The Investment Behaviour of Chinese Listed Firms

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Abstract

This thesis investigates the investment behaviour of the Chinese listed firms. Three main themes are explored. First, we look at how state ownership affects the financial constraints on investment of the Chinese listed firms. Using two different proxies for investment financial constraints, we document that state ownership does not necessarily help in reducing firm's financial constraints on investment in China's state capitalist economy. Second, we examine how the recent global financial crisis of 2008 influenced the Chinese listed firm's investment behaviour via three channels, namely the demand channel, the financial constraints channel and the uncertainty channel. We find that the impact of the global crisis on the Chinese firms is mostly via the demand channel. The firms in the more export driven sectors cut investment in response to the financial crisis and suffer higher degree of financial constraints on investment as compared to other firms. Third, we assess the investment behaviour of China's elite SOE listed firms (SASAC listed firms) with an emphasis on overinvestment. We document that the SASAC listed firms although may be less subject to financial constraints and rich in cash, do not exhibit an overinvestment behaviour that deviates from the other listed firms. Our researches in this thesis contribute to the existing literature by applying the standard as well as the more recently developed theories and practices to firms in a transition economy such as China, and by offering fresh insights into how the corporations in the world's largest developing economy really behave in terms of corporate investment.

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Chapter 1 Introduction

1.1 Motivation

In the recent past decades, the economic ascent of China after its reform and opening in the late 1970s has spurred research interests on the now world's second largest economy. China's economic performance, with an average annual GDP growth rate of about 10 per cent for the last three decades and with over half a billion people benefitted from being lifted out of poverty, has been more than remarkable. China's economy is important and interesting to study not only because of its success and continuous adaptation in economic development that have caught everyone's attention but also because of its many characteristics in some aspects that are different from and in other aspects similar to other economies. From fields in policies, economic institutions, law, and financial system to fields in entrepreneurship, management and etc., scholars and researchers are trying to understand better about the Chinese economy and explore whether the Chinese experience and what aspects from it can be learned.

China after its initiation of the reform and opening in 1978, with its gradualist approach in embracing the market, has transformed itself from a centrally planned economy to a now mixed economy in which the market has functioned relatively well along side with the government-led economic development initiatives and occasional government interventions. With regard to its corporate sector, which is central to our researches in this thesis, China began the reform of its large state-owned enterprises (SOEs) in the early 1990s. The establishments of the two stock exchanges in Shanghai and Shenzhen at the

end of the year 1990 are largely a part of the reform measures to transform the selected SOEs through corporatisation.[1] These firms' shares were floated on the two stock markets, albeit only partially. The issuance of these large SOEs' shares on the stock markets is the government's bid to improve corporate governance in these firms by introducing private/diverse shareholders and by creating pressures. Nonetheless, the rest of the shares of these firms were still held by the state or state-related agencies, an attempt by the government to retain its controls over these newly corporatised SOEs. For example, in 2002, about two third of the total shares of all the listed firms were state-owned shares or legal person shares that remain non-tradable. Although transfers of shares between the government and the legal persons and amongst the legal persons were fairly frequent, it was only until 2005, the conversion of non-tradable shares to tradable shares became possible under the "split share structure" reform. The development and the status of the Chinese public listed sector have been unique. How the Chinese listed firms, of which the vast majority evolved from the SOEs, behave in an economy characterised by state capitalism is what sets the research theme of this thesis. We are interested in how the investment behaviour of these firms, after years of the corporatisation progress and further reforms in the Chinese economy, may demonstrate as compared to firm behaviour in the literature and to their counterparts in mature economies, and how it may respond to economic situations such as the recent global financial crisis.

We focus our researches on the firm level investment behaviour because

[1] For instance, only about 9 per cent of the firms that are publicly listed on the two stock exchanges at the end of 2002 did not start as SOEs.

investment decisions made by the firms are not only crucial to the firms themselves but also in aggregate of vital importance to the economic future of the country where the firms operate. The long-term economic development of a country depends essentially on investment in fixed capital. In the case of China, the significance of investment is especially striking, with an investment to GDP ratio of 46 per cent in 2011 and an average annual year-on-year fixed asset investment growth of 22 per cent for the past three decades (Qu and Sun 2012). Furthermore, fixed capital investment is one of the key determinants that drive business cycles in an economy. All in all, looking into investment at the firm level will help us to gain insights, which may not be perceived in macroeconomic studies, such as the firm heterogeneity and corporate financing behaviours.

There is a large body of existing literature on the investment behaviour of firms. However, the majority of it has focused on theoretical arguments and empirical works based on advanced market economies, for example, on the mature firms in the United States and Western European countries (reviewed in Chapter 3). For instance, most relevant to our study is the development of the asymmetric information approach in the investment literature, which established an important link between investment and financing. A growing number of studies on transition economies have also appeared in the last decades. However, only a limited amount of the works has an emphasis on Chinese firms. Most of these works have focused on the financial side of the investment behaviour and on the ownership types of firms since it is common in the transitions economy at large, the biggest hurdle for firms to engage in real activities (such as investment) and grow their businesses is the difficulty in

credit access. A few studies based on large samples of mainly non-listed companies have documented that while the firms in China's private sector suffer severe financial constraints, state-owned firms do not experience such constraints. These researches have used either investment-cash flow sensitivity (Poncet et al 2010) or the sensitivity of firm total assets growth to cash flow (Guariglia et al 2011) as proxies for the financial constraints. Other studies on the associations between financial factors and firm investment behaviour among Chinese firms have centred on the effect of debt financing. For instance, Firth et al (2008) argue that there exists a negative relation between leverage and investment in Chinese listed firms as a result of the monitoring and disciplinary effect of debt, although the relation is weaker in firms having a higher level of state ownership.

Our researches differ from other studies in the same line. We take into account of the dynamism of the Chinese economy and its corporate sector by focusing on the listed firms that offer more reliable data and allow us to utilise the more accurate information on shares and ownership. The listed firms in question are the largest and leading companies in China, and represent an integral part of the Chinese economy. By studying the investment behaviour of the listed firms in China, we will also be able to learn how and to what extent the Chinese economic reforms have transformed the corporate sector. With the growing number of Chinese firms, many of which are public listed firms, becoming top global firms and participating in global economic activities, understanding better about their behaviour will provide valuable information for policymakers and economists. In the next subsection, we introduce the objective of this thesis and discuss further how our researches may differ from those in the

existing literature.

1.2 Objective

The aim of this thesis is to focus on thorough investigations of how the Chinese public listed firms' investment behaviour may differ from or conform to the existing literature and popular perceptions, and to offer new insights from our results and analyses. We first look at the situation of the investment financial constraints of the listed firms in relation to state ownership by using innovative and advanced methodologies, and provide rigorous robustness tests of our research outcomes. We are interested in how the listed firms, after years of corporatisation that transformed them from SOEs to corporations with at least some degree of diversification of ownership, may behave with relation to state ownership presence. Whether the listed firms having higher or majority presence of state ownership is less subject to financial constraints on investment is examined. Second, we analyse how the listed firms, which operate in a state-led semi-market economy, respond to the global financial shock in terms of their investment decisions. Specifically, we want to learn how the Chinese listed firms reacted to the recent global financial crisis of 2008 with regard to three channels that may convey the impact to their investment behaviour, namely the demand channel, the financial constraints channel and the uncertainty channel. Finally, we focus on the elite state listed firms of China by testing if these firms are actually more inclined to overinvestment because of their superior economic and political status. We are particularly interested in the behaviour of the listed firms that are under the direct management of an important government agent, the SASAC (State-owned Asset Supervision and Administration Commission), because of these firms' unique status in China's

corporate sector. Understanding how the Chinese corporate sector of today behaves in the abovementioned aspects will help us envisage the future prospects of the Chinese economy.

1.3 Contributions

This thesis will contribute to the existing literature by providing valuable and fresh insights about how the Chinese listed firms really behave with respect to investment decisions. Firstly, our findings from chapter 4 offer new evidence of whether state ownership affects the Chinese listed firms with respect to their financial constraints on investment. The implication to our findings is important as it suggests that reform of SOEs through corporatisation is effective and successful in a sense that the soft budget constraints traditionally enjoyed by these firms have been purged along with the progress of corporatisation. Secondly, to the best of our knowledge, chapter 5 is one of the first few researches to offer an analysis of how the recent global financial crisis of 2008 affected the Chinese firms' investment behaviour. The chapter provides insights into how and whether the listed firms' investment behaviour was affected via the output demand channel, the financial constraints channel and the uncertainty channel. We confirm that the Chinese economy was hit most severely via demand shock, and that its manufacturing/exporting sector was most affected by the global downturn. Our analyses in this chapter contribute to the literature on the real effects of macroeconomic events, such as the financial crisis, on firm level investment. Thirdly, chapter 6 offers the first study ever on the behaviour of China's elite state firms, the SASAC listed firms. Applying the concept of overinvestment of free cash flow on the Chinese listed firms, we find that the behaviour of the elite SASAC listed firms do not differ

significantly from the other listed firms. Our results suggest that the special organisation established by the government to oversee the most important corporations in China is effectively fulfilling its function of monitoring and supervising the firms in question.

1.4 Thesis Structure

In chapter 2, we offer an overview of the Chinese economy. How the reforms that have taken part in the past decades transformed the economic system of China and most importantly the implications of some of the institutional changes and aspects to the Chinese listed firms' investment behaviour are discussed. The purpose of chapter 2 is to provide preliminary but useful insights on how might the firms behave in China's economic system.

In chapter 3, we investigate the relationship between state ownership and investment financial constraints of the Chinese listed firms. We examine whether the listed firms that still have higher or majority state-owned shares experience less financial constraints as would be expected conventionally. We begin with using investment-cash flow sensitivity as the proxy for financial constraints on investment to test our research question. To check the robustness we verify our findings by applying the more recently developed KZ index method as an alternative measure for financial constraints to our sample firms. Both of the results from the two independent methodologies suggest that although an average Chinese listed firm from our sample faces a certain degree of financial constraints on investment, state ownership does not necessarily help in reducing the firm's investment financial constraints. Another extensive test on our sample firms also provides evidence that state

ownership does not lead to more borrowing from the Chinese banking sector. The further finding reinforces our main results and implies that state ownership does not alleviate the firm's financial constraints on investment via the government-controlled banking sector. Chapter 3 concludes that the corporatisation movement for large state-owned enterprises (SOEs) in China since the early 1990s is effective in the sense that soft budget constraints once enjoyed by former SOEs have been removed along with the progress of corporatisation. Despite these firms are still state-involved, they can be regarded as modern corporations operating in a market environment.

In chapter 4, we look at how the recent global financial and economic crisis of 2008 affected the Chinese economy with respect to the corporate investment behaviour of the Chinese listed firms during the period. We employ a panel of 1689 firms that are publicly listed on the two mainland Chinese stock exchanges (A share) in the period between 2006 and 2010 with quarterly data. Three channels that can convey the real effect of the financial crisis to firms are examined, namely the demand channel, the financial constraints/balance sheet channel, and the uncertainty channel. Moreover, we investigate how firms in different industry sectors respond to the financial crisis in terms of their investment decisions. Our results show that among the three possible transmission channels, the demand channel has the most prominent effect on the investment decisions of the Chinese firms and firms cut investment in response to the financial crisis. On the investment financial constraints for our sample firms, the evidence obtained from our estimations suggests that the Chinese listed firms in general do not experience severer credit constraints during the financial crisis (but the firms in the more export driven sectors do).

For the uncertainty channel, we do not find uncertainty, based on using two alternative proxies for uncertainty, as an important factor affecting the sample firms' investment behaviour during the financial crisis. The results, in particular for the demand and financial constraints channels, are logical and further proof that the recent global event has only limited impact on the Chinese economy. First, the effect from the crisis on corporate investment in China is largely through the demand channel because of the dire economic conditions in the United States and Europe that caused the slumping demands for goods, which are mostly produced in China. Second, the credit crunch/squeeze that happened in United States and across the Atlantic in Europe did not spread to China. It is because that China has a rather isolated financial system from the rest of the world. Financial deregulation in China is still at the infant stage. Financial derivatives and other financial products are still underdeveloped or non-existent at all. The state-backed banking sector and inflow of "hot money" from investors in other economies seeking for higher returns also mean that Chinese firms in comparison with their counterparts in the west have relatively less to worry about credit shortage during the global financial crisis. In addition to our main results, we examine further whether the Chinese listed firms in separate sectors defined by either being more export driven or more domestic demand driven respond differently to the financial crisis. We find evidence that firms in the more export driven industries are more affected by the global financial crisis and experience stronger financial constraints on investment. The results again support the view that the impact of the financial crisis on the Chinese economy has been predominantly through the contraction in international trade.

In chapter 5, we shift our focus again to the state ownership in the public listed firms sector. However, different from in chapter 3 where we define state ownership purely from the point of view of shareholding structure, we look at the firms in which the government not only maintain its interests by holding shares but also reinforces its rights by direct supervision and administration of the firms or the parent firms. The firms we investigate on are the "elite" firms of the Chinese corporate sector. The firms or their parent firms are considered so important by the government that a special commission directly under the State Council (SASAC)[2] was set up in 2003 to oversee their behaviour. These firms (the SASAC listed firms) are interesting to study not only because of their special status politically but also because of the sheer influence and dominance they possess in the Chinese economy. For instance, the total profits of the firms directly under the central SASAC, the so-called *zhongyang qiye* (central enterprises), account for about 70 per cent of China's state sector. In this chapter, we examine whether the Chinese listed firms in general overinvest by applying the concept of overinvestment of free cash flow and check if the elite state listed firms' (over-)investment behaviour differs from the rest of the listed firms. We find that the SASAC listed firms do not necessarily exhibit a behaviour that deviates from the rest of the listed firms in terms of firm level overinvestment. Although the listed firms in general behave towards overinvestment using free cash flow, the SASAC firms do not have a higher tendency to overinvest in comparison to the other firms despite their special positions in the Chinese economy.

[2] SASAC stands for State-owned Assets Supervision and Administration Commission of the State Council.

In chapter 6, we conclude this thesis with a summary of our findings and discuss the implications and limitations of our findings.

1.5 Data

The datasets used in this thesis are obtained from two main sources that offer reliable accounting data on the domestic A-share listed firms in China. The first one is from the China Centre for Economic Research (CCER) at Peking University, which provides the balance sheet and income statement data needed for the constructions of the variables used in Chapter 3. The second data source is from the GTA Research Service Centre in Shenzhen (GTA information Technology Company Limited). Its *China Listed Firm Shareholder Research Database* provides the ownership structure data used in chapters 3, 4 and 5, and its *CSMAR China Stock Market Financial Statements Database* and *China Stock Market Financial Database – Financial Ratios Database* provide the data for the variables used in chapters 4 and 5. It also provides the daily stock price data required for the calculations of the standard deviation of stock returns for our sample firms, which are used as one of the proxies for uncertainty in chapter 5.

For chapter 3 on the investigation of the effect of state ownership on the Chinese listed firms' financial constraints on investment, the sample period covers from 1999 to 2008. For chapter 4 on the global financial crisis's impact on the Chinese listed firms' investment, the quarterly data used cover the entire period before and after the 2008 financial crisis, from the first quarter of 2006 to the third quarter of 2010. For chapter 5 on the SASAC firms' overinvestment behaviour, the sample period covers from 2003 to 2010.

The variables in chapters 3 and 5 have yearly observations, and in chapter 4, we use quarterly observations for the variables to suit the research purpose. All of the firms in our samples are non-financial firms and the majority of them are in the manufacturing sector. There are a few advantages of using listed firms for our purpose of study. The information and data for these firms are much more reliable and accurate than the non-listed firms since the listed firms have to meet higher standard of regulatory requirements. Moreover, with the listed firms' stock prices and shareholders information available, it makes it possible to construct market based variables such as the (average) q and the volatility of stock returns as the uncertainty proxy (used in chapter 4).

Chapter 2 Background on the Chinese economy and the institutional changes

The objective of this chapter is to provide a background of the Chinese economic system. How the Chinese economy transformed itself from a centrally planned economy to a hybrid market capitalist economy after a series of reforms since the late 1970s is important to our understanding of the behaviour of the firms in China. This chapter is organised as follows. In section 2.1, we first look at China's economic system before the reforms and most importantly its legacies. Section 2.2 then goes through the institutional changes in the economy, which mostly are related to firms, during the reforms in the past three decades. Section 2.3 describes the evolution of the financial system and focuses on the development of the banking sector and the stock markets in China. In section 2.4, we discuss the ownership diversification in the Chinese economy.

2.1 Chinese economic system before the reform and opening

China between 1949 and 1978 was a command economy typified by direct government control and national development strategies. Under this system, individual agents' economic decision making is subordinated by national goals. The behaviour of firms is completely dependent on the government's development plans. After the establishment of the People's Republic of China in 1949, China adopted the soviet socialist style of development strategy that pursued the build-ups of heavy industries as its utmost priority. Almost all the investments were directed and controlled by the government and the allocation

of resources was in every respect under the authority's directives. Any investment decisions were made not at the firm level but at the national level. Most of the investments were aimed at increasing China's (heavy) industrial capacity. As a result, the industrial growth went rapidly at an average rate of 11.5 per cent every year from 1952 to 1978. The entire Chinese industries were owned by the government. The prices of the products were set by the state. The financial system was dominated by a single powerful bank that acted as both the central bank and a commercial bank. Under the direction and control of the government, the single bank's main responsibility was to assign financial flows to the parties/units that required funds for investments according to the state's plan. Moreover, the government's control on the resources was further enhanced through its designated hierarchical personnel system. In the public sector, each level supervises the appointment and the performance of personnel at the next lower level. Thus, the career progressions of the personnel depend on an incentive structure that is closely related to the communist party. With all the different kinds of control in place, the firms (state-owned enterprises) were merely the government's vehicles in implementing the policies. They do not have any decision making power in issues such as pricing, investment projects, employment, and financing.

China during the pre-reform period is characterised by an economic system in which the state directed all the resources into industrialisation in a hope to rapidly accelerate its economy but had from time to time run into troubles because of the fundamental problems. Most notably is the failure in food supply. The Great Famine that happened in 1959 to 1961 was arguably a result of the Great Leap Forward campaign that emphasised the rapid

industrialisation. Even in the 1970s, the problems with food supply and production still lingered. The strategy adopted by the Chinese government neglected the basic needs in the economy. The developments of the industries for consumer goods and services were lagged behind. The growths in household consumption and services were not able to keep up with the growing pace of the gross capital formation, i.e. the fixed investment. Rationing was prevalent throughout the pre-reform period. Underemployment in the economy was another fundamental problem. As most of the industries are capital intensive and due to the lack of development of the service sector, new labour force was not able to be absorbed in the economy. Moreover, the (heavy) industries were filled with inefficiencies. Many production related facilities and factories were left idle or did not operate at full capacity. In brief, everything in the Chinese economy at the time was organised from the top and everything had to be done according to the plans. The economic system is short of the key ingredient, incentives, which would really drive growth voluntarily in an economy.

