listed companies across industries. Panel A shows the results for general networks and panel B illustrates the results for ownership networks. Regarding the industry sector of the listed company, we see relative large network sizes in the Electricity, heat, gas and water production and supply industry, the Financial industry, and in Transportation, storage and postal services. It appears that listed companies in the infrastructure sectors are more likely to engage in large networks. As regards firms in ownership networks, we find that networks for firms in ownership networks are much smaller on average. Overall, firms in key industries have relatively big networks even though there are some differences in specific sectors. For example, firms from the education industry tend to have small networks in general networks but medium networks in ownership networks.

<Table 2.7 inserted here>

In terms of ownership structure, table 2.8 shows the results. Panel A has the results for general networks and panel B reports results for ownership networks. The results suggest that listed companies where the ultimate controller is classified as unknown, SOEs and 'other' have more members in a network. In comparison, listed companies that are private firms, foreign-owned enterprises or collectively owned are involved in relatively small networks. It is interesting that collectively owned businesses are associated with the smallest network size, which is lower than that for foreign-owned firms. Regarding ownership networks, we find similar results to the general network. The only difference in terms of network size is that in ownership networks, it is foreign firms that have the smallest network size.

<Table 2.8 inserted here>

In terms of listed companies' network position, centrality measures provide a valuable opportunity to understand the network members' virtual position in their networks. A central network position brings a listed company greater access to resources and information (e.g. Ahuja, 2000). Evidence shows that listed companies occupying a central network position demonstrate better firm performance (Wang et al., 2014). Figure 2.3[3] presents the centrality measures of listed companies across industries. In terms of industries, the statistics show that listed companies that operate in the following sectors are more centrally positioned in terms of betweenness centrality: Financial; Mining industry; Electricity, heat, gas and water production and supply industry; Environment and water conservancy; and Environment and public facilities management. Of these, listed companies in the Financial sectors, Mining industry, Electricity, heat, gas and water production and supply industry, are significantly more central.

Regarding ownership networks, we find features that are consistent with the general network findings. As measured by betweenness centrality, firms in the Electricity, heat, gas and water production and supply industry are the most centrally positioned, followed by firms in the Water conservancy, environment and public facilities management sector. Firms in the Financial sectors rank third. Even though this feature is overall consistent with the general network, it varies by specific industry.

<Figure 2.3 inserted here>

The literature is consistent about banks' centrality in big inter-firm networks (e.g. Zhu et al., 2013; Levine, 1972). Banks are more likely to be positioned in the center of networks and they are more able to control the resource flow in these networks. Banks hold financial resources that are essential for other firms and this resource availability determines their crucial position in networks. Firms seek to obtain funds from banks, and banks seek to monitor debtors (Elouaer-Mrizak & Chastand, 2013). Banks are thereby a central actor in these networks.

[3] The data for figure 3 are attached in appendix 3.

According to the ownership of listed companies reported in table 2.9, we find that those listed companies whose ownership structure is classified as ‘unknown’ and ‘other’ have more central positions in networks. Further, SOEs are more central than private firms, collectively owned businesses, and FOEs. This is consistent with the structure of the Chinese economy. The government owns SOEs, therefore SOEs have access to more resources and policy privileges. They are in a position of control in the national economy. Private companies have more difficulty accessing resources, especially financial resources, than have SOEs (Sha et al., 2014; Du et al., 2013). This is reflected in their weak position in these networks. Foreign-owned enterprises are the most peripheral in these networks. As suggested by Booth et al. (2014), foreign-owned firms encounter linguistic and cultural differences, which make them less informed about information and policies. As a result, foreign listed companies are less involved in networks and are positioned more peripherally. These findings are generally consistent with those found in ownership networks reported in panel B of table 2.9, although there are some differences as measured by betweenness centrality.

<Table 2.9 inserted here>

In terms of the ego network structure, the aggregate constraint is used to measure the structural holes of a network. Evidence shows that firms with more structural holes are more likely to have non-redundant information and novel ideas, which will enhance firms’ innovation (Semrau & Werner, 2013). Structural holes are negatively related to aggregate constraint, which means that higher constraints are associated with fewer structural holes (Nooy et al., 2005). The aggregate constraint varies according to ownership and industries. Figure 2.4[4] and table 2.10 display the aggregate constraints of listed companies by industry and ownership. Listed companies operating in the financial industry, electricity, heat, gas and water production and supply industry, and mining industry are more likely to have structural holes, which are

[4] Data for the figure is provided in appendix 4.

believed to spark more novel information. Regarding ownership structures in table 2.10, unknown owned business, SOEs and other enterprises have more structural holes in their ego networks while foreign-owned firms, collectively owned businesses, and private firms are more likely to be constrained. Even though there are differences in specific industries, the findings for ownership networks are generally consistent with the general network.

<Figure 2.4 inserted here>

<Table 2.10 inserted here>

2.4.4 The role of state ownership

China is a famous guanxi economy that is widely acknowledged to use guanxi and the network strategy extensively (Ren et al., 2009). It is also characterized by a high level of state capitalism (Lee & Kang, 2012). The dominance of state ownership is widely acknowledged through the preponderance of SOEs in China. Since its liberalization policy in 1978, China has implemented a series of continuous economic reforms. One of the most important reforms was the gradual privatization of SOEs to solve the governance problem caused by the low incentives and scant public responsibility that were associated with SOEs (Driffield & Du, 2007). Private ownership is growing fast and contributes significantly to the national economy.

Despite this, private firms have of late grown increasingly concerned about their survival prospects. This is because it is argued nowadays that there is an anti-privatization trend in the national economy in that SOEs are taking private firms back to public ownership. Prompted by the 2008 financial crisis, the Chinese government implemented a 4000-billion-yuan investment policy to save the market. There are many examples of SOEs taking over private companies, causing universal concern. For example, the state-owned company Shan Dong Steel merged with the loss-making Ri Zhao Steel in 2009. COFCO, which is a state-owned firm in the food sector, acquired 20% equity in MENGNIU and became the first majority shareholder. Numerous privately owned shares in highway companies in many provinces were purchased by local governments. Similar cases abound, creating debate as to whether private firms are retreating. These phenomena are called “Guo Jin Min Tui” in China, which means “the state sector advances and the private sector retreats” (Du et al., 2014)

Scholars argue that the trend of “state advances and private retreats” is reversing the economic reform, that it will undermine private firms, and thus the national economy would be affected (Guo, 2010; Du et al., 2014) while others suggest that it is normal market competition that makes these companies fail (Hu, 2012). Scholars (e.g. Ji, 2010; Hu, 2012) are committed to investigating the existence of such trend since there is no unanimous agreement that it even exists. On the one hand Ji (2010) suggests that SOEs are advancing as the competition environment increasingly discriminates against private firms and Guo (2011), using many criteria, confirms that it exists in some sectors. Qiao (2011) indicates the existence of this trend, showing that 72% of people interviewed think the trend is true. Many similar studies have indicated the trend is true relying on evidence from specific sectors or examining the survival environment. However, these studies provide little empirical evidence for such a trend, leaving it open to debate.

Many other scholars suggest that it is not true to say state advances and private retreats. Xiang (2011) argues that statistics, in the form of an examination of the number of private firms and the proportion of private capital, belie the existence of such a trend. Hu (2012) provides evidence using the number of firms, production, employment, profit and contribution to tax. Li (2010) proves that its non-existence using both qualitative and quantitative methods. These scholars employ statistical data to show that the empirical evidence does not support the trend.

Scholars finding in favor of the trend point to the increasing number of mergers and acquisitions operated by state ownership, and to state ownership’s increasing influence over the market. Scholars who refute the trend’s existence use statistical data, such as the number of firms, production, and profit, which are on the decrease for state ownership firms. A lack of rigor in the arguments of the trend-finders (most particularly concerning the indicators they use) suggests that there is insufficient and inconsistent evidence for the presence of “Guo Jin Min Tui” (Du et al., 2014). Further research using more reliable methods is required to justify the trend's existence.

In this study, we use the network perspective to provide some empirical evidence to add to the debate, which provides a new element of ways that SOEs are advancing. By looking at the evolution of networks among Chinese state-owned and privately owned listed companies, we can have a better understanding of the role of state capitalism, thereby contributing to the debate about state advances and private retreats in China. In this section, we only report results for the general networks since our examination of both networks produced consistent results.

First, the statistics show that the percentage of privately owned business involved in networks has been stable since 2003 at about 22% while the number of listed SOEs in networks as a proportion of all listed SOEs in the market increased significantly and stably to 60%. Table 2.11 shows the percentage of listed companies in SOEs and private firms involved in related party networks. The results show that SOEs are actively expanding their influence through these networks, while private firms, whose influence had increased from 1997, remained stable after 2003. From 2003 to 2011, the percentage of private firms in networks even showed decreases in 2005, 2009 and 2011. One possible reason for that is the private firms' retreat in the face of the advances of SOEs.

<Table 2.11 inserted here>

Additionally, the size of networks for SOEs and private firms also generates some insights. Table 2.12 presents the average size of networks for SOEs and private firms during the period. We find that the size of networks for both types of business increases significantly during the period. However, private firms experienced decreases in network size in 2004 and 2011 while SOEs increased their network size. Evidence shows that while SOEs are stably expanding their influence via the increases in their network size, private firms showed more fluctuation in terms of network size. The results show that private firms are less stable compared with SOEs in China.

<Table 2.12 inserted here>

Moreover, by investigating listed company centrality in the network for SOEs and private firms during the period, we have yet more valuable findings. Evidence shows that central firms in networks have more access to information and resources as well as greater control over the network, which enable them to perform more strongly compared to peripheral firms (Chen & Xie, 2011; Tsai, 2001). Central players can control for other network members by distorting information and resource flow. Central firms are therefore associated with superior influence and control over peripheral firms in networks. Figure 2.5[5] demonstrates degree centrality and betweenness centrality for SOEs and private firms during the period. It is noteworthy that degree centrality for SOEs stably increased from 0.049 to 1.478 during the sample period. This means that SOEs generally have an increasing number of directly connected partners and are able to expand their influence over their networks. However, degree centrality for private firms fluctuated during the period and experienced several decreases, particularly after 2004. In 2011, degree centrality for private firms decreased to 0.284 even though there was an increase in 2010. We find similar trends reflected in the betweenness centrality measures for SOEs and private firms in the period. Generally, both types of firms became more central (as the centrality measure increased during the period). However, there are fluctuations among both types of business. Even though both SOEs and private firms experienced decreases in centrality in the period, private firms experienced greater decreases while SOEs increased their centrality in their networks. In other words, compared with SOEs, private firms were growing increasingly weak in their networks.

<Figure 2.5 inserted here>

[5] Data for the Figure is given in appendix 5

In summary, we find that SOEs make advances and private firms retreat from the perspective of networks influences. The state makes advances in the percentage of listed companies involved in networks, network size, and centrality measures. As networks provide firms with channels to influence and exert control over other firms, private firms are growing increasingly weak in terms of the influence and control they have over the networks. In other words, private firms are indeed retreating compared with SOEs' advancing. By looking at network features, this study provides interesting insights into the debate of "state advances and private retreats" in China. However, there is a pre-assumption, which is that networking brings about power and influence in China. In this sense, it is another facet of the increasingly unfair market environment for private firms that includes entry barriers, financing problems, and discrimination by local government (Jiang, 2010). Private firms may find themselves being crowded out due to the increasing scale and power of SOEs (Liu, 2012). In the marketplace, SOEs benefit from financial and political help, which will weaken market competition and create or enhance SOEs' monopoly position in the national economy (Cao, 2011). The national economy may be further affected due to the tortuous methods of resource allocation and the high incentives for rent-seeking.

2.4.5 Discussion

By investigating the networks of listed companies in China, we have configured a definition of business networks in China. Through an analysis of network level and firm level characteristics, we generate interesting findings. Firstly, the statistics show that network connections are increasingly popular among listed companies. Both network size and network cohesion significantly improved during the research period. The increasing level of network connections has raised a fundamental question, namely why do firms choose to affiliate into business networks? Given the popularity and prominence of various business networks, scholars have become curious about why and how business networks survive and grow (Masulis et al., 2011). This has motivated our next chapter, which investigates the role of business network affiliation in firms' access to financial resources. In that chapter, we expect to contribute a partial answer to the 'why and how?' question by providing evidence that firms in business networks gain financing advantages.

Additionally, the expanding connections among listed companies also motivates studies investigating the consequences of business networks. As ever increasing numbers of firms become involved in various business networks, it is clear firms recognize that they benefit from networks. However, there may also be associated costs for firms, and the net effect of business networks on a firm, taking into account both the costs and the benefits, needs to be investigated. At present the net effect of business networks is ambiguous even though many studies have attempted to contribute to research on the consequences of business networks (Purkayastha & Lahiri, 2016; Keister, 2000; Singh & Gaur, 2009). In order to contribute to the debate about the effects of business networks, this study examines the impacts of business networks on firm performance. We will also contribute to the literature with a discussion about the consequences of business networks on stock return volatility. Given the importance of stock return volatility and the popularity of business networks, a study directly linking business network affiliation and stock return volatility is needed.

We find in this study that the features of networks suggest that ownership of listed companies matter. SOEs are more likely to involved in business networks, their networks are likely to be larger, and they are more likely to occupy a central network position in them. Given the importance of state capitalism in China (Lee & Kang, 2012), it is essential to investigate the role of ownership on the effects of business networks. Whether the consequences of business networks are amplified for SOEs or not deserves inspection. To address this question, in the next chapter of this study we further investigate how ownerships shape network effects. Even though many studies are examining the role of SOEs in business networks, ambiguity still persists, as mentioned in the first chapter. It remains an open question to investigate the role of ownership in business networks.

Furthermore, as firms become increasingly related to other firms, challenges emerge for firm governance. Firms in business networks are more exposed to other firms than are isolated firms and are therefore less independent, which will affect firms' strategy and decision-making

(Gadde et al., 2003). It is important to find a mechanism for firms in networks to manage network cost in order to maximize the benefits of business networks. Firms need to have good governance in order to minimize the cost of business networks. Consequently, it is crucial to understand how firm governance affects business networks. In order to shed light on this issue, we conduct interaction analysis to investigate how firm governance in terms of ownership concentration influences the relationship between network affiliation and firm performance.

Lastly, as the results suggest, network features vary according to the different natures of business networks. Even though the overall results are consistent, several differences are found between general networks and ownership networks. Firms in ownership networks tend to form several small networks. Thereby, we expect that the network effects differ with the definition of business networks. Our definition of related relation incorporates various relationships, which provides a valuable opportunity for looking at the nature of business networks. In the following chapters, we also attempt to add to the literature by investigating how the nature of business networks shapes their role.

2.5 Conclusion

This study investigates networks among Chinese publicly-traded companies. Utilizing (i) listed companies related party information data, (ii) listed companies related party transaction data, and (iii) listed companies' financial indicator data, we constructed related party networks in which the listed companies were involved for the years 1997 through to 2011. Through the analysis of these networks we generate some valuable findings, which suggest novel patterns of connections in the Chinese context.

First, we find that Chinese listed companies are becoming more interrelated. The coverage of networks increased significantly during the research period, from 3% to around 40%. During the period, listed companies grew increasingly densely related and more likely to collaborate with each other. It is notable that key industries and SOEs played an important role in the development of such business networks. Our results further suggest that networks in China are still evolving since firms from this emerging economy are not as well connected as their counterparts in the developed economies. Second, this study provides new insights into the debate of “the state advances and private retreats.” In terms of network perspective, SOEs are expanding their influence through network size and network centrality at a time when private firms are stalled or even shrinking. Governed by the policy of “strong-strong alliance,” the majority of SOEs in the market affiliate into networks while private firms remain fairly isolated. Generally, listed company networks via related relations are developing, and SOEs dominate the development of such networks. The increasing power of SOEs through their influence over networks may broaden the gap between SOEs and private firms, and even weaken market competition.

To the best of our knowledge, this study is the first of its kind to investigate listed company related party networks among listed companies in China. More specifically, the study contributes to our understanding in the following ways. We provide the first attempt to construct listed companies’ inter-organization networks using related party information as disclosed in their annual reports. The construction of such networks reveals important connections among listed companies. In these networks, listed companies can exert control or exercise significant influence over another company. In such networks, information-sharing and resource mobilization are more efficient. These networks are representative of the national economy and capture valuable insights into it. An investigation of business networks as we have defined them is, we believe, more reliable in contributing to the understanding of the national economy and its capitalism.

Additionally, we contributed to the understanding that China’s guanxi-oriented society (Li, 2013) does not necessarily imply a network of dense connections among firms. We were unable to identify densely connected networks in our sample capturing formalized relationships between listed companies. As this study mainly focused on related party networks among listed companies, we included many important relationships but omitted any informal connections that may exist. The sample has important implications for the understanding of the network economy since we constructed representative business networks connected by important relations. The results have suggested that even though guanxi are widely distributed in China’s society, inter-organizational ties are still evolving. The research has important implications for the multidimensionality of guanxi. We have showed evidence that inter-organizational guanxi is different to personal guanxi. Thus, the concept of guanxi in China is more complex than the prior studies showed.

Furthermore, through our investigation of the features and dynamics of business network composition, we expect to contribute to factors that influence the formation of business networks in China. Our findings provide evidence that the government is responsible for the formation and development of business networks in China. Economic features heavily shape the development of business networks in China. Moreover, we provide new insights into the debate of “the state advances and private retreats” in China using network perspectives, which enhance our understanding of China’s state capitalism. We contribute to the understanding of the existence of such trends using SOEs’ expanding influences over networks through network size and centrality.

However, this study also suffers from certain limitations. Firstly, even though we show that guanxi and networks are not necessarily the same, we fail to provide evidence for how they are different from each other. Our dataset does not allow us to differentiate between the two. Additionally, we are unable to comment on how the factors identified in this study affect firms’ decision to enter networks. As this chapter is descriptive, further regression analyses are required to further advance the understanding of drivers of network formation, and the implications for these networks. Finally, we acknowledge that our findings would gain more reliability if we were to investigate the whole network including the non-listed companies. It was purely the lack of data for these firms that meant that we had to omit them and deal only with listed companies.

Tables in Chapter 2

Table 2.1: Percentage of listed companies sampled in each year

year	No. of listed firms in the sample	No. of listed companies in the market	Percentage captured
1997	618	764	80.89
1998	809	853	94.84
1999	953	953	100
2000	1067	1067	100
2001	1154	1160	99.48
2002	1269	1269	100
2003	1311	1311	100
2004	1360	1360	100
2005	1359	1359	100
2006	1450	1450	100
2007	1571	1571	100
2008	1624	1624	100
2009	1769	1769	100
2010	2122	2122	100
2011	2346	2346	100

Note: The table shows the coverage of the sample in the market. It is suggested that the sample captures well the populations in the market, which include around 90% of listed companies in the market. As this chapter presents an overview of business networks in China, the number of listed companies captured here may be different to those in other chapters. The later chapters use data that corresponds with business network data in order to acquire network information. The no. of listed companies captured in the data are computed from our database. The no. of listed companies in the market are from the website of Shenzhen and Shanghai Stock Exchanges.

Table 2.2: Relationships accounted as a related party for listed companies

Relations	Note	Networks
Parent company of listed company		Ownership network
Subsidiary of listed company		Ownership network
Other enterprise under the control of the same parent company as the listed company	Sister company of listed company	Ownership network
Investor exercising joint control over the listed company	Shareholder that jointly control the listed company's operating.	Ownership network
Investor imposing significant influence on the listed company	Shareholder can influence or participate in listed company's decision-making but cannot control the decision making. Normally investor controls less than 30% shares.	Ownership network
Joint venture of listed company	Enterprise and listed company jointly control another company	Collaboration network
Associate of listed company	Enterprise has significant influence over another company in which listed company has equity	Collaboration network
Main individual investor of the listed company and his closely-related family	Individual investors in the listed company and their closely-related family members.	Individual network
Key manager of the listed company or its parent company and his closely-related family	Important managers of listed company and their closely-related family.	Individual network
Enterprise which is controlled, jointly controlled, or significantly influenced by individual investor, key manager and closely-related family of the listed company	Enterprise that shares the same important investor, manager, and closely-related family with the listed company.	Individual network
Others	Other relationship whereby the entity can significantly influence the listed company's decision-making.	Individual network

Note: The table is converted from the definition of variables in CSMAR database. The group of relations are based on the nature of relations. Onet stands for relations from ownership relations; Cnet refers to relations from collaborations; Inet includes relations from key individuals

Table 2.3: Whole network features-listed company and related parties

Year	Size	Density	Average degree	Component	Size largest
1997	4922	0.00036	1.7558	606	75
1998	7138	0.00025	1.7935	774	107
1999	9426	0.00019	1.8218	891	137
2000	10492	0.00017	1.8210	991	135
2001	13708	0.00014	1.8666	1006	138
2002	17402	0.00011	1.9027	1069	366
2003	18106	0.00011	1.9074	1065	240
2004	18954	0.00010	1.9267	1077	308
2005	19971	0.00010	1.9344	1082	545
2006	21995	0.00009	1.9426	1108	566
2007	24856	0.00008	1.9515	1195	564
2008	28859	0.00007	1.9831	1165	680
2009	31019	0.00006	1.9759	1236	1301
2010	40144	0.00005	1.9913	1438	9726
2011	45747	0.00004	1.9927	1651	9753

Note: This table presents the whole network features that include all non-listed related parties. Size refers to the number of members in a network. Density is measured as a proportion of existing links to a theoretical maximum number of the link. Average degree is a measurement of cohesion of the network, which takes the mean value of degrees of each node. The component is a connected sub-network. The increasing network size suggests that whole network is expanding significantly. During the period, listed companies and their related parties are increasingly densely becoming related to each other. The networks are getting more complicated as the number of sub-networks, and the size of individual networks and the whole network increased significantly.

Table 2.4: whole network features-listed company only

Panel A: Networks with all related relations

year	size	density	average_degree	component（>=2）	size_largest
1997	618	0.00006	0.03883	10	4
1998	809	0.00011	0.08900	30	4
1999	953	0.00014	0.13431	46	5
2000	1067	0.00014	0.14620	53	7
2001	1154	0.00022	0.25823	89	8
2002	1269	0.00026	0.32624	112	22
2003	1311	0.00030	0.39512	126	16
2004	1360	0.00033	0.45147	150	14
2005	1359	0.00033	0.44592	148	15
2006	1450	0.00035	0.51172	159	18
2007	1571	0.00033	0.52069	187	15
2008	1624	0.00040	0.64655	187	23
2009	1769	0.00040	0.69983	184	56
2010	2122	0.00036	0.76532	179	312
2011	2346	0.00030	0.71270	189	305

Panel B: Networks with ownership relations

year	size	density	average_degree	component（>=2）	size_largest
1997	618	0.00005	0.02913	7	4
1998	809	0.00008	0.06675	23	4
1999	953	0.00010	0.09234	34	4
2000	1067	0.00009	0.09560	41	4
2001	1154	0.00014	0.16118	66	8
2002	1269	0.00018	0.22222	89	12
2003	1311	0.00019	0.25019	100	10
2004	1360	0.00029	0.39118	147	14
2005	1359	0.00029	0.38852	145	15
2006	1450	0.00030	0.43862	155	18
2007	1571	0.00030	0.46722	182	11
2008	1624	0.00035	0.56773	189	19
2009	1769	0.00034	0.60938	177	53
2010	2122	0.00027	0.58153	194	70
2011	2346	0.00024	0.55413	204	56

Note: This table shows the whole networks that only includes listed companies. These are sub-networks of the whole network mentioned above. Size refers to the number of members in a network. Density is measured as a proportion of existing links to a theoretical maximum number of the link. Average degree is a measurement of cohesion of the network, which takes the mean value of degrees of each node. The component is a connected sub-network.

Table 2.5: Listed companies in networks across different controller types

Panel A: General networks

Control	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Collectively		1	2	3	1	3	5	4	2	4	8	4	4	4	4
Foreign			1	1	1	2	3	2	1	1	0	0	0	1	17
Other	2	3	2	3	3	3	8	16	8	9	11	9	15	5	23
Private	5	13	4	8	23	45	73	91	83	104	121	133	154	283	218
SOE	15	43	95	111	202	249	275	313	327	376	412	491	521	545	577
Unknown		4	3	2	6	7	8	6	3	6	10	7	22	24	42
Total	22	64	107	128	236	309	372	432	424	500	562	644	716	862	881

Panel B: Ownership networks

Control	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Collectively	0	1	1	2	1	2	4	4	2	4	8	4	3	2	4
Foreign	0	0	1	1	1	2	2	2	1	1	0	0	0	0	10
Other	1	3	2	2	3	3	6	14	7	8	11	9	11	5	21
Private	4	9	3	4	10	31	45	82	71	88	99	114	122	214	163
SOE	10	32	68	80	137	182	192	287	299	344	390	459	487	481	522
Unknown	0	4	1	1	5	5	7	6	3	6	10	7	18	22	35
Total	15	49	76	90	157	225	256	395	383	451	518	593	641	724	755

Note: This table illustrates the distribution of listed companies in networks by different types of ultimate controller. The classification of these types of ownership is given by the database of CSMAR.

Table 2.6: Summary of key network variables

Variables	Definition	Observation	Mean	Std. Dev.
Net	Dummy variable, =1 if the firm is network affiliated	20782	0.3020	0.4591
Onet	Dummy variable, =1 if the firms is affiliated to ownership networks	20782	0.2570	0.4370
Cnet	Dummy variable, =1 if the firms is affiliated to collaboration networks	20782	0.0595	0.2366
Inet	Dummy variable, =1 if the firms is affiliated to individual networks	20782	0.0361	0.1867
Net_size	The Number of Firms in a Network	20782	11.4150	52.1812
Degree	The Number of Contacts a Firm has in its Network	20782	0.5477	1.1292
Betweenness	The possibility that a focal firm falls into the paths of other network members	20782	0.0372	0.1628
Aggregate constraint	Total Constraint the Network has to the Firm	20782	0.9680	0.1300
Onet size	The Number of Firms in the Ownership Network	20782	2.6298	7.1121
Onet degree	The Number of Contacts a Firm has in the Ownership Network	20782	0.3860	0.8328
Onet betweenness	The possibility that a focal firm falls into the paths of other network members in the ownership network.	20782	0.000001	0.00002
Onet aggregate constraint	Total Constraint the Network has to the Firm in the Ownership network	20782	0.9687	0.1296

Note: : (1) Degree centrality $DC_i = \sum_j X_{ij}$, where X_{ij} means a connection from firm i to firm j. (2) Betweenness centrality $BC_i = \sum_j \sum_k \frac{g_{jk}(i)}{g_{jk}}$, where g_{jk} means the number of shortest paths from firm j to firm k; $g_{jk}(i)$ refers to the number of shortest paths from firm j to firm k through firm i. (3) Aggregate constraint $AC_i = \sum_j (P_{ij} + \sum_q P_{iq} P_{qi})^2$ where P_{ij} means the proportional strength of the tie from firm i to firm j.

Table 2.7: Network size for listed companies across industries

Panel A: General networks

Industry	Network Size			
	Mean	Std Dev	Min	Max
Electricity, heat, gas and water production and supply industry	28.9247	85.3281	1	312
Financial Industry	26.5064	79.5098	1	312
Transportation, storage and postal services	19.3090	69.6165	1	312
Mining industry	16.4425	62.3867	1	312
Water Conservancy, Environment and Public Facilities Management	13.0366	57.8043	1	312
Manufacturing	9.7857	47.1278	1	312
Real Estate	9.5288	47.2891	1	312
Wholesale and retailing	9.1512	45.6251	1	312
Information transmission, software, and IT services	8.4129	44.8048	1	312
Building industry	8.8982	42.9901	1	312
Culture, Sports and Entertainment	7.3137	42.8208	1	312
Complex	7.1379	39.8434	1	312
Agriculture, forestry, animal husbandry and fishery	5.8880	36.9009	1	312
Accommodation and Catering Services	4.7886	27.7019	1	305
Leasing and Business Services	4.4512	27.8602	1	312
Health and social work	4.0909	7.9681	1	27
Scientific and technical services	1.4130	1.5431	1	11
Resident services, repairs, and other services	1.2907	0.7007	1	5
Education industry	1	.	1	1

Notes: Network size is the number of listed company in a network

Panel B: Ownership networks

Industry	Network Size			
	Mean	Std. Dev.	Min	Max
Electricity, heat, gas and water production and supply industry	4.6751	12.3458	1	70
Financial Industry	3.3709	6.2578	1	70
Transportation, storage and postal services	3.2585	9.1848	1	70
Mining industry	3.1459	7.5496	1	70
Information transmission, software and IT services	2.6861	8.1838	1	70
Manufacturing	2.6389	7.0822	1	70
Building industry	2.5232	6.4040	1	70
Wholesale and retailing	2.2793	5.6595	1	70
Education industry	2.2000	2.7826	1	9
Health and social work	2.1250	3.1596	1	12
Leasing and Business Services	2.0051	3.3678	1	27
Water Conservancy, Environment and Public Facilities Management	1.9375	5.8087	1	70
Real Estate	1.9337	4.4541	1	70
Complex	1.9291	5.5010	1	60
Agriculture, forestry, animal husbandry and fishery	1.8264	5.3166	1	70
Culture, Sports and Entertainment	1.6442	4.9489	1	70
Accommodation and Catering Services	1.5745	1.2941	1	9
Scientific and technical services	1.0488	0.3123	1	3

Notes: Network size is the number of listed company in a network

Table 2.8: Network size for listed companies across controller types

Panel A: General networks

Control	Network Size			
	Mean	Std Dev	Min	Max
Unknown	18.5198	67.8201	1	312
SOE	13.0331	55.2291	1	312
Other	12.4267	54.1903	1	312
Private	6.4595	38.3042	1	312
Foreign	4.8414	31.0181	1	305
Collectively	4.7637	32.2841	1	312

Panel B: Ownership networks

Control	Network Size			
	Mean	Std Dev	Min	Max
Unknown	3.1569	7.6383	1	70
SOE	3.1223	8.1487	1	70
Other	2.5699	5.7809	1	56
Private	1.6973	4.5063	1	70
Collectively	1.5836	4.4536	1	70
Foreign	1.4848	3.9164	1	56

Notes: Network size is the number of listed company in a network. The classification of controller types is given by the CSMAR database.

Table 2.9: Centrality of listed companies across controller types

Panel A: General networks

Control	Degree				Between			
	Mean	Std Dev	Min	Max	Mean	Std Dev	Min	Max
Unknown	0.7526	1.3735	0	10	0.0732	0.2243	0	1
Other	0.6906	1.0220	0	6	0.0580	0.2083	0	1
SOE	0.6794	1.2812	0	18	0.0464	0.1783	0	1
Private	0.3063	0.7421	0	11	0.0186	0.1220	0	1
Collectively	0.1813	0.5035	0	3	0.0158	0.1148	0	1
Foreign	0.1759	0.5262	0	4	0.0086	0.0806	0	1

Panel B: Ownership networks

Control	Degree				Between			
	Mean	Std Dev	Min	Max	Mean	Std Dev	Min	Max
Unknown	0.5246	1.0169	0	6	0.0000019	0.0000146	0	0.000276
Other	0.5018	0.7090	0	3	0.0000003	0.0000024	0	3.86E-05
SOE	0.4797	0.9436	0	14	0.0000017	0.0000178	0	0.000773
Private	0.2050	0.5231	0	6	0.0000003	0.0000079	0	0.000433
Collectively	0.1530	0.4577	0	3	0.0000004	0.0000053	0	0.000089
Foreign	0.0996	0.3408	0	3	0.0000002	0.0000025	0	3.75E-05

Notes: (1) Degree centrality $DC_i = \sum_j X_{ij}$, where X_{ij} means a connection from i to j. Degree refers to the number of contacts a firm has in its network. (2) Betweenness centrality $BC_i = \sum_j \sum_k \frac{g_{jk}(i)}{g_{jk}}$, where g_{jk} means the number of shortest paths from j to k; $g_{jk}(i)$ refers to the number of shortest paths from j to k through i. Betweenness centrality means the number of paths through the firm to all paths in the network.

Table 2.10: Structural hole of listed companies across controller types

Panel A: General networks

Control	Aggregate Constraint			
	Mean	Std Dev	Min	Max
Foreign	0.9950	0.0580	0.5000	1.4791
Collectively	0.9902	0.0719	0.3333	1.2893
Private	0.9873	0.0887	0.1623	1.9445
Other	0.9711	0.1280	0.2678	1.4868
SOE	0.9587	0.1452	0.1210	1.9238
Unknown	0.9316	0.1777	0.2485	1.2936

Panel B: Ownership networks

Control	Aggregate Constraint			
	Mean	Std Dev	Min	Max
Foreign	0.9971	0.0439	0.3333	1.0000
Private	0.9888	0.0792	0.2500	1.1250
Collectively	0.9884	0.0821	0.3333	1.1250
Other	0.9787	0.1156	0.5000	1.1250
SOE	0.9587	0.1470	0.1000	1.1250
Unknown	0.9314	0.1912	0.2000	1.0000

Notes: Constraint measures the structural holes a firm has in its network. It captures total constraint the network has to the firm.

Table 2.11: The percentage of listed companies in networks to listed companies in the market for private firms and SOEs in each year

Control	Private	SOE
1997	2.79	3.94
1998	6.13	8.25
1999	4.60	12.35
2000	7.69	12.86
2001	18.25	21.65
2002	21.95	25.75
2003	25.44	28.95
2004	25.93	33.40
2005	22.19	34.94
2006	22.76	40.13
2007	22.45	43.37
2008	22.70	50.31
2009	21.69	53.49
2010	26.20	57.79
2011	18.78	59.18

Table 2.12: network size for SOE and private firms in each year

Year	Network size for SOE				Network size for private			
	Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Min	Max
1997	1.0499	0.2812	1	4	1.0503	0.3398	1	4
1998	1.1017	0.3711	1	4	1.0896	0.3972	1	4
1999	1.1964	0.6031	1	5	1.0460	0.2106	1	2
2000	1.2549	0.8670	1	7	1.0769	0.2678	1	2
2001	1.4920	1.2129	1	8	1.3095	0.8145	1	5
2002	2.0072	3.2515	1	22	1.5902	2.2876	1	22
2003	2.0347	2.6066	1	16	1.6202	1.8413	1	16
2004	2.1025	2.4508	1	14	1.5783	1.4178	1	9
2005	2.0684	2.3299	1	15	1.5160	1.5144	1	15
2006	2.6916	3.3307	1	18	1.5405	1.4551	1	11
2007	2.5505	2.8383	1	15	1.4972	1.3625	1	15
2008	3.8033	4.8612	1	23	1.9795	3.4527	1	23
2009	7.9569	14.2070	1	56	2.5718	6.3581	1	56
2010	76.1633	131.0700	1	312	24.1720	80.4110	1	312
2011	77.1836	129.9500	1	305	10.7820	51.9760	1	305

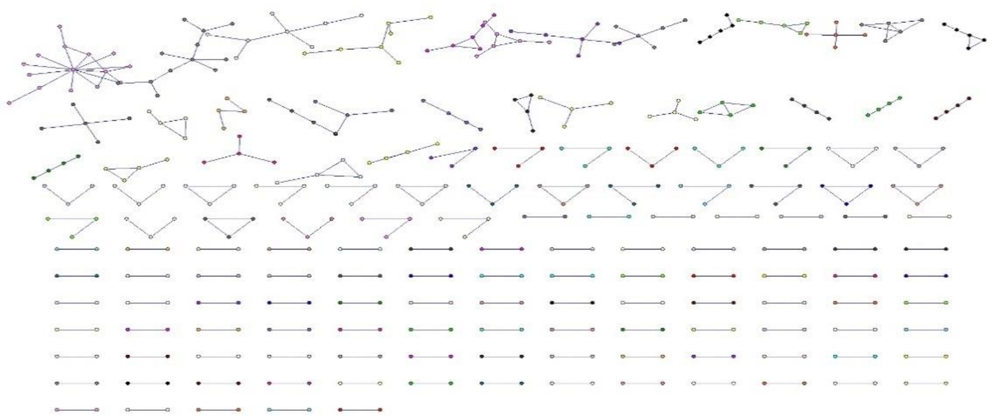
Note: Network size is the number of firms in a business network.

Figures in Chapter 1

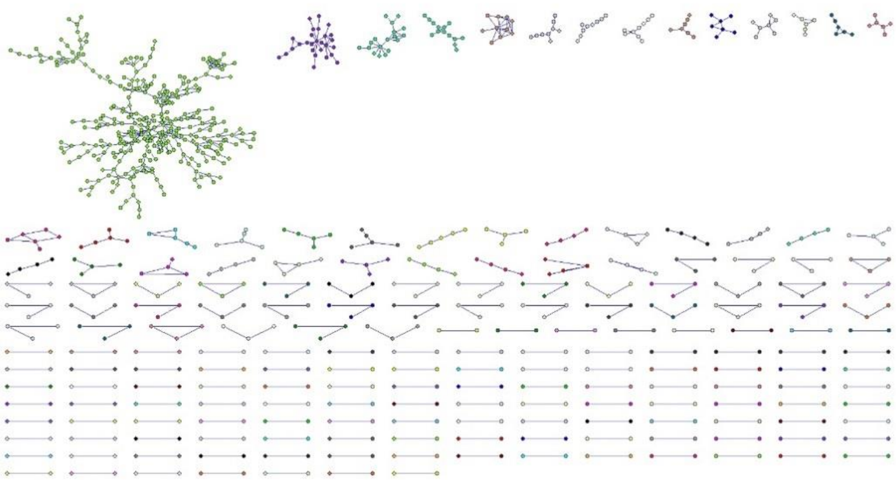
Figure 2.1a: The evolution of business networks

Networks in 1997

Networks in 2005



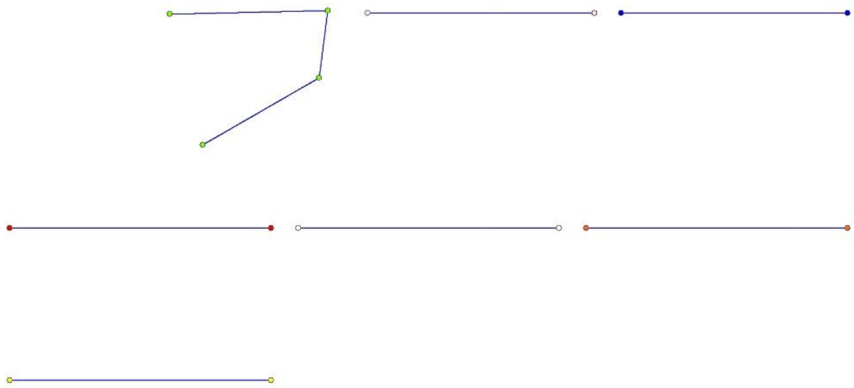
Networks in 2011



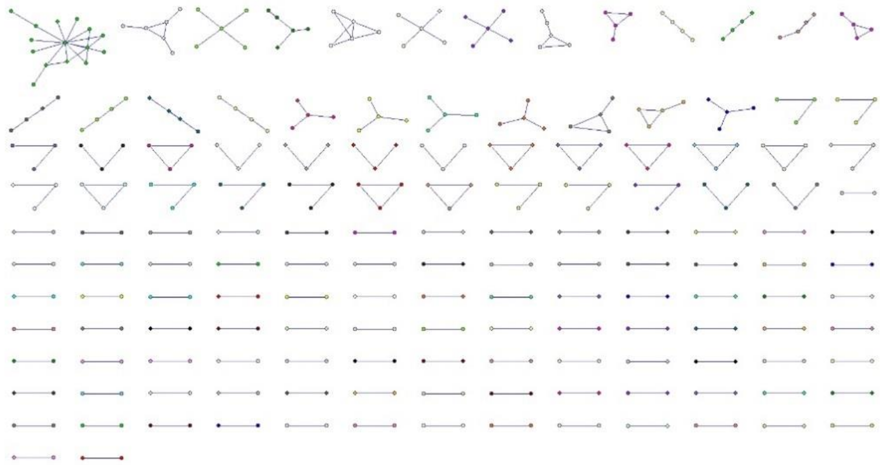
Note: There were 22, 425 and 884 listed companies in networks respectively in 1997, 2005 and 2011. In 1997 there were 10 individual networks, which increased to 148 networks in 2005. Till 2011, the number of individual networks increased to 189.

Figure 2.1b: The evolution of ownership business networks

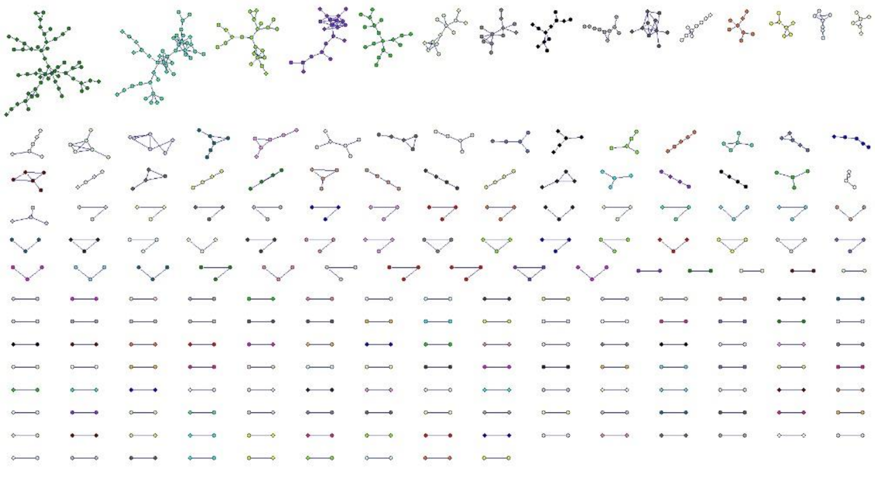
Networks in 1997



Networks in 2005

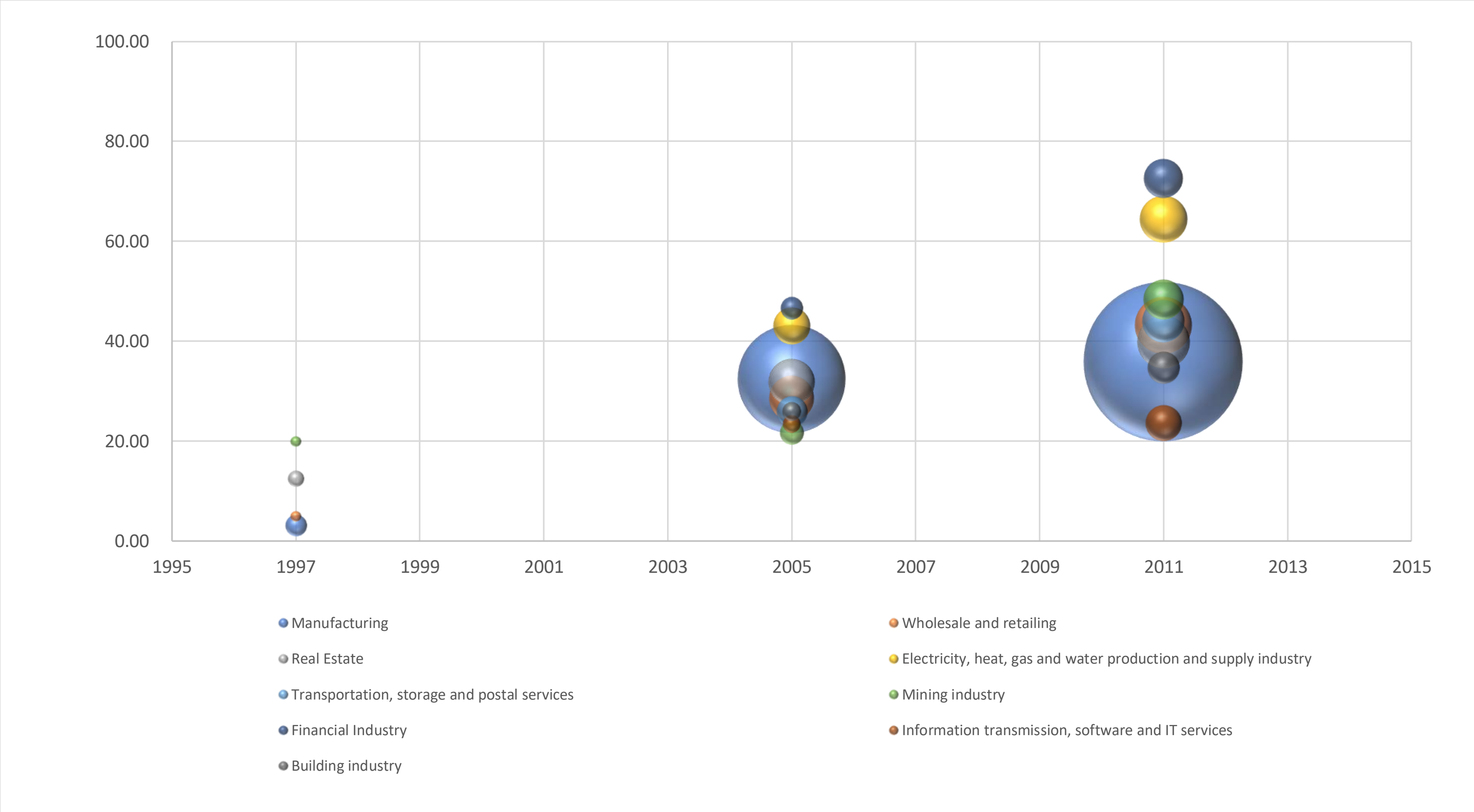


Networks in 2011



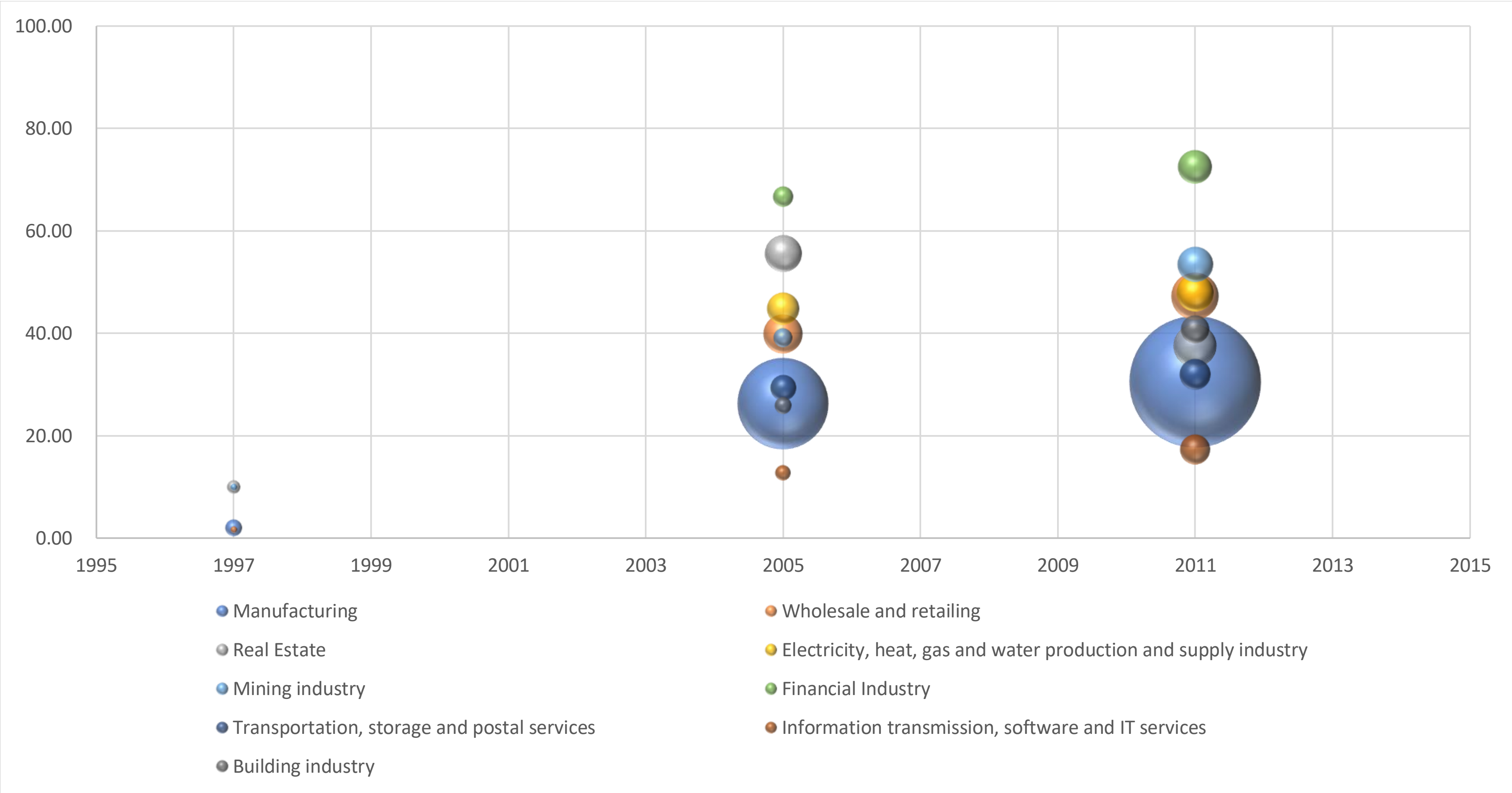
Note: There are 16, 384 and 758 listed companies connected by ownership relations. The number of networks increased from 7 to 145 in 2005 and further increased to 204 in 2011.

Figure 2.2a: Listed companies in networks across key industries



Note: The size of the bubble is the number of listed companies in networks. The vertical line represents percentage of firms in networks.

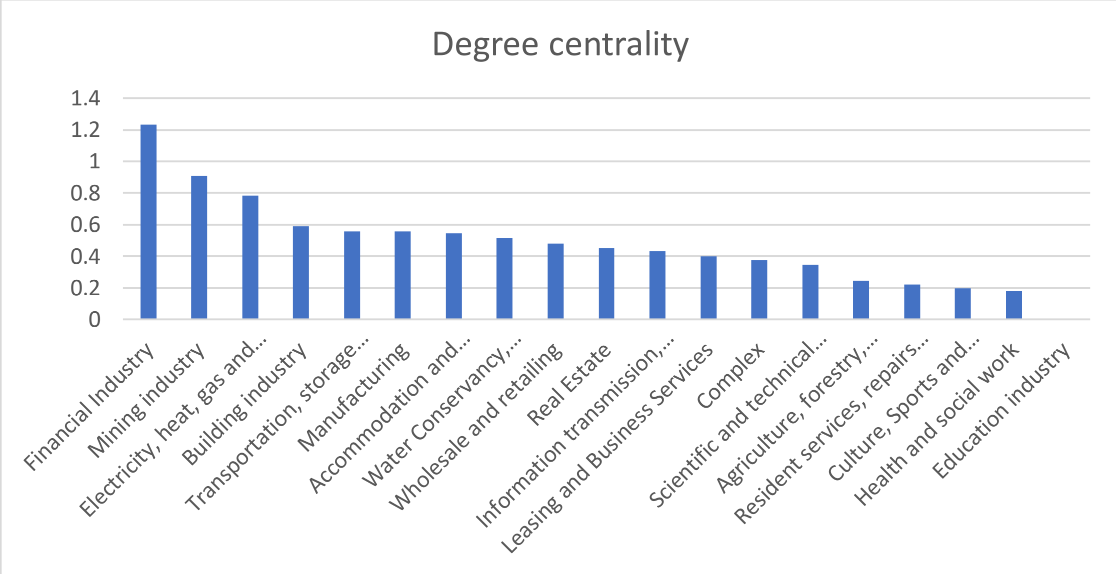
Figure 2.2b: Listed companies in ownership networks across industries

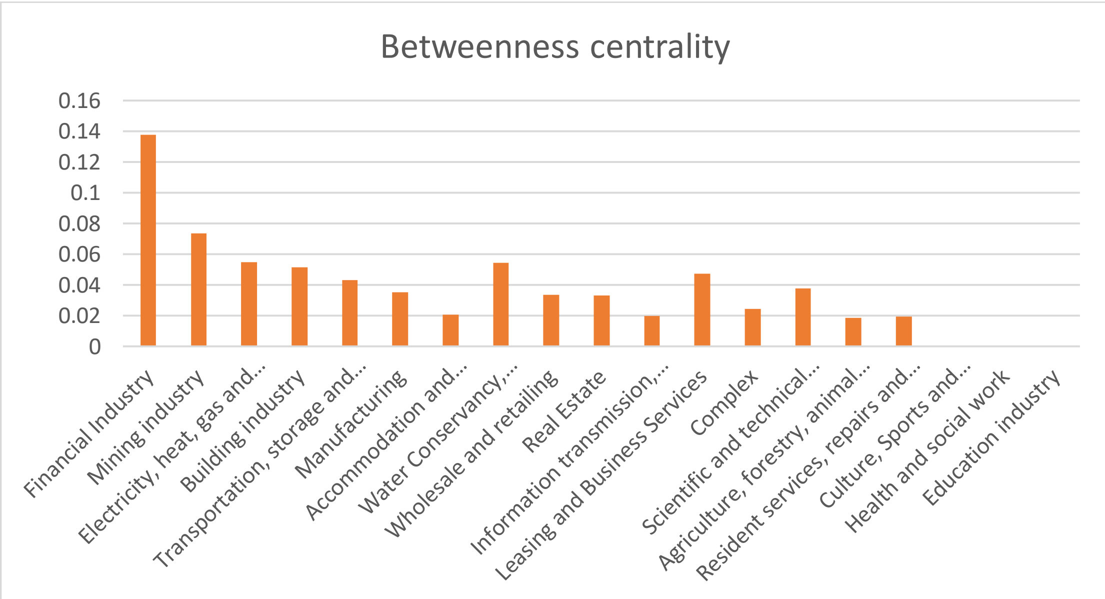


Note: The size of the bubble is the number of listed companies in networks. The vertical line represents percentage of firms in networks.

Figure 2.3: Centrality for firms in different industries

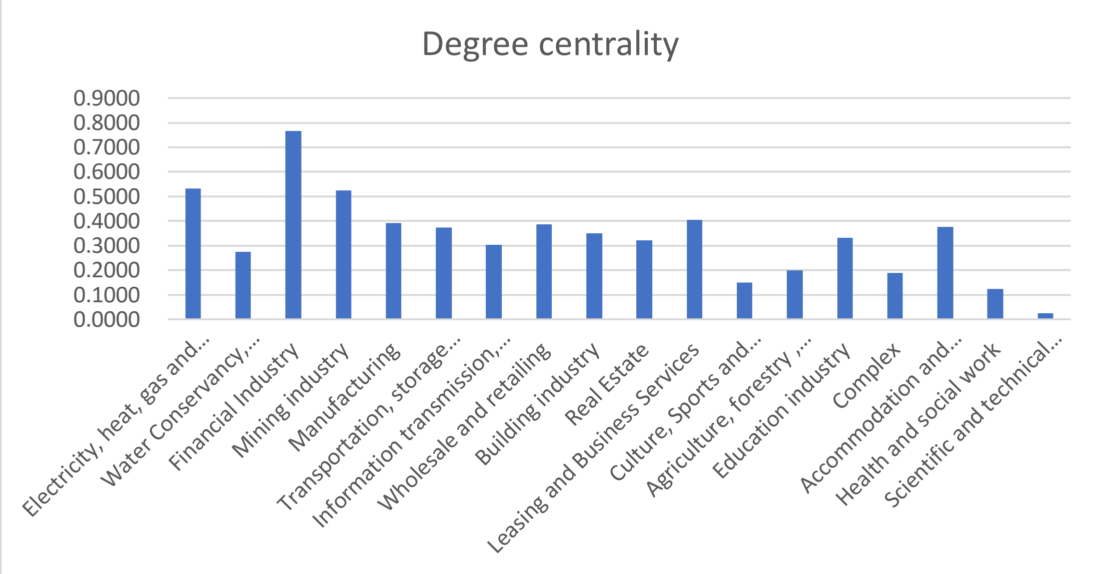
Panel A: Degree centrality and betweenness centrality for firms in general networks

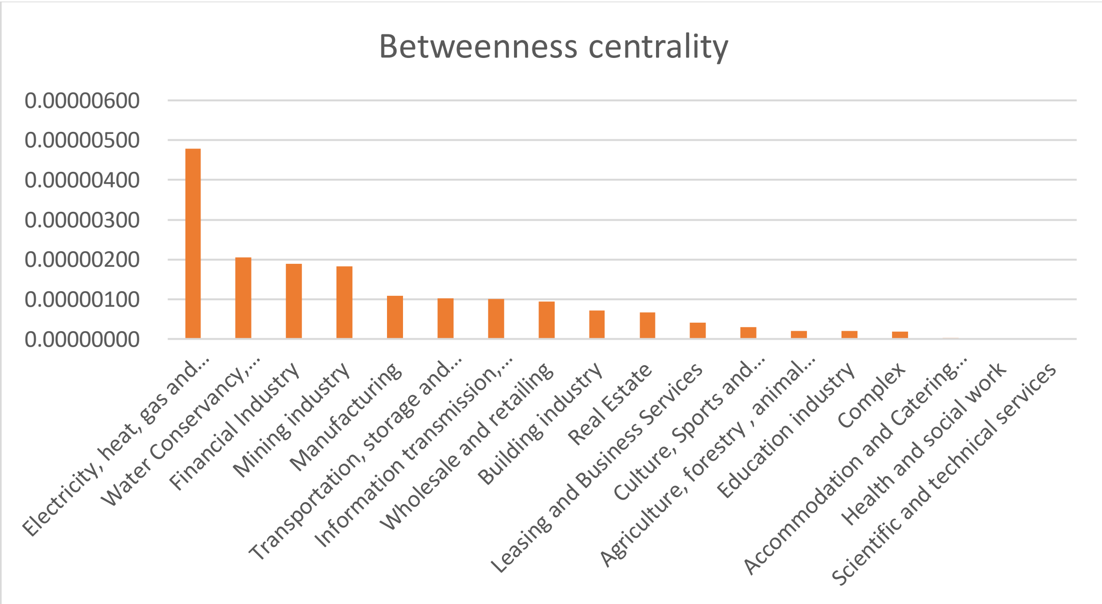




Note: Degree refers to the number of contacts a firm has in its network. Betweenness centrality means the number of paths through the firm to all paths in the network. (1) Degree centrality $DC_i = \sum_j X_{ij}$, where X_{ij} means a connection from i to j. (2) Betweenness centrality $BC_i = \sum_j \sum_k \frac{g_{jk}(i)}{g_{jk}}$, where g_{jk} means the number of shortest paths from j to k; $g_{jk}(i)$ refers to the number of shortest paths from j to k through i. The figure is based on the data in appendix 2, which shows centrality measures for firms in different industries.