2.2 Institutional changes during the reform and opening

The shortcomings of the development strategy in the pre-reform years were finally realised and the issues could only be brought forward after the death of Mao in 1976. Two years later, the decision on the “reform and opening” was made at the meeting of the Central Committee of the Communist Party of China in December 1978, which marked as an important turning point in China’s economic development.

The economic reforms in China can be divided into two phases. The first

phase is usually defined as from 1978 to the early 1990s. During the period, forces and mechanisms such as incentives, hard budget constraints and competitions were gradually established in the economy. The decentralisation of the government authority to local levels began in the late 1970s. Local governments were given more power in local developments. Governments at the township and village level owned and managed the township and village enterprises (TVEs). These provided positive incentives for the local governments in growing out of the planned system. The entry of TVEs (considered as non-state enterprises) created competition with the SOEs in the industrial sectors. This exerted pressure on all enterprises to adapt. An important institutional change during the period was the introduction of market in the state sector through the dual track approach. In essence, SOEs were allowed to sell their products freely in the market once they have met the compulsory plan set by the government. These measures together allowed the firms to have more autonomy in decision-making and to become more profit driven. The implication from these changes is that firms, whether state-owned, collectively owned, or newly emerged privately owned, were given the initial opportunities to react to the market and to pursue profits that can be kept, i.e. to get a feel of the market force. The Chinese firms were able to behave more like their counterparts in the more mature economies, which normally have the objective of maximising firm value. The investment decisions of firms no longer entirely depend on government directives.

The second phase of the economic reforms, which started just before the mid 1990s, emphasised the replacement of the old and transitory system with a market system. The government aimed to build a rule based market system

that incorporates international best practices. The dual track system was abolished as the old planning system faded out. Exchange rates and convertibility of the current account were unified. The tax system and the fiscal system were overhauled. And most importantly, the government started the privatisation and restructuring of the SOEs during the second phase. The larger and healthier SOEs went through the “corporatisation” process and became public listed firms. The smaller, unprofitable and troubled SOEs were disposed as part of the “grasping the large and letting go of the small” policy adopted in 1997. The strategically important ones in industries such as defence, energy and other heavy industries were later placed under the supervision and management of the newly created State Asset Supervision and Administration Commission (SASAC). At the same time, privatisations of the TVEs, collectives and other SOEs through management buyouts became common, and practically all of these firms today are privately held. Moreover, regulatory bodies were set up in an effort to enhance the rule of law that supports the functioning of markets. These included the China Securities Regulatory Commission (CSRC) and the State Intellectual Property Office (SIPO) and etc. It was during the reforms in this period that China virtually became a market based economy although still with notable presence of state ownership and control.

In the next section, we look at how the financial system in China has been transformed. It is crucial to understand the financial system in any economy, as efficient allocation of financial resources is important to economic growth.

2.3 The financial system

2.3.1 Introduction

China's financial system before the reform and opening was very simple. The banking sector was entirely state-owned, which included only one single bank, and there were no stock markets or bond markets. The financial system was virtually the People's Bank of China (PBC), and its primary function was to handle the financial transactions as every investment project was planned by the government and funded with the state budget.

The financial system of China today has effectively all the institutions of a modern financial system. The PBC is now solely a central bank that takes charge of responsibilities such as the monetary policy and financial market regulations (e.g. the interbank lending market), and functions as any other central banks in the more mature market economies. The banking sector is now made up of a rich array of lending institutions including major state commercial banks, regional and city commercial banks, foreign banks, and etc. The domestic capital markets have developed with two stock exchanges in Shanghai and Shenzhen (SSE and SZSE), and each of the stock exchanges has its own different boards, for example the SZSE's SME Board was created to cater small and medium sized firms.

2.3.2 The banking system

China's banking sector is dominated by the "Big Four" state-owned commercial banks. These banks are originally part of the mono-bank system under the planned economy. During the early 1980s, the mono-bank system was dismantled and reorganised into four banks with independent identities

and designated sectors of operations. The Bank of China (BOC), which had maintained its presence overseas, was given the mandate to handle transactions related to foreign trade and foreign exchanges. The China Construction Bank (CCB) specialised in fixed investment project financing. The Agricultural Bank of China (ABC) dealt with all the banking businesses in rural areas. The Industrial and Commercial Bank of China (ICBC), which is the largest in terms of assets, took over the commercial transactions in urban areas.

Nonetheless, the legacies of the old planning system haunted the big four state banks during the early stages of the reform. They were used to providing finances based on the instructions from the central government or local officials, and often lacked the skills and incentives to operate as real commercial banks. Moreover, during the early years of China's economic reforms, the state banking sector acted as a buffer for some of the ailing SOEs that were not able to cope with the increased competitions in the economy. The state-owned banks were lending to those SOEs, and often were not repaid. At the time, the government was still very much in direct control of the lending process. As a matter of course, bad loans were accumulated. For instance, by the beginning of the 2000s, the available official data showed that the non-performing loans (NPLs) amounted to around 20 per cent of the GDP, a figure much higher than most other countries at the same time.[3]

At the end of the 1990s, the government started addressing the problem of its banking system. For instance, in 1998, it recapitalised the banks by issuing

[3] Source: Table 3-A from Allen et al' (2008)

special bonds with a value of 270 billion yuan in an effort to boost the banks' capital base. In the following year, the government set up four asset management companies (AMCs) for each of the big four state banks. The AMCs absorbed the NPLs of these banks that were made before 1996 in a bid to separate out the old and bad policy loans from the new loans. The establishment of the AMCs was another example of the successive reforms in the economy and a further restructuring measure for the banking sector. The AMCs are responsible for the recoveries of the bad loans they assumed. For the big four banks, restructurings have also taken places within the banks themselves through staff downsizing, information technology investment and etc. Furthermore, a series of mechanisms were installed to improve the banking system. The China Banking Regulatory Commission (CBRC) was set up in 2003 to supervise and regulate the banking sector. Central Huijin Investment Ltd was also founded in 2003 to exercise the government's ownership rights and the obligations as an investor.

Today, all four big state banks have their shares traded on the Shanghai Stock Exchange and the Hong Kong Stock Exchange, and have business operations outside their traditional focuses of sectors. The listing of these banks was a further reform measure that started in early 2000s to restructure the banks and improve their operations and performances through corporatisation and selling stakes to strategic international investors.

Besides the formation of the four big state banks, throughout the reform period, there were other financial intermediaries being developed or expanded. Regional and city banks (originally the urban credit cooperatives), which many

of them were owned or partially owned by the local governments, were created in the Special Economic Zones and cities around the country and a number of them have become joint stock commercial banks and are publicly traded on stock exchanges today. In the rural areas, the existing network of Rural Credit Cooperatives (RCCs) was transformed and placed under the supervision of the Agricultural Bank of China. Foreign and private banks were allowed to set up operations although the role they play in China's banking sector is still modest. Other financial intermediaries such as the trust and investment companies (TICs) emerged during the 1980s but the number of these institutions was greatly reduced in the mid 1990s because of increasing control.

All in all, the banking system of China today has virtually all the elements that a modern banking system elsewhere has: a central bank responsible for the monetary policy, a number of big commercial banks that dominate the retail banking market, a number of smaller banks expanding in the market, and more banks entering the market (particularly the foreign banks). The Chinese banking sector has become increasingly more competitive. However, the banking sector in China today in general is subject to rigid government regulations and is still dominated by the Big 4 government controlled banks, and the banks remain the largest and most important fund providers for businesses in China. The tight control of its banking system by the Chinese government, however, is one of the main reasons that China's banking sector escaped the devastating impact of the recent global financial crisis of 2008. The banking sector after the financial crisis remains business as usual with an increased oversight by the CBRC so as to set even higher regulatory

standards for banks (such as capital requirement increase and impairment rules).

The implications of the banking sector to the behaviour of the firms in China are an important question for this thesis. Most previous studies that have been mentioned in the last chapter, argue that the banking sector, which is still very much state influenced, at large remains cautious about lending to the private sector, and the state-involved firms (especially for the traditional SOEs) tend to receive preferential treatments from the banks. Thus, different ownership types of firms may experience different degrees of financial constraints on investment in China. Nonetheless, this issue on how the investment behaviour of firms with regard to financial constraints relates to state ownership will be examined in the next chapter.

2.3.3 Stock Markets

The development of China's capital markets began in the early 1990s with the creation of two stock exchanges in Shanghai and Shenzhen. The establishment of the stock exchanges was in fact part of the government's initiative to further reform the SOE sector. Through corporatisation or "partial privatisation" by publicly listing some of the stocks of the SOEs, new and diverse owners were introduced and it provided better disclosure of information about these firms. At the same time, the stock markets provide a new source of finance for the SOEs as the proceeds from the initial public offerings (IPOs) were kept by the listed firms themselves or their parents instead of being taken by the government.

At the early stage of the stock market development, more than 90 per cent of the listed firms were converted from SOEs, and most of these firms' shares were still held by the government or government controlled parent firms at the beginning. It was an attempt by the state to maintain the control of these firms and partly due to the concern about profiteering during the partial privatisation process. Thus, two classes of shares were formed. The non-tradable shares are the ones still retained by the government or by the so-called legal persons that were linked to the government. The rest of the shares are then publicly traded on the stock exchanges. In the early 2000s, one-third of the total shares were tradable. In 2001, the government began the reform of the stock markets. First, it requested the firms to start disposing the non-tradable shares by paying 10 per cent of the proceedings from all new listings into the social security fund. Second, the requirements on information disclosure and transparency were raised drastically. Finally, It was until 2005 when the reform of the previously described "split share structure" (with the two classes of shares) took place, the conversion of non-tradable shares to tradable shares became possible. The "split share structure" reform involved that the existing holder of the tradable shares to be compensated with bonus shares by the listed firms converting their non-tradable shares, and the holders of the newly converted shares had to agree not to sell more than a small proportion for a lock-up period of three years. The changes are again an important indication of the government's commitment to further reform the corporate sector.

In relation to the implications of the stock market to the investment behaviour of the listed firms, there are a couple of points worth making. First, the corporate governance in these firms (a majority of them were former SOEs) is

supposedly improved as measures needed to be put in place for these firms to be quoted as public corporations. These firms are under higher degree of public scrutiny by investors and their supervisory boards, and are required to be more transparent in terms of their operations and funding practices. Thus, their investment behaviour should be more aligned with modern corporations in more mature economies, i.e. with an objective to maximise the shareholders value (e.g. being responsive to the firm's market value and sales). Second, in terms of financing, the stock markets provide an alternative source of funds for the firms, which could then in effect influence the firms' investment decisions. Apart from the initial public offerings (IPOs), seasoned equity offerings (SEOs) have occurred frequently among the Chinese listed firms, although Bo et al (2011) find that SEOs by the Chinese firms were only weakly related to investment financing but more to the market timing to take the advantage of market overvaluation.

2.4 Ownership diversification in the Chinese economy

One of the most notable institutional changes in the recent past decades of reforms has been the transformation of ownerships in many aspects of the economy. During the first phase of economic reforms, the rise of the TVEs (the rural collectives) and the retreat of the (traditional) SOEs meant that competition had been created in the industrial sectors. The SOEs were not as flexible and adaptable in term of making economic decisions as the TVEs. Many of the smaller SOEs therefore had to be sold or leave the market. Moreover, small private domestic and foreign firms also emerged, exerting more competitive pressure in the economy. For instance, by 1996, the SOEs, TVEs and private firms, each produced around one-third of the total industrial

output in China. Most importantly and relevant to our research is the second phase of China's economic reform, which is signified by the ownership changes of the large SOEs, i.e. the corporatisation movement of the SOEs discussed earlier. An important stage during the time was the adoption of the new Company Law in 1994. The company law provided a framework for the ownership restructuring process that included the conversion of SOEs into corporations. It indicated the government's intention of forming a common legal framework where any types of ownership could operate in the market fairly, in a sense that a level playing field for competitions among different ownership type of firms was created. Nonetheless, the changes and restructuring of the ownership forms through ownership diversification in many of the corporations are still ongoing even until today. Therefore, it provides us an interesting case to investigate how these firms' investment behaviour may differ according to their ownership arrangements or their ultimate ownership types. The legacy of the system treating firms with state ownership more favourably may still linger after year of economic reforms, although it may also depend on how the firm in question is defined with respect to its type. This characteristic in the Chinese economy as a result of its continuous economic reforms largely sets the theme for this thesis. The implication of state ownership to the listed firm's investment behaviour is important for us to assess the extent to which the reforms of China's large SOEs are effective.

Chapter 3 State ownership and financial constraints on investment of Chinese listed firms: new evidence[4]

3.1 Introduction

How state ownership affects firm's real and financial activities has been drawing a lot of academic attention. One view concerns that state ownership damages corporate value mainly because government intervention unavoidably brings about political objectives in corporate decision-making (Shleifer and Vishny 1994, 1998), while the other view argues that state-involved firms are more likely to receive preferential treatment from the government (Blanchard and Shleifer 2001). Particularly, the impact of state ownership on the financing behaviour of newly corporatised firms in transition economies stands out due to historical connections between former state-owned enterprises (SOEs) and sources of external financing available to these firms. Many previous researches on firms in transition economies document that firms that are state-involved in general, experience less financial constraints on investment than firms with other types of ownership, such as those privately owned (Lízal and Svejnar 2002). The argument is centred on the accessibility of external financing for investments that these firms are able to gain in a transition economy where the state is still intervening in the allocation of capital. Hence the conventional view that state-involved firms are less subject to financial constraints is built upon the notion that in

[4] Another version of this chapter is published in the European Journal of Finance (EJF) as "Lin, H.-C.M., Bo, H., 2012. State-ownership and financial constraints on investment of Chinese-listed firms: new evidence. The European Journal of Finance 18, 497–513.". I would like to thank the co-author and my supervisor, Dr Bo, for her inputs and the referees and editors at EJF for their reviews.

transition economies many banks still remain very much state influenced if not state-owned. These banks are often under government pressure, concerning social objectives, such as preserving jobs, to offer state-involved firms loans irrespective of their profitability.

Previous studies on Chinese state ownership had focused on the relation between state ownership and firm performance. The conclusion drawn by this stream of researches is mixed: although some authors provide evidence that state ownership negatively affects firm performance (Sun and Tong 2003), state ownership is also found to promote firm performance under certain circumstances (Tian and Estrin 2008). Concerning the channels through which state ownership affects firm performance, many researchers claim that the negative effect of state ownership can be attributed to the fact that the firm is disturbed by the government's political objectives. The most frequently mentioned political objectives are related to retaining employment for the sake of social stability. Another channel through which state ownership affects firm performance is financing. Although the scale of researches on investment financing of Chinese firms is modest, a few studies find that firms classified as state-owned are less prone to financial constraints (e.g. Poncet et al 2010; Guariglia et al 2011). This conventional view on the relation between state ownership and the firm's financial constraints can be interpreted either way, it can be seen to support the view that state ownership creates firm value since state intervention helps reducing the firm's financial pressure, or it can be that state intervention continues to bring in soft budget constraints to state-involved firms despite years of market transition, which damages the firm's profitability.

In this paper, we provide new evidence on how state ownership affects financial constraints on investment of Chinese listed firms.

We distinguish ourselves from previous studies from the following aspects: First, we exclusively focus on the listed firms with state ownership (the state-involved listed firms hereafter), while previous studies in the same line are mainly based on a mixture of listed and non-listed firms in which listed firms constitute only a small portion (e.g. Poncet et al 2010; Guariglia et al 2011; Ding et al 2013).[5] We believe that the impact of state ownership on the firm's financial constraints differs between listed and non-listed firms. Listed firms are generally larger in size, more profitable, more transparent and have better corporate governance. They are more exposed to market scrutiny. Hence, have to be more responsive to market environment than non-listed firms. One distinguished feature of the Chinese listed firms is that the state has been retaining its dominance in many cases during our sample period of 1999 to 2008, which provides us an opportunity to examine whether these firms after years of corporatisation or partial privatisation still enjoy no or less financial constraints as compared with other firms.

Second, previous studies in this line have exclusively used the investment-cash flow sensitivity as the proxy for the firm's financial constraints on investment. Considering the debate on the investment-cash flow sensitivity (see Section 3.2.1), the results reported by previous studies require robustness check. In this paper, we extend the existing studies by applying an

[5] For example, in Guariglia et al (2011), less than 0.3 per cent of the firms in their sample are publicly listed.

alternative proxy for financial constraints on investment. We use not only the conventional measure of financial constraints on investment, namely the investment-cash flow sensitivity, but also an alternative measure of financial constraints, the KZ index, to test the relation between state ownership and firm's financial constraints on investment.

Third, when examining financial constraints on investment, we explicitly control for the impact of seasoned equity offering (SEO) behaviour of firms. The firm's equity financing behaviour after its initial public offering is relevant to the degree of financial constraints the firm faces because SEO is another main source of external financing for investment, apart from bank loans in China. For example, Huang and Song (2006) report that more than 50 per cent of financing of Chinese listed firms came from external sources and net equity financing made up more than 50 per cent of external financing, suggesting that Chinese firms very often use equity financing as a channel to raise capital. Previous studies on financial constraints of Chinese firms have not taken into account the firm's incremental equity financing behaviour.

Based on a panel of 1,325 Chinese listed firms during 1999 to 2008, we find that although an average firm in our sample experiences a certain degree of financial constraints, state ownership does not necessarily help in reducing it. Evidence shows that listed firms either with the state as the largest shareholder or with a higher state share do not necessarily face no or less financial constraints. Our results are obtained by using the system Generalised Methods of Moments (GMM) estimation technique, which takes account of both endogeneity and heteroscedasticity problems in the dynamic panel data

models. The result is robust to both the conventional proxy for financial constraints, i.e. the investment-cash flow sensitivity, and an alternative proxy for financial constraints, i.e. the KZ index. It is further supported by the evidence that state ownership does not bring in more bank loans to the sample firms, hence state ownership does not necessarily reduce the firm's financial constraints via the state-controlled banking sector. Our result suggests that China's corporatisation movement have been effective in the sense that soft budget constraints once enjoyed by former SOEs has been removed along with the progress of corporatisation. These firms, although still state-involved, can be seen as modern corporations operating in a market environment.