Panel B: Degree centrality and betweenness centrality for firms in ownership networks

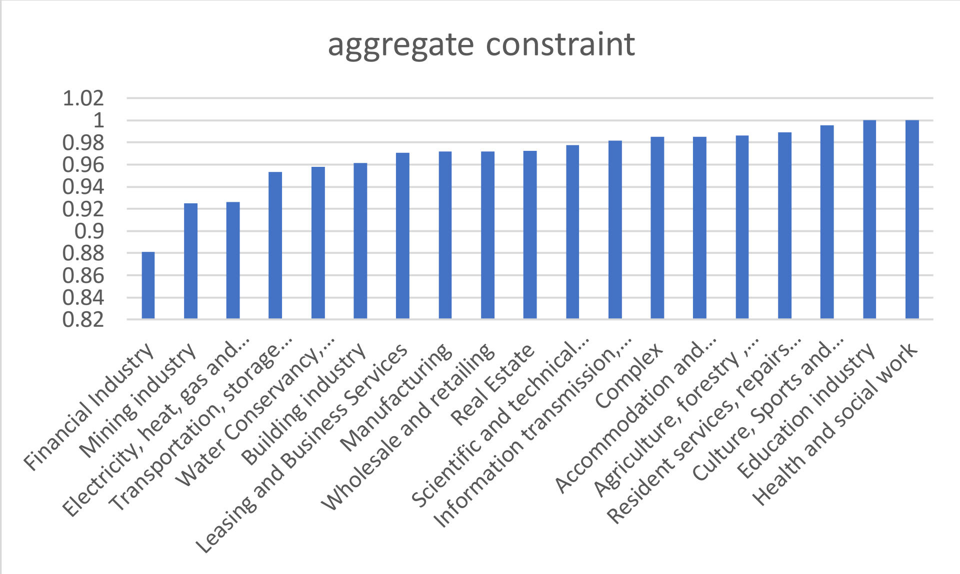




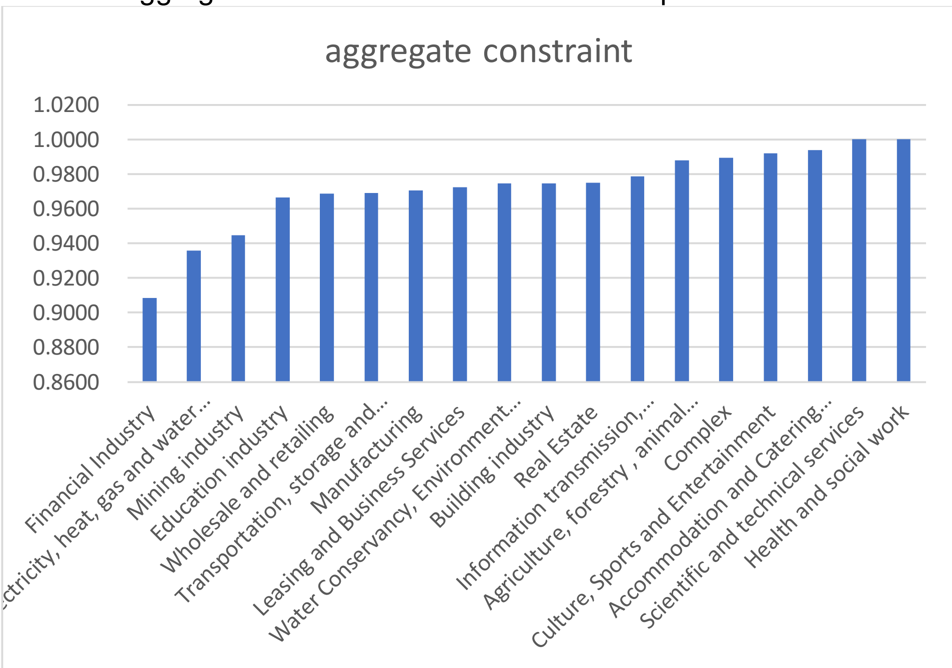
Note: Degree refers to the number of contacts a firm has in its network. Betweenness centrality means the number of paths through the firm to all paths in the network. (1) Degree centrality $DC_i = \sum_j X_{ij}$, where X_{ij} means a connection from i to j. (2) Betweenness centrality $BC_i = \sum_j \sum_k \frac{g_{jk}(i)}{g_{jk}}$, where g_{jk} means the number of shortest paths from j to k; $g_{jk}(i)$ refers to the number of shortest paths from j to k through i. The figure is based on the data in appendix 3, which shows centrality measures for firms in different industries.

Figure 2.4: Aggregate constraint for firms in different industries.

Panel A: Aggregate constraint for firms in general networks across industries

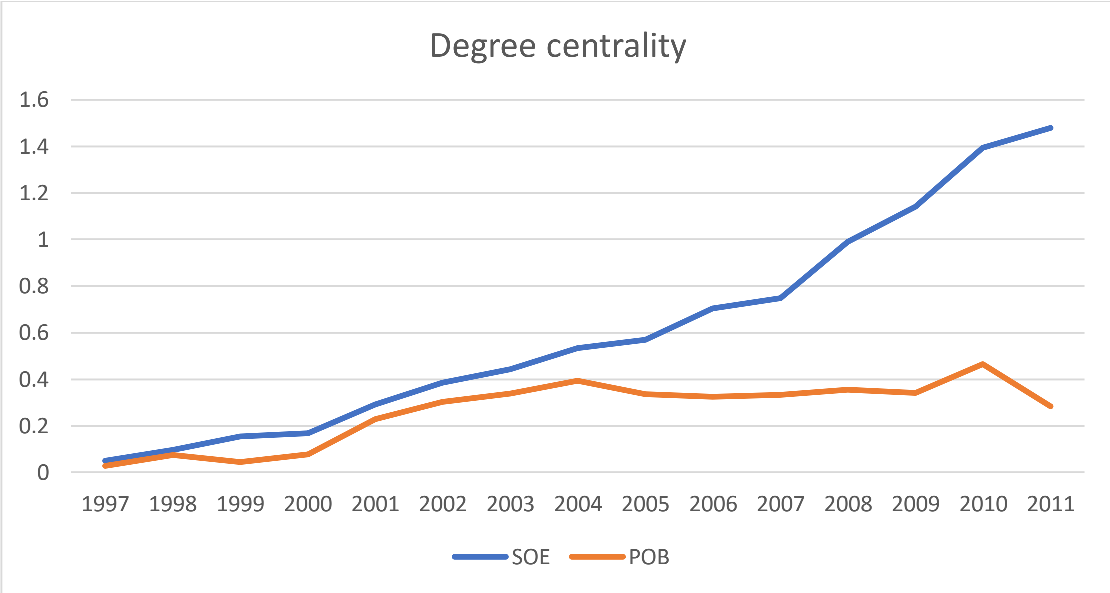


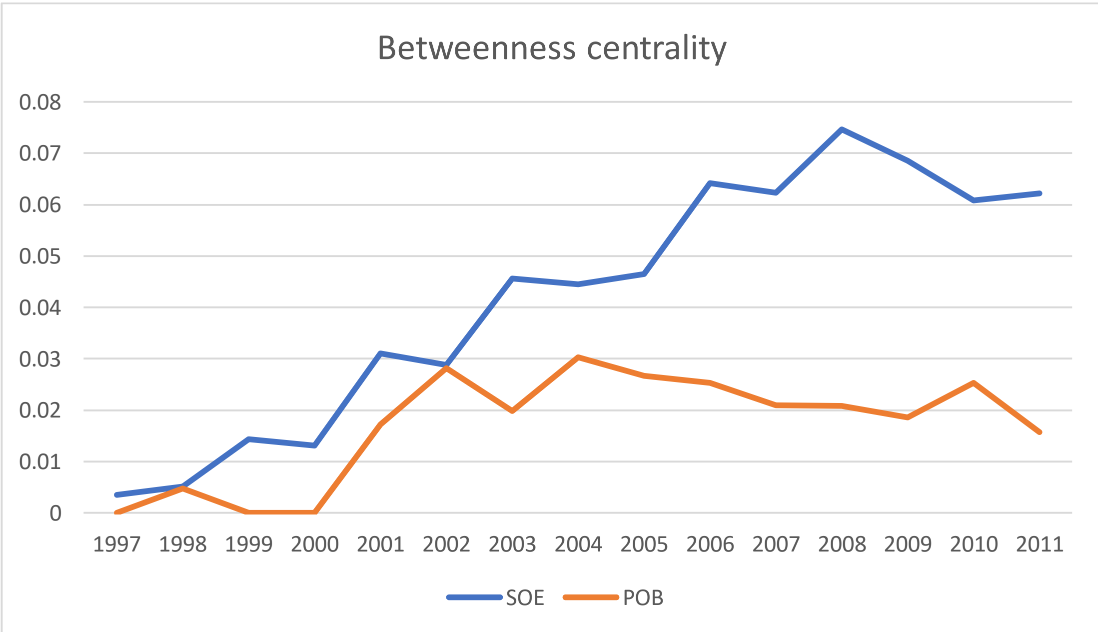
Panel B: Aggregate constraint for firms in ownership networks across industries



Note: Aggregate constraint is a measure of structural holes. The more constraint a firm has, the less likely for the firm to be a broker. Aggregate constraint $AC_i = \sum_j (P_{ij} + \sum_q P_{iq} P_{qi})^2$ where P_{ij} means the proportional strength of the tie from firm i to firm j. The data for the figure is provided in appendix 4.

Figure 2.5: Centralities for SOEs and private firms





Note: Degree refers to the number of contacts a firm has in its network. Betweenness centrality means the number of paths through the firm to all paths in the network. (1) Degree centrality $DC_i = \sum_j X_{ij}$, where X_{ij} means a connection from i to j. (2) Betweenness centrality $BC_i = \sum_j \sum_k \frac{g_{jk}(i)}{g_{jk}}$, where g_{jk} means the number of shortest paths from j to k; $g_{jk}(i)$ refers to the number of shortest paths from j to k through i. The figure is based on the data in appendix 2, which shows centrality measures for firms in different industries. The data for these figures are given in appendix 5.

Chapter 3 Do business networks help firms to finance?

Chapter 3 Do business networks help firms to finance?

3.1 Introduction

The prominent role played by various business networks in the emerging economies is witnessed and researched worldwide (He et al., 2013; Byun et al., 2013; Morck et al., 2005; La Porta et al., 1999). Researchers studying a network choose a set of actors tied by certain relations (Borgatti & Halgin, 2011). As resource-dependency theory (Hillman et al., 2009) suggests, firms try to release constraints, and obtain access to key resources such as expertise, finance, and advice. Establishing and managing relationships with other organizations enables the focal firm to access external resources that, in emerging markets, can be expensive and scarce or even unavailable (He et al., 2013). There is evidence to suggest that the absence of appropriate institutional safeguards makes it more difficult for firms to raise external financing (Gopalan et al., 2007). Firms form business networks due to the under-developed nature of the markets and business networks help to fill institutional voids (Leff, 1978; Goto, 1982; Khanna & Palepu, 1997, 2000).

However, as institutions are continuously improving in the emerging markets, a substantial body of literature has documented some negative impacts of business networks (Bae et al., 2002; Bertrand et al., 2002; Claessens et al., 2002; Sing & Gaur, 2009; Morck et al., 2005). For example, the complex ownership structure of a conglomerate or business group may impose significant governance challenges, and thus increase costs (Ma et al., 2006; Carney et al., 2009). Affiliates of business groups may suffer from agency problems that arise from the conflict of interests between controlling shareholders and minority shareholders. Such conflict may result in the misallocation of resources within the business group. Given the significant adverse effects of business networks, the prevalence and thriving of business networks in many countries (The Economist, 2011) has raised a fundamental question: why and how do business networks survive and continue to grow (Masulis et al., 2011)? The empirical results of research into business networks are mixed and a consensus has not yet been reached about the net effects of business network affiliation (He et al., 2013). This study contributes to the debate by examining the financing advantage that may be gained by membership of business networks.

Previous studies investigating the role of business networks in firms' financing are constrained. They heavily focused on internal capital markets (He et al., 2013; Gopalan et al., 2007; Buchuk et al., 2014) and debts (Byun et al., 2013; Mulyani et al., 2016; Manos et al., 2007; Chakraorty, 2013). Studies investigating the relationship between business networks and firms' financial constraints focus on an examination of investment-cash flow sensitivity (e.g. He et al., 2013). There is limited research on whether and how firms in business networks may be less financially constrained than their counterparts outside the business network. A thorough understanding of how firms in business networks are less financially constrained is not only academically imperative, it has practical benefits since a better knowledge about the role of business networks can govern network strategies for firms. Moreover, examining the role of business networks purely from the point of view of firms' debt financing may limit our understanding about firms' access to financial resources since debt is only one element of financial resources. Our study contributes to the literature by examining how firms in business networks are less financially constrained with regard to a relatively wide range of financial resources, such as firms' debt financing, access to trade credit, working capital management and cash flow adequacy ratio. Thus we obtain a more comprehensive understanding of the role of business networks.

China is an excellent case for a study on the effects of business networks on firms' access to financial resources. First, there are various types of business networks in China, which play significant roles in its national economy. For example, as mentioned in chapter 1, business groups in China contribute close to 60% of the nation's industrial output (China Development Research Center of the State Council, 2000). Business networks are widespread and play prominent roles in the practice of business. This makes China a good and relevant context for business networks studies.

Second, as China is both an emerging and transition economy (Peng et al., 2008), its institutional infrastructure cannot provide consistent and sufficient protection for business activities (Jia & Wang, 2013; Allen et al., 2005). For example, investor protection in China is among the worst in the world (Allen et al., 2005; La Porta et al., 1998) and external capital can be expensive and scarce, or even unavailable (He et al., 2013). In this context, business networks can have significant effects on firms' access to resources.

Third, China has maintained a state-dominated financial system; government at different levels controls the allocation of financial resources in both the banking sector and the securities market (He et al., 2013). Institutional biases and discriminatory economic policy lead to an unfair competitive environment. In such a context, business networks are likely to serve as a resources pool for firms needing to access external finance, particularly for non-SOEs.

Finally, China offers valuable opportunities to study the nature of networks grounded in the importance of the relationships between firms. Its value system entrenched in a deeply rooted culture has promoted the prominence of various guanxi, which provide valuable opportunities for investigating many different types of business networks. As seen in Chapter 2, due to data limitation, previous studies have examined just one type of relationship among firms (Chen & Xie, 2011; Duysters & Lemmens, 2003; Khanna and Rivkin, 2001). This study uses listed company related party data to examine business networks that defined via different types of relationship, through which we can make a contribution to research on the effects of the nature of business network.

In order to gain a more comprehensive understanding of the role of business networks and to contribute to the mixed empirical results in studies about them we address the following issues in this study: (1) whether firms in business networks have superior access to debts than free-standing firms have; (2) whether firms in business networks have superior access to trade credit than free-standing ones; (3) whether firms in business networks have more efficient working capital management than isolated firms; (4) whether affiliated firms have more cash flow for investment than those that are non-affiliated; (5) how ownership and type of networks shape the role of business networks in China; and (6) how the structure of the networks affects the role of business networks in China.

Unlike previous studies that are reliant on an examination of internal capital markets and debts, we can offer a relatively wide range of knowledge about how affiliates of business networks are less financially constrained. Moreover, we investigate how these relations are affected by the ownership type and nature of business networks, which provides a more detailed and complete understanding of the role of business networks. Furthermore, by examining the network effects of network structures, we have an improved understanding of the role of business networks on firm finance.

Using data from the CSMAR (China Stock Market & Accounting Research) database, a widely used database for the study of Chinese listed companies, this study constructs business networks over a 15-year period from 1997 to 2011. By examining the role of business network affiliation, we find that affiliates in business networks typically have superior access to financial resources. Our evidence shows that firms in business networks are less financially constrained because they have a higher degree of leverage, better access to informal finance in terms of trade credit, more efficient working capital management, and greater access to cash for investment. Moreover, the effects of business networks on firms' access to financial resources are swayed by the nature of the business network and the controller type of the firm. Our results suggest, for example, that the role of business networks in firms' cash sufficiency for investment and working capital management is more pronounced for non-SOEs, who are discriminated against by the formal financial systems. Among the different types of business networks, collaboration networks show relatively weak determining effects compared to ownership networks or individual networks. Affiliation to ownership networks has better-determining effects for long-term debts, while individual networks affiliation has more impact on short-term leverage, trade credit, working capital management, and cash sufficiency. Furthermore, we also find that networks effects are mediated by network structures and that the centrality of the firm's position in the network and the degree of network tightness are positively related to firm's finance.

We also perform a battery of robustness checks. Using multiple measures of trade credit, we investigate the role of the business network on firms' granting of trade credit and the net trade credit received. Moreover, we examine alternative measures of ownership by using domestic private firm dummies as a robustness check for the use of non-SOEs. We also control for endogenous network formation and cross-sectional dependence to check the reliability of our results. Our robustness checks provide estimation results that are consistent with the main regression.

The remainder of this chapter is organized as follows. In section 2, we briefly discuss context in Chinese networks and institutions. In section 3, we present the theory and hypotheses development. In Section 4, data is introduced. Section 5 illustrates the empirical strategy. Section 6 gives findings and discussions. In section 7, further analysis, including robustness checks, is presented. We conclude the work in Section 8.

3.2 Business networks and the institutional environment in China

3.2.1 Business networks in China

China has been searching for appropriate methods to govern firms since its market-oriented reforms in 1978 (Nee, 1992). Reformers in China believed that since China fails to provide adequate formal institutions to facilitate the functioning of the market (Ma et al., 2006), business networks, such as business groups, might help firms deliver stable financial performance and achieve international competitiveness (Ma & Lu, 2005). In 1987, the state ministries first issued a formal policy document to signal approval for transforming SOEs into recognized business groups (Carney et al., 2009; Keister, 2000). This formalized earlier experiments on establishing business groups. As a result, business groups, being a typical example of business network, have grown dramatically (Hahn & Lee, 2006). By the early 1990s, the number of business groups in China amounted to 7000 (Wu, 1990; He et al., 2013).

Indeed, to achieve policy goals, it is suggested that significant consolidation was required (Carney et al., 2009). China therefore encouraged firms to form different types of network in order to achieve competitive advantage. These are now widespread in China and include National Trail Groups established in 1991 and 1997 (Nolan, 2001), industry association networks (Liu et al., 2016), interlock directorship networks (Chen & Xie, 2011), and cross-shareholding networks (Sha & Zeng, 2014). Evidence shows that over 50% of listed companies are involved in listed company cross-shareholding networks (Sha & Zeng, 2014).

A relation-based governance regime is very evident in China and is a product of its rich heritage and entrenched value system. It persists despite the country's efforts to transfer to a rule-based governance system as adopted by western countries (Lau & Young, 2013; Li, 2013). For the Chinese, relationships are viewed as essential elements of society (Ambler & Witzel, 2000) and guanxi is at the heart of Chinese rationalism. As mentioned above, guanxi is widely used as a business strategy to gain a competitive advantage (Li et al., 2008; Li & Zhang, 2007). It is important to appreciate that guanxi is deeply rooted in Chinese culture, having been formed and reinforced over centuries (Lau & Young, 2013). It is appropriate to say that the Chinese economy is composed of various guanxi, which constitutes different types of business networks.

In such a context, the blossoming relationships among firms provide us with valuable opportunities for investigating the role of the different business networks. Ownership networks, such as business groups, are promoted by the government while individual networks are deeply rooted in its culture. We argue that the substantially different nature of the various types of network means that firms receive different benefits according to the type of network they are affiliated to.

3.2.2 Institutional environment in China

China is significant as it has an emerging economy as well as a partial transition economy (Peng et al., 2008). As a socialist country, public ownership occupies a dominant position in the national economy, with other forms of ownership developing in its train (Chen & He, 2009). The state controls access to capital, exercises favoritism, and influences investment decisions. Thus, state bureaus and SOEs are crucial to the national economy and often dominate business activities in the market. This leads to one characteristic of China's reform, which is the uneven development of the economic and legal systems. One of the most reported issues identified by researchers is the discriminatory financial system.

The state dominates the financial system and controls the allocation of financial resources in both the banking sector and the securities market (He et al., 2013). The banking system in China is dominated by the four state-owned commercial banks, although there are scores of foreign and regional commercial banks. China's imperfect legal system and market mechanism means that its legal system is less than flexible, and provides neither transparent nor consistent protection for business activities (Jia & Wang, 2013). Due to poor legal protection from opportunistic behaviors, banking systems favor firms with whom they are familiar, for example, large and established SOEs.

In terms of the securities market in China, it is also shaped by the government since in order to be approved as listed by the China Securities Regulatory Commission, companies must be selected by a provincial government or ministry (He et al., 2013). Government-guided financial resource allocation normally favors a few large-scale state-owned enterprises that are critical to the economic development of the country or the specific region. Indeed, Chinese listed companies came about as a direct result of the government's restructuring of SOEs (Wang, 2012). China's aim in establishing two stock exchanges was to list SOEs and thereby solve its property rights problem, improve corporate governance, and develop more efficient business operations (Zhang, 2008). Even now, the states are important shareholders in these companies and in most cases, they are the majority shareholders. The state (or SOEs proxying for the state) can therefore exert significant influence over listed companies. Compared with SOEs, private-owned enterprises are constrained by lack of access to available resources, and discriminatory policies (Li, 2013). Hence, smaller state-owned and most non-state enterprises experience difficulty in securing finance from the official financial system.

Given that China's financial systems discriminate between different types of business entities, we expect firms, particularly private firms, might seek to improve access to external financing by affiliating to business networks, thereby reducing the information asymmetry problem and transaction cost. We also surmise that the result of business networks affiliation on firms' access to resources is different for SOEs and non-SOEs.

3.3 Literature and hypothesis development

The number of network studies has been increasing exponentially over time (Borgatti & Halgin, 2011). One of the dominant explanations of various business networks is the market-based view proposed by the works of Leff (1978) and Goto (1982). This was further developed by Khanna and Palepu (1997, 2000) into 'institutional void.' This view argues that the existence of business networks, such as business groups, is due to the under-developed nature of markets in the developing markets. Business networks emerge to fill the institutional voids caused by the absence of supportive institutions for business activities in many parts of the world. As a result, business units form networks in order to avoid market imperfections by internalizing transactions within network members rather than the market (Leff, 1978; Bugador, 2015). Clearly, the institutional voids hypothesis (Khanna & Palepu, 2000) would suggest that the benefits of business network affiliation would decrease or even disappear as institutions improve, and there is evidence in support of this (see Gaur & Delios, 2006; Hoskisson et al., 2005). Further, studies have increasingly reported on the cost of affiliating to business networks (Gaur & Kumar, 2009; Morck et al., 2005).

We therefore see that both positive effects and negative effects of business network affiliation have been empirically reported. We have outlined these benefits and costs in chapter 1. Given the persistence and prominence of business networks despite an improvement in the institutional environment (Carney, 2008; Siegel & Choudhury, 2012), it is important to examine the benefits of business networks to provide an explanation of firms' persistent motivation to join.

This study expects to partially investigate the benefits of business networks by looking at their role in relation to firms' access to financial resources. We argue that firms in business networks gain a financing advantage through superior access to financial resources. Previous studies have investigated the role of business networks on firms' financial constraints but these have heavily focused on debt and equity (e.g. Byun et al., 2013; Manos et al., 2007; Almeida et al., 2015; Buchuk et al., 2014). Very few studies have examined informal finance mechanisms such as trade credit (Liu et al., 2016) and working capital management (Singh & Kumar, 2014). This study expects to bridge this gap by examining a relatively comprehensive range of financial resources. By doing so, we expect to contribute to the literature by showing *how* firms in business networks are less financially constrained, rather than simply stating that firms in business networks *are* less financially constrained (e.g. He et al., 2013). We argue that business network affiliation significantly impacts on firms' access to debts, trade credit, working capital management, and cash flow sufficiency.

3.3.1 Business networks and firms' access to debts

An investigation into the role of business networks in firms' debt financing is an empirical question since business networks come with both positives and negatives (Byun et al., 2013). Empirical studies examining the relationship between business networks and debt financing present mixed findings. Manos et al. (2007) suggest that group affiliated firms are more highly levered compared with non-affiliated firms as they enjoy better access to external capital. Paligorova & Xu (2012) investigate the motivation of pyramidal firms for the use of debt financing and suggest that pyramidal firms have significantly higher leverage against the risk of expropriation. Kuo & Wang (2015) indicate that network linkages positively affect financial leverage. Mulyani et al. (2016) demonstrate that family firms tend to maintain higher leverage to mitigate agency problems. On the other hand, business network affiliation is found to be negatively related to firms' debt financing. Family firms are found to rely less on leverage for funding to reduce fixed commitment on their cash flows and reduce default probabilities (Jensen, 1986; Shleifer & Vishny, 1986; Faccio et al., 2001). Network linkages based on financial resources can increase firms' overall financial flexibility and capacity for financing, and reduce firms' debt level (Vicente-Lorente, 2001; Kuo, 2006). Managers of group-affiliated firms seem to prefer equity over debt since high leverage increases firms' bankruptcy risk (Chakraborty, 2013).

Given the importance of sufficient capital for firms' performance and survival (Bridges & Guariglia, 2008; Clarke et al., 2012), the impact of business networks on firms' debt financing deserves additional investigation. Even though researchers have found that network affiliation is a major factor affecting firms' financing strategy, there is a lack of research on firms' debt structure in relation to network affiliation, particularly in the context of the emerging economies (Malik & Afza, 2015). In this study we supplement the literature by investigating the role of business networks in firms' long-term leverage and short-term leverage. Moreover, to the best of our knowledge, there is no prior study directly investigating the role of business networks on firms' debt financing in the Chinese context; this study thus fills a gap. Furthermore, previous studies that investigated the role of business networks in firms' debt financing have largely ignored endogenous treatment effects (e.g. Manos et al., 2007; Paligorova & Xu, 2012; Malik & Afza, 2015), which biases the results.

In order to understand the role of business networks in firms' debt financing, we need to bear in mind that the effects of business networks are felt differently in the debt market and in the equity market. From the perspective of debt holders, they are less concerned with the governance of firms so long as the owners maintain the firm's value above the threshold for default (Byun et al., 2013). The adverse effects of business networks exerting influence on the firm may therefore be less significant for debt holders than it would be for the shareholders.

Business networks are composed of various relational ties, which have developed through frequent and repeated interactions and turned into the kind of relational social capital that facilitates firms' access to external finance (Du et al., 2013). Affiliation to business networks can affect firms' access to debts in several ways. First, members of business networks become familiar with each other through frequent interactions. This helps member firms to reduce information asymmetries, as was found in the case of Japan by Dewenter & Warther (1998). In networks, members are familiar with each other and exchange favors for organizational purpose (Gu et al., 2008). Through interactions, norms and trust would be established, which encourage firms to share and exchange different expertise, information, knowledge, and network resources. Disputes are resolved using network norms instead of formal laws, which are inefficient in many emerging economies (Jia & Wang 2013). Aside from the market-related benefits, networks are associated with superior information processing and flexible monitoring (Achrol & Kotler, 1999) which would reduce agency cost (Gul, 1999). An affiliated firm can also share a network's reputation capital, which can help affiliated firms to sustain superior access to capital by mitigating the agency cost of firms' access to financial capital (Anderson et al., 2003). Interactions in business networks enable firms to transfer their credit to other business entities and potential financiers. Thus, the information asymmetry problem and agency cost can be reduced and financiers become more willing to extend credit.

Additionally, by forming business networks, firms can facilitate their access to external resources. Firms bond together to enlarge their bargaining power and gain increased access to resources, such as government support (Majumdar & Sen, 2006; Ghemawat & Khanna, 1998), raw materials and intermediate goods (Khanna & Rivkin, 2001), foreign capital and foreign technology (Khanna & Palepu, 2000), and financial capital (Anderson et al., 2003; Chang & Hong, 2000). By establishing a sharing platform, firms pool their resources for sharing and mobilization. For example, firms in business groups can create virtual (or internal) capital markets to mitigate the distortion in the capital, product, and labor markets (Khanna & Palepu, 1999; Khanna, 2000; Khanna & Rivkin, 2001; Buchuk et al., 2014; Gopalan et al., 2007). By internalizing transactions in the market, firms in business networks can provide and receive loan guarantees from members (Manos et al., 2007; Malik & Afza, 2015), and the cost of debt financing is reduced (Byun et al., 2013). Evidence suggests that the absence of appropriate institutional safeguards makes it harder for firms to raise external finance (Gopalan et al., 2007). Firms in business networks can expand their access to debt from other network members since such networks provide mechanisms for resource sharing by pooling their financial resources.

Moreover, it is suggested that firms in business networks have a lower probability of defaulting on debt repayments (He et al., 2013; Manos et al., 2007; Achrol & Kotler, 1999). By connecting to various partners, firms can make a supplement to firm-level diversification which will reduce risks (Claessens et al., 1999; Manos et al., 2007). In order to avoid the negative spillover of firm default in business networks, most networks will have mechanisms for supporting firms in distress (Gopalan et al., 2007). Creditors will be more likely to grant credit to firms in such networks as there is perceived enhanced protection.

Based on the analysis, we formulate the following hypotheses:

H1a: Firms' business network affiliation will be positively related to long-term leverage.

H1b: Firms' business network affiliation will be positively related to short-term leverage.

3.3.2 Business networks and firms' access to trade credit

Business networks, being a type of informal contract and institution, are increasingly being seen by researchers as a mechanism to reduce credit market frictions and facilitate firms' access to formal finance, such as bank loans and the equity market (Claessens et a., 2008; Liu et al., 2013; Haselmann et al., 2013). It is recognized that information asymmetry and moral hazard are the major problems that impede firms' access to financial resources (Haselmann et al., 2013). Such problems are more severe for firms wishing to access informal finance such as trade credit because the providers of trade credit do not charge any interest or require any collateral (Wu et al., 2014). However, to the best of our knowledge, there has been limited academic focus on how informal institutions affect firms' access to informal finance such as trade credit.

Trade credit, as an important financing channel for firms, is vitally important all over the world (Demirguc-Kunt & Maksimovic, 2002; Guariglia & Mateut, 2006). It is even more important for firms in emerging economies where formal financial institutions are not sufficiently developed to support firms who need to gain access to adequate formal financing (Liu et al., 2016). Many firms use trade credit to finance their own purchases and even offer financing to customers. Current studies about the determinants of trade credit are heavily reliant on financial statement variables or firm/product characteristics (Cunat, 2007; Giannetti et al., 2011; Fabbri & Klapper, 2016). Our study takes the relatively novel approach of investigating how business network affiliation influences firms' access to trade credit.

We argue that firms' access to trade credit can be affected by business network affiliation in the following ways. Firstly, business network affiliation helps firms to reduce information asymmetry and agency cost (Dewenter & Warther, 1998; Anderson et al., 2003). Firms in business networks are more likely to extend and receive trade credit since they know each other better than the financial institutions do. Evidence shows that suppliers of trade credit have a lending advantage due to the availability of better information (Bias & Gollier, 1997). Additionally, business network affiliation helps firms to establish their social capital through interactions in which they build their reputation and trust (Peng & Luo, 2000; Park & Luo, 2001; Luk et al., 2008). Informal financing, such as trade credit, is always reputation and relationship-based (Ayyagari et al., 2010). Having a good reputation and a well-established level of trust are vital for the supply of trade credit (Wu et al., 2014). Consequently, firms in business networks are more likely to access trade credit.

Moreover, business network affiliation provides firms with protection from debtor bankruptcy (He et al., 2013; Manos et al., 2007; Achrol & Kotler, 1999; Gopalan et al., 2007). Firms that use trade credit for finance are more likely to pay it back. Firms in business networks are less likely to behave opportunistically in order to avoid negative spillovers to other network members and this reduction in borrower opportunism means that firms in networks are more likely to use trade credit (Burkart & Ellingsen, 2004). Finally, firms form business networks to enlarge their bargaining power and increase their access to resources (Majumdar & Sen, 2006; Ghemawat & Khanna, 1998). The literature has provided evidence that a supplier’s bargaining power significantly affects trade credit supply (Fabbri & Klapper, 2016). Thereby, we develop our hypothesis as follows:

H2: Firms’ network affiliation will be positively related to firms’ access to trade credit.

3.3.3 Business networks and working capital management

The management of working capital is one of the most important issues in corporate finance (Ben-Nasr, 2016). It represents the source and use of short-term capital, and firms’ liquidity to meet their short-term obligations (Ding et al., 2013; Buchmann et al., 2008). It is evidenced that working capital management plays a significant role in determining firms’ performance and value (Falope & Ajilore, 2009; Gill et al., 2010; Wang, 2002). Working capital is the difference between the current assets and the current liabilities (Pass & Pike, 1984). Ensuring the efficient use of working capital is essential because the level of working capital to total assets is often high (Padachi, 2006). It can be used as an additional source of finance for firms with limited access to long-term capital markets (Ding et al., 2013). However, compared with the development of long-term finance, far less attention has been paid to the area of short-term finance, particularly working capital management (Singh & Kumar, 2014). Our study expects to add to the literature by looking at this much neglected subject.

Current studies about working capital management have heavily focused on the effects of working capital management on the profitability of the firm (Deloof, 2003; Raheman & Nasr, 2007; Garcia-Teruel & Solano, 2007). Very few studies investigate the determinants of working capital management. Effective and efficient working capital management enables a faster availability of cash flow and higher revenues. It is important to investigate the factors that influence firms' working capital management. With a better knowledge of the determinants of working capital management, firms can strategize properly and manage their working capital more efficiently. Our study expects to make a contribution to this by examining the role of business networks affiliation on firms' working capital management. The main components of working capital are inventory, accounts receivable, and accounts payable. Through the administration of these elements, firms can achieve efficient working capital management. Business networks affiliation is associated with several characteristics that may affect firms' working capital management.

Firstly, business network affiliation helps firms in networks to alleviate asymmetric information and reduce agency cost (Dewenter & Warther, 1998; Anderson et al., 2003). Through frequent interaction among network members, trust would be established (Park & Luo, 2001) and firms are more likely to be able to access external financial resources (Anderson et al., 2003; Chang & Hong, 2000). Therefore, firms in business networks acquire a superior capability to adjust working capital to an optimal level, which is evidenced to positively affect firm performance (Aktas et al., 2015; Ding et al., 2013; Ben-Nasr, 2016). Additionally, firms in business networks enjoy superior access to trade credit (Liu et al., 2016), which is a major component of working capital. Internal transactions among network members provide channels for adjusting the working capital level while lowering transaction costs in the market. Furthermore, empirical studies have suggested that leverage level is a factor that determines working capital management (Rimo & Panbunyuen, 2010; Haron & Nomran, 2016). A high level of debt introduces pressure on management to avoid default (Jiang & Kim, 2015). Firms in business networks would therefore have more efficient working capital management since these firms can be highly leveraged, as suggested in our hypothesis 1. Hence, we formulate the following hypothesis:

H3: Firms' business network affiliation will be positively related to working capital management.

3.3.4 Business networks and cash sufficiency

A firm's capacity to acquire sufficient capital for investment is crucial to determine its survival (Bridges & Guariglia, 2008; Clarke et al., 2012). Given the increasingly reported negative impacts of business networks (Morck et al., 2005; Singh & Gaur, 2009), it is worth investigating whether firms in business networks are less financially constrained over time, particularly for firms in emerging economies. Investment-cash flow sensitivity is a popularly used measure of firms' financial constraints (He et al., 2013; Hoshi et al., 1991). It relies on the examination of differences in the investment-cash flow relationship between different groups of firms as evidence of financial constraints. The measure of investment-cash flow sensitivity involves the manual calculation of cash flow to investment in plant and equipment. The measure may create more noise compared with the given accounting index. We argue that the accounting index of cash flow adequacy ratio provides a more direct proxy for firms' financial constraints. It measures a firm's ability to generate sufficient cash flow to maintain itself without acquiring additional debts or having recourse to equity funding. By using the cash flow adequacy ratio, we are able to examine the effects of business networks on firms' financial constraints more directly.

In a well-functioned market without information asymmetry and financial constraints, a firm should have adequate cash for investment. The presence of asymmetric information, agency problems, and transaction costs can create high costs for firms needing to generate financial resources in the market (He et al., 2013). Business network affiliation helps firms reduce information asymmetry, agency cost, and transaction cost (Dewenter & Warther, 1998; Anderson et al., 2003; Manos et al., 2007; Achrol & Kotler, 1999), which will help firms to access financial resources.

Moreover, the widely documented virtual capital markets created by business networks help affiliates to alleviate problems caused by the under-developed capital markets (Khanna & Rivkin, 2001; Buchuk et al., 2014; Gopalan et al., 2007; He et al., 2013). Firms can pool their financial resources and reallocate them to finance profitable investments. Firms in networks create internal markets that enable them to have superior information about investment opportunities (Williamson, 1975). Internal markets also allow firms to access loan guarantees enabling them to take on debt if they fall into financial distress (Manos et al., 2007; Malik & Afza, 2015) and provide efficient monitoring (Achrol & Kotler, 1999). It also helps firms to reduce the risk of opportunism and lowers the need for contract enforcement (He et al., 2013). It is therefore expected that firms in business networks are less financially constrained. As with the analysis that resulted in hypothesis 3, we argue that firms in business networks have more efficient working capital management, which means that they have more immediate availability of cash flow and hence they are expected to be less financially constrained. And so we posit the following hypothesis:

H4: Firms in business networks are less likely to face financial constraints than those that are isolated.

3.3.5 Business networks and ownership

The effects of business networks are significantly influenced by institutional factors (He et al., 2013; Liu et al., 2016). Firms affiliate into business networks to fill institutional voids (Khanna & Palepu, 1997; 2000). In emerging economies, where firms' access to financial resources is constrained, business networks are formed to help firms alleviate financial pressure. A rational extension of this conjecture is that business networks play a more important role when firms are in severe financial conditions. Accordingly, it is expected that the effects of business networks in firms' access to financial resources are more pronounced among non-SOEs since they have a greater need for capital and are more likely to be financially constrained (Liu et al., 2016; He et al., 2013).

China has adopted and maintained a state-controlled financial system that in which various levels of government control the allocation of financial resources in both the banking and securities markets (He et al., 2013). The banking system in China is dominated by the four state-owned commercial banks, although there are large numbers of regional commercial banks and foreign banks. The government also dominates the stock market. A listed company seeking approval by the China Securities Regulatory Commission must be selected by a provincial government or ministry (He et al., 2013). A quota system is adopted by provinces and ministries to process the listing applications, which sets limits for the number of firms to be listed. According to Allen et al. (2012), the corporate bond market is almost non-existent due to China's inefficient and unsound accounting and auditing systems. Government-guided financial resource allocation normally favors a few large-scale state-owned enterprises that are important to the economic development of the country or the specific region. Smaller SOEs and most non-SOEs face difficulties in accessing financial resources from the state-controlled financial systems and suffer from severe financial constraints as a result. Therefore, non-SOEs must rely on business networks to gain access to financial resources. We therefore formulate the following hypothesis.

H5. The effects of business networks on firms' access to financial resources are more pronounced among non-SOEs than among SOEs.

3.3.6 Nature of business networks

There are various types of business network that are defined according to the nature of the relations between firms. We have outlined many types of business networks in chapter 2. In general, we have classified state ties into ownership ties, collaboration ties, and individual ties. These ties constitute different networks. As we summarized in chapter 2, defining the network defines its structure. It is therefore self-evident that network effects will vary according to the networks' definition. Prior studies focused on a single form of relationship and fail to comment on how the nature of business networks shapes the role of business networks. This study contributes to the literature by examining the mediating effects of the nature of business networks.

The rich information we obtained in this study about related party relations also provides a valuable opportunity to investigate the different natures of business networks. Ownership networks, collaboration networks, and individual networks may be extracted separately from the whole network. We argue that different networks are associated with different degrees of control or influence that will differentiate the effects of business networks. Among three types of business networks, ownership networks identify with the strongest control and most direct influence over affiliates. Information-sharing and resource mobilization are effective among these firms. Two specific sub-types of ownership relations are particularly relevant to this discussion, namely control and significant influence (see chapter 2 for details). As regards their influence on network members, a 'control' relationship is more direct and exerts stronger influence, than 'significant influence'.

We argue that, given the importance of guanxi in the Chinese context (Li, 2013), individual networks are significant in affecting firms' access to resources. Studies have shown that firms in China extensively use guanxi to have a competitive advantage (Li et al., 2008; Li & Zhang, 2007).

In comparison to ownership networks and individual networks, collaboration networks are relatively weak and indeed firms in collaboration networks may suffer operational problems. Evidence suggests that over 50% of alliance networks are in trouble within 2 years and the majority of alliance networks disband within 3 (Wu & Lou, 2010; Zhang & Cao, 2004). We therefore hypothesize that collaboration networks are significantly less likely to influence firms' access to resources. The following hypothesis is proposed.

H6a: In ownership networks, networks constructed from control relations are more prominent in affecting firms' access to financial resources than networks constructed from significant influence relations.

H6b: Ownership and individual networks have a stronger effect on firms' access to financial resources than collaboration networks.

3.3.7 The effects of network structure

Network structure is an important factor that shapes the role of business networks. Firms with different network position and ego network structure could benefit differently (Tsai, 2001; Burt, 1982, 1997, 2005). It is important to understand how a difference in network structure affects firms' access to financial resources since without this knowledge, our understanding for business networks is incomplete. Further, firms armed with knowledge of the effects of network structure can adjust their network strategy accordingly to achieve their organizational goals. In this study, we investigate the roles that network position and the tightness of the network play in determining firms' access to financial resources.

Centrality measures the virtual position of individual network members in their networks. Firms in a central network position are more likely to control the flow of resources and information within the network (Freeman, 1978). Many studies have documented the benefits of occupying a central position, such as superior access to scarce resources (Ahuja, 2000; Tsai, 2001; Wang et al., 2014). Firms in a central position are also more likely to increase their creditworthiness and have access to more channels that generate financial resources. Apart from central position, the degree of tightness of the network is an important factor that may influence firms' access to resources. Burt (1982, 1997, 2005) highlights the advantages of sparse networks with disconnected network partners but in a tighter network, firms are well connected to each other and information asymmetries are reduced, which improves firms access resources. The tightness of the network's structure facilitates firms' access to resources held by other network members. We therefore formulate the following hypotheses regarding network structure.

H7a: Firms in central network position have superior access to financial resources.

H7b: Firms in a tighter ego network structure have better access to financial resources.

3.4 Data and summary statistics

3.4.1 Data

This study gets all its financial information and network information from the CSMAR (China Stock Market & Accounting Research) database issued by GTA (Guo Tai An) Research Service Centre. The database provides good coverage of listed companies in the market and is widely used in studies investigating Chinese listed companies (Liu et al., 2016). Three datasets are used to identify listed company networks via related parties and the relevant financial information for individual listed companies. These datasets are: listed company related party information data; listed company related party transaction data; and listed company financial indicator data, all of which span from 1997 to 2011. There are a total of 2,341 listed companies included in the sample during the sample period. The data contains information about listed companies' related party information, key financial indicators, and basic information about listed companies. By dropping some missing observations, we have in total 17,641 firm year observations. As we will run several regressions, observations in each regression may vary depending on the variables captured.

As mentioned in chapter 2, listed company related party information data and listed company related party transaction data are used to construct business networks in this study. Pajek software is used to construct business networks and compute the network structure parameters.

3.4.2 Summary statistics

Table 3.1 provides summary statistics and definitions of key variables in this chapter. The statistics indicate that about 29% of firms are network affiliated - 25% via relations from ownership, 5% from cooperation and 3% from key individuals. The mean value of the leverage ratio, long-term leverage and short-term leverage are 45%, 6%, and 38% respectively. The figures are either the same or similar in essence to those in other studies (e.g. Fan et al., 2012; He et al., 2013; Dong et al., 2014). The debts ratio in China is relatively high compared to those seen in developed countries, such as the US and the UK (Jiang & Kim, 2015; Fan et al., 2012).

In terms of trade credit, the results show that Chinese listed companies receive 10.5% trade credit and offer 14% trade credit to other firms. The level of trade credit reflects previous studies, such as Wu et al. (2014) and Liu et al. (2016) and suggests that trade credit is an important channel for firms to obtain financial resources. In terms of working capital management, Chinese listed firms have an average cash conversion cycle of 192 days. The mean value of cash sufficiency ratio of 0.47 suggests that Chinese listed companies are generally financially constrained as their cash flow is not sufficient for their investment. The growth of sales is 16%, which is very high and consistent with China's impressive economic development. In our sample of listed companies, 64% of firms are SOE dominated. The correlation analysis in Panel B of table 13 suggests that network affiliation is positively related to firms' access to long-term debts, trade credit, working capital management, and cash sufficiency. The correlation analysis generally supports our hypotheses.

<Table 3.1 inserted here>

Table 3.2 presents the univariate test results, where we compare the debt level,

average trade credit, working capital management, and cash flow adequacy ratio between firms with and without network affiliations. The results show that firms with network connections have 7.7% long-term and 40.6% short-term debts, while firms without such links have 6.1% long-term and 37.8% short-term debts. The differences are both statistically significant at the 1% level of significance. In terms of trade credit, firms in networks use 12.1% of trade credit while isolated firms use 9.9% of trade credit. The difference of 2.1% is also statistically significant at the 1% level. Regarding working capital management, the results show that firms in business networks have a significantly shorter cash conversion cycle than those not, which means that firms in business networks have more efficient working capital management. Cash flow adequacy ratio is also significantly different between networked firms and those not. The differences between networked firms and those not in terms of working capital management and cash sufficiency are both significant at 1% level. The univariate analysis is consistent with our hypotheses regarding firms' access to financial resources and suggests that firms in business networks are less financially constrained than isolated firms.

<Table 3.2 inserted here>

3.5 Empirical strategy

In order to investigate the effect of business network affiliation on firms' debt financing, this study follows Du et al. (2013) and Chakraborty (2013) for its baseline model.

$$\mathrm{Lev}_{i,t} = \beta_0 + \beta_1 Net_{i,t} + \beta_2 NonSOE_{i,t} + \beta_3 Fr_{i,t} + \beta_4 Size_{i,t} + \beta_5 Growth_{i,t} + \beta_6 Prof_{i,t} + \beta_7 Dep_{i,t} + \beta_8 Fcf_{i,\mathrm{t}} + v_i + \varepsilon_{i,t} \qquad (1)$$

The dependent variable is the ratio of different debts to total assets of the focal firm in year t. Long-term leverage and short-leverage are used respectively as the dependent variable. The variable of interest is net, which is a dummy variable suggesting business network affiliation status. It is equal to 1 if the focal firm is affiliated into business networks in period t, and otherwise equals 0. Furthermore, this study also includes fixed ratio, depreciation, firm size, sales growth, firm performance (profitability) and cash flow to control for firm-specific characteristics (Ahmed et al., 2002; Shi, 2003; Yu, 2005). Size is measured as the logarithm of total sales; Fr is fixed ratio, which is a proxy for asset structure and is measured as fixed assets scaled by total assets; growth is measured as the percentage change in total sales; dep is depreciation and measured as the ratio of depreciation to total assets; and prof refers to operating profit to total assets. Fcf takes the value of the ratio of free cash flow for firm to total assets. A non-SOE dummy is also included to control for the effects of ownership. v_i is firm specific fixed effects.

In terms of H2, we establish the following baseline regression model, which is used by Liu et al., (2016):

$$Payable_{i,t} = \beta_0 + \beta_1 Net_{i,t} + \beta_2 NonSOE_{i,t} + \beta_3 Fr_{i,t} + \beta_4 Size_{i,t} + \beta_5 Growth_{i,t} + \beta_6 Prof_{i,t} + \beta_7 Lev_{i,t} + \beta_8 Opcash_{i,t} + v_i + \varepsilon_{i,t} \quad (2)$$

In equation 2, trade credit is measured by total accounts payable/total assets. Network affiliation is the main independent variable. Control variables are growth, firm size, profitability, fixed ratio, leverage, and operating cash flow, which are used in previous studies, such as Wu et al. (2014). Definitions of control variables are the same as in equation 1. Leverage in this equation refers to total liability to total assets. Cash flow is the ratio of operating cash flow to total assets.

To test H3, this study follows the model in Haron & Nomran (2016) as a baseline model to investigate the role of business networks in firms' working capital management.

$$CCC_{i,t} = \beta_0 + \beta_1 Net_{i,t} + \beta_2 NonSOE_{i,t} + \beta_3 Current\_\mathrm{ratio}_{i,t} + \beta_4 Size_{i,t} + \beta_5 Growth_{i,t} + \beta_6 Prof_{i,t} + \beta_7 Lev_{i,t} + \beta_8 Fcf_{i,t} + v_i + \varepsilon_{i,t} \qquad (3)$$

The dependent variable is cash conversion cycle (“ccc”), measured as the number of days inventories plus the number of days accounts receivable minus the number of days accounts payable. It is the time difference between the purchase of raw materials and getting paid for finished goods (Singh & Kumar; 2014). Reducing ccc to a reasonable minimum implies more efficient working capital management. The main independent variable is business network affiliation. Control variables use the same definitions as mentioned above.

In order to investigate the relationship between business network affiliation and cash sufficiency, the following model is established and estimated as a baseline model.

$$Cash\ \mathrm{sufficiency}_{i,t} = \beta_0 + \beta_1 Net_{i,t} + \beta_2 NonSOE_{i,t} + \beta_3 Fr_{i,t} + \beta_4 Size_{i,t} + \beta_5 Growth\_{}_{i,t} + \beta_6 Prof_{i,t} + \beta_7 Lev_{i,t} + \beta_8 Fcf_{i,t} + v_i + \varepsilon_{i,t} \qquad (4)$$

In equation 4, the dependent variable is the cash sufficiency ratio, which is measured via the cash flow adequacy ratio. It is the ratio of cash flow from operations to the sum of long-term debt paid, fixed assets purchased, and cash dividends distributed. Any result higher than one indicates that a firm is generating sufficient cash flow to maintain itself without acquiring additional debt or equity funding (Accounting Tools, 2017). Business network affiliation is defined the same as in the other equations. Control variables take the same definitions as in the above models.

In order to test H5, the interaction terms of business network affiliation and non-SOE dummy are added to each baseline model described above. Thus, the model can capture the effects of ownership type on the role played by business networks. For H6, we generate network variables that vary according to the type of relations. Ownership networks, networks from control relations in ownership networks, networks from significant influence relations in ownership networks, collaboration networks, and individual networks are added individually into the baseline models established above. Moreover, interaction terms of ownership and different network indicators are added to investigate the role of ownership types and the effects of different natures of networks. To examine H7, we replace the net variable in the above models with network structure variables that include network position and ego network structure measures. Centrality and aggregate constraints are added individually to each of above models to investigate the role of network structure on firms' access to financial resources.

Models are estimated using firm specific fixed effects[6]. This has also been adopted in many earlier studies investigating the role of business networks (He et al., 2013; Lin et al., 2012; Byun et al., 2013). It controls for any firm level unobservable factors that may cause potential endogeneity. In order to further account for the possible endogenous formation of business networks, this study proposes controls for endogenous treatment effects. Finally, we also test for cross-sectional dependence and suggest the Driscoll-Kraay estimator to control for cross-sectional correlation.

3.6 Results and discussion

3.6.1 Business networks and firms' debt financing

Table 3.3 reports the results of the baseline estimation for the impacts of business network affiliation on firms' access to debts which is equation 1. Depreciation is significantly negatively related to long-term leverage, suggesting that depreciation acts as a substitute for debt in reducing the tax liability of the firm (Huang & Song, 2006). Growth is found to be significantly positively related to both long-term leverage and short-

[6] In Stata, the regression is operated by reghdfe, clustered in firms and years.

term leverage. It means that the higher investment opportunities that are open to a firm, the more debt it will take on (Du et al., 2013). The fixed ratio is statistically significant and positively related to long-term leverage, significantly and negatively associated with short-term leverage. This suggests that firms use their fixed assets as collateral to help them to secure long-term finance. Short-term finance is not secured against fixed assets (Du et al., 2013). Profitability shows a negative and significant coefficient for both long-term leverage and short-term leverage. It indicates that firms with higher profits will reinvest these in their business so that they are less financially constrained, meaning they are less likely to raise debt to finance their business. A positive relationship is found between firm size and all leverages, which suggests that large firms in general have better access to debt. Free cash flow is found to be significantly and negatively related to long-term leverage, suggesting that firms with more cash flow are less likely to use debts for finance. Non-SOE dummies are found to be negatively and significantly related to long-term leverage while being positively and significantly related to short-term leverage, suggesting that non-SOEs have greater access to short-term debt while being less able to secure long-term debt.

<Table 3.3 inserted here>

Business network affiliation is the variable of interest in our study, and our results indicate that business network affiliation is positively related to firms' access to long-term leverage and short-term leverage which support our hypothesis 1. The coefficient of business network affiliation is positive and statistically significant at 1% level. This generally means that business network affiliation can help firms expand their access to both long-term and short-term debt. Looking at the impact of ownership type on the role of business network affiliation on firms' debt financing, non-SOEs in business networks have significantly less short-term leverage when compared to SOEs. This finding partly contradicts the hypothesis 5 proposed. However, as equity is more risk-tolerant than debt, managers of non-SOEs in business networks can be expected to show preference for equity (Chakraborty, 2013). High leverage forces firms to cut capital investments, which will damage firms' competitive position (Reich, 1989). Another explanation could be that non-SOEs in business networks are less financially constrained, therefore they are less likely to need to raise debt for finance. This explanation will be examined in the robustness check and further analysis section.

In order to fully understand the impacts of business networks on firms' access to debt and test the impacts of different business networks on firms' debt financing, we test ownership networks, collaboration networks, and individual networks, one by one in the model. The results suggest that all three network affiliations facilitate firms' access to both short-term and long-term debts. However, when compared to ownership networks and individual networks, collaboration networks show marginally less significant impact on firms' short-term debt financing which confirm our hypothesis 6b. Firms in ownership networks associate with strong connections that foster trust among network members and internal capital markets (He et al., 2013; Wang & Lin, 2013), which encourages resource sharing among network members. Ownership networks from both control and significant influence relations have a statistically significantly positive relationship with both long-term and short-term leverage. Interpersonal relationships are very important in the Chinese context, enhancing trust and creating social capital for firms (Liu et al., 2016; Gu et al., 2008), which help firms gain access to financial resources. Evidence has suggested that collaboration networks, such as alliance networks, have several governance problems that tend to land firms in trouble (Wu & Lou, 2010). We therefore expect affiliation to collaboration networks to have less significant influence over member firms' debt financing.

Regarding the impacts of ownership type on the role of different networks, similar results are found to those seen in the general network affiliation model. Non-SOEs in ownership networks from significant influence relations, collaboration networks, and individual networks have marginally significantly more long-term leverage, which is as expected. However, we did not find evidence for our supposition that non-SOEs in other types of business networks have superior access to long-term debts. Non-SOEs in ownership networks, collaboration networks, and individual networks have less short-term leverage in comparison to SOEs. The explanation for this phenomenon is expected to be the same as for general network affiliation, which will be analysed in the following section.

Our finding partially explains the continued appeal of business networks in the emerging economies irrespective of the significant improvements in the institutional environment. Although improved institutions have mitigated the benefits of business networks (Singh & Gaur, 2009; Gaur & Delios, 2006), business networks remain effective at enabling affiliates to access otherwise scarce financial resources in China. The results also suggest that the perspectives of debtholders are systematically different to the perspectives of shareholders (Byun et al., 2013). While the increasingly reported negative effects of business networks, such as governance challenges, may deflate firm value, debt-holders are nonchalant so long as managers keep the firms out of bankruptcy. By investigating the role of ownership types and the nature of business networks, we can achieve a relatively comprehensive understanding of the role of business network affiliation. The impact of business networks on long-term leverage is marginally more pronounced among non-SOEs while the impact of business networks on short-term leverage is more prominent among SOEs. Relations with different natures would affect the link between business network affiliation and firms' debt financing. These findings have significant managerial implications, enabling firm managers to affiliate to the correct types of business network for their choice of finance.

3.6.2 Business networks and trade credit

Table 3.4 shows the estimation results for the role of business network affiliation on firms' access to trade credit which is equation 2. We find that growth is significantly and positively associated with firms' access to trade credit, suggesting that firms with higher investment opportunities generally take on more trade credit to finance their investment. Firm size is found to be statistically significantly positively related to firms' access to trade credit, which is consistent with Liu et al. (2016) and Ge & Qiu (2007). The results imply that larger firms may have a better established reputation, which will help firms to obtain finance through trade credit. Profit is found to be statistically significantly negatively related to firms' trade credit, meaning that profitable firms are less dependent on trade credit as they can reinvest their profits to finance their investment. The ratio of fixed assets to total assets is statistically significantly negatively associated with firms' access to trade credit, which is in line with Liu et al. (2016) and Wu et al. (2014). Firms with more fixed assets have better access to formal finance such as bank loans, using their fixed assets as collateral (Du et al., 2013; Liu et al., 2016). As a result, these firms have less need of trade credit for finance. Leverage is statistically significantly related to firms' access to trade credit because accounts payable are part of leverage. Thus, firms with high leverage also have a high level of accounts payable. Operating cash flow is also found to be significantly positively related to firms' access to trade credit, which is consistent with Ge & Qiu (2007), Wu et al. (2014), and Liu et al. (2016). It means that firms' with more operating cash flow are better able to repay their payables, so they have a lower default risk. In this case, firms are more likely to access trade credit. Non-SOEs generally have less trade credit compared with SOEs, reflecting their lesser ability to generate finance for investment.

<Table 3.4 inserted here>

Regarding network affiliation, evidence shows that business network affiliation is positively related to firms' access to trade credit. The estimated coefficient of network affiliation is statistically significantly positive at 1% significance level. It suggests that business networking connections help firms to obtain trade credit, which is consistent with our hypothesis 2. As regards the role of different ownership types, the estimated coefficient for the interaction term of non-SOE and business network affiliation is negative but is statistically insignificant, showing that the position of non-SOEs in business networks is not significantly different to that of SOEs in terms of their access to trade credit. Thereby, hypothesis 5 is not supported in this case.

By investigating the role of different networks' affiliation on firms' access to trade credit, we find that ownership networks, collaboration networks, and individual networks are all positively related to firms' access to trade credit. The coefficients estimated are statistically significant at 1% level. Across the three types of business networks, individual networks are marginally more beneficial for firms wishing to access trade credit. The coefficient for individual networks is 0.0143 while the coefficients are 0.00947 and 0.00537 respectively for collaboration networks and ownership networks. This is a reasonable result given the importance of 'guanxi' in Chinese economy (Liu et al., 2016; Gu et al., 2008; Li, 2013; Peng & Luo, 2000). This confirms our hypothesis 6b. In ownership networks, networks from control relations are more prominent than networks from significant influence relations in influencing firms' access to trade credit. This confirms our hypothesis 6a. This is reasonable as networks from control relations feature more direct and powerful ties. Compared to SOEs, non-SOEs in networks are in relatively weak positions; the interaction terms between network affiliation and non-SOEs are negative even though collaboration networks and individual networks show poorly determined coefficients.

Previous studies have investigated the role of business networks on firms' access to formal finance. This study contributes to the literature by providing evidence that informal contracts and institutions help firms to mitigate market frictions, such as information asymmetry and moral hazard, and enable firms to access informal finance. We have provided evidence that business network affiliation has significant positive effects on firms' access to trade credit, which has important implications for managers of those firms that are relatively financially constrained. We also find that some network types are more effective than others in influencing firms' access to trade credit. Firms should be aware that in the Chinese context, the individual relationship is very important and helps firms to achieve and sustain competitive advantages (Li et al., 2008). This is particularly important for international investors' intent on investing in China.

3.6.3 Business networks and working capital management

Table 3.5 reports the estimation results for the impacts of business network affiliation on firms' working capital management which is equation 3. Profitability and free cash flow show significantly negative relationships to the cash conversion cycle, which is a proxy for firms' working capital management. This is consistent with Haron & Nomran (2016) and Zariyawati et al. (2009). It means that profitable firms and less financially constrained firms find it easier to obtain funding. Thus loose cash would be kept at a minimum (Wasiuzzaman & Arumugam, 2013). The leverage ratio is found to be positively related to the cash conversion cycle, suggesting that firms with high leverage need to have high levels of cash available in order to pay back debts. Sales growth is statistically negatively related to the cash conversion cycle, which is also consistent with Haron & Nomran (2016). It means that firms with more investment opportunities generally have more effective working capital management. Firm size is also found to be statistically negatively related to the cash conversion cycle, suggesting that larger firms have more efficient working capital management. The current ratio is positively related to firms' working capital management. It means that firms with high current ratio are less efficient in working capital management. Non-SOE dummy is also positively related to cash conversion cycle, suggesting the non-SOEs generally have less efficient working capital management.

<Table 3.5 inserted here>

When we examine network affiliation, which is our variable of interest, we see a negative relationship to cash conversion cycle. The estimated coefficient is statistically significant at 1% level. This means that firms in business networks have more efficient working capital management and hence a readily available cash flow. Our hypothesis 3 concerning the role of business networks in firms' working capital is therefore supported. When we look at the impact of ownership type, we find that the relationship between business networks and working capital management is more pronounced among non-SOEs, which is consistent with our hypothesis. That is to say, non-SOEs in business networks generally have more efficient working capital management because their cash is recycled very quickly. This supports our hypothesis 5.

Looking at different network types, all three types of networks sampled show a negative relationship to the cash conversion cycle. The estimated coefficients of network affiliation are statistically significantly positive at 1% significance level. This means that firms in any kind of business network are associated with superior working capital management. Among the three types of business networks, individual networks also show stronger marginal effects, which is reasonable given the importance of guanxi in the Chinese context (Liu et al., 2016; Li, 2013). This supports our hypothesis 6b. When compared to networks of relations from control in ownership networks, we see that networks derived from significant influence show poorly determined effects as regards firms' working capital management, which supports our hypothesis 6a. And when we investigate the role of ownership types, the results show that non-SOEs in ownership networks and collaboration networks have more efficient working capital management. However, we do not find evidence that non-SOEs in individual networks are associated with more efficient working capital management.

By looking at the effects of business network affiliation on firms' working capital management this study contributes to the relatively neglected area of short-term finance, and provides evidence that informal institutions help firms to achieve more effective and efficient working capital management. While prior studies mainly investigated the role of working capital management on firms' profitability, our study, focusing as it does on the determinants of working capital management, has profound managerial implications.

Managers of firms, particularly those facing financial constraints, can benefit from learning a new approach to managing their short-term finance. As individual network affiliation provides the biggest marginal effects, firms should be aware that not all types of business networks will meet their needs equally. It is essential for firms to establish the appropriate connections in order to fulfill their organizational goals.

3.6.4 Business networks and cash sufficiency

Table 3.6 reports the estimation results for equation 4 examining the role of business networks on firms' financial constraints, measured using the cash sufficiency. Sales growth is found to be negatively related to cash sufficiency meaning that firms with higher growth opportunities are more likely to be financially constrained. Profitability shows a significantly positive relationship to cash sufficiency, suggesting that profitable firms are less likely to be financially constrained because they can reinvest their profits. Asset structure reports a significantly positive correlation with cash sufficiency, showing that firms with more fixed assets are less likely to be financially constrained because they can use their fixed assets as collateral when accessing bank loans (Du et al., 2013; Liu et al., 2016). Leverage is reported to be negatively related to cash sufficiency, suggesting that firms with high leverage are generally more financially constrained, which is consistent with He et al. (2013). Free cash flow shows a positive relationship to cash sufficiency, indicating that firms with freer cash flow are generally less financially constrained. Firm size is positively related to cash sufficiency, suggesting that larger firms have better access to financial resources, and hence are less financially constrained. The non-SOE dummy is negatively related to cash sufficiency, indicating that non-SOEs in China are financially constrained compared with SOEs.

<Table 3.6 inserted here>

The main results show that business network affiliation is positively related to cash sufficiency for investment. The estimated coefficient is statistically significant at 1% level. This means that firms in business networks typically have more cash for investment and hence they are less financially constrained. This finding is rational and accords with our hypothesis 4. Inspecting the role of different types of ownership, the interaction term of network affiliation and non-SOE is positive but is not significant. This means that non-SOEs in business networks are not significantly different from SOEs in business networks in terms of their access to cash for investment. Hypothesis 5 is not supported in this case.

Examining the role of the nature of business networks, we see that ownership networks and individual networks significantly affect firms' access to cash for investment. The coefficients are statistically significantly positive at 1% level. Thus, firms in ownership networks and individual networks are less financially constrained as they have more cash for investment which supports our hypothesis 6b. Again, we find that in ownership networks, the networks derived from control show more significant effects on firms' cash sufficiency ratio, which is reasonable and in line with our hypothesis 6a. Collaboration networks on the other hand have a poorly determined coefficient, suggesting that affiliation to collaboration networks does not significantly influence firms' access to cash for investment; again, this is consistent with our hypothesis. Concerning the role of business ownership types, we find that non-SOEs in ownership networks and collaboration networks have more cash for investment when compared to SOEs. The coefficients for the interaction terms are statistically significant at 10% level, meaning that the effects of business networks on firms' financial constraints are more pronounced among non-SOEs in ownership networks and collaboration networks. However, we do not find evidence that non-SOEs in individual networks are less financially constrained.

By examining the relationship between network affiliation and cash sufficiency, we gain a more nuanced understanding of the factors affecting firms' financial constraints. This finding offers a potential explanation for the continued boom in business networks even though the negative effects of affiliation are increasingly being reported. The finding supports the internal capital view of business networks in China and offers a better understanding of China's rapidly growing economy.

3.6.5 Business network structure and firms' access to financial resources

Table 3.7 reports the estimation results of the effects of the various business network structures on firms' access to financial resources. Using the baseline models described above (equations 1-4), the results from the control variables are generally rational and consistent with the results outlined above.

In terms of the effects of network position on firms' access to financial resources, we find that firms in central positions have superior access to long-term debts, short-term debts and trade credit, and they have more efficient working capital management and more cash for investments. The coefficients of degree centrality in all specifications are statistically significantly positive at 1% significance level. We therefore find that central positioning generally helps firms to have better access to resources, which is consistent with Wang et al. (2014). This confirms our hypothesis 7a.

Regarding the effects of network tightness on firms' access to financial resources, it is suggested that firms in a tight ego network structure are more likely to have superior access to financial resources. The regression results show that constraint is statistically significantly positively related to firms' access to financial resources at 1% significance level which confirms our hypothesis 7b. While Burt (1982, 2005) showed that firms with more structural holes in their ego network structure have more novel ideas and information, we find that a tight network structure enhances trust, and enables reputations to be established and broadcast, facilitating firms' access to financial resources.

<Table 3.7 inserted here>

3.7 Robustness checks and further analysis

In this section, we aim to provide additional evidence for our main story while finding explanations for results that are not consistent with our hypotheses. We also address potential endogeneity problems by controlling for endogenous treatment effects. The following questions will be addressed: (1) whether affiliates in business networks offer more trade credit to other firms; (2) why non-SOEs in business networks choose lower levels of short-term finance; (3) whether the definition of non-SOEs are robust using alternative measures; and (4) whether our results are robust using Heckman's two stage approach.

3.7.1 The effect of business network affiliation on the supply and net position of trade credit

In table 3.8, we use firms' supply of trade credit, measured as total accounts receivable to total assets, as the dependent variable to investigate the relationship between network affiliation and the supply of trade credit. The results suggest that business network affiliation is positively related to firms' supply of trade credit. The estimated coefficients are statistically significant at the 5% level. It indicates that firms in business networks have strong incentives to provide trade credit, by which means they can establish their reputation and hence receive more trade credit themselves (Liu et al., 2016). In terms of the differing network natures, the results show that firms in collaboration networks are less significant in influencing firms' supply of trade credit, which is a reasonable finding and is consistent with our hypothesis on the different natures of business networks. In ownership networks, networks from control relations have a stronger impact compared with networks from significant influence relations. Compared to SOEs, we find that non-SOEs in ownership networks have a significantly lower supply of trade credit, which means that non-SOEs manage their receivables more efficiently and collect their money back more efficiently. However, non-SOEs in individual networks provide more trade credit to other firms, which is consistent with the findings of Liu et al. (2016).

<Table 3.8 inserted here>

Panel B of table 3.8 reports the results using the net position of trade credit as the dependent variable, measured as the difference between accounts payable and accounts receivable to total assets. The results suggest a positive relationship between business network affiliation and firms' net credit received, which means that firms in business networks receive more trade credit than they offer. Ownership networks and collaboration networks also provide the same results as seen in general networks. The net credit received is marginally significantly negatively affected for non-SOEs in individual networks.

3.7.2 Business network affiliation and non-SOEs' short-term leverage

In our regressions investigating the role of business network affiliation in firms' short-term leverage, we find that non-SOEs in business networks have a significantly lower level of short-term leverage, which contradicts our hypothesis. However, we argue that non-SOEs in business networks choose a lower level of short-term leverage because they have a preference for equity over debts and are in any event generally less financially constrained, so are less likely to need to resort to short-term debt to finance their investments. In this section, we provide empirical evidence to this effect.

Table 3.9 provides the estimation results. Based on the baseline model investigating the role of business network affiliation and firms' access to short-term debts, we add the new interaction terms of network affiliation, ownership type, and cash flow adequacy ratio. If adding the extra term reduces the significance of the interaction term between network affiliation and non-SOE dummy, our analysis would be evidenced. And indeed, from the results, we see that the importance of the interaction term has become either less significant or non-significant. We therefore have evidence that non-SOEs are generally less financially constrained compared to SOEs because they have more readily available cash in short term. They are thus less likely to use debts for financing to reduce pressure on cash in short term.

<Table 3.9 inserted here>

3.7.3 Alternative ownership measures

In order to test the effects of ownership type on the relationship between business network affiliation and firms' access to financial resources, we used a non-SOE dummy to capture the effects of firms that are not SOEs. However, this classification, although widely used (Liu et al., 2016; Ma et al., 2006; He et al., 2013), may create noise since non-SOEs include foreign firms, which may be less affected by domestic financial constraints. In this section, we use an alternative definition of ownership by dropping foreign firms from the category of non-SOEs. In this way we can capture only the domestic private firms, which more susceptible to the financial constraints of the institutional setting in China.

Table 3.10 presents all regressions estimated using a dummy variable of domestic private firms. Results suggest that our results are robust against using an alternative measure of ownership types. Domestic firms in business networks have a lower level of short-term leverage, marginally less accounts payable, more efficient working capital management, and sufficient cash flow. Our results are not weakened by using a domestic private dummy variable and are rather strengthened in the specifications of cash flow adequacy equation. Our hypothesis about the role of ownership types on the relationship between network affiliation and firms' access to financial resources is generally supported.

<Table 3.10 inserted here>

3.7.4 Endogenous treatment effects

It is likely that the group-affiliation is affected by some unobservable factors, which could influence firms' access to financial resources. This potentially creates a bias in the estimation. The treatment assignment process is endogenous because these unobservable components affect both treatment assignment and the potential outcomes (Stata Press, 2017). In order to control for the endogenous formation of business networks, we follow Wooldridge's control function approach (2010). The approach consists of two steps. Firstly, a probit model for treatment assignment is estimated. Secondly, based on the treatment assignment, we estimate a linear model for the potential outcome. The approach controls for endogeneity by including the residuals from the treatment assignment model as a regressor in the second step model. The approach generally treats panel data as pooled cross-sectional data to estimate average treatment effects in population.

In the first stage, we follow He et al. (2013) and Lee & Jin (2009) to model firms' network decisions.

$$Net_{i,t} = \beta_0 + \beta_1 Net_{i,t-1} + \beta_2 {Size_{i,t}}^2 + \beta_3 Size_{i,t} + \beta_4 Current\_ratio_{i,t} + \beta_5 Prof_{i,t} + \beta_6 SOE_{i,t} + \beta_7 Fcf_{i,t} + \beta_8 CTR_{i,t} + \beta_9 Marketization_{i,t} + \beta_{10} Fr_{i,t} + \varepsilon_{i,t} \quad (5)$$

The lagged dependent variable is controlled for any reinforcement effect. Size is firm size. We control both size and squared term of size to control for a quadratic relationship. It is argued that small firms are more likely to be involved in networks to smooth their start-ups stage and large firms are more likely to be networked to have a competitive advantage (Semrau & Werner, 2013; Lee & Jin, 2009; Ren et al., 2009). Current ratio is a liquidity measure. It controls for firms' network entry for liquidity. Profit is also controlled as suggested by Ren et al. (2009) which controls firms' profitability. SOE is added to control whether the firm is a SOE or not. It is argued that SOEs are more likely to be involved in networks (Lee & Jin, 2009). Fcf is controlled in order to account for cash flow. CTR is a new variable here which is composite tax rate, measured as total tax to operating revenue. It is controlled for the governments' tax privilege over networked firms. Marketization is a measure of developments in financial market. It is an index developed by Fan & Wang (2001) which covers the development score for each province and major municipality in China. It is argued that firms in less efficient markets are more likely to get into networks (He et al. 2013). Fixed ratio is also controlled in this model. It is suggested that firms with less fixed assets have more investment opportunities and grow faster (Tian & Estrin, 2008) which is an important driver of network formation (Colli et al., 2016).

Based on the model, the residual is estimated and added to the main regression models. Firms' leverage ratio, access to trade credit, working capital management and cash sufficiency are investigated respectively after controlling for potential endogenous network formation. In order to control for the panel nature of the data, we have applied the algorithm described above for each year and generated a time-variate control function. This procedure is described in Wooldridge (2005). Table 3.11 shows the results of average treatment effects after controlling for potential endogeneity for both algorithms (i.e., considering panel nature v. not considering panel nature). The results are generally consistent with our main regression results, and this provides extra comfort that our results are reliable

<Table 3.11 inserted here>

After we control for the endogenous treatment effects, our results show that firms in business networks generally have better access to debts, trade credit, more efficient working capital management, and more ready cash for investment. The table shows that network affiliated firms have 0.026 long-term leverage, 0.021 short-term leverage, 0.024 trade credit, and 0.17 cash sufficiency attainment compared with free standing firms. Network affiliated firms have more efficient working capital management as they have a shorter cash conversion cycle. We also test for endogeneity with the null hypothesis that treatment and outcome un-observables are uncorrelated. The statistics significantly reject the null hypothesis. It is therefore necessary to consider the endogenous treatment effects.

We also performed Heckman's (1978) two stage approach to control for the potential sample selection problem. As it reports consistent findings, we do not report the results here again.

3.7.5 Cross-sectional dependence

In estimating our models, we work on the assumption that disturbances of a panel model are cross-sectionally independent. However, the actual information in micro-econometric panels is often overstated since micro-econometric data are likely to exhibit all sorts of cross-sectional and temporal dependencies (Hoechle, 2007). The presence of cross-sectional dependence is often the rule rather than the exception. It generally occurs because of common shocks and interaction among networks (Chudik & Pesaran, 2013). According to Petersen (2007), many published articles in leading finance journals still fail to appropriately adjust the standard errors. Ignoring a possible correlation of regression disturbances between units can lead to biased statistical inferences.

To investigate cross-sectional dependence in our data, we perform the CD-test described in Pesaran (2004) and Pesaran (2015). This test is an investigation of the mean correlation between panel units with the null hypothesis indicating either cross-sectional independence or weak cross-sectional dependence. If the extent of cross-sectional dependence is sufficiently weak or limited, then its consequences on the conventional estimators will be negligible (Chudik & Pesaran, 2013). The test (not reported) statistically significantly rejects the null hypothesis and indicates strong correlation among panel units.

To adjust the standard errors of the coefficient estimates for possible dependence in the residuals, we adopt the Driscoll and Kraay (1998) estimator. It is evidenced that the Driscoll-Kraay estimator is robust to general forms of spatial and temporal dependence. The estimator loosely applies a Newey-West-type correction[7] to the sequence of cross-sectional averages of the moment conditions (Hoechle, 2007). It eliminates the deficiencies of the other approaches that become inappropriate when the cross-sectional dimension N gets large.

Table 3.12 reports estimation results after correcting for cross-sectional dependence. The results generally confirm our main regression findings. Firms in business networks generally have better access to long-term leverage, short-term leverage, trade credit, more efficient working capital management, and more sufficient cash for investment. A central network position and tight closed network structure are positively related to firms' access to financial resources. Collaboration networks exert poorly determined effects compared with ownership and individual networks in influencing firms' access to financial resources. Our results are therefore quite robust.

<Table 3.12 inserted here>

3.8 Conclusion

Business networks are popular in emerging economies, being used as responses to market failures due to under-developed institutions. It is stated that an improved institutional environment in emerging economies decreases the benefits of business networks. Irrespective of this, business networks have maintained and indeed increased their popularity in China. Our study offers a partial answer to the question of why this might be so by investigating the role of business networks in firms' access to financial resources.

Using listed companies in China, we construct business networks via related parties from 1997 to 2011. We investigate the role of business networks in firms' debt financing, access to trade credit, working capital management, and cash sufficiency, to provide evidence not only that firms in business networks are less financially constrained but

[7] Newey and West (1987) developed an approach to obtain heteroskedasticity and autocorrelation consistent standard errors. It is a generalized method of moments-based covariance matrix estimator.

also how this is manifest. We find that firms in business networks have superior access to long-term debts, short-term debts, and trade credit. They have more efficient working capital management and sufficient cash for investment. Evidence shows that SOEs in business networks have better access to short-term debts and trade credit, while non-SOEs in business networks have more efficient working capital management and sufficient cash than their non-affiliation counterparts. Comparing the effects of ownership networks, collaboration networks, and individual networks, we find that individual networks have the largest marginal effects overall, while collaboration networks are less significant in influencing firms' access to financial resources. Our study has shed light on the theory of firm finance and provides a better understanding of China's rapidly growing economy.

This study makes several contributions to the literature. First, by investigating the impact of business network affiliation on a relatively wide set of financial resources we contribute to the literature about the effects of business networks on firms' financial constraints. While previous studies suggest that affiliated firms are less financially constrained, they fail to provide evidence about how they are less financially constrained compared with unaffiliated companies. We, on the other hand, provide evidence that firms in business networks are less financially constrained because they have advantages in accessing debts, trade credit, superior working capital management, and sufficient cash for investment.

Second, we extend the existing work on the determinants of the capital structure of emerging markets (Newman et al., 2012, Du et al., 2013) by introducing the importance of business network strategies to debt financing. We argue that in emerging economies, such as China, institutional environments are less developed and less efficient in allocating financial resources because these markets are characterized by significant and frequent government intervention in the capital markets (Allen et al., 2012; Du et al., 2013). By affiliating into various business networks, firms can extend their access to financial resources through the establishment of a sharing platform among network members, improving their credit-worthiness for potential financiers.

Third, we contribute to the literature about how informal institutions affect firms' access to informal finance by examining the effects of business networks on firms' access to trade credit. Previous studies have investigated the role of informal contracts on firms' access to forms of external formal finance such as bank loans and equity issuing (Liu et al., 2013; Khwaja & Mian, 2005). However, there is a lack of evidence for whether business network connections have any influence on firms' access to informal financial resources. Previous examination of the determinants of trade credit has been mainly focused on financial statement variables or firm/product characteristics (Liu et al., 2016), while few studies inspect the role of business networks on firms' access to trade credit.

Fourth, by investigating the role of business networks on firms' management of their working capital, this study contributes to the literature on working capital management, which has been a much neglected area of study for decades (Singh & Kumar, 2014). The few studies focused extensively on the relationship between working capital management and firm performance (e.g. Wang, 2002; Deloof, 2003) with hardly any investigating the determinants of working capital management. This study expects to bridge this gap by shedding light on the effects of business networks on working capital management.

Fifth, this research contributes to the literature on financial constraints. We use cash flow adequacy ratio to proxy for the general financial conditions of the focal firm rather than investment-cash flow sensitivity. The results indicate that firms in business networks have more cash for investment than isolated firms have, suggesting that they are less financially constrained.

Finally, we contribute to the literature on business networks by proposing a new approach to defining business networks and examining the mediating effects of ownership, network nature and network structure. As described in chapter 2, we have defined business networks using related party relations, which includes many important relations while excluding relations that may exert little influence. The definition is more representative in the market as it includes many relations that are widely observed. It also incorporates relations across different dimensions. We believe that in our definition, the results generated can be more reliably applied to a general context. The definition also enables us to investigate the role of different networks on network effects. We find that when compared to ownership networks and individual networks in China, collaboration networks are less dominant in determining firms' access to financial resources. This has been little investigated in prior studies owing to a lack of relations from different dimensions (e.g. Chen & Xie, 2011; Sha & Zeng, 2014; He et al., 2013). Moreover, by investigating the role of SOEs in business networks, we have clarified the impacts of business networks on network effects. We suggest that network effects are more prominent among SOEs in relation to firms' access to short-term leverage and trade credit, while the effects are more pronounced among non-SOEs in their access to the other financial resources examined in the study. Furthermore, we provide evidence that centrality and structural holes are important mediators for network effects. This knowledge helps us to have a more complete understanding of network effects and to guide firms to strategically use the optimal type of network to achieve their organizational goals.

This study has important implications. Obviously, it has implications for firm corporate strategy. Since business networks help firms to obtain superior access to financial resources, managers of firms should be cognizant of how advantageous network affiliation might be for their firm, particularly for firms that are financially constrained. Managers of firms should deliberately determine their network strategy to expand their access to financial resources since the network effects are mediated by many factors. Additionally, this study also has important implications for the state. By examining how network effects are mediated by SOEs, we have generated an understanding that network effects are stronger for SOEs seeking access to debts and trade credit, while network effects are more pronounced among non-SOEs as regards their working capital management and cash sufficiency. The state should promote a fair environment for SOEs and non-SOEs to facilitate their access to financial resources.

Table 3.1: Summary statistics of Chapter 3

Panel A: summary

Variable	Definition	Obs	Mean	Std. Dev.
Network variables				
net	Network indicator, =1 if a firm affiliates to any networks	17596	0.298	0.457
onet	Network indicator, =1 if a firm affiliates to ownership networks	17596	0.253	0.435
cnet	Network indicator, =1 if a firm affiliates to collaboration networks	17596	0.059	0.235
inet	Network indicator, =1 if a firm affiliates to individual networks	17596	0.035	0.184
degree	Degree centrality, the number of direct contacts a firm has.	17596	0.510	0.876
constraint	Aggregate constraint, the total constraint the network has to the firm	17596	0.283	0.429
Leverage variables				
lev	Leverage, the ratio of liabilities to assets	17596	0.455	0.200
ltlev	Long-term leverage, the ratio of non-current liabilities to total assets	17593	0.066	0.085
stlev	Short-term leverage, the ratio of current liabilities to total assets	17593	0.387	0.188
Trade credit				
payable	Ratio of accounts payable to total assets	17490	0.106	0.083
receivable	Ratio of account receivable to total assets	17495	0.144	0.107
netpay	Ratio of (accounts payable minus account receivable) to total assets	17440	-0.037	0.110
Working capital management				
ccc	cash conversion cycle, number of days inventories+number of days accounts receivable-number of days accounts payable	17004	192.107	234.174
Cash sufficiency				
cash sufficiency	Ratio of cash flow from operations to(long-term debt paid + fixed assets purchased + cash dividends distributed)	17595	0.475	0.747
Control variables				
dep	Depreciation, the ratio of Depreciation to Total Assets	17145	0.022	0.016
growth	Growth Rate of Sales	17596	0.162	0.347
fr	Fixed ratio, the ratio of Fixed Assets to Total Assets	17596	0.250	0.172
prof	Profitability, the ratio of Operating Profit to Total Assets	17596	0.052	0.053
size	Logarithm of Sales	17596	19.883	2.245
fcf	Ratio of free cash flow to total assets	17141	-0.382	35.419
opcash	Ratio of operating cash flow to total assets	17212	0.045	0.070
current_ratio	Ratio of current assets to current liabilities	17596	1.811	1.452
non-soe	Indicator variable, =1 if the firms is controlled by non-soe	17596	0.361	0.480

Note: In order to keep observations at a maximum, the observations here may be different from those in regression models.

Panel B: Correlation analysis

	net	onet	cnet	inet	leverage	ltleverage	stleverage	payable_ta	receivable_ta
net	1								
onet	0.9019*	1							
cnet	0.3769*	0.2050*	1						
inet	0.2925*	0.1670*	0.1359*	1					
leverage	0.0919*	0.0922*	0.0197*	0.0660*	1				
ltleverage	0.0791*	0.0765*	0.0511*	0.0292*	0.3807*	1			
stleverage	-0.0045	-0.0068	-0.0026	0.0062	0.0580*	0.0284*	1		
payable_ta	0.1172*	0.1228*	0.0440*	0.0727*	0.3479*	-0.1372*	0.0092	1	
receivable_ta	-0.0576*	-0.0564*	-0.0300*	0.0121	0.0850*	-0.2073*	0.0185*	0.2754*	1
netpay_ta	0.1457*	0.1493*	0.0660*	0.0517*	0.1784*	0.0919*	-0.0058	0.4604*	-0.7028*
ccc	-0.1351*	-0.1433*	-0.0743*	-0.0577*	0.0823*	-0.0104	0.0137	-0.2837*	0.1797*
cash_adequacy	0.0745*	0.0790*	0.0288*	0.0273*	-0.1514*	-0.0780*	-0.0015	0.0350*	-0.1649*
depreciation	-0.0041	0.003	-0.0192*	-0.0076	-0.0192*	0.0992*	0.0194*	-0.0652*	-0.0995*
growth_sale	0.0142	0.0141	0.0207*	0.0056	-0.0071	0.0121	-0.0218*	0.0741*	-0.0277*
fixed_ratio	-0.0377*	-0.0256*	-0.0383*	-0.0142	0.0101	0.2229*	-0.0132	-0.1277*	-0.1978*
prof	-0.0286*	-0.0273*	-0.0053	-0.0180*	-0.3164*	-0.0581*	-0.0305*	-0.0998*	-0.0885*
firmsize	0.0992*	0.1034*	0.0415*	0.0339*	0.0316*	0.0340*	-0.0262*	0.1937*	0.0233*
fcf_ta	0.0055	0.0066	-0.0074	0.0035	-0.0421*	-0.1408*	-0.0405*	0.0209*	-0.0161*
opcash_ta	0.0261*	0.0300*	0.0051	0.0025	-0.1476*	-0.0142	-0.0055	-0.0186*	-0.2142*
nonsoe	-0.1189*	-0.1233*	-0.0245*	-0.0088	-0.0380*	-0.0888*	0.0148*	-0.0155*	0.0042

Note: * suggests the correlation coefficients are significant at the 5% level or better

Correlation analysis continued

	netpay_ta	ccc	cash_adequacy	depreciation	growth_sale	fixed_ratio	prof	firmsize	fcf_ta	opcash_ta	nonsoe
netpay_ta	1										
ccc	-0.3634*	1									
cash_adequacy	0.1771*	-0.2573*	1								
depreciation	0.0361*	-0.2674*	0.1508*	1							
growth_sale	0.0772*	-0.1918*	0.0067	-0.0284*	1						
fixed_ratio	0.0790*	-0.2811*	0.1088*	0.6249*	-0.0056	1					
prof	0.0015	-0.2228*	0.1680*	-0.0051	0.2970*	0.0057	1				
firmsize	0.1160*	-0.2960*	0.0767*	0.1191*	0.1365*	0.1129*	0.1645*	1			
fcf_ta	0.0261*	-0.1135*	0.1540*	0.2112*	-0.0177*	0.2056*	0.1170*	0.0589*	1		
opcash_ta	0.1783*	-0.2658*	0.4314*	0.2673*	0.1114*	0.2457*	0.3400*	0.1259*	0.3274*	1	
nonsoe	-0.0154*	0.0626*	-0.0379*	-0.1475*	-0.0015	-0.1755*	0.0216*	-0.1594*	-0.0773*	-0.0712*	1

Note: * suggests the correlation coefficients are significant at the 5% level or better

Table 3.2: Univariate tests of Chapter 3

Variables	Networks		Non-networks		Difference	
	Mean	Std. Dev.	Mean	Std. Dev.	Diff	T-value
ltlev	0.077004	0.001192	0.061292	0.000687	0.015711	-11.9715***
stlev	0.406425	0.002482	0.378775	0.001563	0.02765	-9.5264***
payable	0.121019	0.001166	0.099497	0.000671	0.021522	-16.7767***
CCC	150.13	2.81575	209.5469	2.060681	-59.4149	16.1618***
cash sufficiency	0.550251	0.009314	0.442516	0.006409	0.107734	-9.3127***

Notes: ltleverage is the ratio of non-current liabilities to total assets. Stleverage is the ratio of current liabilities to total assets. Payable_ta is the ratio of accounts payable to total assets. CCC is cash conversion cycle and is calculated as the number of days inventories plus the number of days accounts receivable minus the number of days accounts payable. Cash flow adequacy is calculated as the ratio of cash flow from operations to(long-term debt paid + fixed assets purchased + cash dividends distributed).

Table 3.3: Business networks and firms' access to debts

Note: These tables report the estimation of long-term and short-term leverage respectively as in equation 1 using fixed effects. In state, it is operated by reghdfe and clustered in firms and years. The definition of variables can be found in table 3.1.

Panel A: Long-term leverage

VARIABLES	(1) ltlev	(2) ltlev	(3) ltlev	(4) ltlev	(5) ltlev	(6) ltlev
dep	-0.245***	-0.246***	-0.244***	-0.244***	-0.245***	-0.245***
	(0.0513)	(0.0513)	(0.0514)	(0.0514)	(0.0514)	(0.0514)
growth	0.00638***	0.00643***	0.00636***	0.00638***	0.00642***	0.00640***
	(0.00188)	(0.00188)	(0.00188)	(0.00189)	(0.00188)	(0.00189)
fr	0.125***	0.125***	0.124***	0.124***	0.124***	0.124***
	(0.00487)	(0.00487)	(0.00487)	(0.00487)	(0.00487)	(0.00487)
prof	-0.116***	-0.116***	-0.116***	-0.116***	-0.117***	-0.117***
	(0.0126)	(0.0126)	(0.0126)	(0.0126)	(0.0126)	(0.0126)
size	0.00131***	0.00132***	0.00132***	0.00132***	0.00132***	0.00132***
	(0.000277)	(0.000277)	(0.000277)	(0.000277)	(0.000278)	(0.000278)
fcf	- 0.000135***	- 0.000135***	- 0.000134***	- 0.000134***	- 0.000134***	- 0.000134***
	(3.55e-05)	(3.55e-05)	(3.55e-05)	(3.55e-05)	(3.55e-05)	(3.55e-05)
nonsoe	-0.00605***	-0.00737***	-0.00610***	-0.00641***	-0.00613***	-0.00570***
	(0.00143)	(0.00167)	(0.00144)	(0.00163)	(0.00144)	(0.00161)
net	0.00928***	0.00790***				
	(0.00139)	(0.00166)				
net_nonsoe		0.00454				
		(0.00296)				
onet			0.00915***	0.00878***		
			(0.00146)	(0.00172)		
onet_nonsoe				0.00129		
				(0.00315)		
onet_123					0.00896***	0.00949***
					(0.00150)	(0.00175)
onet_123_nonsoe						-0.00191
						(0.00326)
Observations	17,138	17,138	17,138	17,138	17,138	17,138
R-squared	0.157	0.157	0.157	0.157	0.157	0.157

Standard errors in parentheses

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

Panel A: Long-term leverage continued

VARIABLES	(1) ltlev	(2) ltlev	(3) ltlev	(4) ltlev	(5) ltlev	(6) ltlev
dep	-0.244***	-0.243***	-0.244***	-0.244***	-0.244***	-0.244***
	(0.0514)	(0.0514)	(0.0514)	(0.0514)	(0.0514)	(0.0514)
growth	0.00640***	0.00642***	0.00637***	0.00634***	0.00644***	0.00649***
	(0.00189)	(0.00189)	(0.00189)	(0.00189)	(0.00189)	(0.00189)
fr	0.124***	0.124***	0.125***	0.125***	0.124***	0.124***
	(0.00487)	(0.00487)	(0.00487)	(0.00487)	(0.00487)	(0.00487)
prof	-0.118***	-0.118***	-0.117***	-0.117***	-0.118***	-0.118***
	(0.0126)	(0.0126)	(0.0126)	(0.0126)	(0.0126)	(0.0126)
size	0.00144***	0.00145***	0.00140***	0.00140***	0.00143***	0.00143***
	(0.000277)	(0.000277)	(0.000277)	(0.000277)	(0.000277)	(0.000277)
fcf	-0.000134***	-0.000134***	-0.000134***	-0.000134***	-0.000134***	-0.000134***
	(3.55e-05)	(3.55e-05)	(3.55e-05)	(3.55e-05)	(3.55e-05)	(3.55e-05)
nonsoe	-0.00744***	-0.00800***	-0.00729***	-0.00787***	-0.00749***	-0.00798***
	(0.00142)	(0.00143)	(0.00142)	(0.00146)	(0.00142)	(0.00144)
onet_5	0.0161***	0.0100**				
	(0.00371)	(0.00445)				
onet_5_nonsoe		0.0198**				
		(0.00802)				
cnet			0.0134***	0.0105***		
			(0.00259)	(0.00308)		
cnet_nonsoe				0.00963*		
				(0.00558)		
inet					0.00910***	0.00510
					(0.00321)	(0.00388)
inet_nonsoe						0.0126*
						(0.00685)
Observations	17,138	17,138	17,138	17,138	17,138	17,138
R-squared	0.156	0.156	0.156	0.156	0.155	0.155

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Panel B: Short-term leverage

VARIABLES	(1) stlev	(2) stlev	(3) stlev	(4) stlev	(5) stlev	(6) stlev
dep	0.101	0.104	0.103	0.106	0.100	0.102
	(0.107)	(0.107)	(0.107)	(0.107)	(0.107)	(0.107)
growth	0.0395***	0.0393***	0.0395***	0.0393***	0.0397***	0.0395***
	(0.00393)	(0.00393)	(0.00393)	(0.00393)	(0.00393)	(0.00393)
fr	-0.0811***	-0.0809***	-0.0821***	-0.0822***	-0.0821***	-0.0821***
	(0.0101)	(0.0101)	(0.0101)	(0.0101)	(0.0101)	(0.0101)
prof	-1.103***	-1.103***	-1.104***	-1.103***	-1.104***	-1.104***
	(0.0262)	(0.0262)	(0.0262)	(0.0262)	(0.0262)	(0.0262)
size	0.00374***	0.00373***	0.00376***	0.00376***	0.00375***	0.00375***
	(0.000578)	(0.000578)	(0.000578)	(0.000578)	(0.000579)	(0.000578)
fcf	-7.46e-05	-7.33e-05	-7.34e-05	-7.22e-05	-7.32e-05	-7.24e-05
	(7.39e-05)	(7.39e-05)	(7.39e-05)	(7.39e-05)	(7.40e-05)	(7.39e-05)
nonsoe	0.00898***	0.0137***	0.00882***	0.0138***	0.00881***	0.0123***
	(0.00299)	(0.00348)	(0.00299)	(0.00340)	(0.00299)	(0.00336)
net	0.0225***	0.0274***				
	(0.00291)	(0.00345)				
net_nonsoe		-0.0162***				
		(0.00616)				
onet			0.0219***	0.0278***		
			(0.00304)	(0.00358)		
onet_nonsoe				-0.0205***		
				(0.00656)		
onet_123					0.0219***	0.0261***
					(0.00312)	(0.00364)
onet_123_nonsoe						-0.0154**
						(0.00679)
Observations	17,138	17,138	17,138	17,138	17,138	17,138
R-squared	0.213	0.214	0.213	0.214	0.213	0.213

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Panel B: Short-term leverage continued

VARIABLES	(1) stlev	(2) stlev	(3) stlev	(4) stlev	(5) stlev	(6) stlev
dep	0.104	0.102	0.103	0.103	0.104	0.104
	(0.107)	(0.107)	(0.107)	(0.107)	(0.107)	(0.107)
growth	0.0397***	0.0396***	0.0397***	0.0398***	0.0396***	0.0396***
	(0.00393)	(0.00393)	(0.00393)	(0.00393)	(0.00393)	(0.00393)
fr	-0.0826***	-0.0823***	-0.0822***	-0.0818***	-0.0831***	-0.0831***
	(0.0102)	(0.0102)	(0.0102)	(0.0102)	(0.0101)	(0.0101)
prof	-1.108***	-1.107***	-1.107***	-1.107***	-1.105***	-1.105***
	(0.0262)	(0.0262)	(0.0262)	(0.0262)	(0.0262)	(0.0262)
size	0.00407***	0.00405***	0.00403***	0.00403***	0.00394***	0.00394***
	(0.000577)	(0.000577)	(0.000578)	(0.000578)	(0.000577)	(0.000577)
fcf	-7.27e-05	-7.24e-05	-7.26e-05	-7.23e-05	-7.46e-05	-7.45e-05
	(7.40e-05)	(7.40e-05)	(7.40e-05)	(7.40e-05)	(7.39e-05)	(7.39e-05)
nonsoe	0.00548*	0.00725**	0.00556*	0.00716**	0.00583**	0.00603**
	(0.00295)	(0.00299)	(0.00296)	(0.00304)	(0.00295)	(0.00300)
onet_5	0.0254***	0.0445***				
	(0.00773)	(0.00927)				
onet_5_nonsoe		-0.0625***				
		(0.0167)				
cnet			0.0145***	0.0224***		
			(0.00541)	(0.00642)		
cnet_nonsoe				-0.0266**		
				(0.0116)		
inet					0.0519***	0.0536***
					(0.00669)	(0.00809)
inet_nonsoe						-0.00532
						(0.0143)
Observations	17,138	17,138	17,138	17,138	17,138	17,138
R-squared	0.211	0.212	0.211	0.211	0.213	0.213

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 3.4: Business networks and firms' access to trade credit

Note: This table reports the estimation of trade credit as in equation 2 using fixed effects. The command in stata is reghdfe that clustered in firms and years. Definitions of variables can be found in table 3.1.

VARIABLES	(1) payable	(2) payable	(3) payable	(4) payable	(5) payable	(6) payable
growth	0.0162***	0.0162***	0.0162***	0.0161***	0.0162***	0.0162***
	(0.00162)	(0.00162)	(0.00162)	(0.00162)	(0.00162)	(0.00162)
size	0.00489***	0.00489***	0.00489***	0.00489***	0.00489***	0.00489***
	(0.000239)	(0.000239)	(0.000239)	(0.000239)	(0.000240)	(0.000240)
prof	-0.0740***	-0.0740***	-0.0739***	-0.0742***	-0.0740***	-0.0742***
	(0.0119)	(0.0119)	(0.0119)	(0.0119)	(0.0119)	(0.0119)
fr	-0.0765***	-0.0764***	-0.0767***	-0.0767***	-0.0767***	-0.0767***
	(0.00357)	(0.00357)	(0.00356)	(0.00356)	(0.00356)	(0.00356)
lev	0.133***	0.133***	0.134***	0.133***	0.134***	0.134***
	(0.00295)	(0.00295)	(0.00294)	(0.00294)	(0.00294)	(0.00294)
opcash	0.0510***	0.0512***	0.0511***	0.0513***	0.0511***	0.0513***
	(0.00845)	(0.00846)	(0.00846)	(0.00846)	(0.00846)	(0.00846)
nonsoe	-0.00889***	-0.00826***	-0.00890***	-0.00772***	-0.00891***	-0.00795***
	(0.00123)	(0.00144)	(0.00123)	(0.00140)	(0.00123)	(0.00139)
net	0.00534***	0.00601***				
	(0.00120)	(0.00143)				
net_nonsoe		-0.00219				
		(0.00254)				
onet			0.00537***	0.00675***		
			(0.00126)	(0.00148)		
onet_nonsoe				-0.00480*		
				(0.00271)		
onet_123					0.00526***	0.00646***
					(0.00129)	(0.00151)
onet_123_nonsoe						-0.00431
						(0.00280)
Observations	17,106	17,106	17,106	17,106	17,106	17,106
R-squared	0.335	0.335	0.335	0.335	0.335	0.335

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 3.4: Business networks and firms' access to trade credit continued

VARIABLES	(1) payable	(2) payable	(3) payable	(4) payable	(5) payable	(6) payable
growth	0.0162***	0.0162***	0.0162***	0.0162***	0.0162***	0.0162***
	(0.00163)	(0.00163)	(0.00162)	(0.00162)	(0.00162)	(0.00162)
size	0.00496***	0.00496***	0.00493***	0.00493***	0.00493***	0.00493***
	(0.000239)	(0.000239)	(0.000239)	(0.000239)	(0.000239)	(0.000239)
prof	-0.0742***	-0.0742***	-0.0738***	-0.0739***	-0.0742***	-0.0742***
	(0.0119)	(0.0119)	(0.0119)	(0.0119)	(0.0119)	(0.0119)
fr	-0.0769***	-0.0769***	-0.0764***	-0.0764***	-0.0769***	-0.0769***
	(0.00357)	(0.00357)	(0.00357)	(0.00357)	(0.00356)	(0.00356)
lev	0.134***	0.134***	0.134***	0.134***	0.133***	0.133***
	(0.00294)	(0.00294)	(0.00294)	(0.00294)	(0.00294)	(0.00294)
opcash	0.0516***	0.0516***	0.0512***	0.0513***	0.0511***	0.0512***
	(0.00846)	(0.00846)	(0.00845)	(0.00846)	(0.00845)	(0.00845)
nonsoe	-0.00973***	-0.00952***	-0.00957***	-0.00944***	-0.00961***	-0.00944***
	(0.00122)	(0.00123)	(0.00122)	(0.00125)	(0.00122)	(0.00124)
onet_5	0.00470	0.00699*				
	(0.00317)	(0.00382)				
onet_5_nonsoe		-0.00740				
		(0.00686)				
cnet			0.00947***	0.0101***		
			(0.00224)	(0.00266)		
cnet_nonsoe				-0.00222		
				(0.00480)		
inet					0.0143***	0.0157***
					(0.00277)	(0.00334)
inet_nonsoe						-0.00437
						(0.00589)
Observations	17,106	17,106	17,106	17,106	17,106	17,106
R-squared	0.334	0.334	0.335	0.335	0.335	0.335

Standard errors in parentheses

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

Table 3.5 Business networks and firms' working capital management

Note: This table reports estimation results of working capital management as in equation 3 using firm fixed effects. In state, it is achieved using reghdfe clustered in firms and years. Definitions of variables can be found in table 3.1.

VARIABLES	(1) ccc	(2) ccc	(3) ccc	(4) ccc	(5) ccc	(6) ccc
prof	-533.2***	-533.3***	-533.3***	-533.9***	-533.0***	-533.6***
	(31.32)	(31.31)	(31.31)	(31.31)	(31.32)	(31.32)
lev	194.1***	193.3***	194.2***	193.3***	193.5***	192.8***
	(10.75)	(10.75)	(10.75)	(10.75)	(10.75)	(10.76)
growth	-85.64***	-85.84***	-85.63***	-85.80***	-85.76***	-85.88***
	(4.449)	(4.449)	(4.449)	(4.449)	(4.450)	(4.450)
fcf	-26.59***	-26.36***	-26.77***	-26.56***	-26.80***	-26.64***
	(8.359)	(8.358)	(8.358)	(8.357)	(8.360)	(8.360)
size	-20.99***	-21.00***	-20.97***	-20.97***	-20.98***	-20.97***
	(0.679)	(0.679)	(0.679)	(0.679)	(0.679)	(0.679)
current_ratio	34.98***	34.84***	34.96***	34.84***	34.96***	34.85***
	(1.581)	(1.582)	(1.581)	(1.581)	(1.581)	(1.582)
nonsoe	22.15***	27.19***	21.78***	25.84***	22.06***	25.06***
	(3.326)	(3.871)	(3.328)	(3.779)	(3.332)	(3.738)
net	-20.93***	-15.71***				
	(3.244)	(3.839)				
net_nonsoe		-17.50**				
		(6.888)				
onet			-23.43***	-18.71***		
			(3.390)	(3.978)		
onet_nonsoe				-16.63**		
				(7.330)		
onet_123					-21.52***	-17.84***
					(3.480)	(4.053)
onet_123_nonsoe						-13.43*
						(7.589)
Observations	16,551	16,551	16,551	16,551	16,551	16,551
R-squared	0.429	0.429	0.429	0.429	0.428	0.429

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 3.5: Business networks and firms' working capital management continued

VARIABLES	(1) ccc	(2) ccc	(3) ccc	(4) ccc	(5) ccc	(6) ccc
prof	-534.1***	-534.3***	-534.4***	-534.4***	-533.5***	-533.5***
	(31.36)	(31.35)	(31.35)	(31.34)	(31.33)	(31.33)
lev	191.1***	190.9***	190.9***	190.4***	194.0***	194.0***
	(10.76)	(10.76)	(10.75)	(10.75)	(10.76)	(10.76)
growth	-85.65***	-85.71***	-85.56***	-85.49***	-85.63***	-85.63***
	(4.455)	(4.455)	(4.453)	(4.452)	(4.451)	(4.451)
fcf	-26.40***	-26.26***	-26.61***	-26.57***	-26.02***	-26.02***
	(8.369)	(8.369)	(8.366)	(8.364)	(8.362)	(8.362)
size	-21.30***	-21.30***	-21.21***	-21.21***	-21.23***	-21.23***
	(0.678)	(0.678)	(0.678)	(0.678)	(0.677)	(0.677)
current_ratio	35.21***	35.21***	35.00***	34.92***	35.26***	35.26***
	(1.583)	(1.582)	(1.583)	(1.583)	(1.581)	(1.581)
nonsoe	25.39***	26.46***	25.06***	27.31***	24.98***	25.11***
	(3.290)	(3.332)	(3.290)	(3.377)	(3.288)	(3.344)
onet_5	-8.859	2.524				
	(8.666)	(10.32)				
onet_5_nonsoe		-38.53**				
		(18.95)				
cnet			-21.89***	-10.59		
			(6.059)	(7.173)		
cnet_nonsoe				-38.36***		
				(13.04)		
inet					-40.69***	-39.63***
					(7.416)	(8.931)
inet_nonsoe						-3.362
						(15.84)
Observations	16,551	16,551	16,551	16,551	16,551	16,551
R-squared	0.427	0.427	0.428	0.428	0.428	0.428

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 3.6: Business networks and cash sufficiency

Note: This table reports the estimation of cash sufficiency using firm fixed effects as described in equation 4. It is operated by reghdfe in stata and clustered in firms and years. The variable definitions can be seen in table 3.1.

VARIABLES	(1) cash sufficiency	(2) cash sufficiency	(3) cash sufficiency	(4) cash sufficiency	(5) cash sufficiency	(6) cash sufficiency
growth	-0.0754***	-0.0749***	-0.0755***	-0.0750***	-0.0751***	-0.0746***
	(0.0161)	(0.0161)	(0.0161)	(0.0161)	(0.0161)	(0.0161)
prof	1.841***	1.840***	1.841***	1.842***	1.841***	1.843***
	(0.114)	(0.114)	(0.114)	(0.113)	(0.114)	(0.114)
fr	0.320***	0.319***	0.317***	0.317***	0.317***	0.317***
	(0.0349)	(0.0349)	(0.0349)	(0.0349)	(0.0349)	(0.0349)
lev	-0.424***	-0.424***	-0.425***	-0.424***	-0.423***	-0.421***
	(0.0290)	(0.0291)	(0.0290)	(0.0290)	(0.0290)	(0.0290)
fcf	0.435***	0.435***	0.436***	0.435***	0.436***	0.435***
	(0.0303)	(0.0303)	(0.0303)	(0.0303)	(0.0303)	(0.0303)
size	0.00882***	0.00884***	0.00873***	0.00874***	0.00879***	0.00878***
	(0.00236)	(0.00236)	(0.00236)	(0.00236)	(0.00236)	(0.00236)
nonsoe	-0.0487***	-0.0600***	-0.0474***	-0.0590***	-0.0487***	-0.0609***
	(0.0122)	(0.0142)	(0.0122)	(0.0138)	(0.0122)	(0.0137)
net	0.0634***	0.0516***				
	(0.0119)	(0.0141)				
net_nonsoe		0.0389				
		(0.0251)				
onet			0.0725***	0.0589***		
			(0.0124)	(0.0146)		
onet_nonsoe				0.0470*		
				(0.0267)		
onet_123					0.0642***	0.0491***
					(0.0127)	(0.0149)
onet_123_nonsoe						0.0545**
						(0.0277)
Observations	17,141	17,141	17,141	17,141	17,141	17,141
R-squared	0.125	0.125	0.125	0.125	0.124	0.125

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 3.6: Business networks and cash sufficiency continued

VARIABLES	(1) cash sufficiency	(2) cash sufficiency	(3) cash sufficiency	(4) cash sufficiency	(5) cash sufficiency	(6) cash sufficiency
growth	-0.0755***	-0.0755***	-0.0755***	-0.0758***	-0.0753***	-0.0752***
	(0.0161)	(0.0161)	(0.0161)	(0.0161)	(0.0161)	(0.0161)
prof	1.841***	1.841***	1.843***	1.843***	1.841***	1.841***
	(0.114)	(0.114)	(0.114)	(0.114)	(0.114)	(0.114)
fr	0.315***	0.315***	0.316***	0.314***	0.314***	0.314***
	(0.0349)	(0.0349)	(0.0349)	(0.0349)	(0.0349)	(0.0349)
lev	-0.414***	-0.414***	-0.413***	-0.413***	-0.417***	-0.417***
	(0.0290)	(0.0290)	(0.0290)	(0.0290)	(0.0290)	(0.0290)
fcf	0.436***	0.436***	0.436***	0.436***	0.435***	0.435***
	(0.0303)	(0.0303)	(0.0303)	(0.0303)	(0.0303)	(0.0303)
size	0.00968***	0.00967***	0.00959***	0.00958***	0.00952***	0.00953***
	(0.00236)	(0.00236)	(0.00236)	(0.00236)	(0.00236)	(0.00236)
nonsoe	-0.0585***	-0.0575***	-0.0585***	-0.0640***	-0.0584***	-0.0595***
	(0.0120)	(0.0122)	(0.0120)	(0.0124)	(0.0120)	(0.0122)
onet_5	0.0725**	0.0837**				
	(0.0315)	(0.0378)				
onet_5_nonsoe		-0.0365				
		(0.0681)				
cnet			0.0341	0.00656		
			(0.0220)	(0.0261)		
cnet_nonsoe				0.0927*		
				(0.0474)		
inet					0.0788***	0.0695**
					(0.0273)	(0.0330)
inet_nonsoe						0.0291
						(0.0582)
Observations	17,141	17,141	17,141	17,141	17,141	17,141
R-squared	0.123	0.123	0.123	0.123	0.124	0.124

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 3.7: Network structure and firms' access to financial resources

Note: This table shows the estimation of firms' access to financial resources using firm fixed effects as described above. Variable definitions can be found in table 3.1.