In the next section, we review both the standard literature of financial constraints on investment and the relevant literatures in relation to transition economies. Section 3.3 sets up the empirical models. Section 3.4 describes the data and presents summary statistics. In Section 3.5, we discuss the estimation results from using the investment-cash flow sensitivity as a proxy for financial constraints. Section 3.6 concerns the results from using the KZ index. In Section 3.7, we provide further robustness by testing the relation between the firm's borrowing and state ownership. Section 3.8 concludes.

3.2 Literature review of financial constraints on investment

3.2.1 Standard literature

An important strand of researches on investment behaviour that relates closely to this chapter as well as the subsequent chapters is based on the linkage between financial variables and investment. Earlier examples include Tinbergen (1939) and Meyer and Kuh (1957) that underline financial

considerations in investment. Nonetheless, these earlier studies that involve financial factors explaining investment to some extent are overshadowed by the seminal work of Modigliani and Miller (1958) who essentially argue that, under the assumption of perfect capital market, the market value of a firm is independent of its capital structure i.e. the firm's investment behaviour is independent of its financing decisions as internal and external funds are perfect substitutes. However, in reality the firm's investment decisions are determined by financial constraints it faces because external financing is more expensive than internal financing due to capital market imperfection and information asymmetry. Stiglitz and Weiss (1981) show that information asymmetry will lead to credit rationing in the loan market because loan providers cannot identify bad borrowers from good borrowers since the risk of a borrower's investment project is unobservable. Raising the interest rate could cause relatively good borrowers to leave the market and increase the riskiness of the lender's loan portfolio, and therefore could hurt the lender's profits. In equilibrium, the lender is likely to set the interest rate at a certain level that leaves an excess demand in the loan market, thus resulting credit rationing. Similarly, Myers and Majluf (1984) argue that since managers are better informed about the value of their investment projects and existing assets than external investors are, external investors will demand a premium to invest in the shares of good firms so as to cover the potential losses incurred from funding bad investments. The higher the degree of the information asymmetry, the costlier the equity financing for firms. Thus, there exists a hierarchy of finance or pecking order, which shows that firms have an order of preference with respect to the sources of finances for investment. They maintain that in terms of corporate financing, firms have the tendency to depend on internal

funds and to favour debt rather than equity if external financing is needed. In essence, the theoretical studies discussed above suggest that due to the asymmetric information problem that resulted external finance being more expensive than internal finance, investment decisions of firms will depend on the financial constraints the firms face.

Fazzari et al (1988) are the first to provide an empirical test for the presence of financial constraints on investment. They incorporate cash flow, a proxy for internal fund, in the q model of investment and use the sensitivity of investment to cash flow as an indication of the presence of financial constraints for the firms that are classified as more likely to experience asymmetric information problems. Using a panel of 421 manufacturing firms, they document that firms that are a priori grouped into “low dividend payout” exhibit higher sensitivity of investment to cash flow, implying greater investment financial constraints for the low dividend payout firms. Following the seminal work of Fazzari et al (1988), similar empirical studies appear in the literature. These studies in general establish the importance of financial constraints for investment decisions of firms and show that for firms regarded as more financially constrained a priori, the higher the sensitivity of investment to the internal fund proxy. Hoshi et al (1991) find that firms affiliated with *keiretsu* (industrial groups) in Japan have weaker sensitivity of investment to liquidity measures, for instance, cash flow and stock of liquidity (short-term securities), and argue that these firms face less financial constraints because of their close relationship with the main bank inside *keiretsu* that reduces the problem of asymmetric information. Another paper by Devereux and Schiantarelli (1990) documents that cash flow is a more important factor for investment for younger

firms than for older firms because information asymmetry is likely to be severer for younger firms. Overall, evidence from these empirical studies suggests that for firms considered a priori to be more (less) financially constrained are found to have stronger (weaker) sensitivity of investment to cash flow-type variables.

Nevertheless, relying on the investment-cash flow sensitivity to gauge financial constraints on investment is not without criticism. Kaplan and Zingales (1997) challenge that firms having higher investment-cash flow sensitivity cannot be taken as evidence of being more financially constrained. They document that in an in-depth study on the subsample firms used by Fazzari et al (1988), the firms that were identified as less financially constrained have in fact significantly higher investment-cash flow sensitivity than the firms that appeared to be more constrained. In response, Fazzari et al (2000) criticise Kaplan and Zingales's (1997) inadequate choice of their subsample firms for the study, and argue that their theoretical model fails to represent the approach used by similar researches in the literature. Allayannis and Muzomdar (2004) point out that the findings from Kaplan and Zingales (1997) are the results of the inclusion of firms in distress defined by negative cash flow observations as well as a few influential observations in a small sample. Recent studies that support Fazzari et al (1988) also include Chirinko and Kalckreuth (2003), who find consistent evidence showing firms that are financially constrained, as identified by their credit worthiness, have higher sensitivity of investment to cash flow. The debate on whether the investment sensitivity to liquidity measures such as cash flow is an indication for financial constraints on investment remains inconclusive.

Nonetheless, there have been some developments on measuring financial constraints without relying on investment-liquidity sensitivity in the literature. The KZ index created by Lamont et al (2001) is the prominent example that makes use of the well-known study by Kaplan and Zingales (1997) that directly challenges the Fazzari et al's (1988) application of investment-cash flow sensitivity as a measure of financial constraints (the KZ index will be discussed further in the later section). Following the KZ index by Lamont et al (2001), a number of studies proposed different index style measures of financial constraints. Whited and Wu (2006), using an investment Euler equation estimated by GMM estimator, construct a new index of financial constraints (WW index) and show that the firms identified as constrained by their index display characteristics associated with exposure to external finance constraints. These firms are small, underinvest, have low analyst coverage and do not have bond ratings. They find that constrained firms have higher returns and that the effect of financial constraints dominates the size effect. Hadlock and Pierce (2010) argue that firm size as well as age are practically the most important determinant of levels of financial constraints after investigating detailed qualitative information on financial constraints from financial filings. They develop an index (SA index) that simply uses firm size and age as the only legitimate factors that determine financial constraints.

In this paper, we use not only the investment-cash flow sensitivity, but also an alternative measure for financial constraints (KZ index) to test the relation between state ownership and the firm's financial constraints on investment. We will discuss the KZ index in detail in section 3.6.

3.2.2 Relevant literature in transition economies

In line with the standard literature of financial constraints on investment, a few studies have touched upon the issue of investment behaviour of privatised or corporatised former SOEs in transition economies. Majority of these studies on firms in transition economies have focused on how, after the economic reforms with outright privatisation of SOEs and/or entries of foreign firms, different types of firms faced with various degrees of credit constraints. For instance, Lízal and Svejnar (2002) using quarterly data on Czech industrial firms during the period of 1992 to 1998, find that among their twelve types of firms classified, while the foreign-owned firms invest the most, the cooperatives invest the least and are credit rationed. In addition, the private firms do not invest more than the SOEs do. However, the SOEs and the former SOEs, despite being less profitable, received more bank credits and operate under soft budget constraints as indicated by their insignificant coefficients of profit in the investment equation. Similarly, Mickiewicz et al (2004) investigating a panel of Estonian manufacturing firms during 1995 to 1999, demonstrate that small domestic firms are particularly financially constrained as compared to those with the presence of foreign investors.

In summary, relevant studies on transition economies in the literature argue that during the transition, the most noticeable issue involving investment by (private and non-foreign) firms has been the access to finance because of the underdeveloped financial system in the economy as well as the legacy of the (once) government controlled banks being still in favour of state related firms, which is described by Lízal and Svejnar (2002) as the “old boys’ network”. Firms with close or former connections with the government tend to continue

enjoying favourable terms with respect to financial access. The investment decisions of these firms are not necessarily determined by profitability or investment opportunities but may be influenced by the government's political or social agendas.

In the context of China, the number of relevant investment studies has been limited. This is partly due to the availability and quality of (firm level) data in China. Other than the concern on reliability of data, conventional perceptions and stereotypes about how and what type of firms would behave in transition economies like China also hinder the possibility of producing researches that would actually provide new insights. Most of the relevant studies on Chinese firms have tried to link the investment behaviour of firms with their ownership types and the possible financing constraints that each ownership type of firms may face. This is because during China's economic transition in the past three decades, one of the most visible and fascinating changes to the Chinese corporate landscape has been the emergence of the unique ownership type of firms such as the rural collective firms, the re-emergence of the private sector, and most importantly the gradual transformation of the SOEs. These studies often find that the state firms in China by their definitions or by most common standards are the least financially constrained, followed by the collectively owned enterprises. Private firms in China have been found to suffer the most from financial constraints on investment as compared to other types of firms. These studies often argue that despite the economic reforms, the still largely state dominant environment have not particularly favoured the private business sector, and the state-controlled banking sector, which remains the most important source of finance for firms, has been lending mostly to the state

sector or former state firms because of their traditionally close relationships.

Two studies on Shanghai's manufacturing sector by Chow and Fung (1998, 2000) are the earliest empirical researches examining how Chinese firms' investment decisions respond to liquidity. Chow and Fung (1998) adopting the common practice used in the standard literature (e.g. Fazzari et al 1988) find that cash flow is a significant determinant of investment for those manufacturing firms and that the private firms are more liquidity constrained than the state-owned and collective-owned firms with regard to the availability of cash flow. In another paper by Chow and Fung (2000) that focuses on the relation between firm sizes and liquidity constraints for firms in Shanghai's manufacturing sector during 1989 to 1992, the results demonstrate that small firms are in fact less liquidity constrained than the larger firms in terms of fixed investment financing. They suggest that the small firms are mostly non-state firms and are fasting growing and efficient. These firms are able to generate enough internal funds for their investment, and although they have only very limited access to credit form the formal banking sector, these small non-state firms can rely on borrowings from the informal market.

These earlier studies provide some initial clues about how different types of firms might behave in China's unique economic environment, though they may be considered outdated as China continues its economic reforms. Much more recent studies on Chinese firms' investment behaviour have appeared in the last few years. For instance, Héricourt and Poncet (2009), using survey data on 1,300 domestic firms during 2000 to 2002 and employing two firm-level measures of financial distress (debt-to-asset ratio and interest coverage) in a

dynamic investment equation, find that investment by domestic private firms are affected significantly by the two measures of financial distress, suggesting the private domestic firms are credit constrained. The state-owned firms in their sample do not face such constraints. They document that FDI inflows are associated with a moderate reduction in financing constraints for private domestic firms in China, and argue that when coping with financial markets, FDI inflows seem to reduce the imperfections experienced by private domestic firms. Poncet et al (2010) argue that 'political pecking order' in credit allocation plays an important role in China. Using a large sample of more than 20,000 Chinese firms during the period of 1998 to 2005, in which the firms are divided into subgroups according to their definitions of ownership types[6], they document the presence of credit constraints in Chinese firms. They find that while the private firms suffer from such constraints on investment as displayed by their higher sensitivity of investment to cash flow, the state-owned firms and foreign firm do not exhibit such trait. Their findings are based on the fixed effect estimation results of an investment model that incorporates the change in turnover over capital as the approximate for investment opportunities and followed the standard literature to employ investment-cash flow sensitivity as the measure for financial constraints on investment. Guariglia et al (2011), by utilising the sensitivity of asset growth (in which investment is a significant component) to cash flow as an indication of financial constraints, show that the SOEs and the collectively owned firms are not influenced by the availability of cash flow from a sample of 79,841 mainly unlisted Chinese firms during 2000

[6] These groups include private firms, SOEs, collective-owned enterprises (COEs), and foreign invested enterprises, where a firm is classified as an SOE if the state owns either directly or indirectly more than 25 per cent of the firm's total shares. In the empirical analysis, they treat COEs as SOEs because COEs' are directly associated with local governments.

to 2007, suggesting these firms are not bounded by financial constraints.[7] They explain this result by that 'probably because of the important role they (SOEs) play in absorbing surplus labour and helping to maintain social stability, which guarantees them unlimited loans from the state banks'. In addition, they find that the private firms as well as the foreign firms are the most affected by cash flow availability, and within the group of private firms, the firms with an average share of state capital of less than 10 per cent and the firms with no political affiliation exhibit positive and statistically significant sensitivities of asset growth to cash flow, whereas the firms with higher than 10 per cent state ownership and firms with political affiliation exhibit insignificant asset growth to cash flow sensitivities. Moreover, by adapting Hovakimian and Hovakimian's (2009) method in calculating firm-level measure of financing constraints, Guariglia at al (2011) provide extensive evidence of the heterogeneity of private firms with respect to the degree of financing constraints the firm face. Ding et al (2013), using a panel of 116,724 Chinese firms over the period of 2000 to 2007, also document that, in terms of fixed investment, the SOEs are insensitive to cash flow while other types of firms exhibit a positive relation between cash flow and fixed investment, and suggest that the SOEs benefit from soft budget constraints.[8] Their further investigation on the effectiveness of working capital management on investment and financing constraints for other firms in China also provides evidence that the firms characterised by high working capital have high sensitivities of working capital investment to

[7] Guariglia et al (2011) classify the firms depending on the shares of paid-in-capital supplied by four different types of investors (state-owned, foreign, private, and collective) in each year. For example, SOEs are firms with majority shares of paid-in-capital contributed by the state, while firms with legal persons or individuals as the majority supplier of paid-in-capital are considered as private firms. They use different criteria from Poncet et al (2010).

[8] Ding et al (2012) use the same criteria as in Guariglia et al's (2011) paper to group their sample firms.

cash flow and low sensitivities of fixed capital investment to cash flow. Following Hovakimian and Hovakimian (2009), Ding et al (2013) construct firm-level sensitivities of investment in fixed and working capital to cash flow to analyse their determinants, and find that the firms with high sensitivities of investment in working capital to cash flow and low sensitivities of investment in fixed capital to cash flow exhibit the highest fixed investment rates in spite of facing severe financing constraints. They argue that these firms are able to alleviate the impacts of cash flow shocks on fixed capital investment by active management of working capital.

Another study that has touched on the financial determinants for Chinese firms' investment behaviour is on how leverage can have an effect on the investment decisions. Utilising a panel of 1,203 Chinese listed firms during 1991 to 2004, Firth et al (2008) document that a negative relation between bank loans and investment exists in Chinese listed firms and the relation is weaker in firms with low growth opportunities and poor operating performance as well as in firms with higher level of state shareholding. These results suggest the monitoring role of debt is working less effectively for poor performing firms and firms with higher state ownership presence. They argue that it is because the lending policy of the state-owned banks is more lenient towards the ailing firms and firms with larger state shareholding due to political considerations.

In summary, previous studies document that firms with significant state ownership in transition economies are not or less subject to financial constraints as compared to other firms with different types of ownership, and these firms may still enjoy some degree of soft budget constraints. However,

several key factors are important to mention in evaluating these previous studies. First, the datasets used in previous studies usually have not exclusively focused on the listed firms, and even if these firms were included, they only formed a very small part in the samples. The findings of these studies may be restricted to traditional state-owned firms in China as opposed to former SOEs that have been corporatised. It is interesting to see how the listed firms, of which the majority are evolved from SOEs may behave differently. In addition, the data on listed firms are much more reliable and accurate. Second, most previous studies have relied on the cash flow sensitivity to either fixed investment or asset growth (Guariglia et al 2011) as the proxy for financial constraints. Considering the debate on using cash flow sensitivity to identify financing constraints, the results reported by these studies require robustness tests. Third, previous studies have not controlled for the firm's seasoned equity financing behaviour when examining financial constraints on investment. Obviously, the firm's incremental equity financing behaviour is also very relevant for investment since it is another important channel of external financing for firms, particularly for Chinese listed firms as these firms normally do not have access to the corporate bond market.

3.3 Empirical specifications

In the standard literature, there are mainly two types of investment models that have been used in testing financial constraints on investment. They are the reduced form investment model, e.g. the Q model of investment (Fazzari et al 1988), and the investment Euler equation (Whited 1992; Bond and Meghir 1994). A major problem of using the Q model to test financial constraints is the measurement error of Q (Erickson and Whited 2000). Clearly, this problem is

more pronounced in emerging markets where a lot of market inefficiency exists, hence academics argue that Q cannot meaningfully reflect the firm's investment opportunity. Considering the aforementioned issue in using Q, we apply alternative model specifications for our investment equations to ensure the robustness of our results. First, we use an augmented accelerator type investment model (model (3.1) below), in which we treat sales growth as the investment fundamental variable and include both standard factors determining firm investment and the interested variables for our purpose of study such as state ownership. Second, we use a combination of the Q model and the accelerator model (model (3.2) below), in which we use both Q and sales growth to capture investment fundamentals. Other right-hand side variables are the same as those in model (3.1). Third, we estimate an investment Euler equation (model (3.3) below), in which we augment the empirical investment Euler equation of Bond and Meghir (1994) by our interested variables. The three investment models are specified as follows:

$$Inv_{i,t} = \beta_1 Inv_{i,t-1} + \beta_2 Sales_{i,t-1} + \beta_3 CashFlow_{i,t-1} + \beta_4 CashFlow_{i,t-1} \times State_{i,t-1} + \beta_5 Debt_{i,t-1} + \beta_6 \Delta WC_{i,t-1} + \beta_7 State_{i,t-1} + \beta_8 Size_{i,t-1} + \beta_9 SEO_{i,t-1} + f_i + f_t + \epsilon_{i,t} \quad (3.1)$$

$$Inv_{i,t} = \beta_1 Inv_{i,t-1} + \beta_2 Sales_{i,t-1} + \beta_3 Q_{i,t-1} + \beta_4 CashFlow_{i,t-1} + \beta_5 CashFlow_{i,t-1} \times State_{i,t-1} + \beta_6 Debt_{i,t-1} + \beta_7 \Delta WC_{i,t-1} + \beta_8 State_{i,t-1} + \beta_9 Size_{i,t-1} + \beta_{10} SEO_{i,t-1} + f_i + f_t + \epsilon_{i,t} \quad (3.2)$$

$$Inv_{i,t} = \beta_1 Inv_{i,t-1} + \beta_2 Inv_{i,t-1}^2 + \beta_3 Sales_{i,t-1} + \beta_4 CashFlow_{i,t-1} + \beta_5 CashFlow_{i,t-1} \times State_{i,t-1} + \beta_6 Debt_{i,t-1} + \beta_7 \Delta WC_{i,t-1} + \beta_8 State_{i,t-1} + \beta_9 Size_{i,t-1} + \beta_{10} SEO_{i,t-1} + f_i + f_t + \epsilon_{i,t} \quad (3.3)$$

The subscripts *i* identifies individual firms and *t* represents the current year. Investment, *Inv*, is measured as ratio of change of fixed assets from the previous year plus depreciation to total assets[9]. *Sales* stands for the annual sales growth rate that captures the accelerator effect. *Q* is Tobin's q, representing the firm's future investment opportunities, which is calculated as the sum of the year-end market value of tradable shares, book value of non-tradable shares, book value of long-term and short-term debts, divided by the year-end total assets. Our key variable is *CashFlow*, defined as the ratio of net profit plus depreciation to total assets. The estimated coefficient for *CashFlow* represents the investment-cash flow sensitivity. It is commonly used in the literature as a measure of financial constraints. A positive and statistically significant coefficient for *CashFlow* presents the existence of financial constraints on investment. We control for the effect of borrowing on investment by including *Debt*, the ratio of total debt to total assets. We also control for the substitution effect between the working capital investment and the fixed investment following Fazzari and Petersen (1993) by including the ratio of change in working capital to total assets, ΔWC. Working capital is calculated as current assets minus current liabilities. If the firm uses the working capital to smooth fixed investment as argued by Fazzari and Petersen

[9] We follow the strand of investment studies that use total assets as the denominator for scaling variables (e.g. Baker et al 2003; Bo 2007; Firth et al 2008; McLean et al 2012).