VARIABLES	(1) ltlev	(2) ltlev	(3) stlev	(4) stlev	(5) payable	(6) payable
dep	-0.243***	-0.246***	0.107	0.0989		
	(0.0513)	(0.0514)	(0.107)	(0.107)		
growth	0.00633***	0.00643***	0.0394***	0.0397***	0.0162***	0.0162***
	(0.00188)	(0.00189)	(0.00392)	(0.00393)	(0.00162)	(0.00162)
fr	0.125***	0.125***	-0.0817***	-0.0812***	-0.0763***	-0.0766***
	(0.00487)	(0.00487)	(0.0101)	(0.0102)	(0.00356)	(0.00357)
prof	-0.115***	-0.117***	-1.101***	-1.105***	-0.0736***	-0.0741***
	(0.0126)	(0.0126)	(0.0262)	(0.0262)	(0.0119)	(0.0119)
size	0.00127***	0.00135***	0.00363***	0.00381***	0.00483***	0.00490***
	(0.000278)	(0.000277)	(0.000578)	(0.000578)	(0.000239)	(0.000239)
fcf	-0.000134***	-0.000135***	-7.38e-05	-7.46e-05		
	(3.55e-05)	(3.55e-05)	(7.39e-05)	(7.40e-05)		
nonsoe	-0.00574***	-0.00648***	0.00984***	0.00822***	-0.00830***	-0.00910***
	(0.00144)	(0.00143)	(0.00299)	(0.00298)	(0.00123)	(0.00123)
net_degree	0.00560***		0.0139***		0.00452***	
	(0.000743)		(0.00155)		(0.000642)	
net_constraint		0.00791***		0.0212***		0.00481***
		(0.00149)		(0.00311)		(0.00129)
lev					0.133***	0.134***
					(0.00295)	(0.00294)
opcash					0.0505***	0.0511***
					(0.00845)	(0.00846)
Observations	17,138	17,138	17,138	17,138	17,106	17,106
R-squared	0.158	0.156	0.214	0.213	0.336	0.335

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 3.7: Network structure and firms' access to financial resources continued

VARIABLES	(1) ccc	(2) ccc	(3) cash sufficiency	(4) cash sufficiency
prof	-533.8***	-533.2***	1.842***	1.840***
	(31.30)	(31.32)	(0.114)	(0.114)
lev	195.2***	193.4***	-0.427***	-0.422***
	(10.75)	(10.75)	(0.0291)	(0.0290)
growth	-85.60***	-85.68***	-0.0755***	-0.0752***
	(4.448)	(4.450)	(0.0161)	(0.0161)
fcf	-26.52***	-26.45***	0.435***	0.435***
	(8.355)	(8.360)	(0.0303)	(0.0303)
size	-20.90***	-21.04***	0.00867***	0.00888***
	(0.679)	(0.679)	(0.00236)	(0.00236)
current_ratio	34.91***	35.01***		
	(1.580)	(1.581)		
nonsoe	21.36***	22.66***	-0.0477***	-0.0498***
	(3.330)	(3.319)	(0.0122)	(0.0121)
net_degree	-12.92***		0.0350***	
	(1.730)		(0.00634)	
net_constraint		-20.92***		0.0676***
		(3.465)		(0.0127)
fr			0.318***	0.320***
			(0.0349)	(0.0349)
Observations	16,551	16,551	17,141	17,141
R-squared	0.429	0.428	0.125	0.125

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 3.8: Business networks affiliation and firms' supply of trade credit and net position of trade credit

Note: The table produce the same estimation process as in table 3.4 using receivable and netpay as dependent variables respectively. They estimate firm fixed effects. The Definitions of variables are available to see in table 3.1.

Panel A: supply of trade credit

VARIABLES	(1) receivable	(2) receivable	(3) receivable	(4) receivable	(5) receivable	(6) receivable
growth	-0.00128	-0.00133	-0.00129	-0.00138	-0.00126	-0.00134
	(0.00210)	(0.00210)	(0.00210)	(0.00210)	(0.00210)	(0.00210)
size	0.00188***	0.00188***	0.00188***	0.00188***	0.00186***	0.00187***
	(0.000309)	(0.000309)	(0.000309)	(0.000309)	(0.000309)	(0.000309)
prof	-0.105***	-0.105***	-0.104***	-0.105***	-0.104***	-0.105***
	(0.0154)	(0.0154)	(0.0154)	(0.0154)	(0.0154)	(0.0154)
fr	-0.160***	-0.159***	-0.160***	-0.160***	-0.160***	-0.160***
	(0.00460)	(0.00460)	(0.00460)	(0.00460)	(0.00460)	(0.00460)
lev	0.0481***	0.0481***	0.0481***	0.0479***	0.0481***	0.0479***
	(0.00380)	(0.00380)	(0.00380)	(0.00380)	(0.00380)	(0.00380)
opcash	-0.189***	-0.189***	-0.189***	-0.189***	-0.190***	-0.189***
	(0.0109)	(0.0109)	(0.0109)	(0.0109)	(0.0109)	(0.0109)
nonsoe	0.00871***	0.0100***	0.00876***	0.0109***	0.00888***	0.0108***
	(0.00159)	(0.00185)	(0.00159)	(0.00181)	(0.00159)	(0.00179)
net	0.00338**	0.00473**				
	(0.00155)	(0.00185)				
net_nonsoe		-0.00445				
		(0.00328)				
onet			0.00372**	0.00625***		
			(0.00162)	(0.00191)		
onet_nonsoe				-0.00874**		
				(0.00349)		
onet_123					0.00445***	0.00682***
					(0.00167)	(0.00195)
onet_123_nonsoe						-0.00847**
						(0.00361)
Observations	17,111	17,111	17,111	17,111	17,111	17,111
R-squared	0.322	0.322	0.322	0.323	0.323	0.323

Standard errors in parentheses

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

Panel A: supply of trade credit continued

VARIABLES	(1) receivable	(2) receivable	(3) receivable	(4) receivable	(5) receivable	(6) receivable
growth	-0.00129	-0.00130	-0.00128	-0.00125	-0.00128	-0.00123
	(0.00210)	(0.00210)	(0.00210)	(0.00210)	(0.00209)	(0.00209)
size	0.00193***	0.00192***	0.00193***	0.00193***	0.00189***	0.00190***
	(0.000308)	(0.000308)	(0.000308)	(0.000308)	(0.000308)	(0.000308)
prof	-0.105***	-0.105***	-0.105***	-0.105***	-0.105***	-0.105***
	(0.0154)	(0.0154)	(0.0154)	(0.0154)	(0.0154)	(0.0154)
fr	-0.160***	-0.160***	-0.160***	-0.160***	-0.160***	-0.160***
	(0.00460)	(0.00460)	(0.00460)	(0.00460)	(0.00460)	(0.00459)
lev	0.0488***	0.0487***	0.0489***	0.0489***	0.0476***	0.0476***
	(0.00379)	(0.00379)	(0.00379)	(0.00379)	(0.00380)	(0.00379)
opcash	-0.189***	-0.189***	-0.189***	-0.189***	-0.190***	-0.190***
	(0.0109)	(0.0109)	(0.0109)	(0.0109)	(0.0109)	(0.0109)
nonsoe	0.00816***	0.00852***	0.00812***	0.00863***	0.00835***	0.00782***
	(0.00157)	(0.00159)	(0.00157)	(0.00161)	(0.00157)	(0.00159)
onet_5	0.000850	0.00478				
	(0.00411)	(0.00493)				
onet_5_nonsoe		-0.0128				
		(0.00889)				
cnet			-0.00126	0.00133		
			(0.00291)	(0.00345)		
cnet_nonsoe				-0.00862		
				(0.00623)		
inet					0.0174***	0.0130***
					(0.00359)	(0.00434)
inet_nonsoe						0.0139*
						(0.00764)
Observations	17,111	17,111	17,111	17,111	17,111	17,111
R-squared	0.322	0.322	0.322	0.322	0.323	0.323

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Panel B: Business network affiliation and firms' net position of trade credit

VARIABLES	(1) netpay	(2) netpay	(3) netpay	(4) netpay	(5) netpay	(6) netpay
growth	0.0165***	0.0165***	0.0165***	0.0165***	0.0165***	0.0166***
	(0.00216)	(0.00217)	(0.00216)	(0.00217)	(0.00216)	(0.00217)
size	0.00298***	0.00298***	0.00298***	0.00298***	0.00298***	0.00298***
	(0.000319)	(0.000319)	(0.000319)	(0.000319)	(0.000319)	(0.000319)
prof	0.0162	0.0162	0.0163	0.0164	0.0162	0.0164
	(0.0159)	(0.0159)	(0.0159)	(0.0159)	(0.0159)	(0.0159)
fr	0.0704***	0.0703***	0.0702***	0.0702***	0.0702***	0.0702***
	(0.00476)	(0.00476)	(0.00475)	(0.00475)	(0.00475)	(0.00475)
lev	0.0853***	0.0853***	0.0853***	0.0854***	0.0855***	0.0855***
	(0.00393)	(0.00393)	(0.00393)	(0.00393)	(0.00393)	(0.00393)
opcash	0.228***	0.228***	0.228***	0.228***	0.228***	0.228***
	(0.0113)	(0.0113)	(0.0113)	(0.0113)	(0.0113)	(0.0113)
nonsoe	-0.0179***	-0.0183***	-0.0179***	-0.0188***	-0.0180***	-0.0187***
	(0.00164)	(0.00191)	(0.00164)	(0.00187)	(0.00164)	(0.00185)
net	0.00302*	0.00260				
	(0.00160)	(0.00191)				
net_nonsoe		0.00135				
		(0.00339)				
onet			0.00308*	0.00202		
			(0.00168)	(0.00198)		
onet_nonsoe				0.00363		
				(0.00361)		
onet_123					0.00261	0.00169
					(0.00172)	(0.00201)
onet_123_nonsoe						0.00331
						(0.00374)
Observations	17,056	17,056	17,056	17,056	17,056	17,056
R-squared	0.317	0.317	0.317	0.317	0.317	0.317

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Panel B: Business network affiliation and firms' net position of trade credit continued

VARIABLES	(1) netpay	(2) netpay	(3) netpay	(4) netpay	(5) netpay	(6) netpay
growth	0.0165***	0.0165***	0.0165***	0.0164***	0.0165***	0.0165***
	(0.00216)	(0.00216)	(0.00216)	(0.00216)	(0.00216)	(0.00216)
size	0.00302***	0.00302***	0.00298***	0.00298***	0.00302***	0.00301***
	(0.000318)	(0.000318)	(0.000318)	(0.000318)	(0.000319)	(0.000319)
prof	0.0161	0.0161	0.0165	0.0166	0.0161	0.0161
	(0.0159)	(0.0159)	(0.0159)	(0.0159)	(0.0159)	(0.0159)
fr	0.0701***	0.0701***	0.0707***	0.0707***	0.0701***	0.0701***
	(0.00475)	(0.00475)	(0.00475)	(0.00476)	(0.00475)	(0.00475)
lev	0.0858***	0.0859***	0.0854***	0.0854***	0.0858***	0.0858***
	(0.00392)	(0.00392)	(0.00391)	(0.00391)	(0.00392)	(0.00392)
opcash	0.228***	0.228***	0.228***	0.228***	0.228***	0.228***
	(0.0113)	(0.0113)	(0.0113)	(0.0113)	(0.0113)	(0.0113)
nonsoe	-0.0184***	-0.0186***	-0.0182***	-0.0185***	-0.0184***	-0.0179***
	(0.00162)	(0.00164)	(0.00162)	(0.00166)	(0.00162)	(0.00165)
onet_5	0.00198	6.92e-06				
	(0.00424)	(0.00509)				
onet_5_nonsoe		0.00644				
		(0.00916)				
cnet			0.0120***	0.0104***		
			(0.00300)	(0.00357)		
cnet_nonsoe				0.00528		
				(0.00643)		
inet					0.00218	0.00665
					(0.00370)	(0.00448)
inet_nonsoe						-0.0140*
						(0.00788)
Observations	17,056	17,056	17,056	17,056	17,056	17,056
R-squared	0.317	0.317	0.318	0.318	0.317	0.317

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 3.9: Further analysis on the role of business networks on non-SOEs' short-term leverage

Note: The table reports firm fixed effects on the estimation of firms' short-term lev. In state it is operated by reghdfe, cluster in firms and years. Definition of variables can be found in table 3.1.

VARIABLES	(1) stlev	(2) stlev	(3) stlev	(4) stlev	(5) stlev	(6) stlev
dep	0.104	0.104	0.106	0.106	0.102	0.101
	(0.107)	(0.107)	(0.107)	(0.107)	(0.107)	(0.107)
growth	0.0393***	0.0391***	0.0393***	0.0391***	0.0395***	0.0392***
	(0.00393)	(0.00393)	(0.00393)	(0.00393)	(0.00393)	(0.00393)
fr	-0.0809***	-0.0806***	-0.0822***	-0.0819***	-0.0821***	-0.0817***
	(0.0101)	(0.0101)	(0.0101)	(0.0101)	(0.0101)	(0.0101)
prof	-1.103***	-1.099***	-1.103***	-1.100***	-1.104***	-1.100***
	(0.0262)	(0.0262)	(0.0262)	(0.0262)	(0.0262)	(0.0262)
size	0.00373***	0.00373***	0.00376***	0.00376***	0.00375***	0.00376***
	(0.000578)	(0.000578)	(0.000578)	(0.000578)	(0.000578)	(0.000578)
fcf	-7.33e-05	-7.33e-05	-7.22e-05	-7.24e-05	-7.24e-05	-7.27e-05
	(7.39e-05)	(7.39e-05)	(7.39e-05)	(7.39e-05)	(7.39e-05)	(7.39e-05)
nonsoe	0.0137***	0.0137***	0.0138***	0.0138***	0.0123***	0.0123***
	(0.00348)	(0.00348)	(0.00340)	(0.00340)	(0.00336)	(0.00336)
net	0.0274***	0.0274***				
	(0.00345)	(0.00345)				
net_nonsoe	-0.0162***	-0.00940				
	(0.00616)	(0.00703)				
net_nonsoe_cash		-0.0129**				
		(0.00638)				
onet			0.0278***	0.0278***		
			(0.00358)	(0.00358)		
onet_nonsoe			-0.0205***	-0.0131*		
			(0.00656)	(0.00761)		
onet_nonsoe_cash				-0.0136*		
				(0.00707)		
onet_123					0.0261***	0.0261***
					(0.00364)	(0.00364)
onet_123_nonsoe					-0.0154**	-0.00444
					(0.00679)	(0.00794)
onet_123_nonsoe_cash						-0.0201***
						(0.00755)
Observations	17,138	17,138	17,138	17,138	17,138	17,138
R-squared	0.214	0.214	0.214	0.214	0.213	0.214

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 3.9: Further analysis on the role of business networks on non-SOEs' short-term lev continued

VARIABLES	(1) stlev	(2) stlev	(3) stlev	(4) stlev	(5) stlev	(6) stlev
dep	0.102	0.100	0.103	0.103	0.104	0.102
	(0.107)	(0.107)	(0.107)	(0.107)	(0.107)	(0.107)
growth	0.0396***	0.0397***	0.0398***	0.0397***	0.0396***	0.0396***
	(0.00393)	(0.00393)	(0.00393)	(0.00393)	(0.00393)	(0.00393)
fr	-0.0823***	-0.0823***	-0.0818***	-0.0817***	-0.0831***	-0.0829***
	(0.0102)	(0.0102)	(0.0102)	(0.0102)	(0.0101)	(0.0101)
prof	-1.107***	-1.109***	-1.107***	-1.107***	-1.105***	-1.104***
	(0.0262)	(0.0262)	(0.0262)	(0.0262)	(0.0262)	(0.0262)
size	0.00405***	0.00405***	0.00403***	0.00403***	0.00394***	0.00394***
	(0.000577)	(0.000577)	(0.000578)	(0.000578)	(0.000577)	(0.000577)
fcf	-7.24e-05	-7.24e-05	-7.23e-05	-7.24e-05	-7.45e-05	-7.44e-05
	(7.40e-05)	(7.40e-05)	(7.40e-05)	(7.40e-05)	(7.39e-05)	(7.39e-05)
nonsoe	0.00725**	0.00726**	0.00716**	0.00716**	0.00603**	0.00603**
	(0.00299)	(0.00299)	(0.00304)	(0.00304)	(0.00300)	(0.00300)
onet_5	0.0445***	0.0446***				
	(0.00927)	(0.00927)				
onet_5_nonsoe	-0.0625***	-0.0832***				
	(0.0167)	(0.0193)				
onet_5_nonsoe_cash		0.0414**				
		(0.0192)				
cnet			0.0224***	0.0224***		
			(0.00642)	(0.00642)		
cnet_nonsoe			-0.0266**	-0.0213		
			(0.0116)	(0.0148)		
cnet_nonsoe_cash				-0.00923		
				(0.0160)		
inet					0.0536***	0.0536***
					(0.00809)	(0.00809)
inet_nonsoe					-0.00532	0.00396
					(0.0143)	(0.0171)
inet_nonsoe_cash						-0.0170
						(0.0171)
Observations	17,138	17,138	17,138	17,138	17,138	17,138
R-squared	0.212	0.212	0.211	0.211	0.213	0.214

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 3.10: Business networks and firms' access to financial resources using alternative ownership measure

Note: The table reports firm fixed effects on the estimation of firms' access to financial resources. Definitions of variables are available in table 3.1.

Panel A: Business network and long-term leverage

VARIABLES	(1) ltlev	(2) ltlev	(3) ltlev	(4) ltlev	(5) ltlev	(6) ltlev
dep	-0.247***	-0.248***	-0.246***	-0.246***	-0.247***	-0.247***
	(0.0514)	(0.0514)	(0.0514)	(0.0514)	(0.0514)	(0.0514)
growth	0.00639***	0.00645***	0.00638***	0.00640***	0.00644***	0.00643***
	(0.00188)	(0.00188)	(0.00188)	(0.00188)	(0.00188)	(0.00188)
fr	0.125***	0.125***	0.124***	0.124***	0.124***	0.124***
	(0.00487)	(0.00487)	(0.00487)	(0.00487)	(0.00487)	(0.00487)
prof	-0.116***	-0.116***	-0.116***	-0.116***	-0.117***	-0.117***
	(0.0126)	(0.0126)	(0.0126)	(0.0126)	(0.0126)	(0.0126)
size	0.00130***	0.00131***	0.00131***	0.00131***	0.00131***	0.00131***
	(0.000277)	(0.000277)	(0.000277)	(0.000277)	(0.000278)	(0.000278)
fcf	-0.000135***	-0.000135***	-0.000134***	-0.000134***	-0.000134***	-0.000134***
	(3.55e-05)	(3.55e-05)	(3.55e-05)	(3.55e-05)	(3.55e-05)	(3.55e-05)
dp	-0.00642***	-0.00758***	-0.00646***	-0.00683***	-0.00649***	-0.00614***
	(0.00144)	(0.00168)	(0.00144)	(0.00163)	(0.00144)	(0.00162)
net	0.00928***	0.00808***				
	(0.00139)	(0.00165)				
net_dp		0.00402				
		(0.00297)				
onet			0.00915***	0.00871***		
			(0.00146)	(0.00171)		
onet_dp				0.00155		
				(0.00316)		
onet_123					0.00895***	0.00938***
					(0.00149)	(0.00174)
onet_123_dp						-0.00156
						(0.00327)
Observations	17,138	17,138	17,138	17,138	17,138	17,138
R-squared	0.157	0.157	0.157	0.157	0.157	0.157

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Panel A continued

VARIABLES	(1) ltlev	(2) ltlev	(3) ltlev	(4) ltlev	(5) ltlev	(6) ltlev
dep	-0.246***	-0.245***	-0.246***	-0.246***	-0.247***	-0.246***
	(0.0514)	(0.0514)	(0.0514)	(0.0514)	(0.0514)	(0.0514)
growth	0.00642***	0.00644***	0.00639***	0.00637***	0.00647***	0.00652***
	(0.00189)	(0.00189)	(0.00189)	(0.00189)	(0.00189)	(0.00189)
fr	0.124***	0.124***	0.125***	0.125***	0.124***	0.124***
	(0.00487)	(0.00487)	(0.00487)	(0.00487)	(0.00487)	(0.00487)
prof	-0.118***	-0.118***	-0.117***	-0.117***	-0.118***	-0.118***
	(0.0126)	(0.0126)	(0.0126)	(0.0126)	(0.0126)	(0.0126)
size	0.00144***	0.00145***	0.00140***	0.00140***	0.00142***	0.00143***
	(0.000277)	(0.000277)	(0.000277)	(0.000277)	(0.000277)	(0.000277)
fcf	-0.000134***	-0.000134***	-0.000134***	-0.000134***	-0.000134***	-0.000135***
	(3.55e-05)	(3.55e-05)	(3.55e-05)	(3.55e-05)	(3.55e-05)	(3.55e-05)
dp	-0.00773***	-0.00826***	-0.00760***	-0.00797***	-0.00781***	-0.00833***
	(0.00142)	(0.00144)	(0.00142)	(0.00146)	(0.00142)	(0.00145)
onet_5	0.0161***	0.0104**				
	(0.00371)	(0.00441)				
onet_5_dp		0.0190**				
		(0.00810)				
cnet			0.0134***	0.0116***		
			(0.00259)	(0.00306)		
cnet_dp				0.00610		
				(0.00561)		
inet					0.00915***	0.00487
					(0.00321)	(0.00388)
inet_dp						0.0135**
						(0.00686)
Observations	17,138	17,138	17,138	17,138	17,138	17,138
R-squared	0.156	0.156	0.156	0.156	0.155	0.156

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Panel B: Business networks and firms' access to short-term leverage

VARIABLES	(1) stlev	(2) stlev	(3) stlev	(4) stlev	(5) stlev	(6) stlev
dep	0.105	0.108	0.107	0.111	0.104	0.106
	(0.107)	(0.107)	(0.107)	(0.107)	(0.107)	(0.107)
growth	0.0395***	0.0393***	0.0395***	0.0392***	0.0396***	0.0395***
	(0.00393)	(0.00393)	(0.00393)	(0.00393)	(0.00393)	(0.00393)
fr	-0.0809***	-0.0807***	-0.0820***	-0.0820***	-0.0819***	-0.0820***
	(0.0101)	(0.0101)	(0.0101)	(0.0101)	(0.0101)	(0.0101)
prof	-1.104***	-1.103***	-1.104***	-1.104***	-1.104***	-1.104***
	(0.0262)	(0.0262)	(0.0262)	(0.0262)	(0.0262)	(0.0262)
size	0.00377***	0.00375***	0.00379***	0.00378***	0.00377***	0.00377***
	(0.000578)	(0.000578)	(0.000578)	(0.000578)	(0.000578)	(0.000578)
fcf	-7.44e-05	-7.29e-05	-7.31e-05	-7.19e-05	-7.30e-05	-7.21e-05
	(7.39e-05)	(7.39e-05)	(7.39e-05)	(7.39e-05)	(7.40e-05)	(7.39e-05)
dp	0.00999***	0.0149***	0.00986***	0.0152***	0.00985***	0.0136***
	(0.00300)	(0.00349)	(0.00300)	(0.00341)	(0.00301)	(0.00337)
net	0.0226***	0.0277***				
	(0.00290)	(0.00344)				
net_dp		-0.0171***				
		(0.00618)				
onet			0.0220***	0.0282***		
			(0.00303)	(0.00356)		
onet_dp				-0.0219***		
				(0.00658)		
onet_123					0.0219***	0.0266***
					(0.00311)	(0.00363)
onet_123_dp						-0.0170**
						(0.00681)
Observations	17,138	17,138	17,138	17,138	17,138	17,138
R-squared	0.214	0.214	0.213	0.214	0.213	0.213

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Panel B continued

VARIABLES	(1) stlev	(2) stlev	(3) stlev	(4) stlev	(5) stlev	(6) stlev
dep	0.107	0.105	0.106	0.107	0.107	0.107
	(0.107)	(0.107)	(0.107)	(0.107)	(0.107)	(0.107)
growth	0.0397***	0.0396***	0.0397***	0.0397***	0.0396***	0.0396***
	(0.00393)	(0.00393)	(0.00393)	(0.00393)	(0.00393)	(0.00393)
fr	-0.0825***	-0.0821***	-0.0821***	-0.0817***	-0.0830***	-0.0829***
	(0.0102)	(0.0102)	(0.0102)	(0.0102)	(0.0101)	(0.0101)
prof	-1.108***	-1.107***	-1.108***	-1.108***	-1.105***	-1.105***
	(0.0262)	(0.0262)	(0.0262)	(0.0262)	(0.0262)	(0.0262)
size	0.00410***	0.00408***	0.00406***	0.00406***	0.00397***	0.00397***
	(0.000577)	(0.000577)	(0.000577)	(0.000577)	(0.000576)	(0.000577)
fcf	-7.24e-05	-7.21e-05	-7.23e-05	-7.20e-05	-7.44e-05	-7.42e-05
	(7.40e-05)	(7.40e-05)	(7.40e-05)	(7.40e-05)	(7.39e-05)	(7.39e-05)
dp	0.00666**	0.00841***	0.00671**	0.00833***	0.00693**	0.00720**
	(0.00297)	(0.00301)	(0.00297)	(0.00305)	(0.00296)	(0.00302)
onet_5	0.0255***	0.0441***				
	(0.00773)	(0.00920)				
onet_5_dp		-0.0627***				
		(0.0169)				
cnet			0.0146***	0.0225***		
			(0.00541)	(0.00639)		
cnet_dp				-0.0270**		
				(0.0117)		
inet					0.0519***	0.0541***
					(0.00669)	(0.00808)
inet_dp						-0.00700
						(0.0143)
Observations	17,138	17,138	17,138	17,138	17,138	17,138
R-squared	0.211	0.212	0.211	0.211	0.214	0.214

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Panel C: Business networks and trade credit

VARIABLES	(1) payable	(2) payable	(3) payable	(4) payable	(5) payable	(6) payable
growth	0.0162***	0.0162***	0.0162***	0.0162***	0.0162***	0.0162***
	(0.00162)	(0.00162)	(0.00162)	(0.00162)	(0.00162)	(0.00162)
size	0.00490***	0.00490***	0.00490***	0.00490***	0.00490***	0.00490***
	(0.000239)	(0.000239)	(0.000239)	(0.000239)	(0.000240)	(0.000240)
prof	-0.0742***	-0.0742***	-0.0741***	-0.0743***	-0.0741***	-0.0744***
	(0.0119)	(0.0119)	(0.0119)	(0.0119)	(0.0119)	(0.0119)
fr	-0.0766***	-0.0765***	-0.0768***	-0.0768***	-0.0768***	-0.0768***
	(0.00357)	(0.00357)	(0.00357)	(0.00357)	(0.00357)	(0.00357)
lev	0.133***	0.133***	0.134***	0.133***	0.134***	0.134***
	(0.00295)	(0.00295)	(0.00294)	(0.00295)	(0.00294)	(0.00294)
opcash	0.0508***	0.0510***	0.0508***	0.0511***	0.0509***	0.0511***
	(0.00846)	(0.00846)	(0.00846)	(0.00846)	(0.00846)	(0.00846)
dp	-0.00856***	-0.00780***	-0.00856***	-0.00730***	-0.00857***	-0.00753***
	(0.00124)	(0.00144)	(0.00124)	(0.00141)	(0.00124)	(0.00139)
net	0.00547***	0.00625***				
	(0.00120)	(0.00142)				
net_dp		-0.00262				
		(0.00255)				
onet			0.00550***	0.00696***		
			(0.00126)	(0.00147)		
onet_dp				-0.00515*		
				(0.00271)		
onet_123					0.00540***	0.00667***
					(0.00129)	(0.00150)
onet_123_dp						-0.00465*
						(0.00281)
Observations	17,106	17,106	17,106	17,106	17,106	17,106
R-squared	0.335	0.335	0.335	0.335	0.335	0.335

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Panel C continued

VARIABLES	(1) payable	(2) payable	(3) payable	(4) payable	(5) payable	(6) payable
growth	0.0162***	0.0162***	0.0162***	0.0162***	0.0162***	0.0162***
	(0.00163)	(0.00163)	(0.00162)	(0.00162)	(0.00162)	(0.00162)
size	0.00498***	0.00497***	0.00495***	0.00495***	0.00494***	0.00494***
	(0.000239)	(0.000239)	(0.000239)	(0.000239)	(0.000239)	(0.000239)
prof	-0.0744***	-0.0744***	-0.0740***	-0.0741***	-0.0744***	-0.0744***
	(0.0119)	(0.0119)	(0.0119)	(0.0119)	(0.0119)	(0.0119)
fr	-0.0771***	-0.0770***	-0.0766***	-0.0765***	-0.0770***	-0.0770***
	(0.00357)	(0.00357)	(0.00357)	(0.00357)	(0.00356)	(0.00356)
lev	0.134***	0.134***	0.134***	0.134***	0.134***	0.134***
	(0.00294)	(0.00294)	(0.00294)	(0.00294)	(0.00294)	(0.00294)
opcash	0.0514***	0.0514***	0.0510***	0.0511***	0.0509***	0.0510***
	(0.00846)	(0.00846)	(0.00846)	(0.00846)	(0.00846)	(0.00846)
dp	-0.00937***	-0.00916***	-0.00922***	-0.00907***	-0.00927***	-0.00912***
	(0.00122)	(0.00124)	(0.00122)	(0.00126)	(0.00122)	(0.00124)
onet_5	0.00470	0.00698*				
	(0.00318)	(0.00379)				
onet_5_dp		-0.00763				
		(0.00692)				
cnet			0.00953***	0.0103***		
			(0.00224)	(0.00265)		
cnet_dp				-0.00265		
				(0.00483)		
inet					0.0144***	0.0157***
					(0.00277)	(0.00334)
inet_dp						-0.00391
						(0.00590)
Observations	17,106	17,106	17,106	17,106	17,106	17,106
R-squared	0.334	0.334	0.335	0.335	0.335	0.335

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Panel D: Business networks and working capital management

VARIABLES	(1) ccc	(2) ccc	(3) ccc	(4) ccc	(5) ccc	(6) ccc
prof	-533.2***	-533.3***	-533.3***	-533.8***	-533.0***	-533.6***
	(31.32)	(31.31)	(31.31)	(31.31)	(31.32)	(31.32)
lev	194.2***	193.4***	194.3***	193.4***	193.6***	193.0***
	(10.75)	(10.75)	(10.75)	(10.75)	(10.75)	(10.75)
growth	-85.70***	-85.90***	-85.69***	-85.87***	-85.83***	-85.94***
	(4.449)	(4.449)	(4.449)	(4.449)	(4.450)	(4.450)
fcf	-26.34***	-26.10***	-26.53***	-26.30***	-26.56***	-26.38***
	(8.360)	(8.360)	(8.359)	(8.358)	(8.362)	(8.362)
size	-21.00***	-21.00***	-20.97***	-20.97***	-20.98***	-20.98***
	(0.679)	(0.678)	(0.678)	(0.678)	(0.679)	(0.679)
current_ratio	35.00***	34.87***	34.98***	34.86***	34.97***	34.88***
	(1.581)	(1.582)	(1.581)	(1.581)	(1.581)	(1.582)
dp	22.40***	27.27***	22.03***	26.16***	22.30***	25.15***
	(3.336)	(3.882)	(3.339)	(3.788)	(3.342)	(3.747)
net	-21.07***	-16.12***				
	(3.240)	(3.818)				
net_dp		-16.95**				
		(6.912)				
onet			-23.56***	-18.82***		
			(3.386)	(3.958)		
onet_dp				-17.01**		
				(7.355)		
onet_123					-21.67***	-18.22***
					(3.475)	(4.035)
onet_123_dp						-12.81*
						(7.610)
Observations	16,551	16,551	16,551	16,551	16,551	16,551
R-squared	0.429	0.429	0.429	0.429	0.428	0.429

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Panel D continued

VARIABLES	(1) ccc	(2) ccc	(3) ccc	(4) ccc	(5) ccc	(6) ccc
prof	-534.0***	-534.2***	-534.3***	-534.3***	-533.4***	-533.4***
	(31.36)	(31.35)	(31.34)	(31.34)	(31.33)	(31.33)
lev	191.2***	190.9***	191.0***	190.5***	194.1***	194.1***
	(10.76)	(10.76)	(10.75)	(10.75)	(10.76)	(10.76)
growth	-85.73***	-85.78***	-85.64***	-85.59***	-85.70***	-85.71***
	(4.455)	(4.454)	(4.453)	(4.453)	(4.451)	(4.451)
fcf	-26.13***	-26.02***	-26.34***	-26.30***	-25.74***	-25.76***
	(8.371)	(8.370)	(8.368)	(8.367)	(8.364)	(8.364)
size	-21.31***	-21.31***	-21.22***	-21.22***	-21.24***	-21.24***
	(0.678)	(0.678)	(0.678)	(0.678)	(0.677)	(0.677)
current_ratio	35.23***	35.23***	35.02***	34.94***	35.29***	35.29***
	(1.582)	(1.582)	(1.583)	(1.583)	(1.581)	(1.581)
dp	25.51***	26.69***	25.21***	27.19***	25.16***	25.34***
	(3.305)	(3.346)	(3.304)	(3.392)	(3.302)	(3.359)
onet_5	-8.773	3.559				
	(8.666)	(10.24)				
onet_5_dp		-43.35**				
		(19.17)				
cnet			-21.99***	-12.20*		
			(6.058)	(7.141)		
cnet_dp				-33.95***		
				(13.12)		
inet					-40.87***	-39.39***
					(7.415)	(8.919)
inet_dp						-4.742
						(15.87)
Observations	16,551	16,551	16,551	16,551	16,551	16,551
R-squared	0.427	0.427	0.428	0.428	0.428	0.428

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Panel E: Business networks and cash sufficiency ratio

VARIABLES	(1) cash sufficiency	(2) cash sufficiency	(3) cash sufficiency	(4) cash sufficiency	(5) cash sufficiency	(6) cash sufficiency
growth	-0.0752***	-0.0747***	-0.0754***	-0.0748***	-0.0750***	-0.0744***
	(0.0161)	(0.0161)	(0.0161)	(0.0161)	(0.0161)	(0.0161)
prof	1.842***	1.842***	1.843***	1.844***	1.842***	1.845***
	(0.114)	(0.114)	(0.113)	(0.113)	(0.114)	(0.114)
fr	0.318***	0.317***	0.316***	0.316***	0.315***	0.315***
	(0.0349)	(0.0349)	(0.0349)	(0.0349)	(0.0349)	(0.0349)
lev	-0.424***	-0.423***	-0.425***	-0.423***	-0.422***	-0.421***
	(0.0290)	(0.0290)	(0.0290)	(0.0290)	(0.0290)	(0.0290)
fcf	0.435***	0.434***	0.435***	0.435***	0.435***	0.434***
	(0.0303)	(0.0303)	(0.0303)	(0.0303)	(0.0303)	(0.0303)
size	0.00874***	0.00877***	0.00865***	0.00867***	0.00871***	0.00871***
	(0.00236)	(0.00236)	(0.00236)	(0.00236)	(0.00236)	(0.00236)
dp	-0.0521***	-0.0649***	-0.0508***	-0.0638***	-0.0521***	-0.0654***
	(0.0122)	(0.0142)	(0.0122)	(0.0139)	(0.0122)	(0.0137)
net	0.0633***	0.0501***				
	(0.0119)	(0.0140)				
net_dp		0.0444*				
		(0.0252)				
onet			0.0723***	0.0573***		
			(0.0124)	(0.0145)		
onet_dp				0.0532**		
				(0.0268)		
onet_123					0.0641***	0.0477***
					(0.0127)	(0.0148)
onet_123_dp						0.0599**
						(0.0278)
Observations	17,141	17,141	17,141	17,141	17,141	17,141
R-squared	0.125	0.125	0.125	0.125	0.125	0.125

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Panel E continued

VARIABLES	(1) cash sufficiency	(2) cash sufficiency	(3) cash sufficiency	(4) cash sufficiency	(5) cash sufficiency	(6) cash sufficiency
growth	-0.0753***	-0.0754***	-0.0753***	-0.0756***	-0.0751***	-0.0750***
	(0.0161)	(0.0161)	(0.0161)	(0.0161)	(0.0161)	(0.0161)
prof	1.842***	1.842***	1.844***	1.844***	1.843***	1.842***
	(0.114)	(0.114)	(0.114)	(0.114)	(0.114)	(0.114)
fr	0.313***	0.314***	0.314***	0.312***	0.312***	0.312***
	(0.0349)	(0.0349)	(0.0349)	(0.0350)	(0.0349)	(0.0349)
lev	-0.414***	-0.414***	-0.413***	-0.412***	-0.417***	-0.417***
	(0.0290)	(0.0290)	(0.0290)	(0.0290)	(0.0290)	(0.0290)
fcf	0.436***	0.436***	0.435***	0.435***	0.434***	0.435***
	(0.0303)	(0.0303)	(0.0303)	(0.0303)	(0.0303)	(0.0303)
size	0.00962***	0.00961***	0.00953***	0.00952***	0.00946***	0.00948***
	(0.00235)	(0.00235)	(0.00236)	(0.00236)	(0.00236)	(0.00236)
dp	-0.0614***	-0.0606***	-0.0614***	-0.0672***	-0.0614***	-0.0627***
	(0.0121)	(0.0122)	(0.0121)	(0.0124)	(0.0121)	(0.0123)
onet_5	0.0721**	0.0805**				
	(0.0315)	(0.0375)				
onet_5_dp		-0.0284				
		(0.0688)				
cnet			0.0341	0.00609		
			(0.0220)	(0.0260)		
cnet_dp				0.0964**		
				(0.0476)		
inet					0.0791***	0.0684**
					(0.0273)	(0.0330)
inet_dp						0.0335
						(0.0583)
Observations	17,141	17,141	17,141	17,141	17,141	17,141
R-squared	0.123	0.123	0.123	0.124	0.124	0.124

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Panel F: Network structure and firms' access to financial resources

VARIABLES	(1) ltlev	(2) ltlev	(3) stlev	(4) stlev	(5) payable	(6) payable
dep	-0.245***	-0.248***	0.111	0.103		
	(0.0513)	(0.0514)	(0.107)	(0.107)		
growth	0.00635***	0.00645***	0.0394***	0.0396***	0.0162***	0.0162***
	(0.00188)	(0.00189)	(0.00392)	(0.00393)	(0.00162)	(0.00162)
fr	0.125***	0.125***	-0.0815***	-0.0810***	-0.0765***	-0.0767***
	(0.00487)	(0.00487)	(0.0101)	(0.0102)	(0.00356)	(0.00357)
prof	-0.115***	-0.117***	-1.101***	-1.105***	-0.0738***	-0.0742***
	(0.0126)	(0.0126)	(0.0262)	(0.0262)	(0.0119)	(0.0119)
size	0.00126***	0.00134***	0.00366***	0.00383***	0.00484***	0.00492***
	(0.000277)	(0.000277)	(0.000578)	(0.000578)	(0.000239)	(0.000239)
fcf	-0.000134***	-0.000135***	-7.36e-05	-7.43e-05		
	(3.55e-05)	(3.55e-05)	(7.39e-05)	(7.40e-05)		
dp	-0.00612***	-0.00683***	0.0108***	0.00926***	-0.00799***	-0.00876***
	(0.00144)	(0.00144)	(0.00300)	(0.00299)	(0.00124)	(0.00123)
net_degree	0.00560***		0.0140***		0.00458***	
	(0.000742)		(0.00155)		(0.000641)	
net_constraint		0.00792***		0.0213***		0.00494***
		(0.00149)		(0.00311)		(0.00129)
lev					0.133***	0.134***
					(0.00295)	(0.00294)
opcash					0.0503***	0.0508***
					(0.00845)	(0.00846)
Observations	17,138	17,138	17,138	17,138	17,106	17,106
R-squared	0.158	0.156	0.215	0.213	0.336	0.334

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Panel F continued

VARIABLES	(1) ccc	(2) ccc	(3) cash sufficiency	(4) cash sufficiency
prof	-533.9***	-533.2***	1.844***	1.842***
	(31.30)	(31.32)	(0.114)	(0.114)
lev	195.3***	193.5***	-0.427***	-0.422***
	(10.75)	(10.75)	(0.0291)	(0.0290)
growth	-85.66***	-85.75***	-0.0754***	-0.0750***
	(4.447)	(4.450)	(0.0161)	(0.0161)
fcf	-26.27***	-26.20***	0.434***	0.434***
	(8.357)	(8.362)	(0.0303)	(0.0303)
size	-20.90***	-21.04***	0.00859***	0.00881***
	(0.679)	(0.678)	(0.00236)	(0.00236)
current_ratio	34.92***	35.03***		
	(1.580)	(1.581)		
dp	21.65***	22.90***	-0.0512***	-0.0531***
	(3.340)	(3.330)	(0.0122)	(0.0122)
net_degree	-13.00***		0.0350***	
	(1.728)		(0.00633)	
net_constraint		-21.07***		0.0675***
		(3.461)		(0.0127)
fr			0.317***	0.318***
			(0.0349)	(0.0349)
Observations	16,551	16,551	17,141	17,141
R-squared	0.429	0.428	0.125	0.125

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 3.11: Endogenous treatment effects correction

Note: The table reports estimation of average treated effects of long-term lev, short-term lev, trade credit, working capital management and cash sufficiency controlling for endogenous treatment effects. In stata, this is achieved by eteffects. Definitions of variables can be found in table 3.1.

ltlev	Without panel		With panel	
	Coef.	P>|z|	Coef.	P>|z|
ATE				
net (1 vs 0)	.0265	0.000	.0269	0.000
POmean				
net 0	.0625	0.000	.0680	0.000

stlev	Without panel		With panel	
	Coef.	P>|z|	Coef.	P>|z|
ATE				
net (1 vs 0)	.0206	0.000	.0209	0.000
POmean				
net 0	.3959	0.000	.3979	0.000

trade credit	Without panel		With panel	
	Coef.	P>|z|	Coef.	P>|z|
ATE				
net (1 vs 0)	0.0244	0.000	.02515	0.000
POmean				
net 0	.1016	0.000	.1074	0.000

ccc	Without panel		With panel	
	Coef.	P>|z|	Coef.	P>|z|
ATE				
net (1 vs 0)	-98.6508	0.000	-108.0739	0.000
POmean				
net 0	229.1596	0.000	201.3711	0.000

cash sufficiency	Without panel		With panel	
	Coef.	P>|z|	Coef.	P>|z|
ATE				
net (1 vs 0)	.1715	0.000	.1901	0.000
POmean				
net 0	. .4556	0.000	.4744	0.000

Test of endogeneity

Outcome variable	Treatment variable	Null hypothesis	Prob>chi2
ltlev	net	Outcome and treatment unobservables are uncorrelated	0.0000
stlev	net	Outcome and treatment unobservables are uncorrelated	0.000
payable	net	Outcome and treatment unobservables are uncorrelated	0.000
ccc	net	Outcome and treatment unobservables are uncorrelated	0.000
cash sufficiency	net	Outcome and treatment unobservables are uncorrelated	0.000

Table 3.12: Correction for cross-sectional dependence

Note: These tables report estimations of firms' access to financial resources using Driscoll-Kraay standard errors to control for cross sectional dependence. In stata, it is operated by xtscc, fe. Definitions of variables can be found in table 3.1.

Panel A: Long-term leverage

VARIABLES	(1) ltlev	(2) ltlev	(3) ltlev	(4) ltlev	(5) ltlev	(6) ltlev
dep	-0.436***	-0.434***	-0.434***	-0.441***	-0.435***	-0.439***
	(0.0977)	(0.0986)	(0.0975)	(0.0989)	(0.0957)	(0.0976)
growth	0.00361	0.00366	0.00379*	0.00356	0.00346	0.00363
	(0.00208)	(0.00209)	(0.00209)	(0.00215)	(0.00223)	(0.00215)
fr	0.0454***	0.0454***	0.0455***	0.0424***	0.0430***	0.0422***
	(0.0106)	(0.0107)	(0.0105)	(0.0119)	(0.0115)	(0.0119)
prof	-0.129***	-0.130***	-0.130***	-0.136***	-0.134***	-0.136***
	(0.0178)	(0.0177)	(0.0177)	(0.0189)	(0.0184)	(0.0189)
size	-0.000112	-0.000115	-0.000126	-4.61e-05	-4.68e-05	-4.90e-05
	(0.000421)	(0.000421)	(0.000426)	(0.000421)	(0.000425)	(0.000421)
fcf	-0.000123***	-0.000122***	-0.000122***	-0.000122***	-0.000122***	-0.000122***
	(1.09e-05)	(1.09e-05)	(1.09e-05)	(1.09e-05)	(1.09e-05)	(1.10e-05)
nonsoe	0.0121***	0.0120***	0.0120***	0.0131***	0.0129***	0.0130***
	(0.00334)	(0.00330)	(0.00328)	(0.00373)	(0.00363)	(0.00368)
net	0.0120***					
	(0.00397)					
onet		0.0134***				
		(0.00397)				
onet_123			0.0136***			
			(0.00431)			
onet_5				0.0121***		
				(0.00277)		
cnet					0.0112**	
					(0.00504)	
inet						0.00335
						(0.00501)
Constant	0.0663***	0.0665***	0.0669***	0.0693***	0.0687***	0.0696***
	(0.00779)	(0.00763)	(0.00775)	(0.00857)	(0.00863)	(0.00867)
Observations	17,156	17,156	17,156	17,156	17,156	17,156
Number of groups	2,141	2,141	2,141	2,141	2,141	2,141

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Panel B: Shot-term leverage

VARIABLES	(1) stlev	(2) stlev	(3) stlev	(4) stlev	(5) stlev	(6) stlev
dep	0.571***	0.572***	0.573***	0.564***	0.564***	0.571***
	(0.0795)	(0.0780)	(0.0790)	(0.0830)	(0.0832)	(0.0825)
growth	0.0249***	0.0250***	0.0252***	0.0249***	0.0250***	0.0249***
	(0.00752)	(0.00756)	(0.00759)	(0.00759)	(0.00754)	(0.00752)
fr	-0.0224	-0.0229	-0.0227	-0.0269	-0.0273	-0.0262
	(0.0179)	(0.0182)	(0.0183)	(0.0195)	(0.0193)	(0.0197)
prof	-0.706***	-0.708***	-0.708***	-0.716***	-0.717***	-0.713***
	(0.112)	(0.112)	(0.113)	(0.115)	(0.115)	(0.114)
size	0.00476***	0.00477***	0.00475***	0.00485***	0.00485***	0.00484***
	(0.000566)	(0.000571)	(0.000569)	(0.000594)	(0.000591)	(0.000596)
fcf	-7.49e-05**	-7.43e-05**	-7.44e-05**	-7.41e-05**	-7.41e-05**	-7.51e-05**
	(2.70e-05)	(2.73e-05)	(2.72e-05)	(2.75e-05)	(2.75e-05)	(2.70e-05)
nonsoe	0.0280**	0.0279**	0.0279**	0.0294**	0.0293**	0.0291**
	(0.00968)	(0.00961)	(0.00967)	(0.00999)	(0.00998)	(0.0101)
net	0.0175***					
	(0.00505)					
onet		0.0171***				
		(0.00462)				
onet_123			0.0176***			
			(0.00412)			
onet_5				0.00933		
				(0.00814)		
cnet					-0.00166	
					(0.00664)	
inet						0.0305***
						(0.00666)
Constant	0.311***	0.312***	0.313***	0.316***	0.317***	0.315***
	(0.0126)	(0.0123)	(0.0121)	(0.0131)	(0.0133)	(0.0130)
Observations	17,156	17,156	17,156	17,156	17,156	17,156
Number of groups	2,141	2,141	2,141	2,141	2,141	2,141

Standard errors in parentheses

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

Panel C: Trade credit

VARIABLES	(1) payable	(2) payable	(3) payable	(4) payable	(5) payable	(6) payable
growth	0.0107***	0.0107***	0.0109***	0.0106***	0.0105***	0.0106***
	(0.00104)	(0.00107)	(0.00110)	(0.00110)	(0.00109)	(0.00109)
size	0.000810*	0.000810*	0.000799*	0.000861*	0.000860*	0.000860*
	(0.000432)	(0.000433)	(0.000429)	(0.000455)	(0.000451)	(0.000450)
prof	-0.0674**	-0.0678**	-0.0682***	-0.0716***	-0.0703**	-0.0712***
	(0.0228)	(0.0226)	(0.0226)	(0.0236)	(0.0235)	(0.0235)
fr	-0.0276***	-0.0276***	-0.0274***	-0.0309***	-0.0304***	-0.0306***
	(0.00805)	(0.00795)	(0.00786)	(0.00936)	(0.00911)	(0.00933)
lev	0.117***	0.117***	0.117***	0.120***	0.120***	0.120***
	(0.0141)	(0.0141)	(0.0142)	(0.0149)	(0.0149)	(0.0150)
opcash	0.0670***	0.0671***	0.0672***	0.0687***	0.0690***	0.0686***
	(0.00467)	(0.00460)	(0.00466)	(0.00569)	(0.00549)	(0.00558)
nonsoe	0.00740***	0.00729***	0.00727***	0.00820***	0.00810***	0.00812***
	(0.00175)	(0.00169)	(0.00169)	(0.00207)	(0.00207)	(0.00207)
net	0.0117***					
	(0.00321)					
onet		0.0128***				
		(0.00386)				
onet_123			0.0131***			
			(0.00396)			
onet_5				0.00728**		
				(0.00270)		
cnet					0.00774**	
					(0.00296)	
inet						0.0102**
						(0.00454)
Constant	0.0362*	0.0365*	0.0368*	0.0380*	0.0376*	0.0380*
	(0.0179)	(0.0179)	(0.0178)	(0.0183)	(0.0182)	(0.0182)
Observations	17,116	17,116	17,116	17,116	17,116	17,116
Number of groups	2,131	2,131	2,131	2,131	2,131	2,131

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Panel D: Cash conversion cycle

VARIABLES	(1) ccc	(2) ccc	(3) ccc	(4) ccc	(5) ccc	(6) ccc
prof	-344.8***	-342.4***	-340.3***	-331.6***	-336.9***	-333.3***
	(68.05)	(67.44)	(66.70)	(72.85)	(72.44)	(72.44)
lev	83.04***	83.80***	83.65***	69.77***	70.86***	73.67***
	(11.54)	(11.28)	(11.30)	(11.58)	(11.23)	(11.61)
growth	-83.68***	-84.00***	-84.51***	-83.16***	-82.79***	-83.20***
	(17.50)	(17.59)	(17.71)	(17.61)	(17.66)	(17.51)
fcf	2.018	1.562	1.442	4.170	3.642	3.967
	(9.651)	(9.750)	(9.677)	(10.23)	(10.03)	(10.14)
size	-8.726***	-8.708***	-8.657***	-9.000***	-8.976***	-9.006***
	(2.666)	(2.667)	(2.664)	(2.774)	(2.761)	(2.751)
current_ratio	23.58***	23.64***	23.59***	23.91***	23.92***	24.01***
	(5.272)	(5.214)	(5.218)	(5.545)	(5.468)	(5.523)
nonsoe	-41.48***	-40.96***	-40.95***	-45.41***	-44.95***	-45.03***
	(9.172)	(8.846)	(8.887)	(10.85)	(10.71)	(10.76)
net	-48.56***					
	(11.22)					
onet		-53.87***				
		(12.77)				
onet_123			-54.17***			
			(12.93)			
onet_5				-7.217		
				(10.22)		
cnet					-30.90***	
					(9.009)	
inet						-44.47***
						(11.13)
Constant	354.9***	353.2***	351.4***	351.4***	352.1***	351.0***
	(63.57)	(63.36)	(63.37)	(65.95)	(65.89)	(65.44)
Observations	16,567	16,567	16,567	16,567	16,567	16,567
Number of groups	2,125	2,125	2,125	2,125	2,125	2,125

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Panel E: Cash sufficiency

VARIABLES	(1) cash sufficiency	(2) cash sufficiency	(3) cash sufficiency	(4) cash sufficiency	(5) cash sufficiency	(6) cash sufficiency
growth	-0.0245	-0.0241	-0.0232	-0.0256	-0.0252	-0.0251
	(0.0183)	(0.0185)	(0.0188)	(0.0185)	(0.0184)	(0.0185)
prof	1.109***	1.106***	1.100***	1.079***	1.077***	1.080***
	(0.258)	(0.259)	(0.259)	(0.276)	(0.272)	(0.274)
fr	-0.133**	-0.133**	-0.133**	-0.159***	-0.160***	-0.158***
	(0.0462)	(0.0457)	(0.0451)	(0.0442)	(0.0440)	(0.0443)
lev	-0.369***	-0.371***	-0.369***	-0.345***	-0.343***	-0.348***
	(0.0548)	(0.0544)	(0.0545)	(0.0604)	(0.0603)	(0.0610)
fcf	0.316***	0.317***	0.317***	0.315***	0.315***	0.315***
	(0.0673)	(0.0680)	(0.0680)	(0.0690)	(0.0690)	(0.0689)
size	0.000206	0.000184	0.000127	0.000588	0.000567	0.000573
	(0.00282)	(0.00280)	(0.00283)	(0.00295)	(0.00294)	(0.00292)
nonsoe	0.171***	0.170***	0.170***	0.178***	0.177***	0.177***
	(0.0435)	(0.0429)	(0.0429)	(0.0454)	(0.0454)	(0.0456)
net	0.0942***					
	(0.0284)					
onet		0.107***				
		(0.0337)				
onet_123			0.102**			
			(0.0356)			
onet_5				0.0766**		
				(0.0329)		
cnet					-0.00134	
					(0.0303)	
inet						0.0684***
						(0.0224)
Constant	0.541***	0.543***	0.547***	0.555***	0.558***	0.557***
	(0.109)	(0.108)	(0.108)	(0.112)	(0.112)	(0.111)
Observations	17,159	17,159	17,159	17,159	17,159	17,159
Number of groups	2,141	2,141	2,141	2,141	2,141	2,141

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Panel F: Network structure

VARIABLES	(1) ltlev	(2) ltlev	(3) stlev	(4) stlev	(5) payable	(6) payable
dep	-0.425***	-0.438***	0.583***	0.567***		
	(0.0972)	(0.0979)	(0.0776)	(0.0800)		
growth	0.00360	0.00364	0.0249***	0.0250***	0.0107***	0.0107***
	(0.00212)	(0.00208)	(0.00750)	(0.00753)	(0.00104)	(0.00105)
fr	0.0464***	0.0444***	-0.0217	-0.0232	-0.0263***	-0.0284***
	(0.0104)	(0.0110)	(0.0177)	(0.0181)	(0.00772)	(0.00827)
prof	-0.127***	-0.131***	-0.704***	-0.708***	-0.0660**	-0.0683**
	(0.0171)	(0.0181)	(0.111)	(0.112)	(0.0226)	(0.0229)
size	-0.000120	-0.000100	0.00476***	0.00476***	0.000810*	0.000813*
	(0.000425)	(0.000420)	(0.000568)	(0.000569)	(0.000432)	(0.000433)
fcf	-0.000123***	-0.000123***	-7.49e-05**	-7.48e-05**		
	(1.09e-05)	(1.10e-05)	(2.70e-05)	(2.71e-05)		
nonsoe	0.0121***	0.0123***	0.0282**	0.0281**	0.00743***	0.00746***
	(0.00331)	(0.00341)	(0.00974)	(0.00966)	(0.00175)	(0.00176)
net_degree	0.00771***		0.00964***		0.00735***	
	(0.00200)		(0.00319)		(0.00200)	
net_constraint		0.0103**		0.0172***		0.0111***
		(0.00367)		(0.00520)		(0.00325)
lev					0.116***	0.118***
					(0.0140)	(0.0142)
opcash					0.0679***	0.0668***
					(0.00451)	(0.00483)
Constant	0.0656***	0.0672***	0.311***	0.312***	0.0361*	0.0366*
	(0.00804)	(0.00793)	(0.0129)	(0.0127)	(0.0178)	(0.0180)
Observations	17,156	17,156	17,156	17,156	17,116	17,116
Number of groups	2,141	2,141	2,141	2,141	2,131	2,131

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Panel F continued

VARIABLES	(1) ccc	(2) ccc	(3) cash sufficiency	(4) cash sufficiency
prof	-349.4***	-342.1***	1.112***	1.104***
	(67.51)	(68.74)	(0.259)	(0.260)
lev	87.75***	79.95***	-0.370***	-0.366***
	(11.58)	(11.60)	(0.0546)	(0.0551)
growth	-83.84***	-83.64***	-0.0246	-0.0244
	(17.63)	(17.48)	(0.0185)	(0.0183)
fcf	0.960	2.870	0.317***	0.315***
	(9.705)	(9.829)	(0.0682)	(0.0672)
size	-8.705***	-8.753***	0.000275	0.000191
	(2.652)	(2.679)	(0.00288)	(0.00281)
current_ratio	24.00***	23.54***		
	(5.210)	(5.306)		
nonsoe	-41.60***	-41.80***	0.173***	0.171***
	(9.206)	(9.268)	(0.0439)	(0.0434)
net_degree	-29.51***		0.0473***	
	(6.741)		(0.0156)	
net_constraint		-46.77***		0.0979***
		(11.10)		(0.0294)
fr			-0.131**	-0.137**
			(0.0462)	(0.0458)
Constant	351.8***	354.9***	0.543***	0.542***
	(63.48)	(63.85)	(0.110)	(0.109)
Observations	16,567	16,567	17,159	17,159
Number of groups	2,125	2,125	2,141	2,141

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Chapter 4 Managing business networks: the role of concentrated ownership

Chapter 4 Managing business networks: the role of concentrated ownership

4.1 Introduction

The influence and reach of various business networks has been considerable in the emerging economies, including those where the institutional environment is improving (Ma et al., 2006; Guest & Sutherland, 2010). Study of the performance of business networks has surged in the past decades, particularly in emerging economies (Carney et al., 2011; Lee et al., 2008; Ramaswamy et al., 2012). An examination of the performance of network affiliated firms could, among other things, contribute to the understanding of economic achievements in the emerging countries, including China.

However, there remains ambiguity about the advantages of business networks (Keister, 2000; Purkayastha & Lahiri, 2016). The link between networks and firm performance has attracted interest from scholars in the fields of organization and strategy (Khanna & Palepu, 2000; Khanna & Rivkin, 2001; Carney et al., 2009). Different explanations have been developed for the existence and prominence of business networks, which indicate their benefits. The literature has identified both the advantages and liabilities of business networks. We have outlined some of these in Chapter 1 and we provide more detail here to illustrate the tension between the costs and benefits.

On the one hand, numerous studies (e.g. Markoczy et al., 2013; Wang et al., 2015; Guest & Sutherland, 2010) have reported the positive effects of joining various business networks. Business networks can fill the institutional voids caused by the absence of supportive institutions for business activities in many parts of the world (Leff, 1978; Goto, 1982). Moreover, business networks can help firms to reduce transaction costs by internalizing market transactions (Chang, 2006; Bugador, 2015). Furthermore, both the resource-based view (Penrose, 1995) and the entrepreneurial process view (Iacobucci & Rosa, 2005; Lechner & Leyronas, 2009) suggest that business networks help firms to expand their access to external resources by establishing sharing platforms among member firms, thereby enabling firms to achieve growth. Colli et al. (2016) argue that business networks, if not the only way to grow, are at least the easiest way to reach a reasonable size. He et al. (2013) examine the effects of business groups' affiliation on firm performance and find positive effects. Guest & Sutherland (2010) also indicate that firms in business groups perform better in terms of profitability when compared to isolated firms.

On the other hand, business networks also have limitations that negatively affect affiliated firms. Isobe et al. (2006) argue that affiliates may feel individual repercussions from membership of a business group with liabilities. For example, a business group's bad reputation is a liability for its affiliated members, and their performance will be impaired rather than improved. Research from the political economy perspective suggests that firms form networks in order to obtain favorable treatment from the power structure, which will pose a barrier to the operation of competitive forces in allocating resources efficiently (Ghemawat & Khanna, 1998). Moreover, even though internal lending among member firms may mitigate pressure on group affiliates' cash flow, it is also a major source of endless "triangle debts" and will in the long run have an adverse impact on the performance of affiliates (Peng & Luo, 2000). Furthermore, the complexity of the ownership structure in conglomerate type business groups presents them with significant governance challenges, and thus additional costs (Gaur & Kumar, 2009). Singh & Gaur (2009) examined the effects of business group affiliation on firm performance in China and India, and found that group affiliates perform worse than free-standing firms. Dong et al. (2013) also investigate the effects of business ties in cultivating marketing channels in China and found negative impacts. Ma et al. (2006) found that as institutional environments improved in China, there were negative impacts from business group affiliation on firm performance.

This finding is further supported by Carney et al. (2009) who that found that the positive effects of business groups on firm performance decrease over time as the institutional environment improves.

In the literature both the theoretical predictions and empirical evidence concerning the relationship between networks and financial performance are mixed. The effect of affiliation on performance remains an open question that deserves additional investigation. In this study, we investigate the role of business networks on firm performance by considering the effects of the management fee ratio. We argue that previous studies have under-estimate the costs of business networks, which may be less reliable. Firms must invest time and money in order to develop and maintain network connections, and this process generates management costs for them. By examining the effects of business networks on firms' management costs we can open a new channel of explanation for the relationship between network affiliation and firm performance, thereby adding to the literature.

Aside from the consequences of affiliation, little research has been done to examine the strategies of network affiliates (Carney et al., 2011). There is therefore little evidence as to whether strategizing can affect the relationship between affiliation and financial performance. In this study, we expect to add to the literature by examining the effects of corporate governance on the relationship between business networks and firm performance. Corporate governance has become an increasingly important issue for scholars and managers all over the world in a context of increasing integration of global economies (Singh & Gaur, 2009). In emerging economies where the institutional environment is improving, business network affiliation provides firms with valuable governance options because they are associated with superior information processing and flexible monitoring (Achrol & Kotler, 1999). However, business network affiliation also could impair firms' independence since firms in networks may need to sacrifice their own self-interest for the common good.

Corporate governance, based on agency theory, has mainly focused on conflicts between shareholders and managers (Rajagopalan & Zhang, 2008). The prominence of business networks in the emerging economies has provided new empirical questions for corporate governance (Singh & Gaur, 2009). Moreover, the complex governance structure of firms in business networks challenges the principal-agent conflicts that are traditional in the developed economies since in the emerging economies principal-principal conflicts are much more common among firms. Studies of corporate governance have facilitated our understanding of firm performance (e.g. Singh & Gaur, 2009). We argue that in emerging economies corporate governance is an important factor in the relationship between business networks and firm performance. In this study, we investigate one aspect of firm governance; namely, concentrated ownership. By examining how within-firm governance affects the relationship between business networks and firm performance, we expect to contribute to the literature on corporate governance by providing more comprehensive empirical findings and theoretical foundations.

Furthermore, we propose a new approach to defining business networks using related relations. The relations are widely seen in the marketplace. Using this definition, we can gain a more generalized understanding of the consequences of business networks on firms' performance in terms of profitability. Moreover, our approach to constructing business networks includes relatively comprehensive relations comprising relations from ownership, relations from collaboration, and relations from key individuals. This rich variety of relations provides us with valuable opportunities for examining the role of different relations on firm performance. In doing so, we expect to add a more holistic understanding to the literature on business networks.

Some studies have empirically investigated firm performance implications of business networks in China. We argue that the data used in prior studies are constrained. Studies that heavily rely on surveys tend to have a small sample size of around 300 firms, while the use of seven-point Likert scales may lead to a lack of objectivity by its reliance on interviewees' assessment of their personal feelings (e.g. Lee & Jin, 2009; Wu, 2015). Moreover, previous studies normally investigate business networks in China limited to specific sectors, such as the manufacturing industry (e.g. Wu, 2015; Carney et al., 2009).

Furthermore, most studies statically investigate networks without taking into account the dynamics of these networks (e.g. Li et al., 2014; Wang, 2008). Unlike these studies, we rely on panel data spanning relatively extended periods of time and systematically investigating business networks in China. We believe that our data are valuable in complementing the understanding about the network economy in the country since our results, unrestrained by the shortcomings of previous studies, can therefore be generalized to reveal an understanding of the relationship between business networks and firm performance in the national economy. By having a panel data from 1997 to 2011 of listed companies in China, we construct a relatively representative sample. We believe that our results are more trustworthy and convincing.

The following sections of the study are organized as follows: the next two sections outline the background and hypothesis development; the research design follow; after that, we demonstrate the results; and finally, we present the discussion and conclusion.

4.2 Background

China has attracted wide attention for its rapid economic development. It is special as it is a transition economy as well as a transition economy (Peng et al., 2008). Like many other emerging economies, China's institutional environment is relatively weak and is characterized by ill-functioning markets (Ma et al., 2006). As suggested by Li (2013) the dominant governance system in China is still relation-based even though it is making efforts to transition to rule-based governance. As an emerging economy, its institutional infrastructures are imperfect in that they cannot provide consistent and sufficient protection for business activities (Jia & Wang, 2013). Governments often implement policies for specific regions and industries; and they tailor policies towards firms of specific size or type of ownership (Child & Tse, 2001). According to Allen et al. (2005), the overall level of investor protection in mainland China is among the worst in the world. Poor investor protection increases the cost of arms-length contracting and market monitoring. Business networks have widely emerged among firms and help them to reduce the transaction costs and uncertainty associated with the market (Achrol & Kotler, 1999). Various business networks are promoted, including the National Trial Groups established in 1991 and 1997, which are known as 'National Team' (Nolan, 2001). We argue that an important feature of China's economy is that various business networks are present in economic activities. An understanding of business networks and financial performance relationship is therefore crucial for understanding the economy.

China has continuously worked on improving its corporate governance standards since good corporate governance practices are essential for the development of a market-based economy and prosperous society (Singh & Gaur, 2009). China's government has implemented numerous laws and regulations during its economic reform. The first step was the Company Law in 1993, further modified in 1999. In 1998, the Securities Law was enacted to regulate the stock markets in China. However, even with these laws, China was still faced with several corporate scandals. In order to further regulate listed companies and establish more advanced corporate governance standards, the Code of Corporate Governance for Listed Companies was issued by the China Securities Regulatory Commission. Despite this, China continued to rank very low in several corporate governance rankings. For example, a report by the Asian Corporate Governance Association (Gill & Allen, 2007) has ranked China at the bottom of 11 Asian Markets. Evidence shows that China is nowhere near the western economies in terms of its corporate governance standards. We argue that business networks affiliation in an emerging economy is also a governance mechanism as it is associated with superior information processing and flexible monitoring (Achrol & Kotler, 1999). In this chapter, we expect to elaborate the performance effects and management cost effects of network affiliation, along with firm level governance mechanism-concentrated ownership.

4.3 Theory and hypotheses

4.3.1 Business network and firm performance

Business networks are particularly popular in emerging markets where the institutional environment is developing. The conduct and performances of firms can be more fully understood by investigating the networks of relationships in which the firms are embedded (Gulati et al., 2000). However, the impacts of business networks on corporate performance are mixed in the literature (He et al., 2013; Ma et al., 2006; Carney et al., 2009; Singh & Gaur, 2009; Guest & Sutherland, 2010; Ren et al., 2009). Previous studies employ relatively old data and short panel data which may constrain the representativeness of the results. Moreover, prior studies have focused on either the advantages of business networks or the disadvantages of business networks. A study that balances the two aspects and investigates the net effects of business networks is therefore necessary. Furthermore, there has been limited academic focus on the management cost of business network affiliation and how such costs would affect firm performance. In order to examine the effects of business networks on firm performance, we first investigate the theoretical foundation that attempts to explain the presence of various business networks.

Scholars have proposed several explanations for the prevalence of business networks. These include the resource-based view (Lee & Jin, 2009; Ren et al., 2009), market-based view (Leff, 1978; Goto, 1982), institutional voids perspecitve (Khanna & Palepu, 1997, 2000), transaction cost view (Bugador, 2015), entrepreneurial process view (Lacobucci & Rosa, 2005; Lechner & Leyronas, 2009), and state activism view (Lee, 2006).Within these theoretical frameworks, the resource-based view and institutional perspective dominate.

As the resource-based view (Penrose, 1995) suggests, firms need to utilize their available ‘resources’ profitably. Such a view posits that the growth of the firm is based on the internal resources available to it. Firms therefore affiliate into business networks to expand their access to the resources that are owned by other network members. Thus, business networks provide mechanisms for firms to access otherwise scarce resources (He et al., 2013). Moreover, business networks are associated with better information processing (Achrol & Kotler, 1999) and firms in business networks can access and mobilize resources and information. These factors could help to enhance firm performance. Furthermore, a firm can benefit from the reputational capital of the business network (Peng et al., 2005) which could help the focal firm to achieve sustained superior performance (Barney, 1991). However, such benefits can be mitigated by other factors. For example, even though business network affiliation can help firms to generate greater access to credit, it also brings about a debt overhang problem (Myers, 1977). A high debt ratio could induce operational risks for firms. Moreover, even though inter-firm lending could mitigate firms' cash flow pressure, it is also a source of the endless "triangle debts" which would negatively affect firm performance (Peng & Luo, 2000). Firms affiliated into business networks would also be tainted by the liabilities of that network (Isobe et al., 2006). For example, a firm's performance would deteriorate if it belongs to a business network with a bad reputation (Chang & Hong, 2000). Many scholars have argued that the potential advantages of business networks affiliation are often not realized for a firm because of the various offsetting costs of affiliation (Claessens et al., 2006; Lee et al., 2008; Carney et al., 2011).

An institutional perspective of business networks suggests that the prevalence of business networks is due to institutional voids and state activism (Singh & Gaur, 2009). Thus, business networks could help firms to overcome the problems that arise due to inadequate institutional support, particularly in the emerging economies (Khanna & Palepu, 1997, 2000). By filling the institutional voids, business networks help firms to access information, resources, markets, and technologies (Singh & Gaur, 2009). Moreover, business networks in emerging economies help firms to obtain benefits through the network's connection to government, and these benefits are not easily secured by free-standing firms (Singh & Gaur, 2009). However, such benefits primarily arise due to the context and are heavily reliant on the extent of the inefficiencies in the external governance environment (Singh & Gaur, 2009). As institutions develop to support market-based transactions, these benefits would decrease and, indeed, studies have shown that the benefits of business networks decrease as the institutional environment is improved (Gaur & Delios, 2006; Hoskisson et al., 2005). In recent years, there has been considerable improvement in the governance standards and institutional environment in the emerging economies (Gaur, 2007), which partially fills the institutional voids.

Moreover, even though business network affiliation fills institutional voids and helps firms to generate resources, the interdependence between the networks' affiliates poses challenges for governance, and consequently increases the costs of affiliation (Gaur & Kumar, 2009). First, firms in business networks are less likely to act independently and their decision-making is subject to reactions from other network members (Gadde et al., 2003). This will increase firms' management cost, which will harm firms' performance. Moreover, firms in business groups could have principle-principle agency problems; these arise due to the conflict between the controlling shareholder and the minority shareholder. Such problems could result in resource misallocation, which is detrimental to firm performance. Furthermore, related party transactions between network members could result in tunneling resources from one firm to another (Bertrand et al., 2002). Finally, firms may need to support unprofitable firms in business networks simply in order to sustain their own operations (Goplan et al., 2007) and the otherwise profitable firm will be negatively affected by the adverse spillovers of other member firms (He et al., 2013). This will negatively affect firms' performance. Looking at the benefits and costs of business networks, we propose the following hypothesis:

H1: Business networks affiliation negatively affect firms' performance with regard to profitability.

4.3.2 Business network and management cost

Even though business networks are associated with superior information processing and flexible monitoring (Achrol & Kotler, 1999), affiliation into business network also bears costs that may affect business operations. Prior studies have investigated many factors that may influence the relationship between network affiliation and firm performance, such as institutional factors (Ma et al., 2006; Carney et al., 2009) and industrial factors (Purkayastha & Lahiri, 2016). To the best of our knowledge, the relationship between business network affiliation and firms' management cost is not directly examined in the literature. In this section, we demonstrate the relationship between business network affiliation and firms' management costs. By doing so, we expect to contribute to the literature about how network affiliation affects firm performance.

Business network affiliation means that firms establish relationships with other firms. Building these relationships incurs expense. Moreover, once the relationships have been forged, firms need to maintain them and this means that they will need to continue to spend time and money. For example, firms affiliated into industrial associations need to pay association fees and attend the organized activities to keep themselves involved. If they fail to do so, the relationship could be broken. Nine out of ten "bridge" relationships disappear in a year (Burt, 2002). Studies (Uzzi, 1997) have suggested that the increasing cost of maintaining relationships would become a financial burden for firms.

Furthermore, business network affiliation brings challenges for independence (Ma et al., 2006; Singh & Gaur, 2009). Firms in business networks may need to sacrifice self-interest to satisfy the joint stake of business networks. The governance system of business networks is a set of norms and rules developed through interactions (Jia & Wang, 2013). Such norms and rules are not necessarily more efficient for the individual firms in the market. Firms in business networks are interdependent (Hakansson & Ford, 2002) and this interdependence means that firms have limited capability to act, or even to develop their own independent strategy (Gadde et al., 2003). Having to take into account the reactions of the other network members will influence the decision-making of the affiliated firm. As a result, focal firms' management cost is affected.

Thereby, we formulate the following hypothesis:

H2: Business network affiliation would be positively related to management cost ratio.

4.3.3 Nature of business networks

There are different types of business networks that depend on the relationship defined between firms. As mentioned in chapter 2, the definition in previous studies of business networks using state ties comes generally from 3 dimensions. These are: relations from ownership; relations from collaboration; and relations from key individuals. We argue that different networks are associated with different strengths of control, which will differentiate the effects of business networks. Business groups, which are a typical kind of business network defined through ownership, are very popular in emerging economies. Business groups normally have very complex ownership structures (Singh & Gaur, 2009) which may lead to governance problems. Such governance problems will incur agency cost and could result in tunneling activities. Such problems will affect firms' management cost and hence negatively influence firms' performance. As a result, we expect that firms in ownership networks experience higher management cost and perform worse than isolated firms.

Moreover, in this study we further divide ownership networks into networks derived from control relations and networks derived from significant influence relations. As control relations are stronger than significant influence in influencing firms' governance, we say that network effects on firms' profitability are stronger in networks from control relations. However, we do not expect to see different network effects on firms' management cost for relations from control and relations from significant influence as both these relations introduce governance cost.

Regarding business networks defined through collaboration, alliance networks are typical examples. These networks are looser than networks based on ownership since the relations linking the firms are more ephemeral. However, firms in alliance networks still need to consider their alliance partners' interest when they are making decisions. This will affect firms' independence, which will influence firms' operational competence. Many firms face operational problems after forming alliances with other firms. Evidence shows that over 50% of alliance networks are in trouble in 2 years, and the majority of alliance networks disband within 3 years (Wu & Lou, 2010; Zhang & Cao, 2004). Consequently, firms in these networks have governance problems that will affect firms' management cost and firm performance. We expect that firms in collaboration networks have higher management cost and hence worse performance.

Regarding business networks via key individuals, a typical example of this would be business networks formed by interlocking directors. In this case, two firms are connected because the key individual has roles in both organizations. The individual that connects two firms acts as a bridge for these firms, enabling them to share and mobilize information and resources. However, such connections are also weak since the individual may leave the organization at any time. Nevertheless even these weak connections will bridge non-redundant information and resources (Granovetter, 1973). Compared to ownership relations and collaboration relations, individual relations are mainly personal behaviors that may be less likely to affect firms' management cost and firm performance. It is not expected that firms in individual networks will have better management cost and performance. Therefore, we formulate the following hypotheses.

H3a: Business networks defined via ownership negatively affect firms' profitability.

H3b: Business networks defined via ownership are positively related to firms' management cost.

H3c: In ownership networks, networks from control relations show a stronger effect than networks from significant influence relations on firms' profitability.

H3d: Business networks defined via collaboration negatively affect firms' profitability.

H3e: Business networks defined via collaboration are positively related to firms' management cost.

H3f: Business networks defined via key individuals do not affect firms' performance

H3g: Business networks defined via key individuals do not affect firms' management cost.

4.3.4 Corporate governance issue-concentrated ownership

While studies abound that investigate the role of business network affiliation in firm performance, there has been limited academic focus on how firm strategy influences the relationship between network affiliation and firm performance (Carney et al., 2011). As business networks have both positive and negative effects, it is to be expected that different firm strategies could produce different effects in promoting the benefits and alleviating the costs of business networks. In this study, we investigate the role of concentrated ownership, an aspect of corporate governance, in generating network effects.

Concentrated ownership within firms means that firms are owned and monitored by one or more of their large shareholders (Jiang & Kim, 2015). Concentrated ownership has attracted wide attention (Shleifer & Vishny, 1997). The literature on concentrated ownership is very much based on agency theory (Varma, 1997). Several advantages of ownership concentration have been outlined in previous studies. First, ownership concentration can help firms to alleviate agency problems. Shleifer and Vishny (1986, 1997) suggest that concentrated ownership empowers large shareholders with the rights, means, and incentives to monitor their firms. In firms with concentrated ownership, owners are able to monitor managers and take action to protect the firm's interests, and even to take outright control of the firm (Shleifer & Vishny, 1986). Demsetz (1983, 1986) also indicates that the existence of concentrated ownership is primarily due to the degree of control and oversight that it brings. Furthermore, concentrated ownership brings efficient and fast decision-making (Carney, 2005). In the changing environment that is typical of emerging economies, efficient decision-making will contribute to the competitive advantage of the firm. Moreover, ownership concentration will encourage owners to be actively involved in their firms' operations even if it is only to protect their own interests (Gaur, 2007). In this case, owners will actively bring their own political and social capital to help firms to access materials, finance, and the market (Singh & Gaur, 2009).

However, concentrated ownership also causes problems. As LaPorta et al. (1999) point out, owners with a high ownership concentration actually control their firms and these controlling shareholders may exploit the minority shareholders. Bertrand et al. (2002) suggest that high ownership concentration may empower large shareholders to exploit minority shareholders, and to pursue actions that are not always in the best interests of the firm. There are many ways in which controlling shareholders can expropriate minority shareholders by using intercorporate loans, favorable transfer pricing for related parties, and the dilution of new shares (Jiang & Kim, 2015). Johnson et al. (2000) refer to such activities as tunneling. These tunneling activities are firm-destroying and negatively affect firms' value (Bai et al., 2000).

As we previously elaborated, even though business network affiliation can help firms in accessing resources, the liabilities of the business networks can lead to problems in operational independence and firm governance, and hence negatively affect firms' profitability. Moreover, firms in business networks would experience higher management costs in their efforts to maintain network connections. It is interesting to investigate how firm governance in the context of concentrated ownership may affect the relationship between network affiliation, and firms' management cost and profitability. Higher concentrated ownership can mitigate agency problems and enable efficient decision making for firms but also introduce the risks of tunneling. Thus, the way in which concentrated ownership interacts with business networks, and consequently impacts on management cost and firm performance is a question for empirical study.

Since high ownership concentration has both positive and negative effects, we argue that firms in business networks with high ownership concentration do not feel any additional effects on their profitability due to the cancelling-out effects of ownership-concentration benefits and liabilities. However, in collaboration networks, the agency problems are severe, as described in 4.3.3. The links between firms are loose and the degree of monitoring and governance in these networks is less efficient and effective when compared with those in ownership networks. We therefore expect to see that firms in collaboration networks with high ownership concentration would have greater opportunities to conduct tunneling activities, which will destroy firm value. Consequently, we expect to see that firms with high concentrated ownership in collaboration networks will have additional negative effects on their performance.

As regards firms' management cost, we expect that ownership concentration has mediating effects on the relationship between business networks and firms' management cost. As ownership concentration introduces higher opportunities for tunneling, firms need to maintain firm value by managing the potential risk. The literature also documents that firms in networks tend to avoid expropriation by using higher levels of leverage (Paligorova & Xu, 2012). We argue that firms' high ownership concentration in business networks is associated with higher management cost in order to manage the potential negative effects.

Therefore, we propose the following hypotheses:

H4a: Firms' with high ownership concentration in business networks are less profitable than those not.

H4b: Firms' with high ownership concentration in business networks experience

higher management cost.

4.3.5 The effects of network structure

As we elaborated in 3.3.7, network structure is significantly influential on network effects. Network centrality and tightness are important factors determining the effects of networks on affiliated firms. Previous studies (Chen & Xie, 2011; Ahuja, 2000; Phelps et al., 2012) have outlined the benefits of central position. However, we argue that these findings are based on the precondition that business networks invariably help firms to achieve superior profitability. These studies have largely ignored the cost of networks. As we mentioned above, network benefits are often not realized due to various offsetting costs. The negative effects of business networks often dominate business performance overall. Firms in central position are well connected to the other firms in the network. Such central firms will therefore have more severe governance problems and will need to invest more heavily in their networks since they need to properly manage their connections and act as an intermediary in information and resource mobilizations. Moreover, as firms in networks are influenced by adverse spillovers, firms in a central position will feel the concentrated force of these negative effects. As a result, we expect that central firms in networks are more likely to be negatively affected.

In terms of structural holes, studies have indicated that there are benefits of affiliating to sparse networks with disconnected partners (Burt, 2005; Borgatti & Halgin, 2011). Firms with more structural holes are argued to have greater opportunities for acquiring novel information and for entering into power bargains with other network members, thereby providing firms with superior capability for performing well. Firms in networks with more structural holes can hold bridging positions, which enable them to have superior bargaining power. Given this increase in bargaining power, we argue that such firms are more likely to perform better and experience lower management cost than those not in loose networks.

Thereby, we formulate the following hypotheses:

H5a: A central network position is negatively related to profitability for the focal firm.

H5b: Firms in networks with more structural holes perform better than those not.

H5c: Firms centrally positioned in business networks experience higher management costs.

H5d: Firms in networks with more structural holes experience reduced management costs.

4.4 Data and methodology

4.4.1 Data

This study investigates the role of business networks and concentrated ownership in firm profitability and firms' management costs, using firms in China as empirical evidence. The data employed in this study are from CSMAR database issued by GTA (Guo Tai An) Research Service Centre. CSMAR data are reliable and widely used in research about China's listed companies (e.g. Chen et al., 2009; Cheung et al., 2009; Li et al., 2014; Berkman et al., 2014). We use listed company related party information data and listed company related party transaction data to construct business networks via related parties. Listed company financial indicator data are used to identify key characteristics of listed firms and financial data. Listed company corporate governance data provide information on firm governance structures. By merging these data, a complete dataset for this study is generated, which spans from 1999 to 2011. After dropping missing values, we have 16,333 total observations.

Business networks are constructed using Pajek software based on the 11 types of relations discussed in chapter 2. Three types of sub-networks are established according to the classification of 11 relations, which are ownership networks, collaboration networks, and individual networks. Ownership networks are further differentiated by the strength of influence into networks from control relations and networks from significant influence relations.

Table 4.1 reports the descriptive analysis and summary statistics of the main financial variables and network variables used in this study. The statistics suggest that firms sampled have 4% profit on average and 12% management fees. The results show that in China the listed firms' 5 largest shareholders own, on average, over half of the firm. Compared to ownership concentration in the United States and many other developed economies, ownership is more highly concentrated in China (Jiang & Kim, 2015; LaPorta et al., 1998). In China, high ownership concentration can potentially reflect good governance outcomes, which is similar to the findings obtained in western developed economies (Singh & Gaur, 2009). The growth rate is 16%, which is consistent with China's rapid economy growth. Regarding network variables, the results indicate that on average 32% of listed companies are affiliated into business networks via related parties, which is a lower figure than that found in prior studies. We believe that this is to be expected since our definition of business networks is stronger than in previous studies because we have excluded many connections that are relatively weak. The correlation analysis in Panel B suggests that network affiliation is negatively related to firm performance.

<Table 4.1 inserted here>

4.4.2 Model specification

This study follows the model of Greenaway et al. (2014) to examine the impacts of business networks on firm performance.

$$Prof_{i,t} = \alpha_0 + \alpha_1 Net_{i,t} + \alpha_2 Size_{i,t} + \alpha_3 Lev_{i,t} + \alpha_4 Fr_{i,t} + \alpha_5 SOE_{i,t} + \alpha_6 Management_{i,t} + \alpha_7 Growth_{i,t} + \alpha_8 Share5_{i,t} + v_i + \mu_{i,t} \qquad (1)$$

This study employs profitability as a performance indicator. We use the ratio of operating profit to total assets as a proxy for profitability. Different network indicators are individually added into the model to investigate the respective role of different networks. v_i is firm fixed effects. Size, leverage ratio, fixed asset ratio, growth, and management fee ratio are used as control variables. Size takes account of the fact that larger firms may have better access to external finance and benefit from economies of scale, which can facilitate firms' performance. The leverage ratio, which measures the firms' debt problem, is expected to have a negative impact. Fixed asset ratio is expected to negatively affect firm performance because firms with more intangible assets tend to have more investment opportunities and grow faster (Tian and Estrin, 2008). SOE is a dummy variable that is equal to one if the ultimate controller is an SOE. This variable is expected to affect firm performance negatively since SOEs are associated with governance problems (Driffield and Du, 2007). Management fee ratio is expected to be negatively related to firms' performance. Growth is the annual percentage change in total sales; it is expected to be positively related to firm performance. Share5 is used in earlier studies and is the percentage of shares hold by the top 5 shareholders

To investigate the impacts of business network affiliation on firms' management cost, we formulate the following model.

$$Management_{i,t} = \alpha_0 + \alpha_1 Net_{i,t} + \alpha_2 Size_{i,t} + \alpha_3 Lev_{i,t} + \alpha_4 Fr_{i,t} + \alpha_5 Growth_{i,t} + \alpha_6 SOE_{i,t} + \alpha_8 Share5_{i,t} + v_i + \mu_{i,t} \qquad (2)$$

The dependent variable is the ratio of the management fee to total revenue in year. It is a given variable in the database. Business network, ownership network, collaboration network, and individual network are individually added into the model to test the effects of different networks. Leverage in this specification is the ratio of liabilities to total assets. SOE is a dummy variable that equals to 1 if the firm is SOE dominated. Firm size is measured as the logarithm of total sales; asset structure is measured as fixed assets scaled by total assets; and growth is measured as the percentage change in total assets. Firm size captures the fact that larger firms can reap the benefits of economies of scale. It is expected to be negatively related to management cost ratio. Leverage captures debt problems and may be supposed to be positively related to management fee ratio. Asset structure is projected to be positively related to management fee ratio since more fixed assets require higher management cost. Growth is argued to be positively related to management fee ratio since firms that are expanding incur more management cost. Share5 is the percentage of shares held by top 5 shareholders, which is consistent with the measure used by Jiang & Kim (2015).

In order to test the contingency effects of ownership concentration on the impacts of business network affiliation with regards to firms' management cost and profitability, we add interaction terms of business network affiliation and concentrated ownership to the above models. To test the effects of network structure, we individually drop centrality and structural hole measures into the variable net in the above baseline models. In this study, all the models are estimated using firm fixed effects[8] to control for firm-level time-invariable unobservable factors that may cause potential endogeneity. The approach is widely used in the literature that examines network effects (He et al., 2013; Byun et al., 2013).

4.5 Results

4.5.1 Business network and firm performance

In this section, we investigate the impact of business network affiliation on firms' profitability. Table 4.2 reports the empirical results for equation 1. Leverage is found to be

[8] In stata, it is operated by reghdfe, clustered in firms and years.

negatively related to performance, which is to be expected because of the overhanging debts problems (Myers, 1977). The fixed ratio is negatively related to performance, which confirms that firms with more non-fixed assets tend to grow faster and have more investment opportunities (Tian & Estrin, 2008). Management fee ratio is negatively related to performance in our models meaning that firms with high operational capability are more profitable than others. The dummy variable SOE is also negatively related to firm performance, which is expected since SOEs are associated with severe governance problems. Growth is positively related to firm performance, suggesting that firms with higher growth opportunities are generally more profitable. Regarding firm size, this is also positively related to firm performance, indicating that large firms benefitting from economies of scale are more profitable.

<Table 4.2 inserted here>

In terms of the area of interest of this study, we find that business network affiliation generally negatively affects firm performance. Our results are consistent with Ma et al. (2006) and Singh & Guar (2009). The coefficient is statistically significant at 1% level. This means that even though business network affiliation enables firms to access information and resources, there are associated costs, such as governance problems, which will mitigate the benefits. As the institutional environments improve, the benefits of business networks decrease. H1 is gently supported.

In order to examine H3, we further investigate the impacts of ownership networks, collaboration networks, and individual networks. Evidence shows that ownership network affiliation is negatively related to firms' profitability. The coefficients are statistically significant at 1%. The regression coefficients also show that network effects are more pronounced among networks from control relations, which is consistent with our hypothesis.

Thus, H3a and H3c are supported. However, we do not find evidence concerning the relationship between firm performance and affiliation to collaboration or individual networks. Thereby, we fail to provide evidence of hypothesis 3d while confirms hypothesis 3f. As individual networks are informal networks arising from key individuals having roles in more than one company, the personal behaviour of the individuals may be less significant in influencing firms' performance.

Moreover, we investigate the interaction effects of business network affiliation and concentrated ownership on firms' profitability. In general, concentrated ownership helps to reduce agency cost and enables efficient decision making, thereby enhancing firm performance. The coefficients of share5 are statistically significantly positive at 1% significance level. Based on data availability and the precedents in the literature on measuring ownership concentration, we use the percentage of shares held by the top 5 shareholders as our measurement of ownership concentration. The interaction term of business network affiliation and concentrated ownership shows a poorly determined coefficient. In terms of different networks, the interaction term of collaboration network affiliation and ownership concentration is negatively related to firms' profitability, which is expected as hypothsis 4a. The estimated coefficient is statistically significant at 5% significance level. We argue that concentrated ownership has enhanced the probability of expropriation, which is a major concern in business networks (Paligorova & Xu, 2012). However, we do not find evidence that firms in ownership and individual networks with high concentrated ownership have compounding effects.

4.5.2 Business networks and management cost ratio

By using the ratio of the management fee to total revenue, we are able to proxy for firms' management cost. Table 4.3 gives the results for the impacts of business network affiliation on firms' management cost which is equation 2. Firm size is found to be negatively related to the ratio of the management fee to total revenue. This means that large firms benefit from economies of scale; lower management costs mean that they have better operational competencies. Leverage, being the ratio of liabilities to total assets, is positively related to management fee's ratio. This means that firms with high leverage need to spend more to manage these liabilities. For example, firms require more expenditure when managing their relationship with creditors. Fixed ratio is found to be negatively related to management cost. This means that firms with more fixed assets generally spend less in management costs. Growth is found to be negatively related to the management fee ratio meaning that firms with a high growth rate spend less in management cost. SOE dummy is not significant in our specifications. Share5 shows a significant negative effect on firms' management cost, evidencing that ownership concentration enables fast and efficient decision making, which reduces management cost.

<Table 4.3 inserted here>

In terms of the network variables, business networks affiliation is positively related to the management fee's ratio. The coefficient is statistically significant at 1% significance level. This generally means that firms that are affiliated into business networks need to invest more in management fees to establish and maintain their network relationships. Our hypothesis 2 is therefore supported.

In order to test H3, we further investigate the role of different business networks in firms' management cost. The results suggest that affiliation to ownership business networks and collaboration networks is positively related to management fees. The coefficients are both statistically significant at 1% significance level. This means that firms in ownership networks and collaboration networks generally need to invest more to manage their network connections. However, we do not find evidence that firms in individual networks incur greater management costs. We argue that this could be potentially attributable to the nature of these networks. Business networks established via ownership and collaboration are formal inter-organizational networks that requirement managerial investment from affiliated firms. Individual networks on the other hand are relatively informal networks formed through social interactions. Such interactions are mainly derived from the individual's personal behavior that may be less likely to affect firms' management cost.

Moreover, we examine the contingent value of concentrated ownership. We argue that the relationship between business network affiliation and firms' management cost is contingent on concentrated ownership; this is because ownership concentration may empower firms with rights and the power to expropriate. The results in the table suggest that the two-way interaction terms between general networks, ownership networks affiliation, and concentrated ownership are positively related to firms' management fee ratio. The coefficient is statistically significant at 5% level. Generally, the results indicate that firms in networks with high ownership concentration do in fact experience higher management cost. These results are consistent in ownership networks and are, we argue, driven by the potential expropriation that ownership concentration brings. Firms tend to monitor these behaviors to avoid value destroying effects. To control for these negative effects, firms need to spend more by way of management costs to minimize the risks. As described in the hypotheses development section, we find no other significant results for collaboration networks and individual networks.

4.5.3 The effects of network structure

In order to capture the effects of network structure, we further investigate the role of network centrality and network tightness on firms' profitability and management cost. Table 4.4 reports the estimation results. Generally, control variables generate sensible results that are consistent with those in the main regression.

<Table 4.4 inserted here>

Turning to the variables of interest for this study, centrality shows a statistically significantly negative relationship with profitability, and a statistically significantly positive relationship with firms' management cost. These coefficients are significant at 1% significance level. The results suggest that firms occupying a central position in business networks performs worse and experience higher management cost which are supportive for H5a and H5c. Even though our results contradict Chen & Xie (2011) and other studies that show a positive relationship between centrality and performance, we argue that our results are rational. As we described in our hypothesis development, firms in central network positions are well connected to other network members; this imposes additional governance challenges and such central firms must invest more heavily in the network in order to maintain their connectedness.

By contrast, we find that structural holes are statistically positively related to firms' profitability and negatively related to firms' management cost. The results are statistically significant at 1% significance level. The results show that firms with more structural holes in their ego network structure generally perform better and experience reduced management cost which confirm our hypothesis 5b and 5d. Our study confirms the advantages of sparse networks with disconnected partners, as was suggested by Burt (1982, 1997, 2005). Firms are more likely to have increased bargaining power over connected partners due to their strong bridging position.

4.5.4 Robustness checks

In order to provide further confidence in our results, we use an alternative measure of profitability and concentrated ownership. Return on assets, a widely used accounting measure of profitability, is used as a dependent variable in our robustness check. Table 4.5 reports the estimation results. Control variables provide results that are consistent to those found in the main regression, which also provides comfort for our results. In terms of network affiliation, the results suggest that business network affiliation is significantly negatively related to firm performance in terms of ROA, which is again consistent with our main results. However, the results are insignificant.

<Table 4.5 inserted here>

Regarding the effects of different business networks. The results indicate that ownership networks are negatively related to firm performance, which is in line with our main regression results. Again, ownership networks derived from control relations show more prominent effects than do networks from significant influence relations. Collaboration networks and individual networks show poorly determined coefficients, suggesting that these networks are less significant in affecting firm performance. The interaction term between ownership network affiliation and concentrated ownership again shows a marginally positive relationship, suggesting that firms with high ownership concentration perform marginally better in ownership networks. This is reasonable since ownership networks are associated with strong ties that enable close monitoring of expropriating activities. Concentrated ownership in ownership networks could therefore contribute to reduced agency cost and fast decision making. The interaction term between collaboration networks and ownership concentration provides consistent results. Our results are robust using different measures of firm performance.

Moreover, we use an alternative measure of concentrated ownership to test the mediating effects of ownership concentration. We use the aggregated shares held by the top 10 shareholders of the listed company to measure ownership concentration. This is another widely used measure of ownership concentration. Table 4.5 displays the results. We suggest the results are consistent with our main regression results. Firms with highly concentrated ownership find that affiliating in business networks will help them to reduce management cost and enhance their performance. Use of the different measure of ownership concentration provides confidence that our results are robust.

Finally, as mentioned in chapter 3, our data suffers from cross-sectional dependence problems that may lead to biased statistical inference. The CD-test suggests there are strong cross-sectional correlations. Adopting the estimator referenced in chapter 3, we are able to control the effects and generate consistent results. Table 4.6 reports the estimation results. The results produce findings consistent to the main regression. Firms in business networks experience higher management costs and perform worse. Central network position is negatively related to firm performance and positively related to management cost while structural hole is positively related to firm performance and negatively related to management cost.

<Table 4.6 inserted here>

4.6 Discussion and conclusion

This study investigates the role of business networks in firms' performance and management cost, with particular consideration being given to the impact of concentrated ownership and network structure. This study makes many contributions.

First, while previous studies emphasize the benefits of business networks (Khanna & Palepu, 1997; Chang & Hong, 2002; He et al., 2013; Byun et al., 2013), we investigate the cost of business network affiliation in terms of the management fee ratio. We find that business network affiliation is associated with significant costs incurred by developing and maintaining network connections, which lead to high management cost ratio. The high management cost ratio could potentially result in weaker firm performance, particularly when the benefits of business networks decrease with improvements in the institutional environment (Singh & Gaur, 2009).

Second, we contribute to the literature concerning the impacts of business networks on firm performance by providing a new approach to explain the relationship between business networks and firms' performance. Given the improved institutional environment, the benefits of business networks are decreasing and the costs of business networks are amplified. Analysis of the effects of business networks on firms' management costs helps us to approach an improved understanding of the relationship between business networks and firm performance in terms of profitability.

Third, we also add to the literature on concentrated ownership. As the institutional environment is improving, the benefits of business networks are disappearing. How firm strategy affects the relationship between business networks and firm performance deserves additional investigation (Carney, 2011). By investigating the contingent value of ownership concentration on the relationship between business network affiliation and management cost ratio, as well as on firm performance, we find that firms with high concentrated ownership in business networks generally incur more management cost and perform worse. We have provided a new insight into the role of concentrated ownership on the impact of business networks.

Fourth, this study contributes to the literature about networks by providing a new approach to constructing network connections. Understanding the relationship between business networks and firm performance using our definition produces more reliable results given that network effects are contextually sensitive (Adler & Kwon, 2002). Moreover, business networks defined through related parties covers relations from ownership, collaboration, and key individuals. It therefore provides valuable opportunities for exploiting the role of subnetworks. By investigating the role of different networks on firms' management costs and firm performance, we find that affiliation to ownership networks and collaboration networks is positively related to firm management cost, and negatively related to firm performance. This has contributed to the knowledge about the effects of the different types of business networks.

Fifth, this study examines the role of network structure on firms' profitability and management cost to provide a thorough understanding of business networks. We have suggested that maintaining a central network position is associated with higher management costs and lower firm profitability. Unlike previous studies that suggest a positive relationship between centrality and firm performance, we argue that a central position brings with it more governance problems, and is more likely to be affected by adverse spillover, which counteracts the benefits of increased access to information and resources. We also confirm the benefits of structural holes for firms' performance. By examining the effects of network structure in a dynamic setting, we provide a more reliable understanding of networks.

Empirically, we use a large and representative database of listed companies in China over a 15 year period to investigate the role of business networks' affiliation on firms' management cost and firm performance. Even though previous work has set out to study the impacts of business networks (Ma et al., 2006; Guest & Sutherland, 2010), the studies have relied on small datasets in relation to a single region of a country, and on relatively static data over one particular year or a short period. By using objective financial data covering a longitudinal timeframe, we provide robust empirical evidence that firms in business networks incur more management costs and are less profitable than non-affiliated firms.

This study has several implications for managers and policymakers. First of all, firms need to consider not just the benefits to be gained from network affiliation but also its negative impacts. We have shown that business network affiliation is positively related to management cost and negatively related to firm performance. In order to maintain the network connection, firms need to sustain their interactions in these networks, which costs them time and money. Firms may also need to sacrifice their independence to adhere to the interests of the network and firm governance may be affected. Consequently, firms in business networks are less profitable. Firms need to be aware of these costs and benefits when making the appropriate networking decisions. Additionally, managers of firms also need to be mindful of the fact that firm strategy is going to affect the relationship between network affiliation, management cost, and firm performance. In order to lower management cost and promote firm performance, firms could choose to reduce their ownership concentration to control for the potential for expropriation. Moreover, it is significant to know that not all networks carry the same degree of influence over management cost and firm performance. Different networks have different network effects; firms need to carefully choose the appropriate networks to fulfill their organizational goals. Furthermore, the structure of the network is an important factor to consider. Firms need to occupy a suitable network position and affiliate to the appropriate network structure to maximize the benefits of networks and avoid the costs.

Further, this study raises implications for policymakers. As we have seen in China, the formation of business networks is an important issue for policy makers. Policy makers should be aware that in an improving institutional environment the benefits of business networks are decreasing and, thus, whether to continue to promote their development is a question that needs to be considered.

In summary, this study investigates the impacts of concentrated ownership on firms' performance and management costs in a network relationship context. Using China as the empirical setting, we model the impacts of business networks and estimate them using fixed effects. We also use robustness checks to provide extra security in our results. We find that business networks affiliation is overall negatively related to firm performance. Evidence suggests that firms in business networks experience higher management cost. Among the three types of business networks, ownership networks and collaboration networks are found to have significant influence over firms' management cost and performance. We find that central position is positively related to management cost and negatively related to profitability, while structural holes are positively related to firm performance and negatively related to management cost. Concentrated ownership imposes a mediating effect on the relationship between business networks, firm performance, and management cost.

Table 4.1: Descriptive analysis and summary statistics of key variables in Chapter 4

Panel A: summary

Variable	Definition	Observation	Mean	Std. Dev.
Dependent variables				
prof	Ratio of Operating Profit to Total Assets	16333	0.0479	0.0525
management	Ratio of management fee to revenue	16333	0.1249	0.1395
Network variables				
net	Dummy variable, =1 if the firm is network affiliated	16333	0.3263	0.4689
onet	Dummy variable, =1 if the firms is affiliated to ownership networks	16333	0.2822	0.4501
cnet	Dummy variable, =1 if the firms is affiliated to collaboration networks	16333	0.0630	0.2430
inet	Dummy variable, =1 if the firms is affiliated to individual networks	16333	0.0391	0.1939
net_degree	Degree centrality, the number of direct contacts a firm has	16333	0.5382	0.8934
net_constraint	Constraint, the aggregate constraint a network has to the firm	16333	0.2962	0.4338
Firm characteristics				
fr	Fixed ratio, ratio of Fixed Asset to Total Assets	16333	0.2582	0.1740
lev	Leverage, ratio of liabilities to assets	16333	0.4700	0.1977
size	Logarithm of Sales	16333	20.6666	1.2924
share5	Percentage of shares hold by top 5 shareholders	16333	54.5501	15.2268
soe	Indicator variable, =1 if the firms is controlled by soe	16333	0.6570	0.4747
growth	Growth Rate of Sales	16333	0.1666	0.3424

Panel B: Correlation analysis

	prof	manag~t	net	onet	cnet	inet	fr	Lev	size	share5	soe	growth
prof	1											
management	-0.3602*	1										
net	-0.0136	-0.0333*	1									
onet	-0.0156*	-0.0449*	0.9008*	1								
cnet	0.003	0.0089	0.3726*	0.2003*	1							
inet	-0.0132	-0.0114	0.2900*	0.1654*	0.1322*	1						
fr	0.0004	-0.1000*	-0.0382*	-0.0262*	-0.0398*	-0.0132	1					
lev	-0.3101*	0.0754*	0.0890*	0.0906*	0.0153	0.0645*	0.0229*	1				
size	0.2287*	-0.4242*	0.2715*	0.2794*	0.1427*	0.0935*	0.0252*	0.1367*	1			
share5	0.1604*	-0.1482*	-0.0127	-0.0138	-0.0043	-0.0123	0.1091*	-0.1343*	0.1091*	1		
soe	-0.0356*	-0.1025*	0.1345*	0.1389*	0.0271*	0.0121	0.1842*	0.0486*	0.1824*	0.1278*	1	
growth	0.2969*	-0.2465*	0.0128	0.0116	0.0200*	0.0043	-0.0081	-0.0052	0.2038*	0.0888*	0.0004	1

*suggests the correlation coefficients significant at the 5% level or better

Table 4.2: Business networks and firms' profitability

Note: These tables report estimation of firms' profitability using firm fixed effects as in equation 1 in this chapter. In stata, it is operated by reghdfe and clustered by firms and years. Definitions of variables can be found in table 4.1.

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	prof	prof	prof	prof	prof	Prof
size	0.00636***	0.00637***	0.00641***	0.00641***	0.00641***	0.00641***
	(0.000349)	(0.000349)	(0.000348)	(0.000348)	(0.000349)	(0.000349)
lev	-0.0765***	-0.0766***	-0.0765***	-0.0765***	-0.0765***	-0.0765***
	(0.00187)	(0.00187)	(0.00187)	(0.00187)	(0.00187)	(0.00187)
fr	-0.0118***	-0.0119***	-0.0118***	-0.0119***	-0.0118***	-0.0118***
	(0.00227)	(0.00227)	(0.00227)	(0.00227)	(0.00227)	(0.00227)
management	-0.0845***	-0.0845***	-0.0844***	-0.0845***	-0.0845***	-0.0846***
	(0.00288)	(0.00288)	(0.00288)	(0.00288)	(0.00288)	(0.00288)
growth	0.0298***	0.0298***	0.0298***	0.0298***	0.0298***	0.0298***
	(0.00105)	(0.00105)	(0.00105)	(0.00105)	(0.00105)	(0.00105)
soe	-0.0105***	-0.0105***	-0.0104***	-0.0104***	-0.0104***	-0.0104***
	(0.000814)	(0.000814)	(0.000814)	(0.000814)	(0.000815)	(0.000815)
share5	0.000206***	0.000190***	0.000206***	0.000181***	0.000206***	0.000190***
	(2.47e-05)	(3.01e-05)	(2.47e-05)	(2.91e-05)	(2.47e-05)	(2.88e-05)
net	-0.00208***	-0.00463				
	(0.000786)	(0.00290)				
share5_net		4.71e-05				
		(5.14e-05)				
onet			-0.00280***	-0.00742**		
			(0.000821)	(0.00300)		
share5_onet				8.55e-05		
				(5.34e-05)		
onet_123					-0.00288***	-0.00572**
					(0.000842)	(0.00280)
share5_onet_123						5.25e-05
						(4.92e-05)
Observations	16,333	16,333	16,333	16,333	16,333	16,333
R-squared	0.318	0.318	0.318	0.318	0.318	0.318

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 4.2: Business networks and firms' profitability continued

VARIABLES	(1) prof	(2) prof	(3) prof	(4) Prof	(5) prof	(6) Prof
size	0.00620***	0.00621***	0.00627***	0.00626***	0.00622***	0.00622***
	(0.000343)	(0.000344)	(0.000346)	(0.000346)	(0.000344)	(0.000344)
lev	-0.0768***	-0.0768***	-0.0768***	-0.0767***	-0.0767***	-0.0767***
	(0.00186)	(0.00186)	(0.00186)	(0.00186)	(0.00187)	(0.00187)
fr	-0.0116***	-0.0116***	-0.0117***	-0.0118***	-0.0116***	-0.0117***
	(0.00227)	(0.00227)	(0.00227)	(0.00227)	(0.00227)	(0.00227)
management	-0.0848***	-0.0848***	-0.0845***	-0.0846***	-0.0847***	-0.0847***
	(0.00288)	(0.00288)	(0.00288)	(0.00288)	(0.00288)	(0.00288)
growth	0.0299***	0.0299***	0.0299***	0.0298***	0.0299***	0.0299***
	(0.00105)	(0.00105)	(0.00105)	(0.00105)	(0.00105)	(0.00105)
soe	-0.0108***	-0.0108***	-0.0108***	-0.0108***	-0.0108***	-0.0108***
	(0.000808)	(0.000808)	(0.000807)	(0.000807)	(0.000807)	(0.000807)
share5	0.000207***	0.000203***	0.000206***	0.000222***	0.000207***	0.000214***
	(2.47e-05)	(2.50e-05)	(2.47e-05)	(2.55e-05)	(2.47e-05)	(2.52e-05)
onet_5	0.000538	-0.00506				
	(0.00205)	(0.00733)				
share5_onet_5		0.000105				
		(0.000133)				
cnet			-0.00235	0.0102*		
			(0.00145)	(0.00540)		
share5_cnet				-0.000231**		
				(9.57e-05)		
inet					-0.00141	0.00864
					(0.00178)	(0.00682)
share5_inet						-0.000188
						(0.000123)
Observations	16,333	16,333	16,333	16,333	16,333	16,333
R-squared	0.318	0.318	0.318	0.318	0.318	0.318

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 4.3: Business networks and firms' management cost

Note: These tables show estimation of management cost using firm fixed effects as in equation 2 in this chapter. It is operated by reghdfe in stata. Firms and years are clustered. Definitions of variables are available in table 4.1.

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	management	management	management	management	management	management
size	-0.0475***	-0.0474***	-0.0473***	-0.0473***	-0.0472***	-0.0472***
	(0.000873)	(0.000873)	(0.000873)	(0.000873)	(0.000874)	(0.000874)
lev	0.101***	0.101***	0.102***	0.101***	0.102***	0.102***
	(0.00502)	(0.00502)	(0.00502)	(0.00502)	(0.00502)	(0.00502)
fr	-0.0423***	-0.0426***	-0.0429***	-0.0432***	-0.0430***	-0.0434***
	(0.00618)	(0.00618)	(0.00618)	(0.00618)	(0.00618)	(0.00618)
growth	-0.0621***	-0.0621***	-0.0622***	-0.0622***	-0.0622***	-0.0622***
	(0.00283)	(0.00283)	(0.00283)	(0.00283)	(0.00283)	(0.00283)
soe	0.00255	0.00255	0.00279	0.00276	0.00302	0.00303
	(0.00222)	(0.00222)	(0.00222)	(0.00222)	(0.00222)	(0.00222)
share5	-0.000377***	-0.000488***	-0.000377***	-0.000478***	-0.000379***	-0.000471***
	(6.72e-05)	(8.18e-05)	(6.72e-05)	(7.91e-05)	(6.72e-05)	(7.85e-05)
net	0.0113***	-0.00684				
	(0.00214)	(0.00789)				
share5_net		0.000334**				
		(0.000140)				
onet			0.00960***	-0.00948		
			(0.00223)	(0.00818)		
share5_onet				0.000353**		
				(0.000145)		
onet_123					0.00781***	-0.00877
					(0.00229)	(0.00762)
share5_onet_123						0.000306**
						(0.000134)
Observations	16,333	16,333	16,333	16,333	16,333	16,333
R-squared	0.284	0.285	0.284	0.284	0.284	0.284

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 4.3: Business networks and firms' management cost continued

VARIABLES	(1) management	(2) management	(3) management	(4) management	(5) management	(6) management
size	-0.0467***	-0.0467***	-0.0473***	-0.0473***	-0.0467***	-0.0467***
	(0.000861)	(0.000861)	(0.000865)	(0.000865)	(0.000862)	(0.000862)
lev	0.103***	0.103***	0.102***	0.102***	0.103***	0.103***
	(0.00501)	(0.00502)	(0.00501)	(0.00501)	(0.00502)	(0.00502)
fr	-0.0431***	-0.0432***	-0.0419***	-0.0419***	-0.0434***	-0.0434***
	(0.00618)	(0.00618)	(0.00618)	(0.00618)	(0.00618)	(0.00618)
growth	-0.0625***	-0.0625***	-0.0622***	-0.0623***	-0.0625***	-0.0625***
	(0.00283)	(0.00283)	(0.00283)	(0.00283)	(0.00283)	(0.00283)
soe	0.00395*	0.00395*	0.00382*	0.00384*	0.00404*	0.00403*
	(0.00220)	(0.00220)	(0.00220)	(0.00220)	(0.00220)	(0.00220)
share5	-0.000377***	-0.000380***	-0.000375***	-0.000362***	-0.000381***	-0.000395***
	(6.72e-05)	(6.82e-05)	(6.71e-05)	(6.94e-05)	(6.72e-05)	(6.85e-05)
onet_5	0.0159***	0.0103				
	(0.00559)	(0.0200)				
share5_onet_5		0.000105				
		(0.000361)				
cnet			0.0257***	0.0360**		
			(0.00393)	(0.0147)		
share5_cnet				-0.000189		
				(0.000261)		
inet					0.00500	-0.0140
					(0.00484)	(0.0186)
share5_inet						0.000355
						(0.000335)
Observations	16,333	16,333	16,333	16,333	16,333	16,333
R-squared	0.284	0.284	0.285	0.285	0.283	0.283

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 4.4: Effects of network structure

Note: This table reports estimation of profit and management cost using firm specific fixed effects. I used the same command in stata as described in the tables above. Definitions are the same as in previous tables and can be found in table 4.1.