(1993), we would expect a negative association between ΔWC and fixed investment. '*State*' is a proxy for state ownership, which is measured in two alternative ways: (a) '*Dstate*' is a dummy variable which takes the value of one if the firm's largest shareholder is the state, and zero otherwise, where the state is defined to include the central government as well as government-related legal persons. (b) '*State*' stands for the ratio of state shares to total shares of the firm, where the state shares includes both the shares held by the central government and the shares held by the government-related legal persons. We use both '*Dstate*' and '*State*', respectively, in the estimations to check the robustness of the result. *Size* stands for firm size, measured by the natural logarithm of the firm's total assets. In addition, to control for the effect of equity financing, we construct an equity financing dummy, *SEO*, which takes the value of one if the firm has conducted SEOs during the sample period, and zero otherwise. We also include the lagged one period investment to take into account the dynamic nature of investment. Considering that current investment decision-making is based on past information, we use the observations lagged one period (t−1) for all explanatory variables. f_i and f_t are firm effects and time effects, respectively. $\varepsilon_{i,t}$ is the error term. In estimating the investment Euler equation (model (3.3)), we follow Bond and Meghir (1994) to allow both time effects and firm effects to control for the variation in the user cost of capital.

As we can see from the above models, we test the effect of state ownership on the investment-cash flow sensitivity by using interaction terms between cash flow and state ownership. We believe that by adding an interaction term rather than splitting firms into subsamples, we are able to exploit the continuous

nature of shareholding data as our data set shows that transfers of state-owned shares occurred fairly frequently during the sample period.

Hypotheses: cash flow variable is positively related to firm investment, and for state ownership to ease financial constraints on investment, the interaction term between cash flow variable and state variable is negatively related to firm investment.

3.4 Data and Descriptive Statistics

The balance sheet and income statement data are obtained from the China Centre for Economic Research at Peking University. The ownership structure data are obtained from the GTA Research Service Centre in Shenzhen. Our dataset contains 1,325 non-financial firms listed on either the Shanghai or Shenzhen Stock Exchanges. The sample period covers from 1999 to 2008. Firms in the financial sector are not included in the data set since they have rather different investment behaviour. Firms with only three years or less of time-series data are dropped as sufficient observations over time are required for the system GMM estimation. We take the top 0.5 per cent and the bottom 0.5 per cent of the observations out of the sample to reduce the impact of possible outliers.

Table 3.1 presents summary statistics for the whole sample. The mean ratio of investment to total assets is 0.134. The average Q is 0.704. The mean ratio of cash flow to total assets is 0.134. The average ratio of state ownership is about 32 per cent, which confirms the significant presence of state ownership in Chinese listed firms. The mean sales growth rate is 22.3 per cent, which

indicates strong growth opportunities in China during the sample period. The average total debt to total assets ratio is 0.518, implying Chinese listed firms' high dependency on loans. Finally, majority of the sample firms have used equity financing (SEO = 1) during the sample period.

Table 3.1: Summary statistics

Variable	N	Mean	Median	Standard Deviation	Minimum	Maximum
Inv	11090	0.134	0.124	0.204	-0.831	0.930
Sales	11029	0.223	0.139	0.670	-0.973	10.649
Q	11737	0.704	0.756	0.459	0.0001	18.141
CashFlow	11625	0.134	0.116	0.155	-0.979	0.929
Debt	11625	0.518	0.494	0.318	0.062	4.870
ΔWC	11110	-0.011	-0.007	0.137	-0.822	0.888
State	11741	0.320	0.343	0.254	0	0.971
Size	11739	21.170	21.073	1.064	14.108	27.346
SEO	11742	0.535	1	0.499	0	1
NDTS	11625	0.114	0.082	0.122	3.16e-15	0.777

Notes:
Explanation of variables:

Inv: ratio of investment to total assets
Sales: annual growth rate of sales
Q: Tobin's q
CashFlow: ratio of cash flow to total assets
Debt: ratio of total debt to total assets
ΔWC: ratio of change in working capital to total assets
State: ratio of state shares to total shares
Size: natural logarithm of total assets
SEO: Seasoned Equity Offering during sample years, = 1 if yes
NDTS: Non-Debt Tax Shield measured as ratio of depreciation to total assets

From Tables 3.2 and 3.3, we can see that firms with the state as the largest shareholder have higher average ratio of investment to total assets, 0.194 as compared with firms in which the state is not the largest shareholder (0.100). In addition, firms with the state as the largest shareholder seem to be more capable of generating internal funds, with the mean cash flow to total assets ratio of 0.183 as compared with their counterparts (0.106). This may be due to the fact that most firms, which are still largely retained by the state, operate in

key strategic sectors and still enjoy their monopolistic position. The mean sales growth rate is also higher for firms that have a greater state influence, with

Table 3.2: Observations with the state as the largest shareholder

Variable	N	Mean	Median	Standard Deviation	Minimum	Maximum
Inv	3978	0.194	0.177	0.208	-0.817	0.919
Sales	3990	0.243	0.155	0.662	-0.972	10.512
Q	4305	0.730	0.790	0.393	0.0001	16.005
CashFlow	4276	0.183	0.160	0.156	-0.917	0.929
Debt	4273	0.475	0.461	0.237	0.062	4.34
ΔWC	4019	-0.016	-0.009	0.121	-0.745	0.884
State	4308	0.593	0.591	0.099	0.346	0.971
Size	4308	21.365	21.219	1.098	17.117	27.346
SEO	4308	0.523	1	0.500	0	1
NDTS	4235	0.152	0.122	0.132	3.28e-15	0.777

Table 3.3: Observations without the state as the largest shareholder

Variable	N	Mean	Median	Standard Deviation	Minimum	Maximum
Inv	7112	0.100	0.095	0.194	-0.831	0.930
Sales	7039	0.212	0.129	0.674	-0.973	10.649
Q	7432	0.690	0.732	0.492	0.0001	18.141
CashFlow	7349	0.106	0.094	0.147	-0.979	0.918
Debt	7352	0.544	0.511	0.355	0.063	4.870
ΔWC	7091	-0.009	-0.009	0.145	-0.822	0.888
State	7433	0.162	0.106	0.168	0	0.5
Size	7431	21.057	20.997	1.027	14.108	26.022
SEO	7434	0.5417	1	0.498	0	1
NDTS	7390	0.092	0.061	0.110	3.16e-15	0.777

Notes:
Explanation of variables:

Inv: ratio of investment to total assets
Sales: annual growth rate of sales
Q: Tobin's q
CashFlow: ratio of cash flow to total assets
Debt: ratio of total debt to total assets
ΔWC: ratio of change in working capital to total assets
State: ratio of state shares to total shares
Size: natural logarithm of total assets
SEO: Seasoned Equity Offering during sample years, = 1 if yes
NDTS: Non-Debt Tax Shields measured as ratio of depreciation to total assets

24.3 per cent as compared with their counterparts (21.2 per cent). The average Q is again higher for the firms with the state as the largest shareholder. Interestingly, the mean ratio of total debt to the total assets is higher for the firms without the state as the largest shareholder. This result

shows some preliminary evidence that the firms with the state as the largest shareholder on average do not necessarily have more debts than their counterparts. However, as part of the purpose for this chapter, in the later sections, we provide further investigations.[10]

3.5 Estimation results using the investment-cash flow sensitivity as a proxy for financial constraints

We use the system GMM estimation method (Blundell and Bond 1998), which is conducted by using xtabond2 in *Stata* (Roodman 2009). In the estimations, we use lagged observations of the variables on the right-hand side of the equations as instruments for the first differenced equations. For levels equations, we use lagged differences of variables on the right-hand side of the equations as instruments. Both time and industry dummies are controlled and used as additional instruments. We report two-step estimators since they are more efficient (Windmeijer 2005).

The system GMM results for the investment model (3.1) are presented in Table 3.4. As we can see, the estimated coefficients for sales growth are significant with positive signs in all the three estimations in Table 3.4, confirming the accelerator effect of investment. The coefficients for our key variable of interest, *CashFlow*, are also positively significant in all the estimations in Table 3.4, suggesting that an average firm in our sample faces a certain degree of financial constraints on investment judging by the

[10] All the mean values of the variables, except for the sales growth rate, compared between the two groups of observations have *t*-test significance level at 1 per cent or lower, i.e. the null hypothesis of no difference in the means is rejected for all variables except for the sales growth rate.

conventional measure of financial constraints, i.e. the investment-cash flow sensitivity.

Table 3.4: System GMM estimation results using the investment-cash flow sensitivity (the accelerator type investment model)

	(1)	(2)	(3)
$Inv_{i,t-1}$	0.024	-0.003	-0.007
	(0.27)	(-0.03)	(-0.07)
$Sales_{i,t-1}$	0.132**	0.127**	0.135***
	(2.44)	(2.50)	(2.63)
$CashFlow_{i,t-1}$	0.617***	0.476***	0.406**
	(4.17)	(3.22)	(2.43)
$CashFlow_{i,t-1}\times Dstate_{i,t-1}$		0.237**	
		(2.00)	
$CashFlow_{i,t-1}\times State_{i,t-1}$			0.498*
			(1.68)
$Debt_{i,t-1}$	-0.090*	-0.105*	-0.119*
	(-1.73)	(-1.68)	(-1.80)
$\Delta WC_{i,t-1}$	-0.478*	-0.457*	-0.460*
	(-1.91)	(-1.81)	(-1.74)
$State_{i,t-1}$	0.030	-0.070	-0.081
	(0.50)	(-0.69)	(-0.65)
$Size_{i,t-1}$	-0.052	-0.036	-0.038
	(-1.59)	(-1.02)	(-1.09)
$SEO_{i,t-1}$	0.220**	0.176*	0.188*
	(2.24)	(1.65)	(1.77)
m1	-6.05	-6.25	-6.02
[p value]	[0.000]	[0.000]	[0.000]
m2	-0.15	-0.28	-0.37
[p value]	[0.879]	[0.776]	[0.710]
J	31.04	30.63	31.73
[p value]	[0.122]	[0. 242]	[0.242]
Number of observations	9484	9484	9484
Number of firms	1323	1323	1323

Notes:

1. Dependent variable: the ratio of investment to total assets $Inv_{i,t}$
2. Time-specific effects are controlled in all estimations by adding year dummies. Industry effects are also controlled in all estimations by adding industry dummies.
3. t-statistics are reported in the parentheses.
4. J test of overidentifying restrictions is asymptotically distributed as chi-square under the null of instrument validity.
5. * significant at the 10 per cent level; ** significant at the 5 per cent level; *** significant at the 1 per cent level.
6. See notes to Table 3.1 for explanations of variables.
7. The instruments used in our GMM estimation include the lagged 2 terms or further of the dependent variable and independent variables. The time dummies as well as the industry dummies are also used as instruments in our estimations. The instruments for the interactions term also include the products of the components.

On average, a one standard deviation decrease in the ratio of cash flow to total assets leads to a decline of 0.077 in the ratio of investment to total assets (the standard deviation for *CashFlow* is 0.155 as shown in Table 3.1). The estimated coefficients for debt are negative and statistically significant, which are in accordance with Firth et al (2008) who also find a negative relation between investment and leverage (defined as the ratio of total bank loans to total assets) for Chinese listed firms. The negative sign implies the disciplinary and monitoring role of debt on firm's investment. The coefficients for working capital investment are negatively significant in all the estimations in Table 3.4, lending support to the notion that Chinese listed firms use working capital to smooth fixed investment, confirming Fazzari and Petersen (1993). The estimated coefficients for the equity financing dummy, SEO, are positive and significant in all the estimations in Table 3.4. This result suggests that firms use SEOs as an alternative external financing for investment. The significant result concerning the estimated effect of the SEO dummy supports our argument that the firm's equity financing behaviour should be explicitly considered when examining financial constraints on investment.

More importantly for the purpose of this paper, we are more interested in the estimated coefficients for the interaction terms between cash flow and state ownership. As it can be seen from column (2) in Table 3.4, the estimated coefficient for the interaction term between cash flow and the state ownership dummy is positively significant. This result does not support the notion that the firm's financial constraints on investment are reduced because of the state's involvement in the firm. According to the conventional measure of financial constraints, i.e. the investment-cash flow sensitivity, if the firms were less

financially constrained due to the reason that the state is the largest shareholder, we would expect this interaction term to be negatively significant. In column (3), the estimated coefficient for the interaction term between cash flow and the state ownership ratio is also positively significant. This result shows that having a higher ratio of state ownership actually increases (rather than reduces) the extent to which the firm is financially constrained. Nonetheless, it is also possible that the result might be due to agency costs as part of the cash flow could be free cash flow. An increase in the free cash flow could lead to an increase in investments under managerial discretion.

This finding is in contrast with previous studies that conclude firms with a large presence of state ownership experience less or no financial constraints. However, different from previous studies using large samples that include mainly unlisted firms in China (e.g. Poncet et al 2010; Guariglia et al 2011), we focus on only the listed state-involved firms that are generically different from those not yet being made public. In addition, we include an SEOs dummy in the investment equation to control for the impact of the firm's incremental equity financing behaviour, which has not been considered in previous studies. In sum, our result suggests that state ownership does not necessarily help in reducing financial constraints for the state-involved listed firms.

The estimation results of the investment model (3.2) are presented in Table 3.5. Table 3.5 shows that adding Q in the investment model (3.1) does not change our main result regarding the impact of state ownership on the investment-cash flow sensitivity. Both columns (2) and (3) show that the estimated coefficients for the interaction term between cash flow and state

Table 3.5: System GMM estimation results using the investment-cash flow sensitivity (Q model and accelerator model combined)

	(1)	(2)	(3)
$Inv_{i,t-1}$	0.144	0.085	0.099
	(1.54)	(0.90)	(1.08)
$Sales_{i,t-1}$	0.045*	0.041**	0.042**
	(1.69)	(1.74)	(2.00)
$Q_{i,t-1}$	0.226**	0.208**	0.192**
	(2.06)	(2.03)	(1.97)
$CashFlow_{i,t-1}$	0.307**	0.249*	0.277*
	(2.17)	(1.81)	(1.82)
$CashFlow_{i,t-1}\times Dstate_{i,t-1}$		0.295***	
		(2.73)	
$CashFlow_{i,t-1}\times State_{i,t-1}$			0.498**
			(2.08)
$Debt_{i,t-1}$	-0.062*	-0.060*	-0.056**
	(-1.92)	(-1.91)	(-2.01)
$\Delta WC_{i,t-1}$	-0.210*	-0.192*	-0.178*
	(-1.74)	(-1.69)	(-1.70)
$State_{i,t-1}$	0.066*	-0.062	-0.081
	(1.68)	(-1.16)	(-1.13)
$Size_{i,t-1}$	-0.047	-0.037	-0.033
	(-1.57)	(-1.28)	(-1.25)
$SEO_{i,t-1}$	0.081	0.071	0.062
	(1.27)	(1.25)	(1.07)
m1	-8.69	-8.10	-9.47
[p value]	[0.000]	[0.000]	[0.000]
m2	0.76	0.36	0.41
[p value]	[0.449]	[0.717]	[0.681]
J	38.42	47.26	54.62
[p value]	[0.201]	[0.171]	[0.110]
Number of observations	9482	9482	9482
Number of firms	1323	1323	1323

Notes:

1. Dependent variable: the ratio of investment to total assets $Inv_{i,t}$
2. Time-specific effects are controlled in all estimations by adding year dummies. Industry effects are also controlled in all estimations by adding industry dummies.
3. t-statistics are reported in the parentheses.
4. J test of overidentifying restrictions is asymptotically distributed as chi-square under the null of instrument validity.
5. * significant at the 10 per cent level; ** significant at the 5 per cent level; *** significant at the 1 per cent level.
6. See notes to Table 3.1 for explanations of variables.
7. The instruments used in our GMM estimation include the lagged 2 terms or further of the dependent variable and independent variables. The time dummies as well as the industry dummies are also used as instruments in our estimations. The instruments for the interactions term also include the products of the components.

ownership (either the state dummy in column (2) or the state ownership ratio in column (3)) remain highly significant with a positive sign. These results confirm

the results we obtained in Table 3.4 that state ownership does not reduce financial constraints faced by the firm. Apart from this main finding, we observe from Table 3.5 that the estimated coefficients for Q are positively significant. Although we have to admit that there must exist noises in measuring the firm's market to book value in the Chinese stock market, the estimated coefficients for Q shown in Table 3.5 are in general consistent with the theoretical prediction. On average, one standard deviation increase of in Q leads to a 0.096 increase in the ratio of investment to total assets (the standard deviation for *Q* is 0.459). The estimated coefficients for sales growth remain positively significant, and the estimated coefficients for debt remain negatively significant. However, the estimated coefficients for the equity financing dummy (SEO) become insignificant although with the predicted positive sign. Moreover, we can see that the estimated coefficient for working capital investment are highly significant with a negative sign in all estimations in Table 3.5, which provides us with further evidence in support of the notion that the firm smoothes fixed investment by adjusting working capital when it experiences negative cash flow shocks (Fazzari and Petersen 1993).

Table 3.6 presents the estimation results of the investment Euler equation (model (3.3)). These results are generally consistent with the results we obtained in both Tables 3.4 and 3.5. The estimated coefficients remain positively significant for sales growth, cash flow, and the equity financing dummy (SEO). The estimated coefficient for working capital investment remains significant with a negative sign in column (3). More importantly, we observe that in column (2), the estimated coefficient for the interaction term between cash flow and the state dummy remains highly significant with a

Table 3.6: System GMM estimation results using the investment-cash flow sensitivity (the investment Euler equation)

	(1)	(2)	(3)
$Inv_{i,t-1}$	0.161**	0.076	0.059
	(2.04)	(0.74)	(0.57)
$Inv_{i,t-1}^2$	0.279	-0.037	-0.021
	(1.17)	(-0.15)	(-0.08)
$Sales_{i,t-1}$	0.066*	0.062*	0.067**
	(1.67)	(1.68)	(2.00)
$CashFlow_{i,t-1}$	0.358**	0.453**	0.534***
	(2.36)	(2.53)	(2.74)
$CashFlow_{i,t-1}\times Dstate_{i,t-1}$		0.176**	
		(2.03)	
$CashFlow_{i,t-1}\times State_{i,t-1}$			0.215
			(0.96)
$Debt_{i,t-1}^2$	0.007	0.013	0.001
	(0.48)	(1.07)	(0.19)
$\Delta WC_{i,t-1}$	-0.039	-0.160	-0.273*
	(-0.22)	(-1.00)	(-1.85)
$State_{i,t-1}$	0.095*	0.024	0.003
	(1.69)	(0.41)	(0.04)
$Size_{i,t-1}$	-0.048	-0.040	-0.025
	(-1.27)	(-1.51)	(-1.00)
$SEO_{i,t-1}$	0.213**	0.177**	0.135**
	(1.97)	(2.53)	(2.04)
m1	-7.10	-6.17	-6.52
[p value]	[0.000]	[0.000]	[0.000]
m2	0.58	-0.13	-0.04
[p value]	[0.564]	[0.895]	[0.967]
J	21.99	25.18	29.09
[p value]	[0.400]	[0. 452]	[0.357]
Number of observations	9484	9484	9484
Number of firms	1323	1323	1323

Notes:

1. Dependent variable: the ratio of investment to total assets $Inv_{i,t}$
2. Time-specific effects are controlled in all estimations by adding year dummies. Industry effects are also controlled in all estimations by adding industry dummies.
3. t-statistics are reported in the parentheses.
4. J test of overidentifying restrictions is asymptotically distributed as chi-square under the null of instrument validity.
5. * significant at the 10 per cent level; ** significant at the 5 per cent level; *** significant at the 1 per cent level.
6. See notes to Table 3.1 for explanations of variables.
7. The instruments used in our GMM estimation include the lagged 2 terms or further of the dependent variable and independent variables. The time dummies as well as the industry dummies are also used as instruments in our estimations. The instruments for the interactions term also include the products of the components.

positive sign, while column (3) shows that the coefficient for the interaction term between cash flow and the state-ownership ratio is not significant. The

results in both columns (2) and (3) further confirm the results we obtained in Tables 3.4 and 3.5 that state ownership does not necessarily reduce financial constraints faced by the firm judging by the investment-cash flow sensitivity.

Regarding the model performance, in Tables 3.4 to 3.6, m1, m2 are the Arellano-Bond tests statistics. It shows that m1 is significantly negative and m2 is not significant from zero at the 5 per cent level. These statistics suggest that the assumptions of no serial correlation in the errors and no autocorrelation in the idiosyncratic errors for the GMM estimator are met. In addition, the J test statistics provide no evidence that the null hypothesis of valid over-identifying restrictions can be rejected. All in all, the outputs of these tests suggest that our models are correctly specified and the instruments employed are valid.

3.6 Test of financial constraints on investment using the KZ index

Considering the debate on the investment-cash flow sensitivity as a proxy for financial constraints (see Section 3.2.1), we provide in this section a robustness test on the results shown in Section 3.5 by following an alternative approach to measuring the firm's financial constrains.

The KZ index of financial constraints is developed by Lamont et al (2001) based on Kaplan and Zingales's (1997)'s in-depth study of Fazzari et al's (1988) sample of low dividend payout firms. Kaplan and Zingales (1997) classify the sample's firm-year observations into five groups, each of which was assigned a categorical variable to indicate the degree of financial constraints. They then check which accounting variables have contributed to the degree of financial constraints by regressing this categorical variable

(degree of financial constraints) against various accounting variables. They find that among other variables, five accounting variables are important in affecting the firm's financial constraints. They are cash flow, Tobin's q, debt, dividends and cash holdings. The estimated coefficients for these five variables are then able to capture the importance of these variables in explaining the degree of financial constraints the firm faces. Lamont et al (2001) apply the estimated coefficients for the five variables obtained by Kaplan and Zingales (1997) to their own sample to construct an index to proxy for the level of financial constraints for the firm. We employ the same practice to create a ranking of financial constraints for our sample firms. We argue that since the index is ranking based, it provides comparative rather than absolute measures of financial constraints. It is suitable for our purpose of investigating the heterogeneity among the listed firms even in the Chinese economy context.

The construction of the KZ index is as follows:

$$KZ_{i,t} = -1.002 \times CashFlow_{i,t} + 0.283 \times Q_{i,t} + 3.139 \times Debt_{i,t} - 39.368 \times Dividend_{i,t} - 1.315 \times Cash_{i,t} \quad (3.4)$$

where *KZ* is the KZ index for each individual firm at time t, and the higher the KZ index, the greater the financial constraints faced by the firm. *CashFlow* is ratio of net profit plus depreciation to total assets; *Q* is Tobin's q; *Debt* is the ratio of total debt to total assets; and *Cash* is the ratio of cash holdings to total assets. Applying the same practice, we construct the KZ index for our sample. As a result, we obtain the KZ index for each firm-year observation. The

average value of the KZ index for our sample firms is 1.25 with a standard deviation of 1.78.

We then regress the KZ index on state ownership to check if there is any association between the two using the fixed effect estimation. We also control for firm size since size can be a very important determinant for financial constraints on investment, and it is not contained in the construction of the KZ index. The estimation equation is:

$$KZ_{i,t} = \beta_0 + \beta_1 State_{i,t} + \beta_2 Size_{i,t} + f_i + f_t + \epsilon_{i,t} \quad (3.5)$$

State stands for state ownership. We use either a dummy variable that equals to one if the firm has the state as the largest shareholder and zero otherwise, or the ratio of state shares to total shares, as we have done in estimating investment equations (Tables 3.4 to 3.6). *Size* is firm size, measured by the natural logarithm of the firm's total assets. f_t is time effect, f_i is fixed effect, and ε_{it} is the error term.

Hypothesis: for state ownership to induce less financial constraints, state variables are negatively related to KZ index

The estimation results of the empirical model (3.5) are presented in Table 3.7. The estimated coefficient for the state dummy is positive, but statistically insignificant. However, the estimated coefficient for the state-ownership ratio is positive and statistically significant. This shows that the firm having greater

state-ownership has a higher value of the KZ index, which implies that the listed firms with greater state involvement (higher ratio of state shareholding) face greater degree of financial constraints than firms with smaller state shareholding, confirming the results we obtained in Tables 3.4 to 3.6 that state ownership does not help in reducing the firm's financial constraints on investment. In addition, the estimated coefficient for firm size is negatively significant in both estimations in Table 3.7, suggesting that larger firms are in general associated with less financial constraints on investment.

Table 3.7: The relation between the KZ index and state ownership (fixed effect estimation with robust standard error)

Variable	(1)	(2)
Dstate	0.026 (0.44)	
State		0.256* (1.68)
Size	-0.550*** (-2.72)	-0.552*** (-2.73)
Constant	14.744*** (2.75)	12.730*** (2.98)
Observations	11672	11671
Firms	1325	1325
R^2	0.187	0.188

Notes:
(1) Dependent variable: KZ index
(2) t-statistics are reported in the parentheses.
(3) * significant at the 10 per cent level; ** significant at the 5 per cent level; *** significant at the 1 per cent level.
(4) See notes to Table 3.1 for explanations of variables.

To summarise, the test using the KZ index provides us with further evidence that listed firms with higher degree of state involvement do not necessarily experience less or no financial constraints on investment, confirming the finding we obtained by using the investment-cash flow sensitivity as a proxy for the firm's financial constraints on investment.

3.7 Further robustness tests: the relation between borrowing and state ownership

The empirical analyses in Sections 3.5 and 3.6 show that state ownership does not necessarily help in reducing the firm's financial constraints on investment. In this section, we further test the robustness of this result by checking the relation between the firm's borrowing and state ownership. The logic is that if the state-involved listed firms have received preferential treatment from the state-controlled banking system, then the firm should have more access to external borrowing from the state-dominated banking sector, implying a less degree of financial constraints on investment. Since the listed firms mainly borrow from banks due to the underdeveloped corporate debt market in China, we can set up a borrowing equation to check whether the listed state-involved firms receive preferential treatment from state-controlled banks. We regress the firm's ratio of total debt to total assets on the state-ownership variables (either the state dummy or the state ownership ratio) after controlling for other standard variables that determine the firm's borrowing. The equation is as follows:

$$Debt_{i,t} = \beta_1 Debt_{i,t-1} + \beta_2 Sales_{i,t-1} + \beta_3 Size_{i,t-1} + \beta_4 ROA_{i,t-1} + \beta_5 State_{i,t-1} + \beta_6 SEO_{i,t-1} + \beta_7 NDTS_{i,t-1} + f_i + f_t + \epsilon_{i,t} \quad (3.6)$$

where *Debt* stands for the ratio of total debt to total assets; *Sales* is the annual sales growth rate; *Size* stands for firm size; *ROA* is the return on assets calculated as net profit divided by total assets; *State* refers to state ownership; *SEO* is the equity financing dummy; and *NDTS* stands for non-debt tax shields.

The control variables included in model (3.6) are common determinants of the firm's borrowing in the capital structure literature. For example, sales growth captures the firm's growth potential and higher growth rate should lead to greater demand for borrowing. Size is also an important factor for leverage. Larger firms tend to be more diversified and less likely to go bankrupt; therefore large firms should be able to borrow more in general (Titman and Wessels 1988). ROA indicates profitability. Increase in the firm's profitability should lead to less reliance on borrowing. Moreover, the firm that has conducted secondary equity offerings may have a tendency to borrow less because the demand for investment financing can be partially met by issuing additional equity on the stock market. Finally, we control for the effect of NDTS on borrowing. A firm with larger NDTS, *ceteris paribus*, is expected to use less debt because NDTS are substitutes for the tax benefits of debt financing (DeAngelo and Masulis 1980). Following Huang and Song (2006), we use depreciation scaled by total assets to measure NDTS.

Hypothesis: state variables are positively related to debt borrowing

The system GMM estimation results of model (3.6) are shown in Table 3.8. The estimated coefficients for sales growth turn out to be insignificant. The estimated coefficients for firm size are highly significant with positive signs, confirming that large firms are able to borrow more (Titman and Wessels 1988). The estimated coefficients for ROA are negatively significant, suggesting that firms with high profitability normally have more internal funds available so they may not need to borrow that much. The estimated coefficients for the SEO

dummy are insignificant, indicating an ambiguous relation between debt financing and equity financing for our sample firms.

Table 3.8: System GMM estimations results: the relation between the firm's borrowing and state ownership

Variable	(1)	(2)
$Debt_{i,t-1}$	0.891***	0.877***
	(11.95)	(12.42)
$Sales_{i,t-1}$	-0.021	-0.022
	(-1.47)	(-1.28)
$Size_{i,t-1}$	0.018**	0.021**
	(2.07)	(2.07)
$ROA_{i,t-1}$	-0.225**	-0.252**
	(-2.09)	(-2.11)
$Dstate_{i,t-1}$	-0.014	
	(-1.37)	
$State_{i,t-1}$		-0.043
		(-1.45)
$SEO_{i,t-1}$	0.005	-0.006
	(0.23)	(-0.23)
$NDTS_{i,t-1}$	-0.120***	-0.123***
	(-3.53)	(-3.32)
m1	-5.58	-5.64
(p value)	(0.000)	(0.000)
m2	0.44	0.57
(p value)	(0.662)	(0.569)
J	162.47	140.11
(p value)	(0.127)	(0.125)
Number of observations	9555	9555
Number of firms	1322	1322

Notes:

1. Dependent variable: the ratio of total debt to total assets $Debt_{i,t}$
2. Time-specific effects are controlled in all estimations by adding year dummies. Industry effects are also controlled in all estimations by adding industry dummies.
3. t-statistics are reported in the parentheses.
4. J test of overidentifying restrictions is distributed as chi-square under the null of instrument validity.
5. * significant at the 10 per cent level; ** significant at the 5 per cent level; *** significant at the 1 per cent level.
6. See notes to Table 3.1 for explanations of other variables.
7. The instruments used in our GMM estimation include the lagged 2 terms or further of the dependent variable and independent variables. The time dummies as well as the industry dummies are also used as instruments in our estimations. The instruments for the interactions term also include the products of the components.

We believe that this result is consistent with the practice in the Chinese corporate sector. Chinese firms have been enjoying very low cost of external financing, the firm would make the most of every possible channel to finance, and therefore it is possible that the substitution effect between debt financing and equity financing predicted by the standard finance theory does not apply to the Chinese firms. We also observe from Table 3.8 that there is a negative relation between borrowing and NDTS, since the estimated coefficients for NDTS are highly negatively significant in both columns (1) and (2) of Table 3.8, confirming DeAngelo and Masulis (1980). Finally and more importantly, the estimated coefficients for both the state dummy and the state ownership ratio are statistically insignificant, based on which we can conclude that in China state firms or firms having a higher ratio of state shareholding do not necessarily have more access to bank loans from the state-controlled banking sector. This finding may be explained by the fact that the state banks in China have already become quasi-commercial banks themselves and started to act indiscriminately towards all firms, regardless of the state involvements in them or not. An in-depth understanding on the lending behaviour of state controlled banks in China is beyond the scope of the current paper, but the result shown in this section provide further evidence in support of our main results in Tables 3.4 to 3.7 that state ownership does not necessarily help in reducing the firm's financial constraints on investment.

3.8 Conclusion

In this paper, we examine how state ownership affects financial constraints on investment of Chinese listed firms during 1999 to 2008. We document that although an average firm in our sample experiences some degree of financial

constraints, state ownership does not necessarily help in reducing the firm's financial constraints on investment. Evidence shows that the listed firms either with the state as the largest shareholder or with higher state shareholding do not necessarily face less or no financial constraints, contrasting with previous studies in this line. Our findings are based on not only the conventional proxy for financial constraints, i.e. the investment-cash flow sensitivity, but also a recently developed proxy for financial constraints, i.e. the KZ index. The result is further supported by the evidence that state ownership does not necessarily bring in more bank loans for the sample firms, hence state ownership does not necessarily reduce the firm's financial constraints via the state-controlled banking sector. Our result suggests that China's corporatisation movement is effective in the sense that soft budget constraints once enjoyed by former SOEs have been removed along with the progress of corporatisation. These firms, although still state-involved, can be seen as modern corporations, operating in a market environment. However, it would be interesting to examine the effect of state ownership on the firm's real and financial activities during the recent global financial crisis, which has been put on our future research agenda.

Chapter 4 Corporate investment of Chinese listed firms and the global financial crisis

4.1 Introduction

The recent financial crisis has a tremendous impact on the global economy. In the United States where the crisis originated from, and in Europe and particularly in the United Kingdom where the financial service sectors are deeply interlinked with their counterpart across the Atlantic, many firms face a prolonged period of financial and economic hardships. These firms have difficulties in obtaining funds because of the credit market squeeze created by distrusts among banks and financial institutions as a result of the breakdown of financial assurance system (Yandle 2010). The predicament causes many firms that were financially unhealthy to go out of business and those relatively healthy to refrain from investment because of the following three reasons. First, the waning consumer confidence in the economy causes demand for goods to drop significantly. Second, the credit shortage in the market makes it more difficult for firms to obtain necessary funds. Third, firms become more prudent in terms of investment amid heightened uncertainty in the global economic environment.

How the global financial crisis actually affected the Chinese economy in any ways or not is a fascinating case to study not only because of its mere size as the world's second largest economy now but also because of its status as a transition economy with its own distinct institutional features. The argument or theory about China being decoupled from the rest of the global economy at the

onset of the recent financial crisis is, after all, a fallacy. China's unique semi-command economic system that insulated itself from external influences to a certain degree, and allowed fast responses from policymakers did not guarantee a complete escape from the global turmoil. China's less dominating and less developed financial service sector as compared to its counterparts in the United States and the United Kingdom as well as the higher weight of its economic dependency on exporting activities also mean that the impact from the financial crisis is inherently different from what the advanced economies have been experiencing. Our paper contributes to the exiting literature by providing a thorough analysis on how China, an emerging market with such a characteristic economic structure, copes with the financial crisis and how the corporate investments are affected via the identified transmission channels.

In this paper we investigate how the recent financial crisis, which devastated the financial systems and real economies in parts of Europe and mainly the United States, has an effect on the Chinese economy from the perspective of the listed firms' investment behaviour during the event. Specifically we examine whether and how via the various transmission channels that the financial crisis can influence the listed firms' investment decisions. We utilise a panel of 1,689 Chinese listed firms with quarterly observation data and employ an accelerator type investment model augmented with factors and interaction terms related to the financial crisis effect to test for each possible channel. First, we examine how the Chinese listed firms' investment decisions may respond to the financial crisis via the output demand channel by making an analogy between two groups of firms, i.e. firms in the more export-driven sectors and firms in the more domestic demand-driven sectors. Second, we examine

whether the Chinese listed firms experience a greater degree of financial constraints on investment during the crisis through the financial constraints channel. Third, we test whether the financial crisis has any impact on the Chinese listed firms' investment behaviour via the uncertainty channel using two alternative uncertainty proxies, i.e. (1) the standard deviations of stock returns of the sample firms, which are commonly applied in the studies of the relationship between uncertainty and firm investment, and (2) the difference between the rates of the United States Treasury bond and corporate bond (to be discussed further in the later section). Moreover, we include in our investment model, the financial asset investment, as a potential determinant of fixed asset investment since it is quite common among the Chinese corporations to engage in a mix of fixed and financial assets investments. This phenomenon is notable in our data. Therefore, the off-business financial assets investment may reveal to have an effect on the investment decisions of firms. We also investigate further if the firms that are in the more export-driven industries suffer more from the crisis as a result of their high dependency on global trade than the firms in the more domestic demand-driven sectors. Our estimations are carried out using the advanced Generalised Method of Moments (GMM) estimator.