VARIABLES	(1) prof	(2) prof	(3) management	(4) management
size	0.00646***	0.00632***	-0.0477***	-0.0473***
	(0.000350)	(0.000347)	(0.000876)	(0.000870)
lev	-0.0763***	-0.0766***	0.101***	0.102***
	(0.00187)	(0.00187)	(0.00502)	(0.00502)
fr	-0.0118***	-0.0118***	-0.0424***	-0.0425***
	(0.00227)	(0.00227)	(0.00617)	(0.00618)
management	-0.0843***	-0.0846***		
	(0.00288)	(0.00288)		
growth	0.0298***	0.0298***	-0.0620***	-0.0622***
	(0.00105)	(0.00105)	(0.00283)	(0.00283)
soe	-0.0104***	-0.0106***	0.00228	0.00287
	(0.000814)	(0.000813)	(0.00222)	(0.00221)
share5	0.000206***	0.000206***	-0.000378***	-0.000377***
	(2.47e-05)	(2.47e-05)	(6.72e-05)	(6.72e-05)
net_degree	-0.00155***		0.00687***	
	(0.000419)		(0.00114)	
net_constraint		-0.00175**		0.0104***
		(0.000838)		(0.00228)
Observations	16,333	16,333	16,333	16,333
R-squared	0.318	0.318	0.285	0.284

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 4.5: Regression results using alternative measures

Note: These results are estimated using firm specific fixed effects. Definitions of variables can be found on table 4.1

Panel A: Alternative measure of profitability

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	roa	roa	roa	roa	roa	roa
size	0.00842***	0.00842***	0.00848***	0.00848***	0.00848***	0.00847***
	(0.000333)	(0.000333)	(0.000333)	(0.000333)	(0.000333)	(0.000333)
lev	-0.104***	-0.104***	-0.103***	-0.104***	-0.103***	-0.104***
	(0.00178)	(0.00178)	(0.00178)	(0.00178)	(0.00178)	(0.00178)
fr	-0.0259***	-0.0259***	-0.0259***	-0.0260***	-0.0259***	-0.0260***
	(0.00217)	(0.00217)	(0.00217)	(0.00217)	(0.00217)	(0.00217)
management	-0.0627***	-0.0627***	-0.0626***	-0.0627***	-0.0627***	-0.0627***
	(0.00275)	(0.00275)	(0.00275)	(0.00275)	(0.00275)	(0.00275)
growth	0.0305***	0.0305***	0.0305***	0.0305***	0.0305***	0.0305***
	(0.00101)	(0.00101)	(0.00101)	(0.00101)	(0.00101)	(0.00101)
soe	-0.00912***	-0.00912***	-0.00901***	-0.00901***	-0.00900***	-0.00900***
	(0.000777)	(0.000777)	(0.000778)	(0.000778)	(0.000778)	(0.000778)
share5	0.000241***	0.000227***	0.000240***	0.000216***	0.000241***	0.000223***
	(2.36e-05)	(2.87e-05)	(2.36e-05)	(2.78e-05)	(2.36e-05)	(2.75e-05)
net	-0.000913	-0.00309				
	(0.000751)	(0.00277)				
share5_net		4.02e-05				
		(4.91e-05)				
onet			-0.00175**	-0.00643**		
			(0.000784)	(0.00287)		
share5_onet				8.65e-05*		
				(5.10e-05)		
onet_123					-0.00179**	-0.00489*
					(0.000804)	(0.00267)
share5_onet_123						5.72e-05
						(4.70e-05)
Observations	16,329	16,329	16,329	16,329	16,329	16,329
R-squared	0.378	0.378	0.378	0.378	0.378	0.378

Standard errors in parentheses

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

Panel A continued

VARIABLES	(1) roa	(2) roa	(3) roa	(4) roa	(5) roa	(6) roa
size	0.00835***	0.00835***	0.00834***	0.00832***	0.00836***	0.00836***
	(0.000328)	(0.000328)	(0.000330)	(0.000330)	(0.000328)	(0.000328)
lev	-0.104***	-0.104***	-0.104***	-0.104***	-0.104***	-0.104***
	(0.00178)	(0.00178)	(0.00178)	(0.00178)	(0.00178)	(0.00178)
fr	-0.0258***	-0.0258***	-0.0258***	-0.0258***	-0.0258***	-0.0258***
	(0.00217)	(0.00217)	(0.00217)	(0.00217)	(0.00217)	(0.00217)
management	-0.0628***	-0.0628***	-0.0628***	-0.0629***	-0.0628***	-0.0628***
	(0.00275)	(0.00275)	(0.00275)	(0.00275)	(0.00275)	(0.00275)
growth	0.0306***	0.0306***	0.0306***	0.0305***	0.0306***	0.0306***
	(0.00101)	(0.00101)	(0.00101)	(0.00101)	(0.00101)	(0.00101)
soe	-0.00924***	-0.00924***	-0.00924***	-0.00920***	-0.00924***	-0.00923***
	(0.000771)	(0.000771)	(0.000771)	(0.000771)	(0.000771)	(0.000771)
share5	0.000241***	0.000239***	0.000241***	0.000264***	0.000241***	0.000246***
	(2.36e-05)	(2.39e-05)	(2.36e-05)	(2.44e-05)	(2.36e-05)	(2.40e-05)
onet_5	0.000257	-0.00275				
	(0.00196)	(0.00700)				
share5_onet_5		5.67e-05				
		(0.000127)				
cnet			0.000320	0.0190***		
			(0.00138)	(0.00516)		
share5_cnet				-0.000344***		
				(9.14e-05)		
inet					-0.000828	0.00555
					(0.00170)	(0.00651)
share5_inet						-0.000119
						(0.000117)
Observations	16,329	16,329	16,329	16,329	16,329	16,329
R-squared	0.378	0.378	0.378	0.378	0.378	0.378

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Panel B: Alternative measure of ownership concentration

VARIABLES	(1) prof	(2) prof	(3) prof	(4) prof	(5) prof	(6) prof
size	0.00621***	0.00621***	0.00625***	0.00625***	0.00625***	0.00625***
	(0.000348)	(0.000348)	(0.000348)	(0.000348)	(0.000348)	(0.000348)
lev	-0.0755***	-0.0755***	-0.0755***	-0.0755***	-0.0755***	-0.0755***
	(0.00186)	(0.00187)	(0.00186)	(0.00186)	(0.00186)	(0.00186)
fr	-0.0118***	-0.0118***	-0.0117***	-0.0118***	-0.0117***	-0.0118***
	(0.00227)	(0.00227)	(0.00227)	(0.00227)	(0.00227)	(0.00227)
management	-0.0841***	-0.0841***	-0.0841***	-0.0841***	-0.0842***	-0.0842***
	(0.00287)	(0.00287)	(0.00287)	(0.00287)	(0.00287)	(0.00287)
growth	0.0295***	0.0295***	0.0295***	0.0295***	0.0294***	0.0294***
	(0.00105)	(0.00105)	(0.00105)	(0.00105)	(0.00105)	(0.00105)
soe	-0.0103***	-0.0103***	-0.0102***	-0.0102***	-0.0102***	-0.0102***
	(0.000812)	(0.000812)	(0.000813)	(0.000813)	(0.000813)	(0.000813)
share10	0.000295***	0.000296***	0.000294***	0.000283***	0.000294***	0.000284***
	(2.49e-05)	(3.07e-05)	(2.49e-05)	(2.96e-05)	(2.49e-05)	(2.92e-05)
net	-0.00199**	-0.00184				
	(0.000785)	(0.00285)				
share10_net		-2.60e-06				
		(4.75e-05)				
onet			-0.00269***	-0.00468		
			(0.000819)	(0.00294)		
share10_onet				3.46e-05		
				(4.91e-05)		
onet_123					-0.00277***	-0.00462
					(0.000841)	(0.00299)
share10_onet_123						3.24e-05
						(5.00e-05)
Observations	16,333	16,333	16,333	16,333	16,333	16,333
R-squared	0.321	0.321	0.321	0.321	0.321	0.321

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Panel B continued

VARIABLES	(1) prof	(2) prof	(3) prof	(4) prof	(5) prof	(6) prof
size	0.00605***	0.00605***	0.00612***	0.00610***	0.00607***	0.00607***
	(0.000343)	(0.000343)	(0.000345)	(0.000345)	(0.000343)	(0.000343)
lev	-0.0758***	-0.0758***	-0.0758***	-0.0756***	-0.0757***	-0.0756***
	(0.00186)	(0.00186)	(0.00186)	(0.00186)	(0.00187)	(0.00187)
fr	-0.0116***	-0.0116***	-0.0117***	-0.0117***	-0.0116***	-0.0116***
	(0.00227)	(0.00227)	(0.00227)	(0.00227)	(0.00227)	(0.00227)
management	-0.0844***	-0.0844***	-0.0842***	-0.0842***	-0.0844***	-0.0844***
	(0.00287)	(0.00287)	(0.00288)	(0.00287)	(0.00287)	(0.00287)
growth	0.0295***	0.0295***	0.0295***	0.0295***	0.0295***	0.0295***
	(0.00105)	(0.00105)	(0.00105)	(0.00105)	(0.00105)	(0.00105)
soe	-0.0105***	-0.0105***	-0.0105***	-0.0105***	-0.0105***	-0.0105***
	(0.000806)	(0.000806)	(0.000806)	(0.000806)	(0.000806)	(0.000806)
share10	0.000296***	0.000293***	0.000295***	0.000313***	0.000296***	0.000302***
	(2.49e-05)	(2.53e-05)	(2.49e-05)	(2.58e-05)	(2.49e-05)	(2.54e-05)
onet_5	0.000547	-0.00463				
	(0.00205)	(0.00775)				
share10_onet_5		9.10e-05				
		(0.000131)				
cnet			-0.00229	0.0110**		
			(0.00144)	(0.00526)		
share10_cnet				-0.000231***		
				(8.77e-05)		
inet					-0.00145	0.00563
					(0.00177)	(0.00643)
share10_inet						-0.000124
						(0.000108)
Observations	16,333	16,333	16,333	16,333	16,333	16,333
R-squared	0.320	0.320	0.321	0.321	0.320	0.321

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Panel B continued

VARIABLES	(1) management	(2) management	(3) management	(4) management	(5) management	(6) management
size	-0.0475***	-0.0475***	-0.0474***	-0.0474***	-0.0472***	-0.0473***
	(0.000873)	(0.000873)	(0.000873)	(0.000873)	(0.000874)	(0.000874)
lev	0.101***	0.101***	0.102***	0.101***	0.102***	0.102***
	(0.00502)	(0.00503)	(0.00503)	(0.00503)	(0.00503)	(0.00503)
fr	-0.0428***	-0.0433***	-0.0434***	-0.0439***	-0.0435***	-0.0440***
	(0.00618)	(0.00618)	(0.00617)	(0.00618)	(0.00618)	(0.00618)
growth	-0.0619***	-0.0618***	-0.0619***	-0.0619***	-0.0620***	-0.0619***
	(0.00283)	(0.00283)	(0.00283)	(0.00283)	(0.00283)	(0.00283)
soe	0.00217	0.00210	0.00241	0.00232	0.00264	0.00259
	(0.00222)	(0.00222)	(0.00222)	(0.00222)	(0.00222)	(0.00222)
share10	-0.000356***	-0.000484***	-0.000356***	-0.000477***	-0.000358***	-0.000468***
	(6.78e-05)	(8.36e-05)	(6.78e-05)	(8.07e-05)	(6.79e-05)	(7.96e-05)
net	0.0113***	-0.00831				
	(0.00214)	(0.00777)				
share10_net		0.000340***				
		(0.000130)				
onet			0.00953***	-0.0118		
			(0.00223)	(0.00802)		
share10_onet				0.000372***		
				(0.000134)		
onet_123					0.00771***	-0.0130
					(0.00229)	(0.00815)
share10_onet_123						0.000362***
						(0.000136)
Observations	16,333	16,333	16,333	16,333	16,333	16,333
R-squared	0.284	0.285	0.284	0.284	0.283	0.284

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Panel B continued

VARIABLES	(1) management	(2) management	(3) management	(4) management	(5) management	(6) management
size	-0.0468***	-0.0468***	-0.0473***	-0.0474***	-0.0468***	-0.0468***
	(0.000861)	(0.000861)	(0.000865)	(0.000865)	(0.000862)	(0.000862)
lev	0.103***	0.103***	0.102***	0.103***	0.103***	0.103***
	(0.00502)	(0.00502)	(0.00501)	(0.00501)	(0.00503)	(0.00503)
fr	-0.0436***	-0.0437***	-0.0423***	-0.0423***	-0.0439***	-0.0438***
	(0.00618)	(0.00618)	(0.00617)	(0.00617)	(0.00618)	(0.00618)
growth	-0.0623***	-0.0623***	-0.0620***	-0.0621***	-0.0622***	-0.0623***
	(0.00283)	(0.00283)	(0.00283)	(0.00283)	(0.00283)	(0.00283)
soe	0.00356	0.00356	0.00343	0.00345	0.00364*	0.00362*
	(0.00220)	(0.00220)	(0.00220)	(0.00220)	(0.00220)	(0.00220)
share10	-0.000359***	-0.000366***	-0.000356***	-0.000341***	-0.000362***	-0.000381***
	(6.79e-05)	(6.89e-05)	(6.78e-05)	(7.02e-05)	(6.79e-05)	(6.93e-05)
onet_5	0.0161***	0.00362				
	(0.00559)	(0.0212)				
share10_onet_5		0.000220				
		(0.000359)				
cnet			0.0257***	0.0370***		
			(0.00393)	(0.0143)		
share10_cnet				-0.000195		
				(0.000239)		
inet					0.00504	-0.0173
					(0.00484)	(0.0176)
share10_inet						0.000392
						(0.000295)
Observations	16,333	16,333	16,333	16,333	16,333	16,333
R-squared	0.283	0.283	0.285	0.285	0.283	0.283

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 4.6: Correction for cross-sectional dependence

Note: These results are estimated using Driscoll-Kraay estimator. Definitions of variables are the same as in table 4.1.

Panel A: Profitability

VARIABLES	(1) prof	(2) prof	(3) prof	(4) prof	(5) prof	(6) prof
size	0.00196*	0.00195*	0.00191*	0.00161	0.00184	0.00166
	(0.00106)	(0.00106)	(0.00105)	(0.00110)	(0.00111)	(0.00108)
lev	-0.0838***	-0.0838***	-0.0838***	-0.0840***	-0.0840***	-0.0839***
	(0.00688)	(0.00687)	(0.00686)	(0.00687)	(0.00688)	(0.00684)
fr	-0.0216***	-0.0216***	-0.0216***	-0.0214***	-0.0217***	-0.0215***
	(0.00239)	(0.00239)	(0.00239)	(0.00234)	(0.00227)	(0.00234)
management	-0.116***	-0.116***	-0.116***	-0.116***	-0.116***	-0.116***
	(0.0228)	(0.0229)	(0.0229)	(0.0229)	(0.0229)	(0.0229)
growth	0.0249***	0.0249***	0.0249***	0.0250***	0.0250***	0.0250***
	(0.00117)	(0.00117)	(0.00117)	(0.00118)	(0.00117)	(0.00118)
soe	-0.0105***	-0.0105***	-0.0105***	-0.0105***	-0.0105***	-0.0105***
	(0.00166)	(0.00166)	(0.00166)	(0.00167)	(0.00166)	(0.00167)
share5	0.000276	0.000276	0.000277	0.000285	0.000283	0.000284
	(0.000191)	(0.000191)	(0.000191)	(0.000192)	(0.000193)	(0.000192)
net	-0.00253***					
	(0.000671)					
onet		-0.00248***				
		(0.000658)				
onet_123			-0.00217**			
			(0.000794)			
onet_5				-0.000343		
				(0.00156)		
cnet					-0.00599***	
					(0.00153)	
inet						-0.00246
						(0.00190)
Constant	0.0553**	0.0555**	0.0562**	0.0614**	0.0570**	0.0604**
	(0.0208)	(0.0207)	(0.0204)	(0.0212)	(0.0212)	(0.0210)
Observations	16,350	16,350	16,350	16,350	16,350	16,350
Number of groups	2,134	2,134	2,134	2,134	2,134	2,134

Standard errors in parentheses

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

Panel B: Management cost

VARIABLES	(1) management	(2) management	(3) management	(4) management	(5) management	(6) management
size	-0.0402***	-0.0399***	-0.0398***	-0.0381***	-0.0389***	-0.0382***
	(0.00680)	(0.00701)	(0.00696)	(0.00680)	(0.00659)	(0.00685)
lev	0.0885*	0.0890*	0.0892*	0.0903*	0.0904*	0.0902*
	(0.0439)	(0.0439)	(0.0441)	(0.0440)	(0.0440)	(0.0440)
fr	-0.0319*	-0.0323**	-0.0323**	-0.0331**	-0.0322**	-0.0332**
	(0.0147)	(0.0148)	(0.0147)	(0.0146)	(0.0143)	(0.0146)
growth	-0.0598***	-0.0599***	-0.0599***	-0.0608***	-0.0606***	-0.0607***
	(0.00866)	(0.00859)	(0.00862)	(0.00885)	(0.00878)	(0.00884)
soe	-0.0139*	-0.0138*	-0.0138*	-0.0140*	-0.0141*	-0.0140*
	(0.00763)	(0.00765)	(0.00766)	(0.00775)	(0.00775)	(0.00770)
share5	-0.00144***	-0.00145***	-0.00145***	-0.00150***	-0.00149***	-0.00150***
	(0.000327)	(0.000328)	(0.000330)	(0.000338)	(0.000336)	(0.000339)
net	0.0157***					
	(0.00297)					
onet		0.0138***				
		(0.00325)				
onet_123			0.0129***			
			(0.00284)			
onet_5				0.00793		
				(0.00790)		
cnet					0.0219***	
					(0.00421)	
inet						0.00620
						(0.00443)
Constant	1.015***	1.011***	1.009***	0.980***	0.994***	0.982***
	(0.113)	(0.116)	(0.115)	(0.113)	(0.109)	(0.113)
Observations	16,350	16,350	16,350	16,350	16,350	16,350
Number of groups	2,134	2,134	2,134	2,134	2,134	2,134

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Panel C: Network structure

VARIABLES	(1) prof	(2) prof	(3) management	(4) management
size	0.00222*	0.00184	-0.0412***	-0.0396***
	(0.00104)	(0.00108)	(0.00674)	(0.00687)
lev	-0.0836***	-0.0839***	0.0876*	0.0892*
	(0.00691)	(0.00686)	(0.0440)	(0.0438)
fr	-0.0219***	-0.0215***	-0.0308*	-0.0324**
	(0.00235)	(0.00239)	(0.0146)	(0.0148)
management	-0.116***	-0.116***		
	(0.0228)	(0.0229)		
growth	0.0248***	0.0249***	-0.0594***	-0.0601***
	(0.00115)	(0.00117)	(0.00857)	(0.00870)
soe	-0.0105***	-0.0105***	-0.0141*	-0.0138*
	(0.00166)	(0.00167)	(0.00769)	(0.00763)
share5	0.000272	0.000278	-0.00142***	-0.00145***
	(0.000191)	(0.000191)	(0.000323)	(0.000330)
net_degree	-0.00206***		0.0108***	
	(0.000357)		(0.00170)	
net_constraint		-0.00201**		0.0136***
		(0.000769)		(0.00302)
Constant	0.0503**	0.0575**	1.034***	1.004***
	(0.0203)	(0.0210)	(0.112)	(0.114)
Observations	16,350	16,350	16,350	16,350
Number of groups	2,134	2,134	2,134	2,134

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Chapter 5 Business networks and firm stock return volatility

Chapter 5 Business networks and firm stock return volatility

5.1 Introduction

Stock return volatility is an important issue for the equity markets, attracting worldwide interest from researchers, investors, and policymakers. In emerging markets, where the institutional environment is underdeveloped and its markets are normally associated with risk and financial and political uncertainty, stock price volatility is relatively high (Vo, 2015). Turbulence in the global equity markets in recent years has witnessed higher price volatility with significant influence on investors (Vo, 2016). Policymakers in the emerging economies are increasingly aware of the importance of understanding the factors that affect volatility. Stock price volatility in the emerging equity markets is therefore of itself an interesting study.

Volatility can be defined broadly as anything that is changeable or variable (Kevin, 2011). The more the variable changes or fluctuates over time, the more volatile the variable is said to be. Volatility is associated with unpredictability, uncertainty, and risk (Kevin, 2011). Understanding stock return volatility in the emerging markets is particularly important, but even so is less studied than are the markets in the developed economies (Mahender et al., 2014) partly because most emerging markets are characterized by high stock return volatility.

There are several reasons stock return volatility is important per se. First of all, when stock returns fluctuate sharply, it may undermine confidence in the stock. This results in reduced capital flow for the company since the investors are likely to focus more on perceived issues with the firm rather than to examine the fundamental economic factors underlying the fluctuation. As investors by nature are risk averse, stock return volatility is a measure of the level of risk they are exposed to (Guo, 2002). Secondly, stock return volatility is an important issue in determining the probability of the firm going bankrupt (Kevin, 2011). The more highly volatile a firm is, and controlling for other factors, the higher becomes the likelihood of default. Thirdly, the level of volatility also affects firms' hedging techniques, such as their portfolio insurance, because the price of insurance increases commensurate with the level of volatility (John & Simon, 2007). Finally, increased stock return volatility over a period may result in intervention from regulatory agencies and providers of capital, which may influence the firm's operations and its resource allocation efficiency (Kevin, 2011). More generally, stock return volatility is a serious matter of concern for investors and policymakers as it can exert huge pressures on the economy (Vo, 2015).

A plethora of papers in the literature have contributed to an understanding of stock return volatility in general and to the drivers of such volatility in the equity markets in particular. The body of literature is extensive and still growing (Clark, 1973; Garman & Klass, 1980; Li et al., 2011; Chen et al., 2013; Gharbi et al., 2014; McMillan & Evans, 2014; Vo, 2015; Vo, 2016). Various factors, such as trading volume (Gallant, 1992) and ownership structure (Vo, 2015), have been identified as elements that significantly influence stock return volatility. However, Mittnik et al. (2015) argue that using different perspectives to identify the factors affecting stock volatility is critical. One interesting question that remains unexplored is whether business network affiliation and network structure may have an impact on stock return volatility.

The popularity of business networks is widely witnessed in emerging economies, where the institutional environment is underdeveloped. For example, business groups are widely used by business units as a response to market inefficiency in India and China (e.g. Carney et al., 2009; Chakraborty, 2013). In emerging markets, where the institutional environment is relatively weak and the market is inefficient, transaction costs such as finding cost, negotiation cost, and contracting cost are very high. Business networks provide a mechanism to reduce transaction costs and the uncertainty associated with them (Achrol & Kotler, 1999), and allow firms to access pooled resources and expertise. In networks, members are familiar with each other and exchange favors for the good of the organizational purpose (Gu et al., 2008). Through repeated interactions, norms and trust would be established, and these govern networked firms' sharing and exchanging of expertise, information, knowledge, and resources. As well as filling lacunae in the market, business networks are associated with superior information processing and flexible monitoring (Achrol & Kotler, 1999) which are favored by business units.

Studies on business networks that investigate inter-firm relationships are particularly useful at explaining finance, corporate governance, and corporate performance (e.g. Markoczy et al., 2013; Wang et al., 2015; Guest & Sutherland, 2010; Byun et al., 2013; Isobe et al., 2006). The bright and dark sides of business networks are both discussed in the literature. On the one hand, business networks are viewed as mechanisms for reducing information asymmetries and transaction costs in the marketplace that occur in an underdeveloped institutional environment (Markoczy et al., 2013; Wang et al., 2015; Guest & Sutherland, 2010). In addition, business networks, serving as a resources pool for network members, can mobilize resources from one affiliate to another one. Consequently, network members bonded together can share risks in the market. On the other hand, business networks are associated with a complicated governance structure and can even facilitate various “tunneling” activities by the controlling shareholder (e.g. Byun et al., 2013; Isobe et al., 2006), which may negatively affect corporate operations. As firms in business networks grow more connected, they are increasingly exposed to other network members in frequent interactions. Firms are thus more likely to be affected by the adverse spillovers of networks, which can lead to higher operational risks.

It is an empirical question to investigate the relationship between business network affiliation and firm stock return volatility in emerging economies. This is a relatively under-addressed question which will contribute to the understanding of the role of business networks on stock return volatility in emerging markets. The co-insurance effects of business groups are evidenced (Byun et al., 2013). Firms in business networks are shown to have a lower probability of default, which may lead to lower volatility. However, the adverse effects of business networks, such as governance problems, may also result in higher volatility.

Business network affiliation by its very nature means that firms are more exposed to other network members. Gopalan et al. (2007) suggest that firms in networks are more likely to suffer from negative spillovers caused by bad news for other network members. To the best of our knowledge, there is no prior study that directly investigates the role of business networks on firms' return volatility. This study expects to fill that knowledge gap.

Moreover, different network structures offer affiliated firms different capabilities in various aspects. Earlier studies (e.g. Chen & Xie, 2011; Tsai, 2001) mainly focus on network position in terms of centrality. In this study, we expect to add to the literature by investigating relatively broad aspects of business network structures, including network size, diversity, position within the network, network structure, and network dominator. It is suggested that a particular network structure may have both positive and negative impacts for the performance of its affiliated firms. For example, centrality is found to be positively related to firm performance (Chen & Xie, 2011). However, studies suggest that a central position would lead to over reliance on other network members, which may bring negative effects for firm performance (e.g. Rothaermel & Alexandre, 2009). Actors also need to invest a considerable amount of money and effort to maintain strong network ties (Uzzi, 1997). The role of business network structure on firm stock return volatility is something that should be empirically tested, not least because network effects are contextually sensitive (Adler & Kwon, 2002).

The high levels of stock return volatility and their effects on investors and firms during crises such as the Asian financial crisis in 1997 and the more recent global financial crisis in 2008 also motivate this study. Stock return volatilities during these periods have affected investors and the market significantly. Consequently, research into stock return volatility, especially into the drivers of volatility, is increasingly important. By understanding the determinants of stock return volatility, we can have a better understanding of the economy and are more able to temper volatility to achieve organizational goals.

We use Chinese listed companies from 1997-2011 to investigate the relationship between listed companies' related party networks and stock return volatility. The data are from CSMAR and Datastream databases. We use China as the empirical setting for the following reasons. First of all, there are various types of business networks in China, which play significant roles in its national economy. For example, 50% of China's listed companies are involved in listed company cross-shareholding networks (Sha & Zeng, 2014) and business groups in China contribute close to 60% of the nation's industrial output (China Development Research Center of the State Council, 2000). Thus, China provides a good and relevant context for the study of networks and their impact on a national economy. Secondly, China is an emerging economy as well as a transition economy. It has seen its equity market capitalize 23 trillion RMB as in 2013 (SHSE and SZSE, 2013) since the establishment of its stock market in the 1990s. Its enormous growth potential is increasingly attractive for both domestic and foreign investors. The volatility of stock return is crucial for these investors. Moreover, as the second largest economy in the world ranking after US (Ling & Li, 2012), it is increasingly being integrated into the global economy, particularly after it entered the World Trade Organization (WTO). A systematic and comprehensive understanding of business networks operating in China, and the relationship between such networks and stock return volatility, would help China's trading partners to get up to speed with financial rules in China and would assist their investment decisions. As a typical emerging economy, understanding the links between business networks and stock return volatility would also have implications for an understanding of other emerging economies.

The remainder of this study is organized as follows. The second part outlines the relevant literature and hypothesis development. We then discuss the data and methodology. The findings and discussion are then presented. Finally, the conclusion of this study is outlined.

5.2 Literature and hypothesis development

5.2.1 Related literature

It is clear from the number of asset pricing studies that have stock return volatility at their core that this is a topic that attracts interest from both investors and policymakers (Zhang, 2010). In this section, we briefly examine the literature on the determinants of stock return volatility. Fundamentals-based theories are derived from traditional asset pricing principles while those related to microstructure and the financial systems are trading volume-based theories (Zhang, 2010). Theoretically, stock return volatility is positively related to the conditional variance of future dividends since the stock price is the present value of expected stock dividends (Zhang, 2010). Vuolteenaho (2002) shows that stock return volatility is positively related to earnings and dividends. Anwar et al. (2015) also document that cash dividend announcements are positively related to stock return volatility. Caner et al. (2005) examined sources of volatility in emerging markets and found that dividends are a major factor influencing stock return fluctuation. Schwert (2002) suggests that volatility is positively related to the value of growth opportunities as it is a component of stock prices, and Cao et al. (2008) concur. Gharbi et al. (2014) suggest that R&D investments are positively related to firms' stock return volatility because R&D represents uncertainty for the firm in the future.

Trading-based theories argue that trading volume causes high stock return volatility. However, the relationship between stock return volatility and trading volume is ambiguous. Some studies argue that increasing trading volume leads to better accounting standards and information, which would reduce volatility (e.g. Schwert, 2002). Other studies posit that stock return volatility is positively related to trading volume (e.g. Gallant, 1992). Moreover, studies also show that as the amount of institutional trading increases institutional ownership is significantly positively associated with stock return volatility (e.g. Xu et al., 2003; Bennett et al., 2003). Furthermore, it is suggested that foreign ownership helps firms to reduce their stock return volatility (e.g. Vo, 2015; Li et al., 2011), theorizing that the stabilizing effect of foreign ownership outweighs the potential destabilizing impacts. However, these studies do not investigate the role that informal contracts among firms, such as business network affiliation and network structure, may have on stock return volatility. Given the importance of stock return volatility in the emerging economies (Chen et al., 2013; Vo, 2015; Vo, 2016) and the prevalence of business networks in those markets (He et al., 2013; Byun et al., 2013; Sha & Zeng, 2014), an investigation into the relationship between business networks and stock return volatility is called for. The effects of business networks are evidenced to touch on some factors that may influence stock return volatility, such as information asymmetry; a direct investigation about the nature of the relationship has therefore become essential to developing an understanding of business networks and stock return volatility.

In the literature about business networks, empirical studies have found they have both positive and adverse effects (Byun et al., 2013). On the one hand, by compensating for underdeveloped markets in finance, labour, and products, business networks may promote exchanges that could not happen in the marketplace. By affiliating to business networks, firms obtain superior access to scarce resources, which provides firms with higher combinative potential and increases their ability to respond flexibly and efficiently to market demand (Ahuja et al., 2008). These benefits enable firms in networks to share risks in the market and decrease the probability of default (Khanna & Yafeh, 2007), which would also help firms to reduce stock volatility. There is empirical evidence of such risk sharing among network members. Gopalan et al. (2007) found that firms in business groups support each other to avoid default and affiliated firms are less likely to go bankrupt than free-standing ones. He et al. (2013) documented the internal capital markets function that is carried out by business groups in China and found that those firms that are affiliated to networks are less financially constrained and are at less at risk of going bankrupt than independent firms. Hoshi et al. (1991) also suggest that bank systems in Japan reduce agency and bankruptcy.

Bae et al. (2008) indicate that member firms' announcement of increased earnings have positive spill over into other member firms' market value. However, although these studies have suggested that firms in business networks are less risky in terms of bankruptcy, they do not directly link business network affiliation to firm stock return volatility. We acknowledge that higher stock return volatility may induce a higher likelihood of default. However, a lower probability of default does not necessarily imply lower stock return volatility. Furthermore, previous research does not consider the effects of different network structures, which carry with them different network effects. We therefore submit that the manner in which the structure of the business network affects firms' stock return volatility is an area requiring investigation.

Theoretical models predict that stock return volatility is positively related to information asymmetry (Gharbi et al., 2014). Attanasio (1990) shows that stock prices tend to be more volatile in the presence of information asymmetry. Gennotte & Leland (1990) suggest that stock return volatility can be explained by the trades of informed investors in a context of information asymmetry. Business networks are effective at reducing information asymmetry among affiliates since firms in networks grow familiar with other network members through frequent interactions. However, affiliation into business networks could also increase the probability of member firms becoming informed investors and this may create information asymmetry between those firms in networks and the public investors outside the networks. As no study has directly investigated the link between business network affiliation and stock return volatility, it is unclear whether the relationship between business networks and stock return volatility is unambiguously virtuous.

Another area of research suggests that business networks perform negatively for member firms, which may result in higher stock return volatility. We have outlined the negative aspects of business networks in previous chapters. These effects could lead to inferior firm performance and consequently lead to higher stock return volatility. It is suggested that firms in emerging markets exhibit higher stock return volatility due to the risk of potential expropriation that is pervasive in weak institutional environments (Bae et al., 2002). The internal markets found in business networks provide a platform for internal transactions, which clearly provides an opportunity for firms to expropriate.

Generally, affiliating to business networks may induce both positive and negative effects for member firms, and the extent and nature of these effects can be examined empirically. Moreover, a detailed understanding of the role of the structure of the business network will facilitate a holistic understanding of business networks, including their impact on stock return volatility.

5.2.2 Hypothesis development

As the literature suggests, firms in networks can mobilize resources and share risks and this results in less risk of bankruptcy for the members. However, this does not necessarily imply lower stock return volatility since firms in business networks feel not only the positive effects of networks, they also suffer from their liabilities. Intra-lending among network members can result in endless “triangle debts” (Peng & Luo, 2000), which will lead to a bad reputation for the network. As suggested by Gharbi et al. (2014), firms with a higher leverage ratio are more volatile. Studies have suggested that firms in business networks generally have a higher leverage ratio because co-insurance effects enhance a firm’s ability to pay back the debts it raised (Goplan et al., 2007; Paligorova & Xu, 2012; Manos et al., 2007; Kuo & Wang, 2015). In this case, firms in networks are expected to be riskier than isolated ones because of the overhanging debt problem (Myer, 1977). Thus, firms in networks are more likely to be volatile than non-affiliated firms. Additionally, even though firms in networks can have reduced information asymmetry among network members, networking can lead to a larger number of informed traders. In addition, firms in networks usually have a more complicated ownership structure and this brings its own governance challenges. It is widely recognized that “tunneling” activities in business networks may undermine firm performance (Bae et al., 2002). In such cases, the information asymmetry between insiders and outsiders is increased. It is suggested that stock return volatility increases as the degree of information asymmetry becomes higher (Gharbi et al., 2014). Thus, firms in networks can be expected to be more volatile than others.

Moreover, Gopalan et al. (2014) suggest that firms in business groups pay out significantly more dividends than their non-affiliated counterparts. Vuolteenaho (2002), and Anwar et al. (2015) suggest that stock return volatility is positively related to dividends. Thus, we expect stock return volatility to be positively related to business network affiliation since stock price is the present value of expected stock dividends (Zhang, 2010).

The entrepreneurial process view (Iacobucci & Rosa, 2005; Lechner & Leyronas, 2009) also provides valuable insight, particularly for small firms, in explaining the emergence of business networks. This view argues that business network formation is an outcome of growth processes linked to entrepreneurial diversification. Colli et al. (2016) claim that the formation and diffusion of business networks are the only way to grow a firm or, at least, the easiest way to reach a reasonable size. As firms in business networks encounter more opportunities for growth, we expect firms in business networks to be more volatile than those not so affiliated. This is because of the received wisdom in finance that stock price is determined as the sum of the current value of earnings and growth opportunities (Zhang, 2010). Finally, firms that become networked are less independent because they must subjugate their own interests to benefit the joint stake of the network (Singh & Gaur, 2009). Through frequent interactions, firms in business networks are increasingly exposed to other network members. Gopalan et al. (2007) claim that when a firm in a network encounters a crisis, will have adverse spillovers for other network members. Given these findings, we expect to see a positive relationship between business networks and stock return volatility. Based on the above analysis, we propose the first hypothesis as follows:

H1: Business network affiliation in China is positively related to stock return volatility.

In addition to the above, we believe that the structure of a business network will also make a difference to the degree of stock return volatility since networks with different structures imply different network effects. Previous studies have overlooked the consequences of business network structure on stock return volatility, and this is where this study expects to contribute to the literature. Unlike previous studies examining network structures that focus on network position (e.g. Chen & Xie, 2011; Sha & Zeng, 2014), we use a relatively wide net of network structures, including network size, network diversity, network position, and network dominator.

In order to understand the relationship between network structure and firms' stock return volatility, we need to bear in mind that stock return volatility is caused by the flow of private information (Roll, 1988). Stock prices change as relevant information becomes available. Lin et al (2014) have suggested that stock volatility in China reflects stock price informativeness. Many studies have suggested that stock return volatility is positively related to information disclosure. Anwar et al. (2015) show that cash dividend announcements are positively related to stock return volatility while Shi et al. (2016) find that the public information flow is positively related to return volatility. Upon receiving news, investors trade accordingly, which will lead to changes in the stock price. We therefore expect to see an increase in return volatility as informativeness increases.

Network size refers to the number of firms in a network. Empirical evidence suggests that resource availability increases with network size (Greve & Salaff, 2003; Liao & Welsch, 2005; Soh, 2010). However, when firms establish network connections with other firms, they need to establish a governance system, and such systems come with at a price that may negatively affect firms' performance. When network size reaches a peak, the benefits from the economies of scale will help firms to minimize these costs. The relationship between network size and firm return volatility is therefore expected to exhibit an inverted U shape. Moreover, as network size increases, the availability of information is increased and becomes asymmetrical, which may cause higher volatility. However, further increases in business network size could generate redundant information (Semrau & Werner, 2013) and reduce the information asymmetry between firms and the wider public since information may disseminate to outside the network. Based on the above analysis, we expect a positive relationship between firm return volatility and business network size in the first stage. After reaching a peak, firm return volatility decreases with further increases in network size.

Network diversity measures the variety of industries operated by network members. Diversification is a common strategy for firms wishing to lower their operational risks. Firms in different industries form business networks to gain scale or scope advantages, and to mitigate the disadvantages of inefficient or absent intermediate institutions (Purkayastha & Lahiri, 2016). However, previous studies have inadequately accounted for the management, organization, and other costs of diversification in emerging economies (Granovetter, 2005). When networks initially expand their diversity, firms will need to establish a sharing platform to lower their risks. Establishing a governance mechanism incurs fixed costs for firms in business networks (Chang & Hong, 2002). We therefore expect that the level of firm risk will increase during the first stage of network diversity. When network diversity reaches an optimal level, the scale or scope advantages could help firms to effectively minimize their market risk. Thus, we expect to see an inverted U shape relationship between network diversity and stock return volatility.

In terms of network position, this is measured by the centrality or peripherality of the focal firm's position. Studies (e.g. Ahuja, 2000; Tsai, 2001; Wang et al., 2014; Coleman, 1988, 1990) suggest that occupation of a central position in networks means that firms are more likely to gain access to crucial resources and information. The central firm is therefore a conduit of information for all other members in the network and this higher availability of information will affect the volatility of the central firm to a greater degree than might be experienced by firms on the periphery of the network. Moreover, as we explained in chapter 4, firms in a central network position generally perform worse than those not. We therefore expect to see higher volatility for firms in central network position. In terms of the effects of network structure, Burt (1982, 1997, 2005) highlights the advantages of sparse networks with disconnected network partners. Firms that hold a bridging position in a network can gain the benefits of being the broker for resource flows within the network (Semrau & Werner, 2013). We use constraints as a measure of the structural holes in firms' ego networks. More constraints imply fewer structural holes (Nooy et al., 2005). Firms with more network constraints will have more information channels in the network than will firms in networks with fewer constraints. In sparse networks, information diffusion is less extensive than in dense networks. Consequently, we argue that firms in network bridging positions are expected to be less volatile since they are more able to gain benefit through their bargaining power over other network members. As we discussed and proved in chapter 4, firms in networks with more structural holes tend to perform better than firms in tighter networks, which can result in lower stock return volatility.

We next turn to the property of networks. A network's property is defined by the properties of its central players. In this study we investigate the role of two types of business network dominator, namely SOE dominated networks and financial institution dominated networks. SOEs dominated networks may have superior information channels thanks to their closer relationships with government. Financial institution dominated networks also have superior information availability because of their relationships with banks. Consequently, we expect firms in both networks to have a higher level of stock return volatility.

We propose the following hypotheses:

H2a: Network size and firm return volatility exhibit an inverted U shape relationship

in China.

H2b: Network diversity and firm return volatility exhibit an inverted U shape relationship in China.

H2c: Network central position is positively related to firm stock return volatility in China.

H2d: Network intermediate position is negatively related to firm stock return volatility in China.

H2e: Firms in a SOE dominated network are more volatile than others in China.

H2f: Firms in a financial institution dominated network are more volatile than others in China

5.3 Data and methodology

5.3.1 Data and construction of business networks

To investigate the impacts of business networks and network structure on stock return volatility in China, this study focuses on companies listed on either the Shanghai or the Shenzhen Stock Exchange. Listed companies are required to publish their financial performance regularly to the public. Data are easy to access through open channels, for example from the official website of the two stock exchanges. These data are more reliable and accurate than those obtained from surveys.

This study uses data from two databases, which are CSMAR database and Datastream database. CSMAR database is maintained by GTA (Guo Tai An) Research Service Centre and we adopt it to construct business networks and identify key financial indicators. The database provides good coverage of listed companies in the market and is used in studies about China’s listed companies (He et al., 2013; Liu et al., 2016). Three datasets are extracted: listed company related party information data; listed company related party transaction data; and listed company financial indicator data. Our data covers the period from 1997 to 2011. The data contains information about listed companies' related party information, key financial indicators, and basic information about listed companies, which we use to construct business networks and identify key financial indicators of listed companies. For the construction of stock return volatility, this study extracts stock price data on a daily basis from the Datastream database. Using stock price daily data, annualized stock return volatility is constructed for each firm in each year. Then the volatility data is merged with data about network information and financial information. After data cleaning, we have a dataset of 1,971 listed companies and 16,567 observations.

In order to construct business networks, this study explores related relations among listed companies. As mentioned above, a related party is an agent that controls or significantly influences the listed company's policy and decision-making (Michele, 2013). The construction of business networks is explained in detail in chapter 2. The business network constructed captures many relations that are widely seen in the marketplace. It is particularly helpful in understanding firms' stock return volatility since the relations included are associated with either control or significant influence. We argue that information sharing among defined business networks is more efficient and effective. The completeness of our definition helps us to generalize our findings on the relationship between business networks and firms' stock return volatility. We then use different variables related to network structure that are calculated using Pajek software. These variables are network size, network diversity, centrality, constraint, and network dominator.

5.3.2 Model and variables

Similar to Chen et al. (2013), Vo (2015), Li et al. (2011), we set up the following model:

$$VOL_{i,t} = \beta_0 + \beta_1 Net_{i,t} + \beta_2 Marketvol_{i,t} + \beta_3 Size_{i,t} + \beta_4 Lev_{i,t} + \beta_5 Trturnover_{i,t} \\ + \beta_6 Growth_{i,t} + \beta_7 Foreign_{i,t} + \beta_8 SOE_{i,t} + v_i + \varepsilon_{i,t}$$

Where $VOL_{i,t}$ denotes the volatility of firm i in year t. As the main objective is to investigate the impacts of business network affiliation and network structure on stock return volatility, the construction of the stock return volatility indicator is crucial. The volatility measure constructed in this study is similar to that used by Chen et al. (2013) and consistent with Li et al. (2011) and Bae et al. (2004). Based on daily stock prices in Shanghai and Shenzhen stock exchanges in China for the period from 1997 to 2011, we construct two measure of return volatility as follows.

$$VOL1_{i,t} = \sqrt{\frac{1}{n-1}\sum_{1}^{n}(return_{i,k} - MEAN_{i,t})^2}$$

And

$$VOL2_{i,t} = \frac{1}{n}\sum_{1}^{n}\ln(return_{i,k})^2$$

Where $return_{i,k}$ is the daily return of stock i in day k, n is the number of trading days for stock i in a year, $MEAN_{i,t}$ is the annual average of stock returns in year t of firm i.

$Net_{i,t}$ is the variable that we are interested in. It is a dummy variable that equals to 1 if firm i affiliates to a business network in year t, and 0 otherwise. Our control variables are selected based on the literature that recognizes that stock return volatility is driven by firm characteristics (Vo, 2015). Firm size, leverage ratio, trading turnover, sales growth, foreign dummy, and SOE dummy are included as control variables in the model. Firm size is the logarithm of the sales at the end of the fiscal year. It is expected to be negatively related to stock return volatility (Bae et al., 2004; Li et al., 2011). Leverage is included as suggested by Wei & Zhang (2006). Leverage is measured as the ratio of total liability to total assets and is expected to be positively related with volatility of return. Growth is defined as the annual growth rate of sales. It is expected to be positively related to return volatility (Zhang, 2010). Trading turnover is the annual average number of shares traded in a day divided by the number of shares outstanding during the year. Foreign dummy variable indicates if the firm's ultimate controller is a foreign company. SOE dummy indicates if the firm's ultimate controller is an SOE. In order to control for market risk, this study adds market volatility as a control variable. The measures of market volatility are consistent with those used to measure firm return volatility. The Shanghai Composite Index and Shenzhen Composite Index are used to construct market volatility. Moreover, this study controls for industrywide and time differences in volatility using dummy variables. v_i is firm specific fixed effects.

In order to investigate the impacts of business network structure, this study further develops the model to include variables of network structure. The following model is constructed.

$$VOL_{i,t} = \beta_0 + \beta_1 Net\ structure_{i,t} + \beta_2 Marketvol_{i,t} + \beta_3 Size_{i,t} + \beta_4 Lev_{i,t} + \beta_5 Trturnover_{i,t} + \beta_6 Growth_{i,t} + \beta_7 Foreign_{i,t} + \beta_8 SOE_{i,t} + v_i + \varepsilon_{i,t}$$

The definition of volatility and the control variables are the same as above. $Net\ structure_{i,t}$ refers to the matrix of network structure. It consists of network size, network diversity, network centrality, constraint, and the property of networks. Network size is measured using the number of companies in a network. Network diversity refers to the ratio of the number of industries to network size. Moreover, this study adopts network position measures to capture the effects of network structures. Centrality measures the virtual position of an individual network member in its networks. A central network position brings the company more access to resources and information (e.g. Ahuja, 2000). Central positions are measured using degree centrality, which measures the number of direct contacts a focal firm has. Moreover, we employ aggregate constraint to measure the tightness of such networks. Both of these measures are calculated using Pajek software. The property of a network is determined by the property of the central firm in a network. We use dummies for SOE dominated and financial institution dominated to measure the property of the central firm. The SOE dominated dummy equals one if the center of the network is an SOE. Financial institution dummy indicates if the center of the network is a financial institution or not.

We use firm specific fixed effects to estimate these models, which is suggested by the literature and data structure. The Hausman test was adopted to choose the appropriate estimating strategy and firm fixed effects are suggested. This approach is widely taken in previous studies such as Vo (2015), Vo (2016), and Chen et al. (2013).

5.3.3 Descriptive statistics

Table 5.1 reports summary statistics of key variables. The mean value of stock return volatility is 0.028 and -8.364 according to the two measures described above. These figures are similar in essence to Chen et al. (2013) and Vo (2015). Figure 5.1 shows the dynamics of firm return volatility during the period. It is clear that firms' stock returns have generally experienced significant volatility since 2007 as a result of the global financial crisis. In terms of firm size measured as the logarithm of sales, the mean value is 19.905 with a standard deviation of 2.306. The average value of leverage is 0.467 with a standard deviation of 0.194, which is consistent with He et al. (2013) and Fan et al. (2012). This means that listed companies on average have 46.7% liabilities, which is relatively high compared to firms in the developed economies, such as US (Jiang & Kim, 2015). The growth of sale on average is 16.6%, which is consistent with the amazing growth rate of the Chinese economy. The trading turnover in the Chinese market is relatively high with an average of 231.9%, which is similar to that found by Chen et al. (2013).

<Table 5.1 inserted here>

<Figure 5.1 inserted here>

Regarding network variables, it is suggested that on average 31.3% of listed companies are affiliated into related party networks, which is much lower than is reported by other studies. We argue that the definition of business networks in our study is stronger than those used in other studies, resulting from our dropping many weak connections. Table 5.2 displays firm return volatility for firms that are in networks and those that are not. It shows that by both measures firms in networks are more volatile than isolated firms. Network size varies significantly with an average of 1.76. Network diversity varies with a mean value of 0.22. On average, each firm has 0.512 partners in networks. Among all firms, 17.4% of listed companies are in an SOE dominated network and 0.8% of listed companies are in a financial institution dominated network.

<Table 5.2 inserted here>

Table 5.3 reports correlation coefficients amongst the variables in this study. At first glance, we see that network affiliation is positively related to stock return volatility, which means that network affiliation may lead to higher stock return volatility. Network size, network diversity, network position, and network dominators are all found to be positively related to return volatility.

<Table 5.3 inserted here>

5.4 Results

Table 5.4 reports the regression results of the relationship between business networks and stock return volatility where the dependent variable is VOL1. Market volatility also shows significant positive coefficients. This means that firm return volatility is consistent with market volatility. Interestingly, we find that firm size is significantly positively related to stock return volatility, which contradicts our expectations. However, the result is consistent with results provided by Chen et al. (2013) and He et al. (2013), and suggests that firms in China become more volatile as the firm size is increased. In terms of trading turnover, this is positively related to volatility, which is consistent with both our expectations and the results found by Chen et al. (2013) and Li et al. (2011). Thus, the higher the firm's turnover, the higher the risk of return. As regarding leverage, we find that highly leveraged firms are significantly more volatile, which is consistent with our expectation that increased leverage makes firm's stock riskier (Gharbi et al., 2014). Growth is found to be significantly negatively related to volatility, and suggests that firms with higher growth potential are less volatile. Even though this contradicts our hypothesis, it is consistent with Vo (2015). As regards foreign dummy, we find that foreign-controlled firms in China are associated with greater stock return volatility. Even though many papers have argued that foreign investors can help to reduce risks for firms and accelerate better management practice, hence reducing return volatility (Vo, 2015; Li et al., 2011), many authors document a positive relationship between foreign ownership and return volatility. It is argued that foreign ownership increases risk exposure to international market risks and could destabilize the local market due to short-term speculations (Bae et al., 2004). SOE dummy is found to be positively related to stock return volatility.

<Table 5.4 inserted here>

Turning now to network affiliation, which is the variable of interest, table 5.4 suggests that network affiliation is statistically significantly positively related to stock return volatility. The estimated coefficient is significant at 1% significance level. This means that firms in related party networks are more volatile than free-standing firms. Our hypothesis 1 is supported. Even though business networks are beneficial for firms wishing to access various resources in inefficient markets, and although affiliation lowers the risk of default because of the internal support found in such networks (He et al., 2013; Gopalan et al., 2007), firms in networks in China actually suffer from higher return volatility. In business networks, firms are more exposed to the shocks experienced by other network members, which causes higher volatility. Whether the news for a member is good or bad, business networks will diffuse the information, which increases the number of transactions in the market and leads to stock return volatility. Moreover, business networks come with certain liabilities that may negatively affect firm performance (Singh & Gaur, 2009) and potentially lead to volatility in returns.

Moreover, the nature of the network structure makes a difference to the volatility of returns. Network size is found to have an inverted U shape relationship with firm return volatility. The estimated coefficients are statistically significant at 1% significance level. Firms' return volatility maps increases in network size until volatility peaks. It then decreases with further increases in network size. Our hypothesis 2a is therefore supported. In terms of network diversity, we see that just as for network size, there is an inverted U shape relationship with firm return volatility. The estimated coefficients are statistically significant at 1% significance level and suggest that as network diversity increases and firms are exposed to more sectors, firm return volatility increases. Once the degree of diversification has reached a peak, firm return volatility decreases with further increases in diversity as firms start to reap the benefits of scope. Consequently, our hypothesis 2b is supported.

As regards network position, we hypothesized that central firms are more volatile than peripheral ones because risks are directed to the central firm. The degree of centrality is found to be statistically positively related to return volatility, which confirms our H2c. The estimated coefficient is significant at 1% level. In terms of network tightness, the aggregated constraint is statistically significantly positively related to firm return volatility. The estimated coefficient is statistically significant at 1% significance level and means that firms in intermediate network positions are generally less volatile than those not, presumably due to their superior bargaining power over network partners which confirms our H2d. Finally, we also provide evidence that firms in SOE dominated networks are generally more volatile than those not which is H2e. The findings are consistent with our hypotheses. The estimated coefficients are statistically significant at 1% significance level. However, we do not find evidence that firms in financial institution dominated networks experience more stock return volatility.

Table 5.5 reports the regression results when the dependent variable is VOL2. Control variables generally have the same effects as were found in the above results. The only difference is firm size. It is found that firm size is significantly negatively related to firm return volatility using VOL2. The coefficients are expected. It means that large firms are less volatile than small firms. The results are consistent with Chen et al. (2013). The impact of business network affiliation and network structure on stock return volatility is generally consistent with the results in table 5.4. Network affiliation is positively related to return volatility. Network size in this specification shows a positive relationship with return volatility. Network diversity exhibits an inverted U shape relationship with stock return volatility. Central network position is positively related to firm return volatility, while networks with structural holes are negatively related to return volatility. Firms in SOE dominated networks are more volatile than those not. The similar results from the two regressions suggest that our results are quite robust.

<Table 5.5 inserted here>

As another robustness test, we employ a range-based volatility measure, which is a high-low volatility estimator. This is believed to incorporate more information about return volatility and is more efficient than the standard measures (Garman & Klass, 1980; Parkinson, 1980; Brandt & Jones, 2006), such as the two we used in this study. The high-low volatility estimator takes the value of the logarithm of difference between the high and low prices in a trading day. Table 5.6 reports the results where the dependent variable is constructed using a high-low volatility estimator, VOL3. The results support the finding that business network affiliation leads to higher stock return volatility. The coefficient is positive and significant at 1% level. Regarding network structure, network size and network diversity both show an inverted U shape relationship with firm return volatility; central network position, SOE dominated networks, and financial institution dominated networks lead to higher volatility. The results also suggest that structural hole is negatively related to firm return volatility. The results are consistent with findings using VOL1 and VOL2, which provides extra comfort for our results.

<Table 5.6 inserted here>

In order to ensure that the dependent variable and independent variable are stationary, we further adjust our model using the differences in non-stationary variables. In our model, firm size and growth are said to be non-stationary. By replacing them with differences in firm size and growth opportunities, we re-estimated our model and table 5.7 shows the estimation results. It is suggested that all the results are consistent with our main regression results, which provides further confidence in our results.

<Table 5.7 inserted here>

This study then examines the dynamic relationship between network affiliation and firm return volatility by adopting the dynamic GMM estimation of Arellano and Bond (1991), which is used to control for the potential endogeneity problem. This approach has been employed by Vo (2016) to settle the endogeneity issue. Table 5.8 shows the estimation results of the dynamic GMM estimation. A combination of lagged values and differenced forms of variables are used as instruments. It is suggested that all of the estimated coefficients for network affiliation are positive. The coefficients are statistically significant at 1% significance level. The Hansen test suggests that the overidentifying restriction is valid in this study. Therefore, the estimation results further confirm our previous estimation results.

<Table 5.8 inserted here>

Generally, our regression analysis shows that in China business network affiliation is associated with higher stock return volatility. Network size, network diversity, and degree centrality are found to be positively related to stock return volatility. Furthermore, it is suggested that foreign-controlled firms are more volatile in China.

The study is prone to cross-sectional dependence as individual units can be correlated due to network interactions. As mentioned in Chapter 3, ignoring cross-sectional correlation could lead to biased results. The CD-test statistically significantly rejects cross-sectional independent or weak cross-sectional correlation. Using the Driscoll-Kraay estimator, we controlled for cross-sectional correlation and delivered results consistent with the main regression. Table 5.9 reports the estimation results controlling for cross-sectional dependence. Network affiliation is proved to be positively related to stock return volatility. Network size and diversity exhibit inverted a U shape relationship with stock return volatility. Network centrality, network constraint and SOE dominated networks are positively related to return volatility.

<Table 5.9 inserted here>

5.5 Discussion and conclusion

This study investigates the role of business network affiliation and network structure on stock return volatility in China. This study makes many contributions. Theoretically, we add to the literature about the drivers of volatility by introducing and examining the effects of business networks. As business networks cause both positive and adverse consequences, the role of business networks in firms' return volatility can be investigated empirically. We argue that in emerging economies, such as China, the institutional environments are less developed and less efficient at allocating financial resources as a result of the frequent and significant government intervention in the capital markets (Allen et al., 2012; Du et al., 2013). Even though affiliation into business networks enables firms to access resources and information, and co-insurance of business networks helps firms to lower default risks (Goplan et al., 2007), firms in business networks are more exposed to other network members through interactions, which will lead to higher stock return volatility. As we established in chapter 3, firms in networks raise more debts. Thus, it is likely that firms will be more volatile since high leverage make firms riskier. Additionally, as network members are stakeholders for each other, networks impose significant governance challenges for firms. Affiliates may suffer from principle-principle agency problems because of the conflicting interest between controlling shareholders and minority shareholders. The widely documented "tunneling" activities will inhibit firm performance (Jiang et al., 2010). It is therefore argued such governance problems render networked firms more volatile. Furthermore, since firms in networks pay higher dividends than independent firms, stock return volatility for affiliates is theoretically higher since the stock price is the present value of expected stock dividends (Zhang, 2010). This study provides evidence that network affiliation is positively related to stock return volatility.