In the next section we review how a financial crisis may be defined and its potential impacts on firms, how the recent global financial crisis originated, and a number of relevant studies on various possible mechanisms and factors that could affect investment behaviour of firms during macroeconomic events such as a financial crisis. In section 4.3, we review the studies on the impact of the most recent financial crisis on firm investment. Section 4.4 discusses how the

global financial crisis affects the Chinese economy. In section 4.5, the empirical specifications are presented and explained. Section 4.6 describes the data and estimation method. Section 4.7 brings forward the results and implications. Section 4.8 concludes.

4.2 Literature review

4.2.1 Definitions of financial crisis and the implications to firm behaviour

As in this chapter our focus is primarily on the financial crisis's impact on the Chinese listed firms' investment behaviour via the identified channels, we therefore pay particular attention to the literature concerning the origins or definitions of financial crises and link the most recent crisis in question with the literature. According to Mishkin (1991), two opposite perspectives of the nature of financial crises in the literature can be summarised. The first one is based on Friedman and Schwartz's (1963) view that financial crises are in general associated with banking panics as the main cause of money supply contractions, which then lead to recession in the real economy. For events that there is an abrupt decline of wealth occurring with no possible banking panics and followed by a sudden contraction in money supply, they are considered as pseudo financial crises. On the other hand, Kindleberger (1978) and Minsky (1972) offer a very different and broader view on how financial crises are defined. Financial crises can include events such that there are either severe drops in asset prices, collapses of large financial or non-financial firms, deflations or disinflations, disturbances in foreign exchange markets, or any combinations of the aforementioned. Nevertheless, Mishkin (1991) argues that the broad definition of financial crises lacks a solid theory of what characterises financial crises. He therefore puts forward an approach that

incorporates the presence of information asymmetry to explain financial crises. Because of the asymmetric information and agency problems between borrowers/equity issuer and lenders/investors, problems such as adverse selection and moral hazard are bound to arise in the markets. These issues will cause fund providers to be more cautious about supplying firms with the money required for their investments. The problems become even severer during financial crises as borrowers' and equity issuers' net worth are gravely reduced because of crashes either in the property markets (that affect the values of loan collaterals) or in the stock markets (declines in firms' market values), or in both markets. The drops in firms' net worth then make it even more difficult for them to raise necessary fund for their investments. Ultimately both the information asymmetry approach on financial crises and the banking panics approach suggest that credit supply shortages in the markets are likely to be the main problem for firms amid heightened uncertainty for both non-financial and financial firms in the periods of financial crises. All in all, the review on the financial crisis literature implies that in the crisis period, the most likely and visible effect on firms is via the credit supply i.e. the balance sheet channel or financial constraints channel.

4.2.2 The global financial crisis of 2008

The recent global financial crisis triggered by the subprime mortgage problems in the United States has many characteristics that are similar to what have been described above. Prior to the crisis, abundant credits, which were fuelled by the low interest rates set by the United States Federal Reserve, were poured into the stock markets and in particular into the property markets. Money was lent to prospective homeowners, even though they were otherwise

considered not creditable. This phenomenon was initially encouraged by the government's promotion on home ownership. The subprime loans issued by mortgage originators were then repackaged or bundled with other financial products and sold to other financial institutions as a means of transferring risks. The practice is the so-called "securitisation". Although very common in the advanced economies in the West, it is highly regulated in China. When subprime borrowers realised that they were not able to keep up their payments and started defaulting, the then large amount of foreclosures sent shock waves to other financial institutions not only within the United States but also other parts of the world. The ripple effect caused many financial and non-financial firms that held subprime related securities or financial products to write down the values of their assets. As discussed previously in the last subsection, similarly these write-downs would cause drops in firms' net worth and exacerbate the problems of information asymmetry (Mishkin 1991). At the same time, the markets were filled with uncertainties that led to further credit freeze because no one was sure about who would be able to repay, particularly in the interbank loan markets. As argued by Yandle (2010), trust was lost among related parties that have stakes in the financial sector. Yandle (2010) maintains that the credit crunch of the 2008 was not the result of banking panics or lack of liquidity but a sudden breakdown of assurance mechanisms including three major components, namely credit ratings, international accounting standards and credit-default swaps that traditionally supported trust in the market. In short, despite the different causes that would result in financial crises, the main characteristic has been the near stoppage of the supply of credits in the economy.

4.2.3 Review on the channels that convey macroeconomic effects to firms

How shocks, such as financial crises and to a larger extent the policymakers' responses to shocks, can have an effect on investment have drawn many attentions. With regard to firm level investments, there are a number of channels via which the firms' investment decisions can be influenced during the events of financial crises, external shocks or policy stimuli and tightening. For instance, government's monetary policy in reaction to such events through interest rate adjustment will affect firms' decisions via the cost of capital.

An important mechanism that transmits the impact of macroeconomic events or policies to individuals in an economy is via the balance sheet channel, i.e. the financial constraints channel. Bernanke and Gertler (1989) argue that because of the inverse relationship between the agency costs of undertaking investments and the borrower's net worth, borrowers with higher net worth, i.e. better balance sheet condition, resulting from the economic upturn will spur more investments, or spending in the case for households, and vice versa when in economic downturn. During a financial crisis, borrowers with lower net worth are more likely to have difficulties accessing external funds and more likely to experience credit rationing. Investment will therefore be reduced further and the overall sensitivity of investment to the measures of net worth would increase. Thus, an amplifier effect on investment exists via this financial constraints channel.

A number of papers have provided empirical evidence on how economic downturns or equivalent situations such as monetary tightening can have an

impact on investment at firm level through the balance sheet channel, i.e. the financial constraints channel. Bernanke et al (1996) investigating a panel of large and small manufacturing firms find that due to the higher agency costs they face, small firms are more sensitive to business cycle. Another research by Gertler and Hubbard (1989) documents that firms classified as “high retention” and “medium retention” (with a dividend-income ratio of less than 0.1 for the former, and between 0.1 and 0.2 for the latter) have stronger investment-cash flow sensitivity during the recession years. Much the same as the impact of adverse shocks, e.g. a credit shortage crisis, on investment, the effect of monetary policy tightening on investment can also feed through the financial constraints channel. Oliner and Rudebusch (1996) using different measures such as increases in the federal funds rate, increases in the spread between the federal funds rate and a long-term bond rate, and historical dates to proxy events of tight monetary policy provide evidence that small firms experience significantly stronger sensitivity of investment to internal funds after a monetary contraction. Similarly for Guariglia’s (1999) paper focusing on inventory investment for UK firms during 1968 to 1991, which finds that firms with low coverage ratios or high debt ratios exhibit higher sensitivity of inventory investment to the coverage ratio during periods of recession and monetary tightening. Another study by Angelopoulou and Gibson (2009) utilises a panel of UK manufacturing firms over the period of 1970 to 1991 to examine the relation between firms’ financial constraints on investment and monetary policy. By dividing firms into financially constrained and unconstrained based on different a priori criteria such as size, dividend policy and leverage ratio, they find that firms classified as financially constrained reveal higher investment sensitivity to cash flow in an augmented Q model of

investment and even more so in periods of monetary tightening as an indication of the existence of the balance sheet/financial constraints channel. In essence, the existing literature maintains that during events such as a financial crisis when there is a sudden squeeze of credit availability, an economic recession or monetary tightening, the conditions for investment particularly for already financially constrained firms or firms with lower net worth are exacerbated through the balance sheet/financial constraints channel.

In addition to the most perceived and major mechanism discussed above, i.e. financial crises and monetary policy responses can feed through the financial constraints channel to influence firms' investment decisions, uncertainty regarding the depth of the crisis or timing of economic recovery and such can also have a profound effect on firms' investment behaviour during the crisis period. Under the assumptions of investment uncertainty and that fixed investments are irreversible, there is a real option for investors or managers in waiting for more information rather than committing the investment that might incur great lost at a time of heightened uncertainty. Delaying investment will be attractive if new information is useful in a way that it provides more gains potentially than short-run return. As a result, the investment dynamics turn out to be particularly sensitive to expectations concerning the rate of information arrival (Bernanke 1983). Uncertainty can have a negative and severe effect on firms' investment behaviour and is one of the potential channels via which financial crises can exert aggravating influence on corporate investment.

Studies focusing in particular on the effect of financial crisis and such on firm

level investment are limited. Greasley and Madsen (2006) studying the cause of the Great Depression in the United States in the 1930s argue that the real reason behind the steep drop in fixed investment was not the reduction of profitability as conventionally viewed, but uncertainty. Using a Q model augmented with stock price volatility as a proxy for uncertainty and alternative fundamentals such as current profits, their results show that the high uncertainty contributed around 80 per cent of the actual drop in the business fixed investment ratio in 1930. Relevant researches in the literature also include Bloom et al's (2007) paper, which rather emphasises the effects of sudden external shocks as well as the following policy stimuli on investment using a panel of UK manufacturing firms. They find that firms have much weaker responsiveness and become very cautious about investment in times of high level of uncertainty despite given policy stimuli. Their results indicate that aftershocks such as September 11, 2001 and the oil shocks in the 1970s, one standard deviation increase in measures of uncertainty could lead to substantial reduction in the sensitivity of investment to subsequent monetary or fiscal policy stimulus responses.

4.3 Review on the recent global financial crisis's impact on firm investment

There are a few studies on the recent financial crisis's impact on the global economy (with emphasis on investment). Campello et al (2010), by surveying 1,050 chief executive officers (CFOs) of non-financial public firms in the United States, Europe, and Asia, document that financially constrained firms planned to slash more investment spending in technology, capital expenditure, and employment during the financial crisis of 2008. They show that constrained

firms were forced to use a fairly large part of their cash savings and to reduce significantly their planned dividend distributions. These firms also depend more heavily on their bank lines of credit (LCs) for immediate liquidity needs and daily operations as a result of the fear that banks would restrict their future access to the LCs, and tend to sell off existing assets to finance their operations during the crisis. Duchin et al (2010), using a sample of 3,668 publicly traded non-financial firms with quarterly observations, find that corporate investment decreases significantly following the outbreak of the recent global financial crisis. Moreover, the decline is largest for firms that lack internal financial resources (i.e. low cash reserves or high net short term debt), are financially constrained, or operate in industries that are external finance dependent.

Kahle and Stulz (2011), in addition to documenting the impact of the recent financial crisis on firms through the credit supply shock, argue that the reduced demand for goods and increased risk were the real causes affected the financial and investment policies of firms. The drop in consumer demand for goods means that the growth opportunities for firms that produce the goods were greatly hit, which leads to a decrease in net worth and future cash flows. Along with the increase in risk in relation to the provision of capital, firms were forced to reduce investment and to increase their cash holdings.

In the next section we discuss the implications of the recent global financial crisis on the Chinese economy, which will provide a background for our main research question on how might the investment behaviour of the Chinese listed firms respond to the financial crisis.

4.4 The global financial crisis on Chinese economy

The global financial turmoil that first emerged in the summer of 2007 is again a synonym for credit shortage in the market. The crisis has particularly affected the economies of United States, United Kingdom, and many other countries in Europe where firms not only in the financial service sector but also in other industries faced a prolonged period of severe credit squeeze and has brought serious consequences to the real economy. However, the impact of the global crisis on China has been limited as compared to what have been happening in the United States and Europe, largely thanks to its relatively isolated financial system and the less weight of its financial sector in the economy. Unlike in the United States and Europe, the impact on China was mostly on its real economy rather than its financial system (Batson 2009). China's economy is highly dependent on international trade. For instance, in 2007, one-third of China's GDP growth was made up by its net export, and during the period of 1985 to 2008 China's exports of goods and services as a share of its GDP increased from 9.1 per cent to 37.8 per cent (Morrison 2009). China has been the main manufacturer for and exporter of consumer goods to the United States and Europe. The global financial crisis and recessions inevitably caused the demand for goods made by Chinese manufacturing firms to drop substantially, thus the damage on China's exports. For example, one indicator showed that in November 2008, the Chinese exports fell 2.2 per cent from a year earlier, a decline for the first time in 7 years (Dyer and Anderlini 2008). In summary, although China's economy has been spared from the spread of financial system collapses of the United States and Europe, it was however significantly affected by the weak demands from overseas because of its large stake in global trade. Therefore in addition to our main researches on the

channels that transmit the effect of the financial crisis to Chinese listed firms in general we also look at how firms in the more export-driven sectors and firms in the more domestic demand-driven sectors differ accordingly to each channel. This allows us to dig deeper into the real effect of the financial crisis.

To examine how China responds to the recent global crisis particularly for its large corporations, we deliberately focus on the Chinese listed firms' investment behaviour for the period between 2006 and 2010. In the next section we explain in details the methodology applied to distinguish the effect of the financial crisis on the Chinese firms investment behaviour before and during the event through each possible channel.

4.5 Empirical specifications

We employ the standard accelerator-type investment model as in Chapter 3 and augment the reduced form model with other factors that may be determinant for corporate investment during the crisis period. In our investment model, we use sales growth as the investment fundamental for the reason that market-based measures of investment fundamentals such as Tobin's q may not accurately reflect the firms' investment opportunities in China due to the less-developed stock markets, and especially during the financial crisis, the problem of mispricing may be worsening amid higher uncertainty and lower investor confidence in the economy, which could lead to even less credibility of the measurement of Tobin's q. Moreover, since our data are based on quarterly observations, the higher frequency of our observations may not accurately represent the value of a firm.

4.5.1. Demand channel test

First of all, in order to test the impact of the financial crisis on the Chinese listed firms' investment via the demand shock, we categorise our sample firms into two groups according to the industries that the firms operate in. Firms in the first group are the ones in manufacturing and the more export-driven sectors, and firms in the second group are the ones in the more domestic market-driven sectors. Our classification of the industries that belong to the more export-driven sectors coincides with the industries identified by the government that needed special attention as these industries were greatly affected by the global financial crisis because of their high reliance on exports.[11]

We differentiate firms this way partly because the information on each firm's export activities such as whether the firm exports or not, or the firm's percentage of sales sold abroad is unavailable. The official report provides a clear recognition of which industries are highly dependent on exports, and therefore provides a good reference point for our purpose. We believe that utilising the official report is the most convincing way we can do in sorting our sample firms. The contraction of demand from the economies that were directly hit by the financial crisis, such as the United States, suggests that the firms in the identified industries that are more export driven were likely to experience severer impact from the financial crisis than firms in other industries do.

[11] The official announcement was reported by China's official paper, People's Daily on 27th of February 2009. For an online version of the official report, please see: http://english.peopledaily.com.cn/90001/90778/90857/90862/6602754.html

We use the following investment equation to compare the two groups of firms in order to detect the financial crisis's effect via demand channel. The equation is modified version of the accelerator-type investment model in chapter 3 (model (3.1)) and is used as our benchmark model for this chapter:

$$Inv_{i,t} = \beta_1 Inv_{i,t-1} + \beta_2 Sales_{i,t-1} + \beta_3 Liquidity_{i,t-1} + \beta_4 Debt_{i,t-1} + \beta_5 Size_{i,t-1} + \beta_6 FinAsset_{i,t-1} + \beta_7 Interest_{i,t-1} + \beta_8 State_{i,t-1} + \beta_9 FinCrisis + \beta_{10} Uncertainty_{i,t} + f_i + f_t + \varepsilon_{i,t} \quad (4.1)$$

The subscript *i* represents each individual firm and the subscript *t* identifies the present quarter. f_i captures the firm specific effect and f_t represents the time effect. $\varepsilon_{i,t}$ is the idiosyncratic error term. *Inv* is the ratio of change in net fixed assets from the previous quarter to total assets. On the right hand side of the equation, we include the lagged one term of *Inv* to take into account the dynamics of investment. *Sales* is sales growth measured as quarterly growth rate of total operating revenue, which captures the accelerator effect and represents the firm's investment fundamental/opportunities. *Liquidity* is measured as the ratio of cash and cash equivalents to total assets. Liquidity measures such as cash flow or cash holdings are commonly employed in investment models to represent internal funds or net worth for the purpose of detecting financial constraints on investment. For instance, Hoshi et al (1991) use both flow and stock measures of cash to test the presence of financial constraints for Japanese firms. *Debt* is defined as the ratio of short-term borrowings and long-term debts to total assets, which is also a standard financial factor for investment (e.g. Lang et al 1996; Bo 2007; Firth et al 2008). *Size* is natural logarithm of total assets. We also control two possible financial

determinants of investment especially in a time of financial crisis when credit can be relatively scarce. (1) *Finasset* is the ratio of the fair value of financial assets available for sale to total assets. It is important to include the available-for-sales financial assets variable in the model because it could affect a firm's liquidity situation and ultimately its investment decision, especially during the financial crisis. (2) *Interest* is the ratio of interest payable to total assets, where interest payable is defined as interest accrued from long-term borrowings, bonds receivable and other long-term liabilities for which interest is paid at regular intervals and principal is paid when due. Fixed investments in China are mostly financed by long-term loans if not by internal funds. This variable is essential because the amount of interest to be paid affects the investment decisions of a firm and can be regarded as a deterrent to (over-)investment. Higher interest payments should refrain the firm from investing further. State ownership is also controlled in the equation. *State* is ratio of state shares to total shares of a firm. It is included because state ownership and government policies, particularly in China's state capitalist economy, may influence firm investment behaviour especially during the financial crisis. Since present investment decisions are based on past information, we use observations lagged one period (t-1) for the explanatory variables described above. In addition, we control for uncertainty in the investment equation. *Uncertainty* is measured as quarterly average of standard deviations of daily stock returns for each firm. The standard deviation of stock returns, i.e. the volatility of stock returns, is commonly used in the literature (e.g. Bloom et al 2007; Leahy and Whited 1996) as a proxy for uncertainty, which can have a profound effect on firms' investment decisions.

Our key variable of interest, *FinCrisis*, is a dummy variable that equals to one if the quarter in question is within our defined period of the recent global financial crisis and the subsequent economic recession; otherwise it is taken as zero. We interpret this particular period as in and after the beginning of 2008 when destructions and contagion effects from the subprime loan crisis that broke out around mid-2007 really started to emerge across the United States and soon after in other parts of the world.[12] A series of negative events happened to major international financial institutions, such as the rescues of the almost fallen Northern Rock, Bear Sterns and American International Group (AIG) and the later bankruptcy of Lehman Brothers, caused the markets around the globe to start tumbling and the confidence in the global economic condition plummeting. The exact period covers a total of 11 quarters from the first quarter of 2008 to the third quarter of 2010[13]. Our chosen period of financial crisis is logical. Although the recent crisis may have started in the summer of 2007 as a result of the United States subprime mortgage market turmoil, its effect on the global economy as a whole and especially on some parts of world was not realised or being felt until later. This is particularly the case for China, as the financial crisis's effect on China was not immediately apparent in the later part of 2007.

We conduct three separate estimations of Equation 4.1. Firstly, we estimate the investment equation using the full sample so as to see how the investment

[12] Some papers define the beginning of the recent financial crisis differently. For example, Duchin et al (2010) choose July 2007 as the start of the crisis.

[13] Despite the announcement by the National Bureau of Economic Research that the US economic recession ended in September 2009 (see http://www.nber.org/cycles/sept2010.html), we cover the financial crisis period up to the third quarter of 2010 as we suspect the confidence in the markets is fully restored to pre-crisis level.

behaviour of Chinese listed firms in general may respond to the financial crisis. We then estimate the investment equation with the data on firms in the more export driven sectors and the data on firms in the more domestic demand driven sectors respectively so that we could distinguish the difference between the two groups. By comparing the effect of the crisis on the two groups of observations, we are able to uncover whether the firms in the more export driven industries cut fixed investments more than the other firms do, which would therefore show that the impact of the crisis on firm investment is effectively transmitted via the demand channel.

Hypotheses: the financial crisis dummy is negatively related to firm investment; firms in the more export driven sectors respond more to the global financial crisis than firms in the more domestic demand driven sectors as global demand contracts.

4.5.2. Financial constraints channel test

To test of the effect of the financial crisis on firms' investment behaviour via the financial constraints channel, we include an interaction term between the liquidity variable and the financial crisis dummy to form the estimation equation as follows:

$$\begin{aligned} Inv_{i,t} = {} & \beta_1 Inv_{i,t-1} + \beta_2 Sales_{i,t-1} + \beta_3 Liquidity_{i,t-1} \\ & + \beta_4 Liquidity_{i,t-1} \times FinCrisis + \beta_5 FinCrisis + \beta_6 Leverage_{i,t-1} \\ & + \beta_7 Size_{i,t-1} + \beta_8 Finassets_{i,t-1} + \beta_9 Interests_{i,t-1} + \beta_{10} State_{i,t-1} \\ & + \beta_{11} Uncertainty_{i,t} + f_i + f_t + \varepsilon_{i,t} \end{aligned} \quad (4.2)$$

where all the variables and terms are defined as previously.

Our key focus for this test is on the liquidity variable and the interaction term between the liquidity variable and the financial crisis dummy. The sensitivity of investment to liquidity is a commonly accepted indication of the presence of financial constraints in the literature. We should expect to see that both the estimated coefficients of the liquidity variable and the interaction term to be positive and statistically significant. If that is the case, it would suggest that the overall sensitivity of investment to liquidity, i.e. the degree of financial constraints on investment, is stronger during the financial crisis as access to credit could have potentially become relatively more difficult for firms.

During our defined crisis period, there were a series of negative events, such as that when Northern Rock in the United Kingdom and Bear Sterns in the United States ran into deep troubles and had to be bailed out in early 2008 as well as when later in the same year a number of major banks and financial institutions like Lehman Brothers, AIG and HBOS collapsed or had to be rescued. These events generally trigger disruptions in the markets and caused confidence waning and uncertainty rising across the global, even in China where the financial system is relatively isolated. Subsequently, the problems of information asymmetry and agency cost become more serious. Firms' access to external fund would be even more limited while their net worth diminishes as the market value of their assets depreciates. In the recent case of financial crisis, despite China's moderate entanglement financially, its four major commercial banks still suffered a total loss on derivative products such as the mortgage-backed securities (MBS) and collateralized debt obligations (CDOs)

that amounted to 20 billion US dollars in early 2008. Moreover, the collapse of Lehman Brothers led to the additional loss of 0.76 billion US dollars to seven Chinese commercial banks that held Lehman Brothers bonds (Yu 2010). The loss among the Chinese commercial banks, despite being minor, together with the continued turmoil in the global financial market could make lenders to be extra cautious in providing funds to firms amid the pessimistic economic climate. Therefore, it is interesting to see if during the global crisis, the Chinese listed firms experience greater degree of financial constraints.

We conduct three separate estimations of Equation 4.2. We first estimate the equation with the full sample in order to check if the Chinese listed firms generally experience greater financial constraints on investment during the financial crisis. Two other estimations of the investment equation are then conducted using the data on firms in the more export driven sectors and the data on firms in the more domestic market driven sectors respectively. We are interested in whether the two groups of firms face different degrees of financial constraints since the two groups of firms are driven by different markets. It is possible that the firms in the more export driven sectors are more likely to suffer more as the impact of the recent financial crisis on China in theory may have been largely through international trade rather than through direct credit supply shortage. Firms in the more export driven sectors as a result of their net worth being affected by global demand may experience their financial constraints on investment exacerbated.

Hypotheses: the financial crisis dummy is negatively related to firm investment; firms suffer more from financial constraints during the global financial crisis;

firms in the more export driven sectors suffer more from financial constraints than firms in the more domestic demand driven sectors during the global financial crisis.

4.5.3. Uncertainty channel test

Finally, for the uncertainty channel test, we include in our model an interaction term between the uncertainty proxy and the financial crisis dummy. The equation is shown as follows:

$$\begin{aligned} Inv_{i,t} = {} & \beta_1 Inv_{i,t-1} + \beta_2 Sales_{i,t-1} + \beta_3 Liquidity_{i,t-1} + \beta_4 Debt_{i,t-1} + \beta_5 Size_{i,t-1} \\ & + \beta_6 Finasset_{i,t-1} + \beta_7 Interest_{i,t-1} + \beta_8 State_{i,t-1} \\ & + \beta_9 Uncertainty_{i,t} + \beta_{10} Uncertainty_{i,t} \times FinCrisis + \beta_{11} FinCrisis \\ & + f_i + f_t + \varepsilon_{i,t} \end{aligned} \tag{4.3}$$

where all the variables and terms are defined as previously.

The same as previous tests, we run three separate estimations for Equation 4.3. We first estimate the equation with the full sample to see if the recent financial crisis in general aggravates the uncertainty felt by the Chinese listed firms. We then conduct two other estimations using the data on firms in the more export driven sectors and the data on firms in the more domestic demand driven sectors so as to check if the two group of firms' investment behaviour are affected by the financial crisis differently via the uncertainty channel.

Hypotheses: the financial crisis dummy is negatively related to firm investment;

firms respond more negatively to volatility/uncertainty during the global financial crisis; firms in the more export driven sectors respond more negatively to market volatility/uncertainty than firms in the more domestic demand driven sectors during the global financial crisis.

4.6 Data and estimation method

The data used in this chapter are obtained from the GTA Research Service Centre based on the databases including *CSMAR China Stock Market Financial Statements Database* and *China Stock Market Financial Database – Financial Ratios*. Our dataset contains 1,689 non-financial firms that are publicly listed on either the Shanghai Stock Exchange or the Shenzhen Stock Exchange (A share). The entire time period covers a total of 19 quarters from the first quarter of 2006 to the third quarter of 2010, which spans from the pre-crisis period to the aftermath of the global financial crisis and the subsequent recession (the structure of the panel is provided in the Appendix). To treat for potential outliers, we remove observations that have extreme values for the relevant variables. Precisely we delete the top 0.5 per cent and the bottom 0.5 per cent of the observations for the variables. The final dataset is an unbalanced panel and has a total of 28,948 firm-quarter observations.

Table 4.1 presents the descriptive statistics of the variables used in this chapter. We can see that on average, firms in export driven sectors have higher *Inv* than the firms in domestic market driven sectors, indicating that the firms in export driven sectors, of which the majority are manufacturing firms, are inherently required to engage more in fixed asset investment. The firms in both sectors have average sales growth rates of approximately 38.5 per cent,

Table 4.1 Descriptive Statistics

	(1) All firms			(2) Firms in export driven sectors			(3) Firms in domestic market driven sectors			t
	N	Mean	σ	N	Mean	σ	N	Mean	σ	mean(0) -mean(1)
Inv	28175	0.003	0.032	13641	0.004	0.033	14534	0.002	0.031	4.810***
Sales	28125	0.385	0.836	13661	0.385	0.821	14464	0.385	0.850	-0.001
Liquidity	28594	0.155	0.122	13872	0.157	0.119	14722	0.154	0.125	1.987**
Debt	28443	0.227	0.173	13816	0.230	0.171	14615	0.224	0.175	2.463***
Size	28480	20.171	1.647	13867	20.281	1.581	14613	20.066	1.701	11.070***
FinAsset	28729	0.009	0.045	13945	0.008	0.046	14784	0.009	0.044	-2.626***
Interest	28106	0.003	0.020	13677	0.003	0.022	14429	0.003	0.019	0.801
State	28870	0.196	0.228	13978	0.194	0.226	14892	0.198	0.230	-1.330*
Uncertainty	27759	0.036	0.010	13473	0.036	0.010	14286	0.035	0.011	5.605***

Notes:

1. N: number of observations; Mean: variable sample average; σ: standard deviation
2. t: t-test statistics;
   mean(0)-mean(1): mean(firms in export driven sectors)-mean(firms in domestic market driven sectors)
3. Definition of variables:
   Inv: ratio of change in net fixed assets from previous quarter to total assets;
   Sales: Quarterly growth rate of total operating revenue;
   Liquidity: Ratio of cash and cash equivalents to total assets;
   Debt: Ratio of short-term borrowing and long-term debts to total assets;
   Size: natural logarithm of total assets;
   FinAsset: Ratio of the fair value of financial assets available for sales to total assets;
   Interest: Ratio of interest payable to total assets, where interest payable is interests accrued from long-term borrowing, bond receivable and other long-term liabilities for which interest is paid at regular intervals and principal is paid when due;
   State: Ratio of state shares to total shares;
   Uncertainty: Quarterly average of standard deviations of daily stock returns.
4. * significant at the 10 per cent level; ** significant at the 5 per cent level; *** significant at the 1 per cent level

suggesting general strong growth opportunities in China. On average, the firms in export driven sectors have more liquidity (cash and cash equivalents) as well as more debts than the firms in domestic market driven sectors. The firms in domestic market driven sectors, averagely speaking, hold slightly more

financial assets than the firms in export driven sectors. In terms of state ownership, the firms in domestic market driven sectors have on average higher ratio of shares held by the government or government legal persons than their counterparts. Interestingly, the firms in export driven sectors have slightly higher volatility of stock returns (*Uncertainty*) than the firms in domestic market driven sectors. At first glance, the descriptive summary seems to suggest that the firms in export driven sectors experience higher degree of uncertainty (measured by firm stock price volatility) than the firms in domestic market driven sector, an initial indication that the financial crisis may have affected the firms in export driven sectors more via the demand channel. Nonetheless, further investigations are provided in the later sections.

We employ the difference Generalised Method of Moments (GMM) estimator for our estimations.[14] A number of reasons are considered here for the choice of the estimator. Endogeneity problem is likely to arise, for example, while growth variable could drive investment, investment also determines growth for a firm. In addition, since the lagged dependent variable is also included in the equation, the issue of autocorrelation will occur. The GMM estimator takes into account of these potential problems. The estimator uses lagged observations of the explanatory variables as instruments for the first differenced equations.

[14] We check whether the difference GMM estimator is likely to suffer from finite sample bias by comparing the estimated coefficients of the lagged dependent variable from the GMM and the Within-Groups estimations of the equations. The Within-Groups estimate of the lagged dependent variable coefficient is normally downward biased in short panels (Nickell, 1981). A consistent estimate of the coefficient using the GMM estimator would be expected to lie above the estimated coefficient using the Within-Groups estimator. Our estimated coefficients are larger than the Within-Groups ones, therefore indicating that our results are unlikely to suffer from serious finite sample bias. In addition, if the estimates using the difference GMM estimator lie close or below the estimates using the Within-Groups estimator, there is a possibility that the GMM estimates are downward biased as well, perhaps due to weak instruments, in which case it would be required to use the system GMM estimator (Blundell and Bond, 1998; Bond et al, 2001).

We use the statistical software package *Stata 10* and the command *xtabond2* developed by Roodman (2009) for the package to conduct the difference GMM estimations.

4.7 Estimation results and interpretations

The difference GMM estimation results of the test on how the recent financial crisis affects the investment behaviour of the Chinese listed firms via the output demand channel (model (4.1)) are presented in Table 4.2. We can see that the estimated coefficients of our key variable of interest, the financial crisis dummy (*FinCrisis*), are negative and highly statistically significant in both columns (1) and (2), i.e. for the whole sample and firms in the more export driven sectors respectively. However, in column (3), which presents the estimation results for the firms in the more domestic demand driven sectors, the estimated coefficient of the financial crisis dummy (*FinCrisis*) is shown to be insignificant. The overall results suggest that the firms in the more export driven industries were more affected by the financial crisis than the other firms as a result of the decline of demand from the global market. In response, these firms cut their investment spending during the financial crisis.

Apart from our key explanatory variable in model (4.1), i.e. the financial crisis dummy (*FinCrisis*), the estimated coefficients of the operating revenue growth variable (*Sales*) is positive and statistically significant in columns (1) and (2) suggesting the behaviour of these firms as a whole and for firms in export driven sectors depended firmly on the investment opportunities, whereas in column (3) the coefficient of the same variable is insignificant statistically.

Table 4.2 Difference GMM estimation results for demand channel test

	(1) All firms	(2) Firms in export-driven sectors	(3) Firms in domestic demand-driven sectors
Inv_{t-1}	-0.015	-0.022	-0.005
	(-1.53)	(-1.49)	(-0.36)
$Sales_{t-1}$	0.003**	0.005*	-0.001
	(2.25)	(1.80)	(-.034)
$Liquidity_{t-1}$	0.033**	0.039*	0.062*
	(2.02)	(1.81)	(1.78)
$Debt_{t-1}$	0.029*	0.012	0.119***
	(1.67)	(0.53)	(2.89)
$Size_{t-1}$	-0.005	-0.007	-0.001
	(-1.62)	(-1.55)	(-0.12)
$FinAssets_{t-1}$	0.045	0.004	0.069
	(1.61)	(0.17)	(1.55)
$Interests_{t-1}$	-0.147**	0.055	-0.268
	(-2.58)	(0.64)	(-1.27)
$State_{t-1}$	-0.000	0.002	-0.004
	(-0.10)	(0.41)	(-0.52)
FinCrisis	-0.015***	-0.018***	-0.007
	(-6.31)	(-4.93)	(-1.60)
$Uncertainty_t$	-0.088	0.123	0.293
	(-0.57)	(0.63)	(0.92)
m1	-22.57	-16.54	-15.28
[p value]	[0.000]	[0.000]	[0.000]
m2	-1.38	0.11	-1.54
[p value]	[0.167]	[0.914]	[0.124]
J	617.02	439.38	219.06
[p value]	[0.159]	[0.237]	[0.105]
Number of Observations	21582	10646	10882

Notes:

1. Dependent variable: ratio of change in net fixed assets from the previous quarter to total assets (*Inv*)
2. Time-specific effects are controlled in all estimations by adding year dummies; industry effects are also controlled in all estimations by adding industry dummies
3. t-statistics are reported in the parentheses
4. J test of overidentifying restrictions is asymptotically distributed as chi-square under the null of instrument validity
5. * significant at the 10 per cent level; ** significant at the 5 per cent level; *** significant at the 1 per cent level
6. Explanatory variable definitions:
   Sales: quarterly growth rate of total operating revenue;
   Liquidity: ratio of cash and cash equivalents to total assets;
   Debt: ratio of short-term borrowing and long-term to total assets;
   Size: natural logarithm of total assets;
   Finasset: ratio of fair value of financial assets available for sale to total assets;
   Interest: ratio of interest payable to total assets, where interest payable is interests accrued from long-term borrowings, bonds receivable and other long-term liabilities for which interest is paid at regular intervals and principal is paid when due;
   State: ratio of state shares to total shares;
   FinCrisis: equals to 1 if the corresponding quarter is in or after January 2008, otherwise equals 0;
   Uncertainty: quarterly average of standard deviations of daily stock returns.
7. Sectors regarded as export driven: Textile manufacturers; Manufacturers of clothes & other fibre products; Manufacturers of leather, fur, feather and other products; Timber and furniture producers; Paper and paper products manufacturers; Cultural, educational and sports products manufacturers; Chemical material and products manufacturers; Chemical fibres manufacturers; Rubber manufacturers; Plastic manufacturers; Electronics manufacturers; Metal related products manufacturers; Machinery, equipment and instrument manufacturers; IT products manufacturers
8. The instruments used in our GMM estimation include the lagged 2 terms or further of the dependent variable and independent variables. The time dummies as well as the industry dummies are also used as instruments in our estimations.

All the estimated coefficients of the internal fund proxy (*Liquidity*) in the two

columns are showing to be positive and statistically significant, indicating the average listed firms in China experience some degree of financial constraints. Interestingly, the estimated coefficients of the leverage variable (*Debt*) turn out to be positive and statistically significant in column (1) and (3) but not in column (2). The above results together may suggest that while the firms in the more export driven industries were greatly affected (as shown by the negative effect of the financial crisis dummy (*FinCrisis*) and more active response to investment fundamental (*Sales*)), the firms in the more domestic market oriented industries do not seem to suffer from the crisis and have reacted differently (investment responded positively to lagged one period of debt). There are two possible reasons for the discrepancies. First, the financial crisis's impact on China can be largely attributed to the weakened demand in the international market, therefore the greater influence felt by firms in the more export driven industries. Second, during the period, the government's response to the slowdown in GDP growth caused by the financial crisis was to offer a stimulus package that was aimed at promoting domestic demand[15] instead of rescuing the export industries which have often been questioned as having problems with overcapacity and being unsustainable in the longer term for the Chinese economy (e.g. Guo and N'Diaye 2009). Much of the capital for infrastructure improvements in China comes from the state banks rather than directly from the central and local governments. The positive relations between investment and debt may be indicative that the stimulus package was working its way through the state banks to the firms in the more domestic demand oriented sectors.

[15] For instance, the two biggest components of the four trillion yuan stimulus package, which was announced in November 2008, were on the public infrastructure development and the post-quake reconstruction. Together they made up more than 60 per cent of the total package.