Moreover, while prior studies have focused on the fundamentals-based and volume-based factors influencing firm return volatility (Zhang, 2010), this study investigates the role of informal contracts, such as business networks, on firms' return volatility. While previous studies identified many factors that influence firm return volatility such as trading volume (Zhang, 2010; Mahender et al., 2014) or the presence of informed traders (Gangopadhyay et al., 2014), there is no study investigating the role of business networks on firm stock return volatility. By investigating and finding a statistically positive relationship between business network affiliation and firm stock return volatility, we add to the knowledge about the determinants of stock return volatility. To the best of our knowledge, this is the first study that explores and exploits the relationship between business networks and stock return volatility.

We also make important theoretical contributions by investigating the effects of network structure on firm stock return volatility. It is widely known that the form of network structure makes a difference to the degree of access to resources and information (Soh, 2010; Ahuja, 2000; Tsai, 2001). However, it is less well studied whether such differing effects lead to different results in stock return volatility. Unlike previous studies that focused more on network position (Chen & Xie, 2011; Sha & Zeng, 2014), we include a relatively wide set of network structures. We employ network size, network diversity, network position, and network dominators to examine the effects of network structures. Network size and network diversity exhibit an inverted U shape relationship with stock return volatility. Central position is found to be positively related to stock return volatility while an intermediate position is negatively related to stock return volatility. Moreover, firms in SOE dominated networks are more volatile than those not. By introducing to the literature a consideration of the impacts of network structure, we have proved that different network structures can be drivers of stock return volatility. Firms can therefore strategically adjust their return volatility by controlling for network structure.

Moreover, this study contributes to literature about networks by providing a new approach to the construction of network connections, and a detailed assessment of the impacts of network structure. We argue that listed company networks via related parties capture important connections among listed companies, which disclose the important components of the national economy. Such connections enable companies in networks to share information more efficiently. Networks constructed through such connections are more representative and the findings are more likely to be generalizable.

Empirically, we use a large and representative database of 1,971 listed companies over a 15 year period to investigate (i) the effects of business network affiliation on firm return volatility and (ii) how network structure shapes the impact of business networks on firm return volatility. Even though previous work has started to investigate the impacts of business networks (Ma et al., 2006; Guest & Sutherland, 2010), it has relied on small datasets for a single region of a country, and on relatively static data in a particular year or other short period. By using objective financial data over a longitudinal timeframe, we provide robust empirical evidence that business networks would lead to high stock return volatility in China. Moreover, we clarified the role of foreign ownership in the Chinese market. Even though the literature has documented both the bright and dark sides of foreign ownership, we provide evidence that in China foreign-controlled firms are more volatile than others. Unlike domestic firms in China that better understand the rules and can access local support, foreign firms are hampered by relative ignorance and can rarely access local support. Thus, foreign firms in China are more volatile than domestic firms.

Finally, this study contributes to the understanding of emerging markets by investigating business networks and stock return volatility in the emerging markets. Since stock return volatility has been widely investigated in the developed economies, examining the emerging economies through the lens of that understanding can enhance our knowledge, which in turn is important for those engaged in the international portfolio and risk management (McMillan & Evans, 2014).

This study has several implications for managers and policymakers. Firstly, when operating in emerging economies where the institutional framework is underdeveloped, managers can use network strategies to improve firms' access to otherwise scarce resources. However, firms also need to take into account the negative impacts of network affiliation. As we see in this study, business network affiliation leads to high stock return volatility. Firms need to manage the costs of being affiliated into networks. In order to maintain the network connection, they need to maintain the level of their interactions and this involves an investment of time and money. Firms may also need to sacrifice their independence so as to uphold the interests of the network, and firm governance may be affected. Firms need to balance the benefits and costs of business network affiliation.

Additionally, different network structures are associated with different effects. An understanding of the relationship between business network and firm return volatility helps managers to use the appropriate network strategies to maximize the benefits of networks and achieve strategic goals for firms. For example, a firm's manager could use this knowledge to manage the firm's strategies to attract different investors. Conservative investors may prefer low stock return volatility while gamblers are interested in highly volatile stocks. Some knowledge of the effects of business networks and network structure on firm return volatility can help managers' decision-making in order to attract specific types of investors. Moreover, this study also emphasizes the importance of policymakers improving the institutional environment so that firms, particularly foreign firms, can operate in a fair competitive environment. Policymakers also need to regulate the establishment of business networks and minimize the cost of such networks. Understanding the effects of business networks on firm return volatility is important for policy setting. Understanding the drivers of stock return volatility is particularly important in such a large emerging economy since the stock market is acutely vulnerable to shocks in the global market.

In summary, this study investigates the relationship between business network affiliation and network structure and stock return volatility. Using data from a listed company related party information database, listed company related party transaction database, listed company financial indicator database and stock price data, we construct a sample of 1971 listed companies over the period 1997-2011.

Adopting a fixed effects panel estimator and using several robustness checks, we find that firms in business networks via related parties are more volatile than isolated firms. It is necessary for the manager to be aware that business networks can generate adverse effects for affiliates, including a higher degree of stock return volatility. Additionally, it is suggested that as network size and network diversity increases, firm return volatility increases, peaks, and decreases. Furthermore, a central network position is positively related to firm return volatility while an intermediate network position is negatively related to firm return volatility. The network dominator also imposes significant influence over firm return volatility. It is suggested that, in China, firms in SOE dominated networks are more volatile than those others. Finally, our study also suggests that foreign-owned firms in China are more volatile in the market than domestic firms.

Tables for chapter 5

Table 5.1: Summary statistics of key variables in Chapter 5

Variable	Definition	Obs	Mean	Std. Dev.
Dependent Variable				
vol1	Annualised Standarded Deviation of Daily Returns for Each Year	16567	0.0279	0.0074
vol2	Annual Average of the Logarithm of Squared Returns	16565	-8.3640	0.5566
Network Variable				
net	Dummy Variable Takes Value 1 if Firms is Affiliated to Networks	16567	0.313	0.464
net_size	The Number of Firms in a Network	16567	1.766	3.652
net_diversity	Ratio of Number of Industries to Number of Network Members in the Networks	16567	0.222	0.357
net_degree	The Number of Contacts a Firm has in its Network	16567	0.512	0.876
net_constraint	Total Constraint the Network has to the Firm	16567	0.284	0.429
centre_soe	Dummy Variable Takes Value 1 if Firms Affiliated to a Network Dominated by SOE	16567	0.174	0.379
centre_financial	Dummy Variable Takes Value 1 if Firms Affiliated to a Network Dominated by a financial institution	16567	0.008	0.088
Control Variable				
marketvol1	Annualised Standarded Deviation of Market Composite Index	16567	238.338	254.172
marketvol2	Annual Average of the Logarithm of Squared Market Composite Index	16567	14.160	1.332
trturnover	The annual average number of shares traded in a day divided by the number of shares outstanding during the year.	16567	2.319	2.109
lev	Ratio of Total Liability to Total Assets	16567	0.467	0.194
size	Logarithm of Sales	16567	19.905	2.306
growth	Growth Rate of Sales	16567	0.166	0.343
foreign	Dummy Variable Takes Value 1 if Firms is Foreign-owned	16567	0.008	0.091
SOE	Dummy Variable Takes Value 1 if Firms is a SOE	16567	0.670	0.470

Table 5.2: Univariate analysis of Chapter 5

VARIABLES	Isolate		Network			
	Mean	Std Dev	Mean	Std Dev	Difference	Pr(T < t)
VOL1	0.02771	0.00008	0.02879	0.00012	-0.00108	0.00000
VOL2	-8.38870	0.00579	-8.32538	0.00865	-0.06332	0.00000

Note: Vol1 is the annualized standarded deviation of daily returns for each year. Vol2 is Annual Average of the Logarithm of Squared Returns.

Tabel 5.3: Correlation coefficients amongst variables

	vol1	vol2	net	net_size	net_di~y	net_de~e	net_co~t	centre~e	centre~l	marke~1	marke~2	trtur~r	lev	size	growth	foreign
vol1	1															
vol2	0.8711	1														
net	0.0699	0.0527	1													
net_size	0.0473	0.0224	0.7163	1												
net_divers~y	0.062	0.0484	0.9223	0.5013	1											
net_degree	0.0629	0.0423	0.8659	0.7614	0.7333	1										
net_constr~t	0.0735	0.0578	0.9801	0.6427	0.9253	0.7757	1									
centre_soe	0.0521	0.0316	0.6786	0.7514	0.5032	0.7378	0.6149	1								
centre_fin~l	0.0402	0.0325	0.1317	0.1863	0.1355	0.1111	0.1271	0.0044	1							
marketvol1	0.5949	0.534	0.0861	0.0757	0.0709	0.0806	0.0868	0.0757	0.0476	1						
marketvol2	0.1849	0.1219	0.0959	0.1498	0.0583	0.1087	0.0871	0.1125	0.0133	0.6353	1					
trturnover	0.4471	0.5055	-0.0276	-0.0211	-0.0221	-0.0229	-0.0239	-0.0424	-0.0139	0.2519	0.1659	1				
lev	0.0838	0.1654	0.093	0.0828	0.0815	0.0987	0.0829	0.0848	-0.0062	0.076	0.0416	-0.0103	1			
size	-0.059	-0.1078	0.0916	0.0831	0.0605	0.1059	0.0835	0.0995	-0.0204	0.0259	0.0478	-0.0808	0.0443	1		
growth	-0.0608	-0.0658	0.0091	0.0035	0.002	0.012	0.0057	0.0049	-0.0026	-0.0231	0.0161	0.0698	0.0066	0.1277	1	
foreign	0.0082	0.0028	-0.0375	-0.0327	-0.0335	-0.0392	-0.0349	-0.035	-0.0006	-0.0177	-0.0132	-0.0103	-0.014	-0.007	-0.014	1

Table 5.4: Business networks and firm return volatility using VOL1

Note: This table reports estimation of vol1 using firm fixed effects as in equation 1 in this chapter. Definitions of variables can be found in table 5.1.

VARIABLES	(1) vol1	(2) vol1	(3) vol1	(4) vol1	(5) vol1	(6) vol1	(7) vol1	(8) vol1
marketvol1	2.05e-06***	2.05e-06***	2.06e-06***	2.06e-06***	2.07e-06***	2.05e-06***	2.06e-06***	2.04e-06***
	(2.88e-07)	(2.88e-07)	(2.88e-07)	(2.88e-07)	(2.88e-07)	(2.88e-07)	(2.88e-07)	(2.88e-07)
size	6.10e-05***	5.86e-05***	5.89e-05***	5.86e-05***	5.85e-05***	5.88e-05***	5.99e-05***	6.13e-05***
	(1.55e-05)	(1.55e-05)	(1.55e-05)	(1.55e-05)	(1.55e-05)	(1.55e-05)	(1.55e-05)	(1.55e-05)
lev	0.00104***	0.00101***	0.000992***	0.00100***	0.000997***	0.00102***	0.00102***	0.00105***
	(0.000242)	(0.000242)	(0.000242)	(0.000242)	(0.000242)	(0.000242)	(0.000242)	(0.000242)
trturnover	0.00103***	0.00103***	0.00103***	0.00103***	0.00103***	0.00103***	0.00103***	0.00103***
	(2.45e-05)	(2.45e-05)	(2.46e-05)	(2.45e-05)	(2.46e-05)	(2.45e-05)	(2.46e-05)	(2.45e-05)
growth	-0.000466***	-0.000464***	-0.000460***	-0.000464***	-0.000463***	-0.000464***	-0.000464***	-0.000466***
	(8.93e-05)	(8.93e-05)	(8.93e-05)	(8.93e-05)	(8.93e-05)	(8.93e-05)	(8.93e-05)	(8.93e-05)
foreign	0.00129***	0.00127***	0.00127***	0.00127***	0.00128***	0.00127***	0.00127***	0.00129***
	(0.000419)	(0.000418)	(0.000418)	(0.000418)	(0.000418)	(0.000418)	(0.000419)	(0.000419)
soe	0.000364***	0.000346***	0.000330***	0.000341***	0.000337***	0.000351***	0.000326***	0.000363***
	(0.000118)	(0.000118)	(0.000118)	(0.000118)	(0.000118)	(0.000118)	(0.000119)	(0.000118)
net		0.000355***						
		(8.76e-05)						
net_sizesquare			-4.47e-06*					
			(2.49e-06)					
net_size			0.000105***					
			(3.47e-05)					
net_diversitysquare				-0.00138***				
				(0.000446)				
net_diversity				0.00162***				
				(0.000433)				
net_degree					0.000199***			
					(4.92e-05)			
net_constraint						0.000350***		
						(9.10e-05)		
centre_soe							0.000287***	
							(0.000103)	
centre_financial								0.000424
								(0.000348)
Constant	0.0248***	0.0249***	0.0249***	0.0249***	0.0249***	0.0249***	0.0249***	0.0248***
	(0.000805)	(0.000806)	(0.000805)	(0.000806)	(0.000805)	(0.000806)	(0.000806)	(0.000805)
Observations	16,567	16,567	16,567	16,567	16,567	16,567	16,567	16,567
R-squared	0.761	0.761	0.761	0.761	0.761	0.761	0.761	0.761
Number of id	1,971	1,971	1,971	1,971	1,971	1,971	1,971	1,971
Industry*Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors in parentheses

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

Table 5.5: Business networks and firm return volatility using VOL2

Note: This table gives the estimation of vol2 using firm fixed effects. Definitions of variables can be found in table 5.1.

VARIABLES	(1) vol2	(2) vol2	(3) vol2	(4) vol2	(5) vol2	(6) vol2	(7) vol2	(8) vol2
marketvol2	0.0147	0.0148	0.0148	0.0147	0.0147	0.0149	0.0146	0.0146
	(0.0117)	(0.0117)	(0.0117)	(0.0117)	(0.0117)	(0.0117)	(0.0117)	(0.0117)
size	-0.00457***	-0.00465***	-0.00467***	-0.00467***	-0.00465***	-0.00465***	-0.00464***	-0.00455***
	(0.00106)	(0.00106)	(0.00106)	(0.00106)	(0.00106)	(0.00106)	(0.00106)	(0.00106)
lev	0.257***	0.256***	0.255***	0.256***	0.256***	0.257***	0.256***	0.258***
	(0.0165)	(0.0166)	(0.0166)	(0.0166)	(0.0166)	(0.0165)	(0.0165)	(0.0165)
trturnover	0.0764***	0.0765***	0.0767***	0.0766***	0.0766***	0.0765***	0.0766***	0.0765***
	(0.00168)	(0.00168)	(0.00168)	(0.00168)	(0.00168)	(0.00168)	(0.00168)	(0.00168)
growth	-0.0472***	-0.0471***	-0.0470***	-0.0472***	-0.0471***	-0.0471***	-0.0471***	-0.0473***
	(0.00612)	(0.00612)	(0.00612)	(0.00611)	(0.00612)	(0.00612)	(0.00612)	(0.00612)
foreign	0.0389	0.0381	0.0380	0.0376	0.0386	0.0381	0.0377	0.0387
	(0.0287)	(0.0287)	(0.0287)	(0.0287)	(0.0287)	(0.0287)	(0.0287)	(0.0287)
soe	0.0146*	0.0140*	0.0131	0.0133	0.0137*	0.0142*	0.0123	0.0146*
	(0.00809)	(0.00809)	(0.00810)	(0.00810)	(0.00810)	(0.00809)	(0.00814)	(0.00809)
net		0.0122**						
		(0.00600)						
net_sizesquare			-0.000210					
			(0.000170)					
net_size			0.00476**					
			(0.00238)					
net_diversitysquare				-0.0985***				
				(0.0305)				
net_diversity				0.0990***				
				(0.0296)				
net_degree					0.00650*			
					(0.00337)			
net_constraint						0.0117*		
						(0.00623)		
centre_soe							0.0171**	
							(0.00703)	
centre_financial								0.0290
								(0.0238)
Constant	-8.584***	-8.581***	-8.580***	-8.577***	-8.580***	-8.582***	-8.577***	-8.582***
	(0.164)	(0.164)	(0.164)	(0.164)	(0.164)	(0.164)	(0.164)	(0.164)
Observations	16,565	16,565	16,565	16,565	16,565	16,565	16,565	16,565
R-squared	0.791	0.791	0.791	0.791	0.791	0.791	0.791	0.791
Number of id	1,971	1,971	1,971	1,971	1,971	1,971	1,971	1,971
Industry*Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 5.6: Regression results where the dependent variable is VOL3

Note: This table gives the estimation of vol3 using firm fixed effects. Definitions of variables can be found in table 5.1.

VARIABLES	(1) vol3	(2) vol3	(3) vol3	(4) vol3	(5) vol3	(6) vol3	(7) vol3	(8) vol3
marketvol3	0.0159	0.0180	0.0151	0.0169	0.0161	0.0183	0.0157	0.0151
	(0.0232)	(0.0231)	(0.0231)	(0.0231)	(0.0231)	(0.0231)	(0.0232)	(0.0232)
size	0.0152***	0.0148***	0.0149***	0.0148***	0.0147***	0.0148***	0.0151***	0.0153***
	(0.00154)	(0.00154)	(0.00154)	(0.00154)	(0.00154)	(0.00154)	(0.00154)	(0.00154)
lev	-0.238***	-0.244***	-0.243***	-0.244***	-0.246***	-0.242***	-0.241***	-0.237***
	(0.0240)	(0.0239)	(0.0239)	(0.0239)	(0.0239)	(0.0239)	(0.0240)	(0.0240)
trturnover	-0.0140***	-0.0134***	-0.0134***	-0.0134***	-0.0132***	-0.0136***	-0.0136***	-0.0139***
	(0.00243)	(0.00243)	(0.00243)	(0.00243)	(0.00243)	(0.00243)	(0.00243)	(0.00243)
growth	0.0524***	0.0528***	0.0530***	0.0529***	0.0529***	0.0529***	0.0527***	0.0523***
	(0.00886)	(0.00884)	(0.00885)	(0.00884)	(0.00884)	(0.00884)	(0.00886)	(0.00886)
foreign	0.151***	0.147***	0.148***	0.147***	0.150***	0.147***	0.148***	0.151***
	(0.0415)	(0.0414)	(0.0414)	(0.0414)	(0.0414)	(0.0414)	(0.0415)	(0.0415)
soe	0.0502***	0.0467***	0.0466***	0.0471***	0.0451***	0.0477***	0.0446***	0.0502***
	(0.0117)	(0.0117)	(0.0117)	(0.0117)	(0.0117)	(0.0117)	(0.0118)	(0.0117)
net		0.0697***						
		(0.00867)						
net_sizesquare			- 0.00142***					
			(0.000246)					
net_size			0.0234***					
			(0.00344)					
net_diversitysquare				-0.146***				
				(0.0441)				
net_diversity				0.213***				
				(0.0428)				
net_degree					0.0392***			
					(0.00487)			
net_constraint						0.0696***		
						(0.00900)		
centre_soe							0.0429***	
							(0.0102)	
centre_financial								0.0696**
								(0.0345)
Constant	-2.420***	-2.403***	-2.395***	-2.398***	-2.401***	-2.407***	-2.406***	-2.417***
	(0.134)	(0.134)	(0.134)	(0.134)	(0.134)	(0.134)	(0.134)	(0.134)
Observations	16,547	16,547	16,547	16,547	16,547	16,547	16,547	16,547
R-squared	0.627	0.629	0.628	0.629	0.629	0.628	0.627	0.627
Number of id	1,970	1,970	1,970	1,970	1,970	1,970	1,970	1,970
Industry*Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors in parentheses

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

Table 5.7: Business networks and firm return volatility controlling for non-stationary variables

Note: This table gives the estimation of vol1 using firm fixed effects. Definitions of variables can be found in table 5.1.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	vol1	vol1	vol1	vol1	vol1	vol1	vol1	vol1
marketvol1	1.07e-06***	1.08e-06***	1.08e-06***	1.08e-06***	1.10e-06***	1.08e-06***	1.09e-06***	1.07e-06***
	(3.05e-07)	(3.05e-07)	(3.05e-07)	(3.05e-07)	(3.05e-07)	(3.05e-07)	(3.05e-07)	(3.05e-07)
diff_size	-7.87e-06	-8.67e-06	-8.24e-06	-8.45e-06	-8.32e-06	-8.81e-06	-8.34e-06	-7.68e-06
	(1.21e-05)	(1.21e-05)	(1.21e-05)	(1.21e-05)	(1.21e-05)	(1.21e-05)	(1.21e-05)	(1.21e-05)
leverage	0.00118***	0.00114***	0.00113***	0.00114***	0.00113***	0.00115***	0.00116***	0.00119***
	(0.000260)	(0.000260)	(0.000260)	(0.000260)	(0.000260)	(0.000260)	(0.000260)	(0.000260)
trturnover	0.00107***	0.00107***	0.00108***	0.00107***	0.00107***	0.00107***	0.00107***	0.00107***
	(2.73e-05)	(2.73e-05)	(2.74e-05)	(2.73e-05)	(2.73e-05)	(2.73e-05)	(2.74e-05)	(2.73e-05)
diff_growth	-0.000189***	-0.000185***	-0.000183***	-0.000185***	-0.000186***	-0.000185***	-0.000187***	-0.000189***
	(6.69e-05)	(6.69e-05)	(6.68e-05)	(6.69e-05)	(6.69e-05)	(6.69e-05)	(6.69e-05)	(6.69e-05)
foreign	0.00145***	0.00143***	0.00144***	0.00142***	0.00144***	0.00143***	0.00143***	0.00144***
	(0.000446)	(0.000445)	(0.000445)	(0.000445)	(0.000445)	(0.000445)	(0.000446)	(0.000446)
soe	0.000488***	0.000462***	0.000447***	0.000460***	0.000456***	0.000468***	0.000444***	0.000487***
	(0.000127)	(0.000127)	(0.000128)	(0.000128)	(0.000128)	(0.000127)	(0.000128)	(0.000127)
net		0.000424***						
		(9.33e-05)						
net_sizesquare			-4.93e-06*					
			(2.59e-06)					
net_size			0.000117***					
			(3.65e-05)					
net_diversitysquare				-0.00142***				
				(0.000468)				
net_diversity				0.00173***				
				(0.000456)				
net_degree					0.000222***			
					(5.19e-05)			
net_constraint						0.000413***		
						(9.68e-05)		
centre_soe							0.000316***	
							(0.000108)	
centre_financial								0.000369
								(0.000357)
Constant	0.0205***	0.0206***	0.0206***	0.0206***	0.0206***	0.0206***	0.0206***	0.0205***
	(0.000769)	(0.000769)	(0.000768)	(0.000769)	(0.000768)	(0.000769)	(0.000769)	(0.000769)
Observations	14,172	14,172	14,172	14,172	14,172	14,172	14,172	14,172
R-squared	0.767	0.767	0.768	0.767	0.767	0.767	0.767	0.767
Number of id	1,629	1,629	1,629	1,629	1,629	1,629	1,629	1,629
Industry*Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors in parentheses

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

Table 5.8: Dynamic GMM estimation results in Chapter 5

Note: This table gives the estimation of vlo1 and vol2 using dynamic gmm. Instruments are differences and lags of variables. Definitions of variables can be found in table 5.1.

VARIABLES	(1) vol1	(2) vol2
marketvol1	1.66e-05***	
	(4.76e-06)	
marketvol2		0.402**
		(0.190)
firmsize	-0.00195***	-0.000853
	(0.000498)	(0.0250)
leverage1	0.00244	0.0145
	(0.00991)	(0.424)
trturnover	0.00360***	0.118***
	(0.000874)	(0.0433)
growth_sale	0.000373	-0.0228
	(0.00243)	(0.0963)
foreign	1.869***	73.88*
	(0.496)	(43.84)
soe	0.0533***	8.096***
	(0.00994)	(3.018)
net	0.00786***	6.904***
	(0.00280)	(2.603)
Hansen's J	0.82	4.53
Observations	14,172	14,168
Number of id	1,629	1,629

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 5.9: Correction for cross-sectional dependence

Note: These table are estimated using Driscoll-Kraay estimator to control for cross-sectional dependence. The definition of variables can be found in table 5.1.

Panel A: Vol1

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	vol1	vol1	vol1	vol1	vol1	vol1	vol1	vol1
marketvol1	2.05e-06***	2.06e-06***	2.06e-06***	2.06e-06***	2.07e-06***	2.05e-06***	2.06e-06***	2.04e-06***
	(2.93e-07)	(2.91e-07)	(2.94e-07)	(2.92e-07)	(2.92e-07)	(2.91e-07)	(2.93e-07)	(2.93e-07)
size	5.87e-05***	5.62e-05***	5.64e-05***	5.61e-05***	5.61e-05***	5.64e-05***	5.75e-05***	5.90e-05***
	(1.85e-05)	(1.85e-05)	(1.86e-05)	(1.84e-05)	(1.82e-05)	(1.85e-05)	(1.86e-05)	(1.87e-05)
lev	0.00101	0.000975	0.000959	0.000968	0.000964	0.000985	0.000985	0.00101
	(0.000675)	(0.000684)	(0.000681)	(0.000688)	(0.000679)	(0.000682)	(0.000683)	(0.000675)
trturnover	0.00102***	0.00103***	0.00103***	0.00103***	0.00103***	0.00103***	0.00103***	0.00102***
	(0.000104)	(0.000104)	(0.000105)	(0.000105)	(0.000105)	(0.000104)	(0.000105)	(0.000104)
growth	-0.000454**	-0.000451**	-0.000447**	-0.000451**	-0.000451**	-0.000451**	-0.000451**	-0.000454**
	(0.000176)	(0.000176)	(0.000175)	(0.000176)	(0.000177)	(0.000176)	(0.000177)	(0.000176)
foreign	0.00131***	0.00129***	0.00129***	0.00128***	0.00130***	0.00128***	0.00129***	0.00131***
	(0.000394)	(0.000393)	(0.000390)	(0.000392)	(0.000389)	(0.000394)	(0.000394)	(0.000393)
soe	0.000361**	0.000342**	0.000327*	0.000338*	0.000334*	0.000347**	0.000321*	0.000361**
	(0.000161)	(0.000158)	(0.000163)	(0.000159)	(0.000159)	(0.000158)	(0.000163)	(0.000161)
net_sizesquare			-4.96e-06***					
			(1.42e-06)					
net_size			0.000111***					
			(1.94e-05)					
net		0.000365***						
		(7.40e-05)						
net_diversitysquare				-0.00135**				
				(0.000539)				
net_diversity				0.00160***				
				(0.000491)				
net_degree					0.000200***			
					(4.96e-05)			
net_constraint						0.000361***		
						(7.62e-05)		
centre_soe							0.000297***	
							(8.36e-05)	
centre_financial								0.000417
								(0.000280)
Constant	0.0269***	0.0270***	0.0270***	0.0270***	0.0270***	0.0270***	0.0270***	0.0269***
	(0.000418)	(0.000425)	(0.000427)	(0.000431)	(0.000420)	(0.000422)	(0.000428)	(0.000418)
Observations	16,567	16,567	16,567	16,567	16,567	16,567	16,567	16,567
Number of groups	1,971	1,971	1,971	1,971	1,971	1,971	1,971	1,971

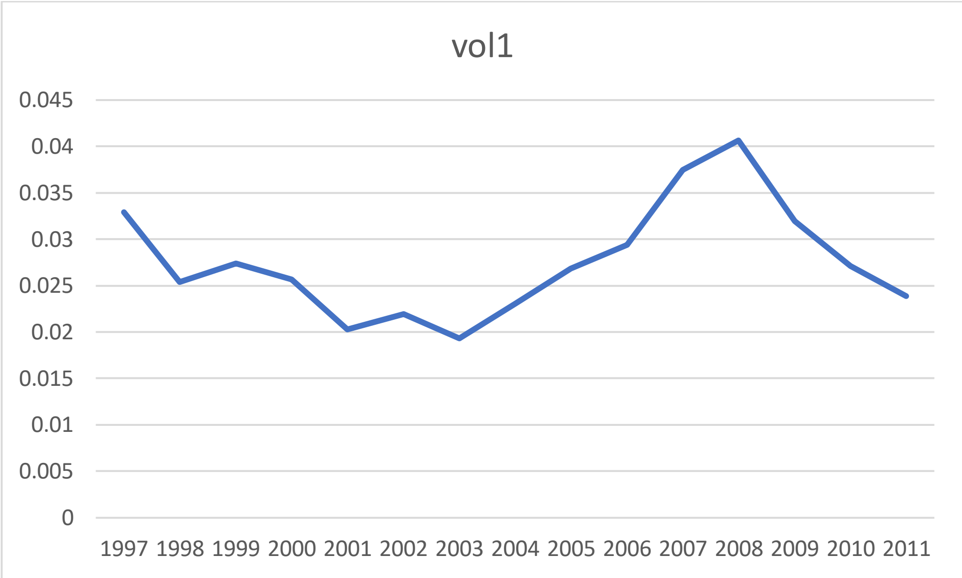
Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

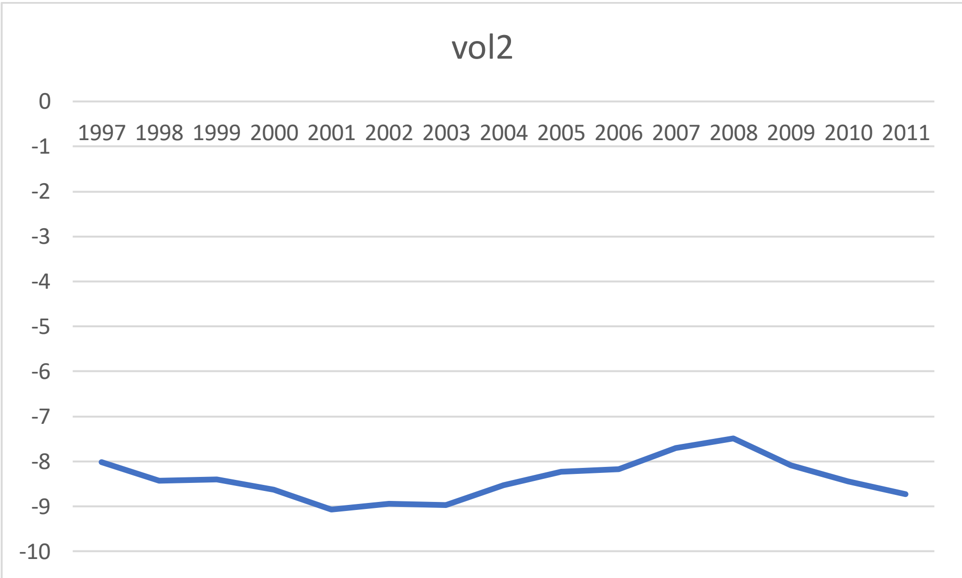
Panel B: Vol2

VARIABLES	(1) vol2	(2) vol2	(3) vol2	(4) vol2	(5) vol2	(6) vol2	(7) vol2	(8) vol2
marketvol2	0.0136	0.0137	0.0137	0.0136	0.0136	0.0138	0.0135	0.0134
	(0.00985)	(0.00994)	(0.00996)	(0.00998)	(0.00999)	(0.00991)	(0.0101)	(0.00979)
size	-0.00464*	-0.00473*	-0.00475*	-0.00475*	-0.00473*	-0.00472*	-0.00472*	-0.00462*
	(0.00248)	(0.00246)	(0.00247)	(0.00248)	(0.00248)	(0.00246)	(0.00248)	(0.00248)
lev	0.259***	0.258***	0.257***	0.257***	0.258***	0.259***	0.258***	0.260***
	(0.0579)	(0.0586)	(0.0589)	(0.0591)	(0.0584)	(0.0584)	(0.0589)	(0.0578)
trturnover	0.0764***	0.0765***	0.0766***	0.0766***	0.0765***	0.0765***	0.0766***	0.0764***
	(0.0100)	(0.0100)	(0.0100)	(0.0100)	(0.0100)	(0.0100)	(0.0101)	(0.0100)
growth	-0.0468***	-0.0467***	-0.0465***	-0.0467***	-0.0467***	-0.0467***	-0.0467***	-0.0468***
	(0.00829)	(0.00829)	(0.00821)	(0.00828)	(0.00828)	(0.00830)	(0.00829)	(0.00829)
foreign	0.0398	0.0390	0.0389	0.0384	0.0395	0.0389	0.0386	0.0396
	(0.0270)	(0.0268)	(0.0266)	(0.0266)	(0.0267)	(0.0269)	(0.0268)	(0.0269)
soe	0.0149	0.0142	0.0134	0.0135	0.0140	0.0144	0.0125	0.0149
	(0.00914)	(0.00887)	(0.00916)	(0.00878)	(0.00906)	(0.00888)	(0.00878)	(0.00916)
net_sizesquare			-0.000226*					
			(0.000115)					
net_size			0.00503***					
			(0.00142)					
net		0.0130**						
		(0.00482)						
net_diversitysquare				-0.102***				
				(0.0341)				
net_diversity				0.103***				
				(0.0329)				
net_degree					0.00701***			
					(0.00195)			
net_constraint						0.0126**		
						(0.00508)		
centre_soe							0.0180***	
							(0.00470)	
centre_financial								0.0279
								(0.0194)
Constant	-8.523***	-8.523***	-8.522***	-8.519***	-8.520***	-8.524***	-8.518***	-8.522***
	(0.130)	(0.131)	(0.131)	(0.131)	(0.131)	(0.131)	(0.132)	(0.129)
Observations	16,565	16,565	16,565	16,565	16,565	16,565	16,565	16,565
Number of groups	1,971	1,971	1,971	1,971	1,971	1,971	1,971	1,971

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Figure 5.1: Firm return volatilities during 1997-2011





Note: Vol1 is the annualized standard deviation of daily returns for each year. Vol2 is Annual Average of the Logarithm of Squared Returns.

Chapter 6 Conclusion

Chapter 6 Conclusion

6.1 Summary

This study was initially motivated by the pervasiveness and popularity of various business networks and their importance for business operations and firm performance. Business networks are widely seen and extensively used by firms in the emerging economies due to the prevalence of market failure and information problems. Business networks are particularly popular in China. By adopting and managing appropriate network strategies, firms can achieve and sustain competitive advantages. The literature has documented the importance of business networks on sale growth, market expansion, firm efficiency, and operating performance. Adopting a network perspective is helpful in reaching an understanding of this economic phenomenon. It is suggested that network connections are crucial and can even determine the survival of firms.

The importance and popularity of business networks in the emerging economies has sparked interest from researchers. However, the findings thus far have been relatively ambiguous, with studies concentrating on either the advantages or the disadvantages of business networks. Further, the literature is relatively blank in relation to some aspects of the topic. For example, there has been limited academic focus on how business networks affect firms' stock return volatility. The nature and extent of the impacts of business networks remains an open question that deserves additional investigation.

To investigate the role of business networks, we construct business networks employing data from CSMAR database and Datastream. These databases give us access to listed company related party information data, listed company related party transaction data, listed company financial indicator data, listed company corporate governance data, and listed company stock price data. We are, as a result, able to construct business networks that capture a wide range of important network relationships and are, we believe, superior to the definitions used previously in the literature. Using these networks we are able to further investigate the consequences on firms of affiliating into business networks. We believe our findings are more reliable due to the completeness of relations captured.

The thesis is composed of 6 chapters that approach a thorough understanding of business networks in China. First of all, an introduction chapter presents an overview of the motivations, research questions, data and methodology, and key findings. In the next chapter, we discuss an overview of business networks in China in which we outline the dynamics and features of business networks. These two chapters are descriptive in nature to provide an overall picture and some background to business networks. The understandings gleaned from the business networks we construct in chapter 2 underpin the three empirical studies that follow, which investigate the role of business networks on firm finance, corporate performance and market response.

In chapter 3, we examine the financing advantages accessible by firms in business networks in order to provide a potential answer to the question of why business networks are so prevalent. We do this by testing the effects of business networks on firms' debt financing, access to trade credit, working capital management and cash sufficiency.

After exploiting the effects of business networks on firms' access to financial resources, we examine in chapter 4 the relationship between business networks and firm performance, and test how firm strategy can affect the relationship. This chapter provides a new insight into performance implications using management costs calculations, and contributes to the literature on the net effects of business networks. In chapter 5, we investigate the effects of business networks on firms' market response using firms' stock return volatility. This gives us a more complete understanding of the consequences of business networks. Finally, we conclude the thesis and outline contributions and limitations.

This study has generated interesting findings. Through a systematic descriptive analysis of business networks in China, we disclose the dynamics of business networks, business network composition, and some individual features of business networks in China.

Moreover, by adopting network perspectives we also provide new insights into state capitalism in China. We find that the number of firms in business networks has expanded considerably during the period studied. We see how the development of business networks in China is shaped by the development of its economy, with business network development being uneven across sectors, and SOEs remaining actively involved in the process. Moreover, we provide new insights into the debate of "the state advances and private retreats". From a network perspective, we can see that SOEs are indeed expanding their influence through network size and network centrality at a time when private firms are relatively stalled or even shrinking. By comparing the features of ownership networks and general networks, we generate insights that different networks impose different effects.

Using the business networks we constructed in chapter 2, we further investigate their consequences. Firstly, this study investigates the role of business networks on firms' debt financing, access to trade credit, working capital management, and cash sufficiency, to offer a view on the financing advantage of business networks. We find that firms in business networks have superior access to long-term debts, short-term debts, trade credit and have more efficient working capital management and sufficient cash for investment. Moreover, we find that the effects of business networks are mediated by institutional factors and the nature of business networks. Evidence shows that SOEs in business networks have better access to debts and trade credit while non-SOEs in networks have more efficient working capital management and sufficient cash. Among ownership networks, collaboration networks, and individual networks, individual networks have the largest marginal effects while collaboration networks are less significant in influencing firms' access to financial resources. Network centrality and structural holes are significant factors that shape network effects.

This study also investigates the impacts of business network affiliation on firms' management cost and firm performance, and the impacts of concentrated ownership on such relationships. We find that business networks affiliation is negatively related to firm performance in terms of profitability. Evidence shows that firms in business networks incur higher management costs. Among the three types of business networks, ownership networks and collaboration networks are found to have significant influence over firm performance and management cost. Interestingly, concentrated ownership is an important mediator for these relationships.

Finally, since firms in business networks are exposed to other network members, this study examines the relationship between business networks and stock return volatility to model the effects of business networks on firms' market response. We find that firms in business networks are more volatile than independent firms. Additionally, the results show that network size and network diversity exhibit an inverted U shape relationship with stock return volatility. Holding a central position in a network is positively related to stock return volatility while structural hole networks are negatively related to stock return volatility. Moreover, we also find that firms in SOE dominated networks are more volatile than those not.

6.2 Contributions

Through this study, we have made several contributions. First of all, as previous studies use business network definitions that either include weak connections or exclude important connections, we propose a new approach to defining business networks. Using relations classified as related parties, we construct business networks that capture many important relations. We believe the definition is superior to those used in previous studies (e.g. Carney et al., 2009; Wu et al., 2010; Ren et al., 2009) since it ensures that all network members have control or significant influence over each other. While previous studies were heavily focused on related party transactions, we adopt a network perspective to assess the extent of the relations among listed companies. Using this definition of business networks, we are also able to configure how different types of relationships work based on the rich information available on relations between listed companies. Previous studies have used a single sole relationship to define their business networks (Ren et al., 2009; He et al., 2013; Gulati, 1998); this study identifies ownership networks, collaboration networks, and individual networks and investigates the role of each. Knowledge has been added to the literature of business networks by this understanding of how the nature of business networks affects the network's effects.

Additionally, we contribute to network studies in China by providing a systematic understanding of the features and dynamics of business networks and examining how network structures shape network effects. This research has provided an overall picture of business networks, something that has been relatively absent from the literature since studies on China have heavily focused on how guanxi matters (Ren et al., 2009; Li et al., 2014). We find that business networks have expanded significantly over the period we studied, and that the development of business networks is shaped by the economic features of the national economy. Using panel data, we have been able to comment on the dynamics of business networks; this is something that is not often seen in the literature due to data constraints. This study also contributes to network studies by examining the role of network structure. Network structure is an important factor that shapes network effects. Unlike previous studies that suggested a positive relationship between central position and firms' access to financial resources and firm performance, we have found that there is a positive relationship between central position and firms' access to financial resources, but a negative relationship between central position and firm performance.

Moreover, by adopting a network perspective, we have been able to model the channels for how business networks affect firms in terms of firm financing, operating performance, and market response. We have provided evidence that firms in business networks have superior access to finance, impaired firm performance due to higher management cost, and more volatile stock return in the market. We have provided a complete view of business networks incorporating both their bright sides and dark sides.

Furthermore, this study contributes to the literature of corporate finance in several ways. Firstly, we investigate the role of business network affiliation on firms' access to financial resources in order to partially answer the question of why and how business networks are still prominent given the significant improvement in the institutional environment (Byun et al., 2013). By inspecting the relationships between business network affiliation and firms' access to debts, trade credit, working capital management, and cash sufficiency and how the nature of business networks and institutional factors affect these relationships, we contribute to the literature by establishing that firms in business networks are less financially constrained.

Second, while previous studies were relatively focused on the influences of firm/product characteristics on trade credit (Liu et al., 2016), this study examines how informal contracts affect firms' access to trade credit. Previous studies looked at the impact of business networks on firms' access to formal finance (Claessens et a., 2008; Liu et al., 2013; Haselmann et al., 2013), while this study examines the relationship between business networks and firms' access to informal finance, which is severely affected by information asymmetry and moral hazard. Third, by investigating the role of business networks on firms' working capital management, we contribute to a relatively neglected area of study (Singh & Kumar, 2014). Studies on working capital management are limited in number and scope, with focus being concentrated on the relationship between working capital management and firm performance (e.g. Wang, 2002; Deloof, 2003). This study expects to add to the knowledge by shedding light on the determinants of working capital management.

Fourth, we investigate the role of business network affiliation on management cost and subsequent financial performance to provide another channel of understanding for how business network affiliation affects firm performance. This chapter contributes to the debate on the net benefits of business networks (Purkayastha & Lahiri, 2016) by adding empirical evidence to the effect that business networks cause higher management costs for firms. We also examine the contingency value of concentrated ownership on the relationship between business network affiliation and management cost as well as firm performance to provide evidence for how corporate governance can shape the role of business network effects. We add empirical evidence of how firm strategy can affect the relationship between network affiliation and financial performance (Carney et al., 2011).

Fifth, adopting stock price data, we construct measures of stock return volatility and investigate the relationship between business network affiliation and network structure and stock return volatility. We identify the impacts of the informal contracts and institutions that are typical of business networks on firm return volatility rather than relying on the traditional fundamental or trading volume-based factors (Zhang, 2010). We have identified that business networks are important factors that cause higher stock return volatility. Network structures also carry significant weight in shaping the role of the effects of business networks.

We contribute to the research on emerging economies. Studies have stressed the role that the political economy has on firms, particularly regarding the lack of formal institutions (Cull et al., 2015; Zhou, 2013; Chen et al., 2011). This study further investigates the role of business connections among firms and provides evidence that business networks are vitally important for firms in emerging markets.

Finally, by investigating the role of SOEs in business networks, this research further contributes to the literature on state capitalism. Adopting a network perspective, we provide new insights into the debate of “state makes advances and private retreats”, which is a theory that has until now gained little empirical support (Ji, 2010; Hu, 2012). This study further contributes to the literature on state capitalism by investigating the role of ownership in the relationship between network affiliation and firms’ access to financial resources. The results suggest that the role of business networks in firms’ financing is mediated by the ownership of the focal firm.

Through studying business networks in China, we have knowledge of their characteristics and their impacts on firms' access to financial resources, firm performance, and market response in terms of stock return volatility. The findings of this study have significant managerial implications. We have outlined both the positive and negative aspects of business networks in this study, which enables managers to consciously select a network strategy that best fits the needs of the firm. Understanding the relationship between business networks and firms' finance helps firms to choose a financing strategy that is appropriate for them; this is crucial for firms' survival and growth. Greater knowledge of the effects of business networks on firm performance and the role of ownership concentration helps firms to properly choose their network strategy and guides firms in networks to better manage their network costs; they can therefore reap the full benefits of affiliation. Managers should search for ways to maximize the benefits of business networks while minimizing the costs.

The findings concerning the relationship between business networks and firm stock return volatility equip firms with the tools to attract investors properly. Network effects are shaped by many factors including network nature, institutional factors, corporate governance, and network structure; this knowledge can encourage firms to use business networks strategically.

Understanding the impacts of business networks also has strong policy implications for Chinese policymakers, who can use this knowledge to assist their management of the market and achieve their goals for economic reform in China. This study provides some evidence of the advance of SOEs and their more prominent roles in networks. It is important for policy makers to come up with ways of managing the market to promote a fairer competitive environment. The knowledge of determinants of stock return volatility provides important tools for policy makers to control for volatility. More broadly, this study also has important implications for foreign investors in China. It is necessary for foreign competitors to realize that in China they may not be competing with individual firms but rather with a network of firms, and that their solution could be to get involved themselves in business networks in China.

6.3 Limitations and future studies

Like many other studies, this study suffers from several limitations. First of all, because we do not have data for non-listed companies in China, this study only looks at the networks in which listed companies are involved. The listed company network is clearly a sub-network of the whole network, and this narrowing of focus prevents us from gaining a more direct and accurate picture of business networks in China. Even though we have been able to perform some network measures for the whole network, we have not investigated its consequences and features. According to our definition related parties have either control or significant influence over each other, meaning that our definition only captures major relations while omitting many existing connections. Investigating a network that involves all firms would undoubtedly be more helpful in understanding the national economy. Moreover, as we exclude non-listed companies, there is the potential for sample selection. Future studies could consider using our definition to construct business networks involving both listed and non-listed companies to gain a more complete and reliable understanding of business networks.

Additionally, even though this study sheds some light on business networks dynamics and evolution in chapter 2, we do not identify the factors that affect the formation of business networks. As business networks are crucial for firms' survival and growth, greater understanding of the factors that prompt their formation would be useful in assisting firms' networking decisions. Many network studies investigate the consequences of business networks but there has been limited academic focus on identifying the factors that influence firms' decisions to network. Knowledge of the determinants of business networks would enable firms to refine their tactics for managing business networks. Future studies could consider what factors drive the formation and evolution of business networks, and provide a more thorough understanding of business networks. Potential research questions could be "What factors drive the entry and exit of business networks?" and "How does firm strategy affect firms network decisions?"

As has been evidenced in this research, firms in business networks have financing advantages over independent firms. However, firms' performance in terms of their profitability deteriorates rather than improves. Studies have suggested that the benefits of business networks are often not realized due to various offsetting costs (Claessens et al., 2006; Lee et al., 2008; Carney et al., 2011) but studies that outline how the costs of business networks affect firm performance are limited. In this study, we use management cost of firms to explain the negative relationship between business networks and firm performance and thereby partly answer the question of how business networks tarnish firm performance. A thorough understanding of the internal working systems of business networks needs to be generated to capture how the cost of business networks outweigh their benefits. Understanding the internal working of business networks could also explain in detail how the benefits and costs of business networks conflict with each other. For example, future studies could investigate resource allocation among firms in networks to have an idea of how business networks work and why networked firms relatively underperform in comparison to free-standing firms.

Furthermore, although this study investigates the effects of network affiliation status it does not provide evidence on how the extent of firms' involvement in business networks affects firms' network effects. In this study, we use different types of relations to identify different networks and outline the strength of networks. We also have some network structure measures to examine how firms are positioned differently in business networks.

We have therefore partially captured the intensity of business networks. However, as we mainly use a dummy variable to indicate firms' network affiliation status, we have been unable to capture the effects of all the different extents to which firms may be involved in business networks. We are aware that some firms actively participate in network activities while other firms do not. Some firms in networks are activity organizers, while the others are merely participants. We expect that different degrees of involvement in business networks would make a difference to firm performance. Future studies can consider proxying the level of participation in network activities to provide evidence of how the extent of involvement mediates network effects.

Fifth, there are many findings that need further exploration and we believe that mixed methodologies can be used to generate a more complete understanding of business networks. We can interview firms in networks to capture their internal working mechanism and thereby explain more thoroughly the benefits and costs of business networks affiliation. Using primary data, we can incorporate unlisted companies to generate a more representative sample to investigate business networks. By using mixed methods, we can potentially investigate the reasons underlying the empirical evidence. This study has presented a swathe of empirical evidence to support our hypotheses but the explanations of many of our results are based on previous studies in the literature. These studies were based on different definitions and research contexts and thus may not sufficient in explaining the current findings. With mixed methods, we can further examine the underlying principles of our findings and provide extra comfort for our results.

Last but not least, the study suffers from cross-sectional dependence problems as suggested by the CD-test. This is a common issue in every panel data study and may affect parameter estimation and inference since the presentation of the panel statistics has assumed that individuals are cross-sectional independent (Sarafidis & Wansbeek, 2012; Kok & Munir, 2015). It is evidenced that conventional panel estimators, such as fixed or random effects, are subject to misleading inference and even inconsistent estimators (Kok & Munir, 2015). In our case, firms have bonded together and formed networks to take coordinated actions. Fisher (1935) claims that "patches in close proximity are commonly more alike." We acknowledge the possibility that our network dependent variable can be jointly determined. In this case, our estimations may produce misleading results. We have dealt with it using the Driscoll and Kraay estimator which is cross-sectional dependence robust.

However, we also aware that this approach is unlikely to resolve the remaining endogeneity issue. This approach only works to correct standard errors if the unobserved factor that create the joint dependence are not correlated with the included independent variables. However, the estimators we used are some form of firm fixed effects model which a control for individual level of time invariable unobserved component. To some extent, which control for individual level time invariable unobservable components that may cause potential endogeneity. To some extent, we hope that this would address some potential endogeneity, although it may not be adequate in the cases when there are omitted variables that are not time-invariant firm specific, such as management skills. Moreover, in this study we adopted endogenous treatment effects which controls endogeneity issue for all models in Chapter 3. In order to solve this problem better, future studies could adopt models that control cross-sectional dependence to deliver more efficient results. For example, future studies can use spatial models to deal with this issue. Another alternative approach is the factor structure approach, which also effectively corrects for the dependence. Future research can also consider using GMM estimator to eliminate the possibility of endogeneity.

References

Accounting tools. Cash Flow Adequacy Ratio https://www.accountingtools.com/articles/cash-flow-adequacy-ratio.html (accessed September 08, 2017).
Achrol R. & Kotler P. (1999) Marketing in the Network Economy. Journal of Marketing 63, 146-163.
Adler, P. S. & Kwon, S. (2002) Social capital: Prospects for a new concept. Academy of Management Review, 27: 17-40.
Aguilera R. (1998) Directorship Interlocks in Comparative Perspective: The Case of Spain. European Sociological Review. 14: 319-342.
Ahmed A., Billings B., Morton R. & Stanford-Harris M. (2002) The Role of Accounting Conservatism in Mitigating Bondholder-Shareholder Conflicts over Dividend Policy and in Reducing Debt Costs. Account. Rev. 77: 867-890.
Ahuja, G. (2000) Collaboration Networks, Structural Holes, and Innovation: A Longitudinal Study. Administrative Science Quarterly, 45: 425-455.
Ahuja M., Robert L. & Dennis A. (2008) Social Capital and Knowledge Integration in Digitally Enabled Teams. Information Systems Research. 19, 314-335
Aktas N., Croci E. & Petmezas D. (2015) Is working capital management value-enhancing? Evidence from firm performance and investments. Journal of Corporate Finance. 30, 98-113
Allen F., Qian J. & Qian M. (2005) Law, Finance, and Economic Growth in China. Journal of Financial Economics, 77: 57-116.
Allen F., Qian J., Zhang C. & Zhao M. (2012) Chinas Financial System: Opportunities and Challenges. National Bureau of Economic Research Working Paper No. 17828. Cambridge, MA: National Bureau of Economic Research.
Almeida H., Kim C. & Kim H.B. (2015) Internal capital markets in business groups: evidence from the Asian Financial Crisis. The Journal of Finance. 6, 2539-2586
Amber T. & Witzel M. (2000) Doing business in China. London: RoutledgeCurzon
Anderson R., Mansi S. & Reeb D. (2003) Founding Family Ownership and the Agency Cost of Debt. J. Account. Econ. 68, 263-285.
Anwar S., Singh S. & Jain P. K. (2015) Cash Dividend Announcements and Stock Return Volatility: Evidence from India. Procedia Economics and Finance. 30: 38-49
Arellano M. & Bond S. (1991) Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. Rev. Econ. Stud. 58 (2): 277-297
Attanasio O. P. (1990) Asset Price Volatility and Information Structure. Econ. Lett. 33 (2): 159-164
Ayyagari M., Demirguc-Kunt A. & Maksimovic V. (2010) Formal versus informal finance: Evidence from China. Rev. Financ. Stud. 23, 3048-3097.
Bae K-H., Kang J-K. & Kim J-M (2002) Tunneling or value added? Evidence from mergers by Korean business groups. Journal of Finance. 57, 2695-2740.
Bae K., Chan K., Ng A. (2004) Investibility and Return Volatility. Journal of Financial Economics. 71: 239-263.
Bae G., Cheon Y. & Jun-Koo K. (2008) Intragroup Propping: Evidence from the Stock-Price Effects of Earnings Announcements by Korean Business Groups. Review of Financial Studies. 21 (5): 2015-2060.
Barney J. (1991) Firm resources and sustained competitive advantage. Journal of Management, 17 (1): 99-120.
Ben-Nasr H. (2016) State and foreign ownership and the value of working capital management. Journal of Corporate Finance. 41, 217-240.
Bennett J., Sias R. & Starks L. (2003) Greener Pastures and the Impact of Dynamics Institutional Preferences. Review of Financial Studies. 16: 1203-1238.
Berkman H., Cole R. & Fu L. (2014) Improving Corporate Governance Where the State is the Controlling Block Holder: Evidence from China, The European Journal of Finance, 20:7-9, 752-777.
Bertrand M., Mehta P. & Mullainathan S. (2002) Ferreting out tunneling: an application to Indian business groups. Q. J. Econ. 117, 121-148.
Bezuidenhout C.N., Bodhanya S., Sanjika T., Sibomana M. & Boote G.L.N. (2012) Network-analysis approaches to deal with causal complexity in a supply network. International Journal

of Production Research. 50 (7): 1840-1849.
Bias B. & Gollier C. (1997) Trade credit and credit rationing. Rev. Financ. Stud. 10, 903-937.
Bradford Harry (2012) These 10 Companies Control Enormous Number Of Consumer Brands. Online: http://www.huffingtonpost.com/2012/04/27/consumer-brands-owned-ten-companies-graphic_n_1458812.html
Brandt M. & Jones C. (2006) Volatility Forecasting with Range-Based EGARCH Models. Journal of Business & Economic Statistics. 24 (4): 470-486.
Borgatti, S. & Halgin, D. (2011) On Network Theory. Organization Science, 22 (5): 1168-1181.
Bridges S & Guariglia A. (2008) Financial constraints, global engagement, and firm survival in the UK: Evidence from micro data. Scottish Journal of Political Economy, 55 (4): 444-464.
Buchmann P., Roos A., Jung U. & Wortler M. (2008) Cash for growth: the neglected power of working-capital management. The Boston Consulting Group.
Buchuk D., Larrain B., Munoz F. & Urzua F. (2014) The Internal Capital Markets of Business Groups: Evidence from Intra-group Loans. Journal of Financial Economics, 112: 190-212.
Bugador R. (2015) The Stages of International Growth of the Business Groups from Emerging Economies. Organizations and Markets in Emerging Economies. 6 (2): 22-34.
Burkart M. & Ellingsen T. (2004) In-kind finance: a theory of trade credit. Am. Econ. Rev. 94, 569-590
Burt R.S. (1982) Toward a Structural Theory of Action. Network Models of Social Structure, Perception, and Action. New York: Academic Press
Burt R.S. (1997) The Contingent Value of Social Capital. Administrative Science Quarterly. 42 (2): 339-365
Burt R.S. (2005) Brokerage and Closure: An Introduction to Social Capital. Oxford: Oxford University Press.
Booth, G., Gurun, G. & Zhang, H. (2014) Financial Networks and Trading in Bond Markets. Journal of Financial Markets, 18: 126-157.
Buchuk D., Larrain B., Munoz F., Urzua F. (2014) The Internal Capital Markets of Business Groups: Evidence from Intra-group Loans. Journal of Financial Economics 112: 190-212.
Byun H., Choi S., Hwang L. & Kim R. (2013) Business Group Affiliation, Ownership Structure, and the Cost of Debt. Journal of Corporate Finance. 23: 311-331.
Caner S. & Önder Z. (2005) Sources of volatility in stock returns in emerging markets. Applied Economics. 37 (8): 929-941.
Cao C., Simin T. & Zhao J. (2008) Can Growth Options Explain the Trend in Idiosyncratic Risk? Review of Financial Studies. 21: 2599-2633.
Cao Z. 2011, The Rethinking and Exploration of Guo Jin Min Tui, China Opening Journal, No.6 Dec. 2011.
Carney M. (2008) Asian Business Groups: Context, Governance and Performance. Oxford, UK: Chandos Publishing.
Carney M., Gedajlovic E., Heugens P., Essen M. & Oosterhout J. (2011) Business Group Affiliation, Performance, Context, and Strategy: A Meta-Analysis. Academy of Management Journal. 54(3): 437-460.
Carney M., Shapiro D. & Tang Y. (2009) Business Group Performance in China: Ownership and Temporal Considerations. Management and Organization Review. 5:2, 167-193.
Chakraborty, I. (2013) Does Capital Structure Depend on Group Affiliation? An Analysis of Indian Firms. Journal of Policy Modelling, 35: 110-120.
Chang S. (2006) Business Groups in East Asia: Post-crisis Restructuring and New Growth. Asia Pacific Journal of Management, 23 (4): 407-417.
Chang S.J. & Hong J. (2000) Economic performance of group affiliated companies in Korea: Intragroup resource sharing and internal business transactions. Academy of Management Journal. 43(3), 429-448.
Chang S.J. & Hong J. (2002) How Much does the Business Group Matter in Korea? Strategic Management Journal. 23: 265-274.
Chen C. J. P., Li Z., Su X. & Sun Z. (2011) Rent-seeking incentives, corporate political connections, and the control structure of private firms: Chinese evidence. Journal of Corporate Finance. 17: 229-243
Chen E. & He G. (2009) Public Ownership and All other Kinds of Ownerships. Haipai Economics, 1: 14-23.

Chen, G., Firth, M., Xin, Y. & Xu, L. (2008) Control Transfers, Privatization, and Corporate Performance: Efficiency Gains in Chinas Listed Companies. Journal of Financial and Quantitative Analysis, 43 (1): 161-190Chen & Xie, 2011.
Chen, Y., Chen, C. & Chen, W. (2009) The Impact of Related Party Transactions on the Operational Performance of Listed Companies in China. Journal of Economic Reform, 12 (4): 285-297.
Chen, Y. & Xie, D. (2011) Network Position, Independent Director Governance and Investment Efficiency. Management World, 7: 113-127.
Chen Z., Du J., Li D. & Ouyang R. (2013) Does Foreign Institutional Ownership Increase Return Volatility? Evidence from China. Journal of Banking & Finance. 37: 660-669.
Cheung, Y., Jing, L., Lu, T., Rau, R. & Stouraitis, A. (2009) Tunneling and Propping Up: A Analysis of Related Party Transactions by Chinese Listed Companies. Pacific-Basin Finance Journal, 17: 372-393.
Child, J. & Tse, D. K. (2001) Chinas Transition and Its Implications for International Business. Journal of International Business Studies, 32 (1): 5-21.
China Development Research Center of the State Council (2000) China Economic Yearbook. Economic Yearbook Press, Beijing, China.
China Securities Regulatory Commission (CSRC) (1999) Announcement about Guidelines for stock IPO pricing and analysis report.CSRC No. 1999-2008.
Choi J., Hiraki T. & Landi J. (2014) The Value of Multinationality and Business Group for Japanese Firms. Journal of Corporate Finance, 29: 88-110.
Chudik A. & Pesaran M. H. (2013) Large Panel Data Models with Cross-sectional Dependence: A Survey. Federal Reserve Bank of Dallas Globalization and Monetary Policy Institute. Working Paper No. 153 http://www.dallasfed.org/assets/documents/institute/wpapers/2013/0153.pdf
Claessens S., Djankov S., Fan J.P.H. & Lang L.H.P. (1999) Corporate diversification in East Asia: The role of ultimate ownership and group affiliation. The World Bank policy research working paper 2089. Washington D.C.: The World Bank.
Claessens S., Djankov S., Fan J.P.H. & Lang L.H.P. (2002) Disentangling the incentive and entrenchment effects of large shareholdings. Journal of Finance. 57, 2741-2771
Claessens S., Fan P., Joseph H., and Lang L. (2006) The Benefits and Costs of Group Affiliation: Evidence from East Asia. Emerging Markets Review. 7: 1-26.
Claessen S., Feijen E. & Laeven L. (2008) Political connections and preferential access to finance: the role of campaign contributions. J. Financ. Econ. 88, 554-580
Clark P.K. (1973) A subordinated stochastic process model with finite variance for speculative prices. Econometrica: Journal of Econometric Society. 41 (!): 135-155.
Clarke G., Cull R. & Kisunko G. (2012) External finance and firm survival in the aftermath of the crisis. World Bank Policy Research Working Paper No.6050. Washington, DC: World Bank.
Coase R. (1937) The Nature of the Firm. Economica, 4: 386-405.
Coffey Brendan (2011) The Four Companies That Control the 147 Companies That Own Everything. Online: https://www.forbes.com/sites/brendancoffey/2011/10/26/the-four-companies-that-control-the-147-companies-that-own-everything/#1edbfc36685b
Cohen-Cole E., Kirilenko A. & Patacchini E. (2014) Trading networks and liquidity provision. Journal of Financial Economics.
Coleman J.S. (1988) Social Capital in the Creation of Human Capital. The American Journal of Sociology. 94(Suppl.): S95-S120
Coleman J.S. (1990) Social Capital. In J.S. Coleman (Ed.), Foundations of Social Theory (2nd ed., pp.300-321) Cambridge, MA: Belknap Press.
Colli A., Rinaldi A., and Vasta M. (2016) The Only Way to Grow? Italian Business Groups in Historical Perspective. *Business History*, 58 (1): 30-48.
Cull R., Li W., Sun B. & Xu L. (2015) Government connections and financial constraints: Evidence from a large representative sample of Chinese firms. Journal of Corporate Finance. 32: 271-294
Cunat V. (2007) Trade credit suppliers as debt collectors and insurance providers. Rev. Financ. Stud. 20, 491-527.
Davis G.F., Diekman K. & Tinsley C.H. (1994) The decline and fall of the conglomerate firm

in the 1980s: The deinstitutionalization of an organizational form. American Sociological Review. 59: 547-570.
Deloof M. (2003) Does working capital management affect profitability of Belgian firms? Journal of Business Finance & Accounting. 30, 573-588
Demirguc-Kunt A. & Maksimovic V. (2002) Firms as financial intermediaries: evidence from trade credit data. University of Maryland. Working Paper
Demsetz H. (1983) The Structure of Ownership and the Theory of the Firm. J. Law Econ. 26: 375-390.
Demsetz H. (1986) Corporate Control, Insider Trading, and Rates of Return. Am. Econ. Rev. 76: 313-316.
Dewenter K. & Warther V.A. (1998) Dividends, asymmetric information and agency conflicts: evidence from a comparison of the dividend policies of Japanese and U.S. firms. Journal of Finance.
Ding S., Guariglia A. & Knight J. (2013) Investment and financing constraints in China: Does working capital management make a difference. Journal of Banking & Finance. 37, 1490-1507.
Dong M., Li C. & Tse D. (2013) Do Business and Political Ties Differ in Cultivating Marketing Channels for Foreign and Local Firms in China. Journal of International Marketing, 21: 39-56.
Dong Y., Liu Z., Shen Z. & Sun Q. (2014) Political Patronage and Capital Structure in China. Emerging Markets Finance & Trade. 50 (3): 102-125
Du J., Guariglia A. & Newman A. (2013) Do Social Capital Building Strategies Influence the Financing Behavior of Chinese Private Small and Medium-Sized Enterprises? Entrepreneurship Theory & Practice.
Duysters G. & Lemmens C. (2003) Alliance Group Formation. Int. Studies of Mgt & Org. 33 (2): 49-68.
Driffield N. & Du J 2007, Privatisation, State Ownership and Productivity: Evidence from China, Journal of the Economics of Business, Vol. 14, No.2, July 2007, 215-239
Driscoll J. & A. C. Kraay (1998) Consistent covariance matric estimation with spatially dependent data. Review of Economics and Statistics. 80:549-560
El-Khatib R., Fogel K. & Jandik T. (2015) CEO network centrality and merger performance. Journal of Financial Economics. http://dx.doi.org/10.1016/j.jfineco.2015.01.001.
Elouaer-Mrizak S., Chastand M. (2013) Detecting Communities within French Intercorporate Network Social and Behavioral Science. 79: 82-100Fracassi & Tate, 2012.
Fabbri D. & Klapper L. (2016) Bargaining power and trade credit. Journal of Corporate Finance. 41, 66-80.
Faccio M., Lang L.H.P. & Young L. (2001) Dividends and expropriation. Am. Econ. Rev. 91, 54-78.
Falope O.L. & Ajilore O.T. (2009) Working capital management and corporate profitability: evidence from panel data analysis of selected quoted companies in Nigeria. Research Journal of Business Management. 3(3), 73-84.
Fan J., Titman S. & Twite G. (2012) An International Comparison of Capital Structure and Debt Maturity Choices. Journal of Financial and Quantitative Analysis. 47 (1): 23-56.
Fauver L., Houston J. & Naranjo A. (2005) Capital Market Development Integration, Legal, Systems, and the Value of Corporate Diversification: A Cross-Country Analysis. The Journal of Financial and Quantitative Analysis. 38 (1): 135-157.
Fisher R. A. (1935) The design of experiments. Edinburgh: Oliver and Boyd.
Freeman, L. (1979) Centrality in Social Networks: Conceptual Clarification. Social Networks, 1: 215-239.
Forbes, The worlds biggest public companies. Online: https://www.forbes.com/global2000/#707c1f89335d
Gadde L., Huemer L. & Håkansson H. (2003) Strategizing in Industrial Networks. Industrial Marketing Management. 32(5):357-364.
Gallant A., Rossi P. & Tauchen G. (1992) Stock Prices and Volume. Review of Financial Studies. 5 (2): 199-242.
Garcia-Teruel P.J. & Martinez-Solano P. (2007) Effects of working capital management on SME profitability. International Journal of Managerial Finance. 3(2), 164-177.

Garman M. & Klass M. (1980) On the Estimation of Security Price Volatilities from Historical Data. Journal of Business. 53 (1): 67-78.
Gangopadhyay P., Yook K. C. & Shin Y. (2014) Insider Trading and Firm-specific Return Volatility. Rev. Quant. Finan. Acc. 43: 1-19
Gaur A.S. (2007) Essays on Strategic Adaptation and Firm Performance during Institutional Transition. Unpublished Doctoral Dissertation, National University of Singapore.
Gaur A.S. & Delios A. (2006) Business group affiliation and firm performance during institutional transition. In K. M. Weaver (Ed.). Proceedings of the sixty-sixth annual meeting of the Academy of Management (CD). ISSN 1543-8643
Gaur A.S. & Kumar V. (2009) International diversification, firm performance, and business group affiliation: Empirical evidence from India. British Journal of Management. 20, 172-186.
Ge Y. & Qiu J. (2007) Financial development, bank discrimination and trade credit. J. Bank. Financ. 31, 513-530.
Gennotte G. & Leland H. (1990) Market Liquidity, Hedging and Crashes. Am. Econ. Rev. 80 (5): 999-1021.
Gerlach M.L. (1992) Alliance capitalism: The social organization of Japanese business. Berkeley: University of California Press.
Gharbi S., Sahut J. & Teulon F. (2014) R&D Investments and High-tech Firms Stock Return Volatility. Technological Forecasting & Social Change. 88: 306-312.
Ghemawat P. & Khanna T. (1998) The nature of diversified business groups: a research design and two case studies. The Journal of Industrial Economics. 46(1), 35-61
Giannetti M., Burkart M. & Ellingsen T. (2011) What you sell is what you lend? Explaining trade credit contracts. Rev. Financ. Stud. 24, 1261-1298.
Gill A. & Allen J. (2007) On a Wing and a Prayer: the Greening of Governance. Hong Kong: CLSA Asia-Pacific Markets.
Gill A., Biger N. & Mathur N. (2010) The relationship between working capital management and profitability: evidence from the United States. Business and Economics Journal. 1, 1-9
Gopalan R., Nanda V. & Seru A (2007) Affiliated Firms and Financial Support: Evidence from Indian Business Groups. Journal of Financial Economics, 86: 759-795.
Gopalan R., Nanda V. & Seru A. (2014) Internal Capital Market and Dividend Policies: Evidence from Business Groups. The Review of Financial Studies, 27: 1102-1142.
Gopalan R., Nanda V., Seru A. (2007) Affiliated Firms and Financial Support: Evidence from Indian Business Groups. Journal of Financial Economics. 86:759-795
Gopalan R., Nanda V., Seru A. (2014) Internal Capital Market and Dividend Policies: Evidence from Business Groups. The Review of Financial Studies. 27: 1102-1142.
Goto A. (1982) Business Groups in a Market Economy. European Economic Review, 19 (1): 53-70.
Granovetter, M. (1985) Economic Action and Social Structure: the Problem of Embeddedness. The American Journal of Sociology, 91 (3): 481-510.
Granovetter M.S. (1973) The Strength of Weak Ties. The American Journal of Sociology. 78(6): 1360-1380
Granovetter M.S. (2005) Business Groups and Social Organization. In N.J. Smelser & R. Swedberg (Eds.). The Handbook of Economic Sociology (2d ed.): 429-450. Princeton, NJ: Princeton University Press.
Greenaway D., Guariglia A. & Yu Z. (2014) The More the Better? Foreign Ownership and Corporate Performance in China. The European Journal of Finance, 20: 681-702.
Greve A. & Salaff J.W. (2003) Social Networks and Entrepreneurship. Entrepreneurship Theory and Practice. 28(1): 1-22
Gu, F., Huang, K., & Tse, D. (2008) When does Guanxi Matter? Issues of Capitalization and Its Dark Sides. Journal of Marketing, 72 (4): 12-28.
Guariglia A. & Mateut S. (2006) Credit channel, trade credit channel, and inventory investment: evidence from a panel of U firms. J. Bank. Financ. 30, 2835-2856.
Guest P. & Sutherland D. (2010) The Impact of Business Group Affiliation on Performance: Evidence from Chinas National Champions. Cambridge Journal of Economics. 34: 617-631.
Gul F.A. (1999) Growth opportunities, capital structure and dividend policies in Japan. Journal of Corporate Finance. 5(2), 141-168.
Gulati R. (1998) Alliances and networks. Strategic Management Journal. 19 (4): 293-317.

Gulati R., Nohria N. & Zaheer A. (2000) Strategic Networks. Strategic Management Journal. 21(3): 203-215.
Guler I. & Guillen M.F. (2010) Home country networks and foreign expansion: Evidence from the venture capital industry. Academy of Management Journal. 53 (2): 390-410
Guo H. (2002) Stock Market Returns, Volatility, and Future Output. Federal Reserve Bank of St. Louis Review. 84 (5): 75-85.
Guo Y. (2011) The double consideration of the criterion of Guo Jin Min Tui, Academic Research, May 2011
Guo Y. (2010) Phenomena of Guo Jin Min Tui: Double Win or Verse Market?. Modern Economic Research. 37: 79-82.
Hahn D. & Lee K. (2006) Chinese business groups: Their origins and development. In S. J. Chang (Ed.). Business groups in East Asia: Financial crisis, restructuring, and new growth: 207-231. Oxford: Oxford University Press.
Hakansson H. & Ford D. (2002) How should companies interact in business networks? Journal of Business Research. 55(2): 133-139
Haron R. & Nomran N.M. (2016) Determinants of working capital management before, during, and after the global financial crisis of 2008: evidence from Malaysia. The Journal of Developing Areas. 50(5), 461-468
Haselmann R. Schoenherry D. & Vig V. (2013) Lending in social networks. University of Warwick working paper.
He J., Mao X., Rui O. & Zha X. (2013) Business Groups in China. Journal of Corporate Finance, 22: 166-192.
Hillman A., Withers M. and Collins B.J. (2009) The Resource Dependency Theory: A Review Journal of Mangement, 35(6): 1404-1427.
Hoechle D. (2007) Robust standard errors for panel regressions with cross-sectional dependence. The Stata Journal. 7 (3): 281-312
Hoshi T., Kashyap A. & Scharfstein D. (1991) Corporate structure, liquidity, and investment: evidence from Japanese industrial groups. Q. J. Econ. 106, 33-60.
Hoskisson R.E., Johnson R.A., Tihanyi L. & White R.E. (2005) Diversified business groups and corporate refocusing in emerging economies. Journal of management. 31, 941-965.
Hu A. (2012) The prove of phenomena of Guo Jin Min Tui, National Administration College, 2012.1
Huang G. & Song F.M. (2006) The determinants of capital structure: evidence of China. China Economic Review. 17, 14-36.
Iacobucci D. & Rosa P. (2005) Growth, Diversification, and Business Group Formation in Entrepreneurial Firms. Small Business Economics, 25: 65-82.
Isobe T., Makino S. & Goezen A. (2006) Falling Down Together?: Japanese Keiretsu and the Performance Implications of Affiliation. Asia Pacific Journal of Management.
Jarillo J.C. (1988) On strategic networks. Strategic Management Journal. 9 (1): 31-41
Ji S. (2010) The Profound Effects on the Future Economy Brought by Guo Jin Min Tui, Zhong Guan Cun, 2010.4 (83).
Jia, F. & Wang, J. (2013) Marketing Channel Relationships in China: A Review and Integration with An Institution-based Perspective. Journal of Business Research, 66: 2545-2551.
Jiang F. & Kim K. (2015) Corporate Governance in China: A Modern Perspective. Journal of Corporate Finance. 32: 190-216.
Jiang G., Lee C. & Yue H. (2010) Tunneling through intercorporate loans: The China experience. Journal of Financial Economics. 98 (1): 1-20.
Jiang S. (2010), Guo Jin Min Tui—Inside and Outside data, Journal of Anhui University, No.5 2010.
John C. & Simon S. (2007) Uncovering Volatility Dynamics in Daily REIT Returns. Journal of Real Estate Portfolio Management. 13 (2): 119-128.
Keister L. (2000) Chinese business groups: The structure and impact of interfirm reltions during economic development. Oxford, NY: Oxford University Press.
Kevin D. (2011) An Overview of the Determinants of Financial Volatility: An Explanation of Measuring Techniques. Modern Applied Science. 5 (5): 46-63.
Khanna T. (2000) Business Groups and Social Welfare in Emerging Markets: Existing

Evidence and Unanswered Questions. European Economic Review. 44: 748-761
Khanna T. & Palepu K. (2000) Is Group Affiliation Profitable in Emerging Markets? An Analysis of Diversified Indian Business Groups. J. Finance. 55, 867-891.
Khanna T. & Palepu K. (1999) The right way to restructure conglomerates in emerging markets. Harvard Business Review. 77(4), 125-134
Khanna, T. & Palepu, K. (1997) Why Focused Strategies may be Wrong for Emerging Markets. Harvard Business Review, 75 (4): 41-51.
Khanna T. & Rivkin J. (2001) Estimating the Performance Effects of Business Groups in Emerging Markets. Strateg. Manag. J. 22, 45-74.
Khanna T. & Yafeh Y. (2007) Business groups in emerging markets: paragons or parasites? Journal of Economic Literature. 45 (2): 331-372.
Khwaja A. & Mian A. (2005) Do lenders favor politically connected firms? Rent provision in an emerging financial market. Q. J. Econ. 120(4), 1371-1411
Kok S. C. & Munir Q. (2015) Malaysian finance sector weak-form efficiency: Heterogeneity, structural breaks, and cross-sectional dependence. Journal of Economics, Finance and Administrative Science. 20: 105-117.
Kuo H.C. (2006) Network linkage and financial leverage. Journal of Financial Studies. 14(1), 95-123
Kuo H. & Wang L. (2015) Do network linkages affect financial leverage? A group governance perspective. Romanian Journal of Economic Forecasting. XVIII(4), 50-69
La Porta R., Lopez-de-Silanes F. & Shleifer A. (1998) Law and finance. J. Polit. Econ. 106, 1113-1155
Lau K.L.A. & Young A. (2013) Why China shall not completely transit from a relation-based to a rule-based governance regime: a Chinese perspective. Corporate Governance: An International Review. 21(6), 577-585.
Lechner C. & Leyronas C. (2009) Small-business Group Formation as an Entrepreneurial Development Model. Entrepreneurship: Theory and Practice. 33(3): 645-667
Lee K. (2006) Business Groups as an Organizational Device for Catch-up. In J. Nakagawa (Ed.), *Managing Development: Globalization, Economic Restructuring and Social Policy*, (pp. 217-233). London: Routledge.
Lee K. and Jin X. (2009) The Origins of Business Groups in China: An Empirical Testing of the Three Paths and the Three Theories. *Business History*, 51 (1): 77-99.
Lee K., and Kang Y. (2012) Business Groups in China. The Oxford Handbook of Business Groups. Edited by Colpan A., Hikino T., Lincoln J. 1st ed. Oxford University Press.
Lee K., Peng M. & Lee K. (2008) From Diversification Premium to Diversification Discount during Institutional Transitions. Journal of World Business. 43(1): 47-65
Levine, J. H. (1972) The Sphere of Influence. American Sociological Review, 37: 14-27.
Leff N. (1978) Industrial Organization and Entrepreneurship in the Developing Countries: The Economic Groups. Economic Development and Cultural Change, 26 (4): 661-675.
Li D., Nguyen Q., Pham P. & Wei S. (2011) Large Foreign Ownership and Firm-Level Stock Return Volatility in Emerging Markets. Journal of Financial and Quantitative Analysis. 46 (4): 1127-1155.
Li, H., An, H., Gao, X., Huang, J. & Xu, Q. (2014) On the Topological Properties of the Cross-shareholding Networks of Listed Companies in China: Taking Shareholders Cross-shareholding Relationships into Account. Physica A, 406: 80-88.
Li H. & Zhang Y. (2007) The role of managers political networking and functional experience in new venture performance: Evidence from Chinas transition economy. Strategic Management Journal. 28, 791-804
Li J.J., Poppo L. & Zhou K.Z. (2008) Do managerial ties in China always produce value? Competition, uncertainty, and domestic vs. foreign firms. Strategic Management Journal. 29, 383-400.
Li, N. (2012) Empirical Study on the Relationship between Network Characteristics of Interlocking Directorates in Interlocking Company and the Performance of Listed Company. Journal of Beijing City University, 3 [Online]. Available from: www.cnki.net [Accessed on 26 July 2014].
Li S. (2013) Chinas (painful) Transition from Relation-Based to Rule-Based Governance: When and How, Not If and Why. Corporate Governance: An International Review, 21 (6):

567-576.
Li Z. (2010) The Review and Clarify of “Guo Jin Min Tui”, Social Science, No. 5 2010
Liao J. & Welsch H. (2005) Roles of Social Capital in Venture Creation: Key Dimensions and Research Implications. Journal of Small Business Management, 43: 345-363.
Liao J. & Welsch H. (2005) Roles of Social Capital in Venture Creation: Key Dimensions and Research Implications. Journal of Small Business Management, 43: 345-363.
Lin, Y. & Zhu, T. (2000) The Restructuring of Ownership and Governance in China: An Empirical Study of the Shareholding Reform. Seoul Journal of Economics, 13: 279-300.
Ling, F. & Li, S. (2012) Using Social Network Strategy to Manage Construction Projects in China. International Journal of Project Management, 30: 398-406.
Liu M. (2012), The Summary of the Effects on Chinese Market Economy Brought by the Expansion of Guo Jin Min Tui, Economic Research Guide, 2012.10 (156) pp. 3-5.
Liu Q., Luo J. & Tian G. (2016) Managerial professional connections versus political connections: Evidence from firms access to informal financing resources. Journal of Corporate Finance. 41, 179-200
Liu Q., Tang J. &Tian G. (2013) Does political capital create value in the IPO market? Evidence from China. J. Cor. Fin. 23, 395-413
Luk C.L., Yau O.H.M., Sin L.Y.M., Tse A.C.B, Chow R.P.M. & Lee J.S.Y (2008) The effects of social capital and organizational innovativeness in different institutional context. J. Int. Bus. Stud. 39(4), 589-612
Ma X. & Lu J. (2005) The critical role of business groups in China. Ivey Business Journal. 69(5), 1-12
Ma X., Yao X. & Xi Y. (2006) Business Group Affiliation and Firm Performance in a Transition Economy: A Focus on Ownership Voids. Asia Pacific J. Manage, 23: 467-489.
Mahender, Aggarwal S. & Verma H. (2014) Investors Perceptions on Trading Volume and Stock Return Volatility in Indian Stock Market. The IUP Journal of Applied Economics. 8 (4): 52-73.
Majumdar S. & Sen K. (2006) The Debt Wish: Rent Seeking by Business Groups and the Structure of Corporate Borrowing in India. Public Choice. 130: 209-223.
Malik Q.U.Z. & Afza T. (2016) Do group affiliated firms specialize in debts? Evidence from Pakistan. Journal of Economic and Administrative Science. 32(1), 46-62
Manos R., Murinde V. & Green C. (2007) Leverage and business groups: evidence from Indian firms. Journal of Economics and Business. 59, 443-465
Markoczy L., Sun S., Peng M., Shi W. & Ren B. (2013) Social Network Contingency, Symbolic Management, and Boundary Stretching. Strategic Management Journal. 34, 1367-1387.
Masulis R.W., Pham P.K. & Zein J. (2011) Family business groups around the world: financing advantages, control motivating, and organizational choice. Review of Financial Studies. 24, 3556-3600.
McMillan D. & Evans P. (2014) Stock Returns and Volatility Dynamics in China. Does the Control of State-owned Enterprises Matter? China Finance Review International. 5 (2): 103-131.
Michele, P. (2013) Related Party Transactions under a Contingency Perspective. Journal of Management Governance, 17: 309-330.
Mittnik S., Robinzonov N. & SSpindler M. (2015) Stock Market Volatility: Identifying Major Drivers and the Nature of their Impact. Journal of Banking and Finance. 58: 1-14.
Molina-Morales F. X., Belso-Martinez J., Mas-Verdu F. & Martinez-Chafer L. (2015) Formation and dissolution of inter-firm linkages in lengthy and stable networks in Clusters. Journal of Business Research. 68: 1557-1562.
Morck R., Wolfenzon D. & Yeung B. (2005) Corporate governance, economic entrenchment, and growth. Journal of Econ. Lit. 43, 655-720.
Mulyani E. Singh H. & Mishra S. (2016) Dividends, leverage, and family ownership in the emerging Indonesian market. Journal of International Financial Markets, Institutions & Money. 43, 16-29.
Myers S. (1977) The Determinants of Corporate Borrowing. Journal of Financial Economis, 5: 147-175.
Nee V. (1992) Organizational dynamics of market transition: Hybrid forms of property rights

and mixed economy in China. Administrative Science Quarterly. 37 (1), 1-27.
Newman A., Gunessee S. & Hilton B. (2012) Applicability of financial theories of capital structure to the Chinese cultural context: A study of private owned SMEs. International Small Business Journal. 30 (1), 65-83.
Nolan P. (2001) China and the global economy. Basingstoke, UK: Palgrave.
Nooy, W., Mrvr, A. & Batagelj, V. (2005) Exploratory Social Network Analysis with Pajek. Cambridge: Cambridge University.
Nriffield, N. & Du, J. (2007) Privatization, State Ownership, and Productivity: Evidence from China. Journal of Economics of Business, 14 (2): 215-239.
Pablos, P. (2005) Western and Easter Views on Social Networks. The Learning Organization, 12 (5): 436-456.
Padachi K. (2006) Trends in working capital management and its impact on firms performance: an analysis of Mauritian small manufacturing firms. International Review of Business Research Papers. 2(2), 45-58
Paligorova T. & Xu Z. (2012) Complex ownership and capital structure. Journal of Corporate Finance. 18, 701-716.
Park S.H. & Luo Y. (2001) Guanxi and organizational dynamic: organizational networking in Chinese firms. Strateg. Manag. J. 22(5), 455-477.
Parkinson M. (1980) The Extreme Value Method for Estimating the Variance of the Rate of Return. Journal of Business. 53 (1): 61-65.
Parnell M. (2005) Chinese business guanxi: An organization or non-organization? Journal of Organisational Transformation & Social Change. 2, 29-47
Pass C.L. & Pike R.H. (1984) An overview of working capital management and corporate financing. Managerial Finance. 10(3), 1-11
Peng M. (2004) Outside Directors and Firm Performance during Institutional Transitions. Strategic Management Journal. 25(5): 453-471.
Peng M., Lee S. & Wang D. (2005) What Determines the Scope of the Firm over Time? A Focus on Institutional Relatedness. Academy of Management Review. 30(3): 622-633.
Peng, M. & Luo, Y. (2000) Managerial ties and firm performance in a transition economy the nature of a micro-macro link. Academy of Management Journal, 43 (3): 486-501.
Peng M.W. & Heath P.S. (1996) The growth of the firm in planned economies in transition: Institutions, organizations, and strategic choice. Academy of Management Review. 21 (2): 492-528.
Peng, M. W., Wang, D.Y.L. & Jiang, Y. I. (2008) An Institution-based View of International Business Strategy: A Focus on Emerging Economies. Journal of International Business Studies, 39: 920-936.
Peng, X. (2009) Research the way of effects of enterprises network on technological innovation. Zhejiang University Doctoral Research. [Online] Available from: www.cnki.net [Accessed on 26 July 2014].
Penrose E. (1995) The Theory of the Growth of the Firm. (3rd ED.) London: Oxford University Press.
Perry-Smith, J. E. (2006) Social yet Creative: The Role of Social Relationships in Facilitating Individual Creativity. Academy of Management Journal, 49: 85-101.
Pesaran, M. Hashem. (2004) General Diagnostic Tests for Cross Section Dependence in Panels. CESifo Group Munich CESifo Working Paper Series 1229.
Pesaran, M. Hashem. (2015) Testing weak cross-sectional dependence in large panels. Econometric Reviews.
Petersen M. A. (2007) Estimating standard errors in finance panel datasets: Comparing approaches. Review of Financial Studies.
Phusavat K., Kess P., Law K.M.Y. & Kanchana R. (2010) Sustaining effective business value chain: Future challenges. Industrial Management and Data Systems. 110 (8): 1176-1191
Purkayastha S. & Lahiri S. (2016) Do Diversified Business Groups Help Organizational Performance? An Industry-wise Analysis. International Studies of Management & Organization. 46: 24-34.
Qiao G. (2011) The Review of Debate of “Guo Jin Min Tui”, Journal of Henan University, Vol. 51 No. 4 Jul. 2011
Raheman A. & Nasr M. (2007) Working capital management and profitability: case of

Pakistani firms. International Review of Business Research Papers. 3(1), 279-300.
Rajagopalan N. & Zhang Y. (2008) Corporate Governance Reforms in China and India: Challenges and Opportunities. Business Horizons. 51(1): 55-64
Ramaswamy K., Li M. & Petitt B. (2012) Why do business groups continue to matter? A study of market failure and performance among Indian manufacturers. Asia Pacific Journal of Management. 29(3): 643-658.
Reich R.B. (1989) Leveraged buyouts: America pays the price. New York Times Magazine. January 29.
Ren B., Au K. & Birtch T. (2009) Chinas Business Network Structure during Institutional Transitions. Asia Pac. J. Manag. 26: 219-240.
Rimo A. & Panbunyuen P. (2010) The effect of company characteristics on working capital management: a quantitative study of Swedish listed companies. Umea School of Business. 2-31.
Rothaermel, F. & Alexandre, M. (2009) Ambidexterity in Technology Sourcing: The Moderating Role of Absorptive Capacity. Organization Science, 20: 759-780.
Schilling, M. & Phelps, C. (2007) Interfirm Collaboration Networks: The Impact of Large-Scale Network Structure on Firm Innovation. Management Science, 53 (7): 1113-1126.
Schwert W. (2002) Stock volatility in the new millennium: how wacky is Nasdaq? Journal of Monetary Economics. 49 (1): 3-26.
Scott J. (1992) Corporate Interlocks and Social Network Analysis. Hong Kong: University of Hong Kong: Social Science Research Centre.
Semrau T. & Werner A. (2013) How Exactly Do Network Relationships Pay Off? The Effects of Network Size and Relationship Quality on Access to Start-up Resources. Entrepreneurship Theory & Practice, 501-525.
Sha, H. & Zeng, Y. (2014) An Empirical Study on Cross-shareholding, Network Location and Firm Performance. Journal of Management Science, 27 (1): 131-142.
Shi C. (2003) On the Tade-Off Between the Future Benefits and Riskiness of R&D: A Bondholders Perspective. Journal of Accounting & Economics. 35: 227-254.
Shleifer A. & Vishny R. (1986) Large shareholders corporate control. J. Polit. Econ. 94, 461-488.
Shleifer A. & Vishny R. (1997) A Survey of Corporate Governance. J. Financ. 52: 737-783.
SHSE, online: http://www.sse.com.cn/market/overview/
Siegel J. and Choudhury P. (2012) A Reexamination of Tunneling and Business Groups: New Data and New Methods. Review of Financial Studies, 25 (6): 1763-1798
Singh D. & Gaur A. (2009) Business Group Affiliation Firm Governance, and Firm Performance: Evidence from China and India. Corporate Governance: An International Review, 17: 411-425.
Singh H. & Kumar S. (2014) Working capital management: a literature review and research agenda. Qualitative research in Financial Markets. 6(2), 173-197
Stata Press (2017) Stata treatment-effects reference manual: Potential outcomes/Counterfactual outcomes Release 15. StataCorp LLC College Station, Texas
Soh, P. (2010) Network Patterns and Competitive Advantage before the Emergence of a Dominant Design. Strategic Management Journal, 31 (4): 438-461.
SZSE, online: http://www.szse.cn/main/marketdata/
The Economist, March 5, 2011. Emerging-market Giants: Tata Sauce. The Economist.
Tian L. & Estrin S. (2008) Retained State Ownership in Chinese PLCs: Does Government Ownership always Reduce Corporate Value? Journal of Comparative Economics. 36, 74-89.
Tsai, W. (2001) Knowledge Transfer in Intraorganizational Networks: Effects of Network Position and Absorptive Capacity on Business Unit Innovation and Performance. Academy of Management Journal, 44: 996-1004.
Upbin Bruce (2011) The 147 Companies That Control Everything. Online: https://www.forbes.com/sites/bruceupbin/2011/10/22/the-147-companies-that-control-everything/#253d3fb65105
Uzzi, B. (1997) Social Structure and Competition in Interfirm Networks: The Paradox of Embeddedness. Administrative Science Quarterly, 42: 5-67.
Varma J.R. (1997) Corporate Governance in India: Disciplining the Dominant Shareholder. IIMB Management Review. 9: 5-18

Vicente-Lorente J.D. (2001) Specificity and opacity as resource-based determinants of capital structure: evidence for Spanish manufacturing firms. Strategic Management Journal. 22(2), 157-177.
Vo, X. V. (2015) Foreign ownership and stock return volatility – Evidence from Vietnam. Journal of Multination Financial Management, 30 (March 2015): 101-109.
Vo, X. V. (2016) Does institutional ownership increase stock return volatility? Evidence from Vietnam. International Review of Financial Analysis, 45(2016): 54-61.
Vuolteenaho T. (2002) What Drives Firm-Level Stock Returns? The Journal of Finance. 57 (1): 233-264.
Wang C., Yi J., Kafouros M. & Yan Y. (2015) Under What Institutional Conditions Do Business Groups Enhance Innovation Performance? Journal of Business Research, 68: 694-702.
Wang, C., Rodan, S., Fruin, M. & Xu, X. (2014) Knowledge Networks, Collaboration Networks, and Exploratory Innovation. Academy of Management Journal, 57 (2): 484-514.
Wang H. & Lin C. (2013) Debt Financing and Earnings Management: An Internal Capital Market Perspective. Journal of Business Finance and Accounting, 40: 842-868.
Wang, W. (2012) The Empirical Research on the Influence of Ownership Structure to Related Party Transaction and Corporate Performance. Zhejiang University of Finance and Economics.
Wang, Y. (2008) Foreign Subsidiaries Alliance Network, Social Capital and Network Studies. Fudan University Doctoral Research [Online]. Available from: www.cnki.net [Accessed on 26 July 2014].
Wang Y.J. (2002) Liquidity management, operating performance, and corporate value: evidence from Japan and Taiwan. Journal of Multinational Financial Management. 12 (2), 159-169
Wang C., Yi J., Kafouros M. & Yan Y. (2015) Under What Institutional Conditions Do Business Groups Enhance Innovation Performance? Journal of Business Research, 68: 694-702.
Wasiuzzaman S. & Arumugam V.C. (2013) Determinants of working capital investment: a study of Malaysian public listed firms. Australasian Accounting Business and Finance Journal. 7(2), 63-83.
Wei S. & Zhang C. (2006) Why Did Individual Stocks Become More Volatile? Journal of Business. 79: 259-292.
Willianson O. (1975) Markets and hierarchies: analysis and antitrust implications. Free Press. New York.
Williamson O. (1985) The Economic Institutions of Capitalism. New York: The Free Press.
Woodridge J. M. (2005) Fixed effects and related estimators for correlated random-coefficient and treatment-effect panel data models. The Review of Economics and Statistics. 87 (2): 385-390
Wooldridge, J. M. (2010) Econometric Analysis of Cross Section and Panel Data. 2nd ed. Cambridge, MA: MIT Press
World bank, online: https://data.worldbank.org/
Wu C. (1990) Enterprise groups in Chinas industry. Asia Pacific Journal of Management. 7(2), 123-136
Wu W., Firth M. & Rui O.M. (2014) Trust and the provision of trade credit. J. Bank. Financ. 39, 146-159.
Wu X., Dou W., Du J. & Jiang Y. (2015) Production Network Positions, Innovation Orientation and Environmental Dynamics: An Empirical Analysis of Chinese Firms. International Journal of Technology Management. 67 (1), 77-102
Wu X., Lou W. (2010) Companies Alliance Network and Empirical Analysis of Enterprises Collaboration and Competition Based on Social Network Analysis. Practical Research 33: 52-57.
Xiang Q. (2010) The profound thinking about the debate of Guo Jin Min Tui, Research of Contemporary Economics 2011 (1)
Xu Y. & Malkiel B. (2003) Investigating the Behavior of Idiosyncratic Volatility. The Journal of Business. 76 (4): 613-645.
Yiu D., Bruton G. & Lu Y. (2005) Understanding Business Group Performance in an Emerging Economy: Acquiring Resources and Capabilities in order to Prosper. Journal of Management Studies. 42: 183-296.

Yu F. (2005) Accounting Transparency and the Term Structure of Credit Spreads. Journal of Financial Economics, 75: 53-84.
Zariyawati M.A., Annuar MN, Taufiq H. & Abdul Rahim A.S. (2009) Working capital management and corporate performance: case of Malaysia. Journal of Modern Accounting and Auditing. 5(11), 190-193
Zhang, C (2010) A Reexamination of the Causes of Time-Varying Stock Return Volatilities. Journal of Financial and Quantitative Analysis, 45(3): 663-684.
Zhang Q. & Cao Z. (2004) Prevention and Control of Firms Dynamic Alliance Risks. Management Science. 3: 8-15
Zhang, R. (2008) Does Government Ownership Always Reduce Firm Values? Evidence from Publicly Listed Companies in China. Academy of Management Perspectives, 116-118.
Zhao, Y., Wang, Q. & Guo, X. (2014) A Study on Performance of Strategic Alliance Inter-enterprise Innovation Network. East China Economic Management, 28 (1): 108-112.
Zheng, X. & Zhao, Y. (2013) Impact of Network Embeddedness and Geographic Embeddedness on the Innovation Performance of the Alliance Enterprises: An Empirical Research on the High-tech Listed Companies in China. Science Research Management, 34 (11): 9-17.
Zhou W. (2013) Political connections and entrepreneurial investment: Evidence from Chinas transition economy. Journal of Business Venturing. 28: 299-315
Zhu, X., Liu, Z. & Hou, H. (2013) Empirical Study on the Correlation among Interlock Directorship Network Structure and Enterprise Performance: The Evidence from Listed Companies of CSI300 Index. The 9th Annual Academy Conference of China Technology and Management [Online]. Available from: www.cnki.net [Accessed on 26 July 2014].

Appendix 1a: Listed companies in networks across different industries

Industry	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Manufacturing	9	33	55	68	122	164	205	238	240	280	326	373	416	512	523
Real Estate	5	8	10	16	31	26	31	48	44	47	43	43	53	54	57
Wholesale and retailing	2	7	11	11	28	35	37	41	41	45	46	53	51	61	66
Mining industry	2	2	5	5	7	15	13	13	11	21	22	25	28	29	33
Accommodation and Catering Services	2	2	1	1	1	3	3	3	1	3	5	7	6	5	6
Leasing and Business Services	1	1	1	2	1	4	4	4	3	4	5	5	7	11	11
Culture, Sports and Entertainment	1	1	1	0	1	1	1	3	3	5	2	3	2	4	5
Agriculture, forestry , animal husbandry and fishery	0	1	1	0	2	4	5	4	5	5	7	7	7	11	8
Electricity, heat, gas and water production and supply industry	0	2	5	5	9	15	17	24	28	30	31	37	39	47	46
Building industry	0	1	2	1	2	5	7	6	7	10	15	20	20	21	21
Transportation, storage and postal services	0	3	7	6	11	16	17	19	19	20	25	32	35	38	36
Information transmission, software and IT services	0	1	1	3	8	10	11	8	6	8	10	10	16	28	26
Financial Industry	0	1	4	5	7	9	12	12	10	12	16	18	24	29	31
Scientific and technical services	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
Water Conservancy, Environment and Public Facilities Management	0	1	1	2	3	2	3	3	3	3	6	6	5	6	6
Education industry	0	0	0	0	1	0	1	0	0	0	0	1	1	1	1
Health and social work	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
Complex	0	0	1	1	3	2	4	6	4	8	4	6	7	6	7
Total	22	64	106	126	237	312	372	433	425	501	563	646	717	863	884

Appendix 1b: Listed companies in ownership networks across different industries

Industry	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Manufacturing	7	25	39	48	81	124	148	221	217	251	302	341	365	430	452
Wholesale and retailing	1	5	9	8	18	26	23	38	39	43	43	49	48	51	59
Real Estate	4	7	7	12	23	15	21	40	35	39	34	39	44	42	48
Electricity, heat, gas and water production and supply industry	0	2	4	3	6	12	13	22	26	27	29	35	37	40	35
Mining industry	1	2	3	4	4	12	9	13	9	20	20	24	28	28	31
Financial Industry	0	1	2	1	6	7	8	12	10	12	16	16	22	27	29
Transportation, storage and postal services	0	3	7	6	6	12	9	19	17	19	23	28	32	29	24
Information transmission, software and IT services	0	1	0	2	5	7	9	7	6	8	9	10	16	22	22
Building industry	0	1	1	1	0	1	3	4	7	10	14	20	19	20	20
Leasing and Business Services	1	1	1	2	1	3	2	3	3	3	5	4	6	9	10
Complex	0	0	0	1	3	2	3	5	4	6	4	5	7	6	7
Agriculture, forestry , animal husbandry and fishery	0	0	0	0	2	2	2	3	4	4	7	7	6	9	6
Accommodation and Catering Services	1	1	1	1	1	1	2	2	1	3	5	6	5	4	5
Water Conservancy, Environment and Public Facilities Management	0	1	1	1	2	2	3	3	3	3	6	6	4	4	4
Culture, Sports and Entertainment	0	0	1	0	0	0	0	3	3	4	2	3	2	3	4
Education industry	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1
Health and social work	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
Scientific and technical services	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Total	15	50	76	90	158	226	256	396	384	452	519	594	642	725	758

Appendix 2: Within industry ratio of firms in networks across industries

Industry	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Financial Industry	0.00	14.29	32.05	14.29	30.77	50.00	57.14	66.67	46.67	58.82	51.85	55.56	70.00	75.00	72.50
Electricity, heat, gas and water production and supply industry	0.00	0.00	11.66	11.90	20.00	24.49	27.45	36.36	43.10	47.46	40.00	48.33	53.13	66.67	64.38
Accommodation and Catering Services	20.00	20.00	0.00	0.00	0.00	33.33	28.57	33.33	14.29	50.00	55.56	77.78	60.00	45.45	54.55
Mining industry	0.00	0.00	7.40	14.29	11.76	30.00	31.82	25.00	21.74	27.59	41.67	44.44	47.62	45.28	48.28
Transportation, storage and postal services	0.00	7.41	12.33	9.52	23.40	23.21	25.45	33.33	25.86	27.42	36.92	43.28	43.06	50.68	44.00
Wholesale and retailing	5.00	2.63	6.87	7.69	15.31	22.55	19.80	27.27	28.57	35.35	31.31	33.66	34.00	39.29	43.20
Leasing and Business Services	0.00	12.50	9.62	8.33	23.08	14.29	21.43	20.00	20.00	18.75	29.41	33.33	42.11	33.33	40.74
Real Estate	12.50	12.00	13.74	10.34	28.33	21.31	25.40	35.48	31.75	30.30	32.00	23.81	37.50	39.02	39.84
Complex	2.13	4.48	8.01	10.67	18.92	23.61	28.77	29.85	26.87	32.35	30.88	36.51	37.50	44.44	37.04
Manufacturing	3.14	8.48	10.80	12.87	20.83	24.03	29.37	32.65	32.37	34.99	36.64	41.33	40.91	39.58	35.87
Building industry	0.00	15.38	6.01	17.65	22.22	22.73	34.62	18.52	25.93	31.25	38.89	45.95	45.24	42.86	34.69
Health and social work	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	33.33
Water Conservancy, Environment and Public Facilities Management	0.00	20.00	12.02	10.00	10.00	18.18	18.18	45.45	54.55	54.55	50.00	42.86	40.00	37.50	30.00
Culture, Sports and Entertainment	0.00	33.33	24.04	25.00	50.00	50.00	25.00	0.00	0.00	0.00	0.00	0.00	11.11	25.00	27.78
Resident services, repairs and other services	0.00	0.00	0.00	0.00	0.00	20.00	40.00	40.00	40.00	20.00	14.29	37.50	12.50	11.11	25.00
Information transmission, software and IT services	4.35	12.90	8.24	10.81	19.51	25.53	21.15	23.53	23.40	24.07	24.14	24.19	26.83	28.70	23.62
Agriculture, forestry , animal husbandry and fishery	0.00	0.00	10.12	0.00	3.85	17.24	23.33	11.43	12.12	13.89	17.14	22.22	29.41	25.00	20.93
Scientific and technical services	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	33.33	28.57	20.00	10.00
Education industry	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Appendix 3a: Centrality of listed companies across industries

Industry	Degree				Between			
	Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Min	Max
Financial Industry	1.2308	1.5481	0	10	0.1377	0.2949	0	1
Mining industry	0.9111	1.8728	0	18	0.0735	0.2279	0	1
Electricity, heat, gas and water production and supply industry	0.7849	1.4122	0	13	0.0549	0.1786	0	1
Building industry	0.5885	1.0246	0	7	0.0515	0.1884	0	1
Transportation, storage and postal services	0.5587	1.1318	0	12	0.0432	0.1734	0	1
Manufacturing	0.5565	1.1219	0	14	0.0352	0.1586	0	1
Accommodation and Catering Services	0.5447	0.8708	0	4	0.0208	0.1184	0	1
Water Conservancy, Environment and Public Facilities Management	0.5183	1.0594	0	6	0.0546	0.2057	0	1
Wholesale and retailing	0.4817	1.0800	0	11	0.0337	0.1606	0	1
Real Estate	0.4504	1.0396	0	16	0.0331	0.1532	0	1
Information transmission, software and IT services	0.4312	1.0813	0	10	0.0199	0.1170	0	1
Leasing and Business Services	0.3984	0.7953	0	4	0.0472	0.1934	0	1
Complex	0.3736	0.8510	0	10	0.0245	0.1329	0	1
Scientific and technical services	0.3478	0.8998	0	4	0.0377	0.1809	0	1
Agriculture, forestry, animal husbandry and fishery	0.2448	0.6270	0	3	0.0185	0.1216	0	1
Resident services, repairs and other services	0.2209	0.4703	0	2	0.0194	0.1289	0	1
Culture, Sports and Entertainment	0.1961	0.4231	0	2	0.0001	0.0013	0	0.0128
Health and social work	0.1818	0.4045	0	1	0.0000	0.0000	0	0
Education industry	0.0000	.	0	0	0.0000	.	0	0

Notes:Degree refers to the number of contacts a firm has in its network. Betweenness centrality means the number of paths through the firm to all paths in the network.

Appendix 3b: Centrality of listed companies in ownership networks across industries

Industry	Degree				Betweenness			
	Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Min	Max
Financial Industry	0.7665	1.1124	0	6	0.00000190	0.00000922	0	0.000118
Electricity, heat, gas and water production and supply industry	0.5314	1.0262	0	8	0.00000479	0.00003310	0	0.000514
Mining industry	0.5241	1.1863	0	12	0.00000183	0.00001260	0	0.000201
Leasing and Business Services	0.4061	0.7610	0	4	0.00000041	0.00000267	0	2.77E-05
Manufacturing	0.3915	0.8243	0	10	0.00000109	0.00001500	0	0.000773
Wholesale and retailing	0.3870	0.8567	0	14	0.00000095	0.00001210	0	0.000366
Accommodation and Catering Services	0.3759	0.6922	0	4	0.00000002	0.00000019	0	2.00E-06
Transportation, storage and postal services	0.3744	0.7092	0	6	0.00000102	0.00001310	0	0.000346
Building industry	0.3510	0.6605	0	4	0.00000072	0.00000572	0	7.93E-05
Education industry	0.3333	0.6172	0	2	0.00000021	0.00000080	0	3.11E-06
Real Estate	0.3210	0.7684	0	10	0.00000067	0.00000901	0	0.00027
Information transmission, software and IT services	0.3044	0.7852	0	7	0.00000101	0.00001070	0	0.00017
Water Conservancy, Environment and Public Facilities Management	0.2750	0.7081	0	5	0.00000205	0.00002810	0	0.000433
Agriculture, forestry , animal husbandry and fishery	0.1994	0.4740	0	2	0.00000021	0.00000212	0	3.02E-05
Complex	0.1890	0.5140	0	3	0.00000019	0.00000328	0	0.000064
Culture, Sports and Entertainment	0.1490	0.4417	0	3	0.00000030	0.00000285	0	3.02E-05
Health and social work	0.1250	0.3416	0	1	0	0	0	0
Scientific and technical services	0.0244	0.1562	0	1	0	0	0	0

Notes:Degree refers to the number of contacts a firm has in its network. Betweenness centrality means the number of paths through the firm to all paths in the network.

Appendix 4a: Structural hole of listed companies across industries

Industry	Constraint			
	Mean	Std Dev	Min	Max
Agriculture, forestry , animal husbandry and fishery	0.9862	0.0772	0.3994	1.1285
Mining industry	0.9251	0.1942	0.1331	1.6441
Manufacturing	0.9720	0.1237	0.1210	1.9445
Electricity, heat, gas and water production and supply industry	0.9264	0.1804	0.1939	1.2986
Building industry	0.9612	0.1323	0.3284	1.6389
Wholesale and retailing	0.9720	0.1156	0.2806	1.8631
Transportation, storage and postal services	0.9531	0.1562	0.1267	1.6667
Accommodation and Catering Services	0.9850	0.0901	0.3973	1.1250
Information transmission, software and IT services	0.9818	0.0986	0.2544	1.6200
Financial Industry	0.8809	0.2246	0.2282	1.3263
Real Estate	0.9727	0.1223	0.2000	1.7516
Leasing and Business Services	0.9705	0.1218	0.3968	1.5636
Scientific and technical services	0.9775	0.1117	0.3243	1.0000
Water Conservancy, Environment and Public Facilities Management	0.9578	0.1445	0.2655	1.0000
Resident services, repairs and other services	0.9893	0.0700	0.5000	1.0000
Education industry	1.0000	.	1.0000	1.0000
Health and social work	1.0000	0.0000	1.0000	1.0000
Culture, Sports and Entertainment	0.9953	0.0475	0.5200	1.0000
Complex	0.9849	0.1077	0.2800	1.9150

Notes: Constraint measures the structural holes a firm has in its network. It captures total constraint the network has to the firm.

Appendix 4b: Structural hole of listed companies in ownership networks across industries

Industry	Constraint			
	Mean	Std Dev	Min	Max
Financial Industry	0.9083	0.2184	0.2000	1.0000
Electricity, heat, gas and water production and supply industry	0.9359	0.1798	0.2000	1.1250
Mining industry	0.9448	0.1733	0.1000	1.1250
Education industry	0.9667	0.1291	0.5000	1.0000
Wholesale and retailing	0.9686	0.1289	0.1391	1.1250
Transportation, storage and postal services	0.9693	0.1291	0.2439	1.1250
Manufacturing	0.9707	0.1254	0.1429	1.1250
Leasing and Business Services	0.9724	0.1259	0.3333	1.1250
Water Conservancy, Environment and Public Facilities Management	0.9745	0.1051	0.4397	1.0000
Building industry	0.9747	0.1160	0.2500	1.1250
Real Estate	0.9750	0.1178	0.1250	1.1250
Information transmission, software and IT services	0.9786	0.0987	0.3333	1.0069
Agriculture, forestry , animal husbandry and fishery	0.9881	0.0745	0.5000	1.0000
Complex	0.9893	0.0720	0.5000	1.1250
Culture, Sports and Entertainment	0.9921	0.0671	0.3333	1.0069
Accommodation and Catering Services	0.9940	0.0835	0.3767	1.1250
Scientific and technical services	1.0000	0.0000	1.0000	1.0000
Health and social work	1.0000	0.0000	1.0000	1.0000
Financial Industry	0.9083	0.2184	0.2000	1.0000

Notes: Constraint measures the structural holes a firm has in its network. It captures total constraint the network has to the firm.

Appendix 5: network centrality for SOE and POB in each year

Year	Degree-SOE				Between-SOE				Degree-POB				Between-POB			
	Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Min	Max
1997	0.0499	0.2618	0	2	0.0035	0.0482	0	0.6667	0.0279	0.1652	0	1	0.0000	0.0000	0	0
1998	0.0960	0.3541	0	4	0.0051	0.0684	0	1	0.0755	0.3139	0	2	0.0047	0.0687	0	1
1999	0.1547	0.4573	0	4	0.0143	0.1116	0	1	0.0460	0.2106	0	1	0.0000	0.0000	0	0
2000	0.1680	0.5082	0	4	0.0131	0.1043	0	1	0.0769	0.2678	0	1	0.0000	0.0000	0	0
2001	0.2915	0.6458	0	7	0.0310	0.1556	0	1	0.2302	0.5391	0	3	0.0172	0.1112	0	0.8333
2002	0.3857	0.8323	0	11	0.0288	0.1493	0	1	0.3024	0.6688	0	5	0.0282	0.1581	0	1
2003	0.4432	0.8785	0	12	0.0456	0.1813	0	1	0.3380	0.6537	0	3	0.0198	0.1075	0	0.8333
2004	0.5347	1.0352	0	18	0.0445	0.1828	0	1	0.3932	0.7851	0	4	0.0303	0.1569	0	1
2005	0.5694	1.0120	0	13	0.0465	0.1859	0	1	0.3369	0.7602	0	5	0.0267	0.1478	0	1
2006	0.7033	1.1710	0	14	0.0642	0.2105	0	1	0.3260	0.7047	0	6	0.0254	0.1491	0	1
2007	0.7484	1.1462	0	9	0.0623	0.2078	0	1	0.3321	0.7105	0	5	0.0209	0.1356	0	1
2008	0.9898	1.3812	0	9	0.0747	0.2186	0	1	0.3567	0.7806	0	6	0.0209	0.1358	0	1
2009	1.1417	1.6380	0	14	0.0685	0.1931	0	1	0.3408	0.7600	0	5	0.0185	0.1150	0	1
2010	1.3934	1.8725	0	12	0.0608	0.1946	0	1	0.4657	1.0100	0	9	0.0254	0.1342	0	1
2011	1.4790	1.9761	0	16	0.0621	0.1926	0	1	0.2842	0.7288	0	11	0.0158	0.1130	0	1

Note: Degree centrality is the number of contacts a firm has in its network. Betweenness centrality is the possibility that a focal firm falls into the paths of other network members.