Table 4.3 presents the difference GMM estimation results for the test of the effect of financial crisis on the firms' investment behaviour via the financial constraints channel. Column (1) shows the estimation results for model (4.2) for all our sample firms. We can see that the coefficient of the investment fundamental variable, *Sales*, is positive and highly statistically significant, therefore consistent with the theoretical predication of the accelerator effect on investment. The estimated coefficient of the internal fund proxy (*Liquidity*) is positive and statistically significant, again implying the general presence of financial constraints. However, the estimated coefficient of one of our key variable, the interaction term between *Liquidity* and the financial crisis dummy (*Liquidity*×*FinCrisis*), which signals the aggravation of the financial constraints for firms during the crisis if it shows to be statistically significant and positive, turns out to be poorly determined. This result seems to suggest that the Chinese listed firms do not face more severe credit constraints during the crisis. In short, although an average Chinese listed firm experiences financial constraints in general, the advent of the global financial crisis did not aggravate the condition for the firms as a whole, i.e. the exacerbated credit shortage problem that occurred in other economies owing to the reasons discussed before does not entirely apply to China. Another key explanatory variable in model (4.2), i.e. the financial crisis dummy (*FinCrisis*), is showing to have a negative and statistically significant coefficient. Again it indicates the negative effect of the crisis on the listed firms' investment decisions.

Table 4.3 Difference GMM estimation results for the financial constraints channel test

	(1) All firms	(2) Firms in export driven sectors	(3) Firms in domestic demand driven sectors
Inv_{t-1}	-0.018*	-0.020	-0.006
	(-1.82)	(-1.30)	(-0.49)
$Sales_{t-1}$	0.005**	0.007**	-0.001
	(2.48)	(2.11)	(-0.39)
$Liquidity_{t-1}$	0.033*	0.033*	0.068**
	(1.91)	(1.68)	(2.21)
$Liquidity_{t-1}$×*FinCrisis*	0.009	0.021*	-0.000
	(1.07)	(1.66)	(-0.00)
FinCrisis	-0.018***	-0.024***	-0.008
	(-6.21)	(-4.78)	(-1.56)
$Debt_{t-1}$	0.028	0.039	0.104***
	(1.30)	(1.13)	(2.66)
$Size_{t-1}$	-0.002	-0.008	0.000
	(-0.62)	(-1.76)	(0.07)
$FinAssets_{t-1}$	-0.006	0.049	0.066
	(-0.25)	(0.92)	(1.50)
$Interests_{t-1}$	-0.107**	0.180	-0.235
	(-2.00)	(1.12)	(-1.20)
$State_{t-1}$	-0.002	0.002	-0.004
	(-0.42)	(0.36)	(0.53)
$Uncertainty_t$	-0.124	-0.009	0.219
	(-3.12)	(-0.04)	(0.73)
m1	-22.34	-16.70	-15.39
[p value]	[0.000]	[0.000]	[0.000]
m2	-1.63	-0.01	-1.63
[p value]	[0.104]	[0.991]	[0.104]
J	469.99	525.52	240.66
(p value)	[0.113]	[0.547]	[0.186]
Number of Observations	21582	10646	10882

Notes:

1. Dependent variable: ratio of change in net fixed assets from the previous quarter to total assets (*Inv*)
2. Time-specific effects are controlled in all estimations by adding year dummies; industry effects are also controlled in all estimations by adding industry dummies
3. t-statistics are reported in the parentheses
4. J test of overidentifying restrictions is asymptotically distributed as chi-square under the null of instrument validity
5. * significant at the 10 per cent level; ** significant at the 5 per cent level; *** significant at the 1 per cent level
6. Explanatory variable definitions:
   Sales: quarterly growth rate of total operating revenue;
   Liquidity: ratio of cash and cash equivalents to total assets;
   Debt: ratio of short-term borrowing and long-term to total assets;
   Size: natural logarithm of total assets;
   Finasset: ratio of fair value of financial assets available for sale to total assets;
   Interest: ratio of interest payable to total assets, where interest payable is interests accrued from long-term borrowings, bonds receivable and other long-term liabilities for which interest is paid at regular intervals and principal is paid when due;
   State: ratio of state shares to total shares;
   FinCrisis: equals to 1 if the corresponding quarter is in or after January 2008, otherwise equals 0;
   Uncertainty: quarterly average of standard deviations of daily stock returns.
7. Sectors regarded as export driven: Textile manufacturers; Manufacturers of clothes & other fibre products; Manufacturers of leather, fur, feather and other products; Timber and furniture producers; Paper and paper products manufacturers; Cultural, educational and sports products manufacturers; Chemical material and products manufacturers; Chemical fibres manufacturers; Rubber manufacturers; Plastic manufacturers; Electronics manufacturers; Metal related products manufacturers; Machinery, equipment and instrument manufacturers; IT products manufacturers

8. The instruments used in our GMM estimation include the lagged 2 terms or further of the dependent variable and independent variables. The time dummies as well as the industry dummies are also used as instruments in our estimations. The instruments for the interactions term also include the products of the components. The instruments for the interactions term also include the products of the components.

Nevertheless, when we take a closer look at the crisis's effect on the listed firms by splitting them according to their operating industries and by running separate estimations using the same model for each group, the investment behaviours of our two groups of firms are found to differ. While the estimated coefficients of the main determinants of investment such as the proxy for investment opportunities (*Sales*) and the internal fund proxy (*Liquidity*) remain mostly statistically significant with the conventional signs in columns (2) and (3), the groups of firms reacted differently to our key explanatory variables in model (4.2). For the group of firms in the more export driven industries, the estimated coefficient for the interaction term (*Liquidity×FinCrisis*) turns out to be positive and statistically significant and the estimated coefficient for the financial crisis dummy (*FinCrisis*) is negative and significant statistically. But for the other group of firms, the estimated coefficients for the same variables are showing to be insignificant. In other words, these results are suggesting that while the firms in the more domestic demand driven sectors did not suffer from the financial crisis, the firms in the more export driven sectors, firstly, experienced greater financial constraints on investment during the crisis (judging by the higher overall investment-liquidity sensitivity summarised by both the estimated coefficients of *Liquidity* and the interaction term (*Liquidity×FinCrisis*)), and secondly, cut their investment spending in response to the financial crisis. These firms feel the pinch of the higher costs of external finances. It is because of the government's initial reluctance to put more emphasis on export-led industrial sectors due to the fear of more overcapacity

in the economy, these firms may have therefore faced direr situation of financial constraints on investment. Moreover, similar to what have been discussed in the literature review, the net worth, i.e. the balance sheets, for these firms are likely to be affected because of the nature of the crisis that caused the slumping demand for Chinese exports and waning confidence in the economy, and as a result, it would exacerbate the financial conditions of these firms. In addition to the results of the key explanatory variables discussed above, we observe that the estimated coefficient of *Debt* in column (3) appears to be positive and highly statistically significant. This result is again indicative that the government's stimulus package aimed at encouraging domestic demand is working at the time and it is being delivered via the investment spending of the firms in the domestic demand driven sectors using the capital provided by China's state banking sector.

All in all, the financial crisis's impact on the investment behaviour of the Chinese listed firms through the financial constraints channel has been limited, and it is the firms in the more export driven industries were affected. Our results support the argument that the recent crisis that has devastating effects on the United States and European economies has only a restricted direct financial impact on the Chinese economy because of its relatively isolated and conservative financial system.

Table 4.4 presents the estimation results for the test of the financial crisis's effect on Chinese firms' investment behaviour via the uncertainty channel using standard deviation of stock returns as the proxy for uncertainty. We can see that the estimated coefficients of the standard variables of the investment

Table 4.4 Difference GMM estimation results for uncertainty channel test using stand deviation of daily stock returns as uncertainty proxy

	(1) All firms	(2) Firms in export driven sectors	(3) Firms in domestic demand driven sectors
Inv_{t-1}	-0.0134	-0.0207	-0.0091
	(-1.36)	(-1.45)	(-0.69)
$Sales_{t-1}$	0.0057***	0.0073**	0.0072**
	(3.05)	(2.28)	(2.24)
$Liquidity_{t-1}$	0.0258*	0.0410*	0.0566*
	(1.65)	(1.82)	(1.86)
$Debt_{t-1}$	0.0414*	0.0176	0.0982***
	(1.77)	(0.73)	(2.82)
$Size_{t-1}$	-0.0038	-0.0076	0.0011
	(-1.25)	(-1.60)	(0.21)
$FinAssets_{t-1}$	0.0016	0.0025	0.0402
	(0.07)	(0.11)	(0.97)
$Interests_{t-1}$	-0.1370	0.0503	-0.2041
	(-1.00)	(0.45)	(-1.41)
$State_{t-1}$	-0.0014	0.0031	0.0014
	(-0.32)	(0.66)	(0.19)
$Uncertainty_t$	-0.3852*	0.0002	-0.6035
	(-1.72)	(0.00)	(-1.05)
$Uncertainty_t$*FinCrisis	0.1097	-0.1358	0.4025
	(0.44)	(-0.46)	(0.65)
FinCrisis	-0.0223***	-0.0165*	-0.0303
	(-2.64)	(-1.65)	(-1.52)
m1	-22.46	-16.55	-15.23
(p value)	[0.000]	[0.000]	[0.000]
m2	-1.41	-0.06	-1.59
(p value)	[0.159]	[0.953]	[0.112]
J	476.21	478.53	280.43
(p value)	[0.148]	[0.277]	[0.366]
Number of Observations	21582	10646	10882

Notes:

1. Dependent variable: ratio of change in net fixed assets from the previous quarter to total assets (*Inv*)
2. Time-specific effects are controlled in all estimations by adding year dummies; industry effects are also controlled in all estimations by adding industry dummies
3. t-statistics are reported in the parentheses
4. J test of overidentifying restrictions is asymptotically distributed as chi-square under the null of instrument validity
5. * significant at the 10 per cent level; ** significant at the 5 per cent level; *** significant at the 1 per cent level
6. Explanatory variable definitions:
   Sales: quarterly growth rate of total operating revenue;
   Liquidity: ratio of cash and cash equivalents to total assets;
   Debt: ratio of short-term borrowing and long-term to total assets;
   Size: natural logarithm of total assets;
   Finasset: ratio of fair value of financial assets available for sale to total assets;
   Interest: ratio of interest payable to total assets, where interest payable is interests accrued from long-term borrowings, bonds receivable and other long-term liabilities for which interest is paid at regular intervals and principal is paid when due;
   State: ratio of state shares to total shares;
   FinCrisis: equals to 1 if the corresponding quarter is in or after January 2008, otherwise equals 0;
   Uncertainty: quarterly average of standard deviations of daily stock returns.
7. Sectors regarded as export driven: Textile manufacturers; Manufacturers of clothes & other fibre products; Manufacturers of leather, fur, feather and other products; Timber and furniture producers; Paper and paper products manufacturers; Cultural, educational and sports products manufacturers; Chemical material and products manufacturers; Chemical fibres manufacturers; Rubber manufacturers; Plastic manufacturers; Electronics manufacturers; Metal related products manufacturers; Machinery, equipment and instrument manufacturers; IT products manufacturers

8. The instruments used in our GMM estimation include the lagged 2 terms or further of the dependent variable and independent variables. The time dummies as well as the industry dummies are also used as instruments in our estimations. The instruments for the interactions term also include the products of the components.

model, such as the investment fundamental (*Sales*) and the internal fund proxy (*Liquidity*), remain statistically significant with positive signs in all three columns. The estimated coefficient of the leverage variable (*Debt*) turns out to be statistically significant and positive for the whole sample (column (1)), and highly statistically significant and positive for the firms in the domestic demand driven sectors (column (3)). These results again demonstrate the importance of debt financing on investment during the time when the stimulus package was focused on boosting domestic demand.

As in column (1), for the uncertainty proxy, the estimated coefficient turns out to be statistically significant with a negative sign for the estimation for all sample firms. The result is consistent with most studies in the literature (e.g. Bernanke 1983; Dixit and Pindyck 1994; Lensink et al 2001) that argue the irreversibility of investment or real options should cause a negative effect of uncertainty on investment. However, the estimated coefficients for our key variable in this test, i.e. the interaction term between the uncertainty proxy and financial crisis dummy (*Uncert×FinCrisis*), reveal to be not statistically significant for all the estimations shown in Table 4.4. Therefore, judging by the results based on using standard deviation of stock returns as the uncertainty proxy, we do not find evidence that the financial crisis has any tangible impact on the investment behaviour of Chinese firms via the volatility/uncertainty channel. Nonetheless, for the other key explanatory variable, the financial crisis dummy (*FinCrisis*), the estimated coefficients are again showing to be negative and statistically significant in columns (1) and column (2), suggesting

the general negative impact of financial crisis on firms' fixed investments and particularly so for firms in the more export driven industries.

All in all, in this test using standard deviation of stock returns as the proxy for uncertainty, we do not observe evidence that via the uncertainty channel the financial crisis had an effective impact on the listed firms' investment behaviour. However, the poorly determined results of estimated coefficients for the uncertainty proxy employed in our models may be a possible indication of the chosen proxy being unfit, i.e. the standard deviation of stock returns may not be a good representation of uncertainty for firms in China. Therefore, we employ an alternative uncertainty proxy that is more likely to link better with the macroeconomic event (the global financial crisis) to test whether it really is the case that via the uncertainty channel the financial crisis had no tangible impact on the investment behaviour of the firms.

We provide a further test for the uncertainty channel by using an alternative proxy for measuring uncertainty, namely the difference between the rates of the United States Treasury bond and corporate bond. The estimation equation for the uncertainty channel test is as follows.

$$\begin{aligned} Inv_{i,t} = {} & \beta_1 Inv_{i,t-1} + \beta_2 Sales_{i,t-1} + \beta_3 Liquidity_{i,t-1} + \beta_4 Leverage_{i,t-1} \\ & + \beta_5 Size_{i,t-1} + \beta_6 Finassets_{i,t-1} + \beta_7 Interests_{i,t-1} + \beta_8 State_{i,t-1} \\ & + \beta_9 Uncertainty2_{i,t} \\ & + \beta_{10} Uncertainty2_{i,t} \times FinCrisis + \beta_{11} FinCrisis + f_i + f_t + \varepsilon_{i,t} \end{aligned} \tag{4.4}$$

where *Uncertainty2* is the alternative proxy for uncertainty calculated as the

difference between the quarterly average of the monthly 6-month Treasury bill secondary market rate and the quarterly average of the monthly yield of Moody's seasoned corporate bonds (Aaa)[16]. The difference reflects the degree of uncertainty in the market. Investors traditionally view the United States government bonds as a safer option for investments, and during a time of higher uncertainty in the economy, the Treasury bond rates tend to be lower as the demands increase. Whereas for the corporate bonds, during the financial crisis and recession, because of the credit shortage and uncertainty in all other financial markets and because of their riskier nature, the demands for the corporate bonds will be low and the rates will be higher so as to attract potential investors. The wider the difference between the rates of the government bonds and the corporate bonds should indicate a higher degree of uncertainty in the economy, and the difference should provide a good proxy for uncertainty about the global economy as a whole. This uncertainty proxy is relevant to the Chinese listed firms because most of these firms nowadays have operations and markets throughout the world, the changes in the world economic situation will definitely affect the risks felt by the firms and will therefore influence their decisions. The United States remains the biggest player in the global economy and the condition of its economy represents the global economic health. Moreover, the majority of the listed firms in our sample are in the manufacturing sectors and these firms have a large stake in the global market where the United States dominates. Therefore, the volatility in the United States bond markets can be provided as a gauge for uncertainty for our research purpose.

[16] The information on the bond rates is obtained from the Federal Reserve's Research and Data website. Please see: http://www.federalreserve.gov/datadownload/

Hypotheses: the financial crisis dummy is negatively related to firm investment; firms respond more negatively to uncertainty measured by volatility of US bond rates during the global financial crisis; firms in the more export driven sectors respond more negatively to uncertainty measured by volatility of US bond rates than firms in the more domestic demand driven sectors during the global financial crisis.

Table 4.5 shows the estimation results using the alternative measure as the proxy for uncertainty in our model. The estimated coefficients of the standard determinants of investment such as the investment fundamental (*Sales*) and the internal fund proxy (*Liquidity*) are again statistically significant with positive signs in all three columns, showing consistency for our estimations. As for our alternative proxy for uncertainty, the estimated coefficients of this variable turn out to be negative and highly statistically significant in all three columns, conforming to the notion that higher uncertainty prevents firms from further investment under the assumption of irreversibility.

The results from our application of the alternative measure of uncertainty are consistent and better determined than our previous proxy for uncertainty, which confirm that uncertainty in general has a negative impact on investment behaviour of firms. Nevertheless, as shown in the table, the estimated coefficients of the interaction term included in the model to capture the possible effect of the financial crisis on firms' sensitivity of investment to uncertainty in all three estimations are insignificant statistically. We do not find evidence that the global financial crisis has any aggravating effect via the

uncertainty channel on the Chinese firms' investment.

Table 4.5 Difference GMM estimation results for uncertainty channel test using bond rate difference as uncertainty proxy

	(1) All firms	(2) Firms in export driven sectors	(3) Firms in domestic demand driven sectors
Inv_{t-1}	-0.0207**	-0.0253*	-0.0135
	(-2.13)	(-1.69)	(-1.09)
$Sales_{t-1}$	0.0061***	0.0099***	0.0047**
	(2.65)	(2.85)	(2.07)
$Liquidity_{t-1}$	0.0318*	0.0367*	0.0503*
	(1.77)	(1.88)	(1.70)
$Debt_{t-1}$	0.0239	0.0225	0.0705***
	(1.28)	(1.23)	(2.91)
$Size_{t-1}$	-0.0017	-0.0066	-0.0014
	(-0.42)	(-1.29)	(-0.31)
$FinAssets_{t-1}$	-0.0145	-0.0023	0.0338
	(-0.61)	(-0.09)	(0.86)
$Interests_{t-1}$	-0.1790**	-0.0554	-0.1948**
	(-2.46)	(-0.83)	(-2.00)
$State_{t-1}$	-0.0024	0.0009	-0.0057
	(-0.54)	(0.18)	(-0.80)
$Uncertainty2_t$	-0.0234***	-0.0372***	-0.0155***
	(-4.79)	(-5.02)	(-2.80)
$Uncertainty2_t*FinCrisis_t$	-0.0029	0.0022	-0.0043
	(-0.27)	(0.17)	(-0.40)
$FinCrisis_t$	-0.0848*	-0.1021*	-0.0686
	(-1.80)	(-1.73)	(-1.58)
m1	-22.70	-16.78	-15.77
[p value]	[0.000]	[0.000]	[0.000]
m2	-1.23	0.27	-1.48
[p value]	[0.219]	[0.788]	[0.138]
J	466.54	500.03	328.84
[p value]	[0.406]	[0.858]	[0.340]
Number of Observations	22259	10966	11228

Notes:

1. Dependent variable: ratio of change in net fixed assets from the previous quarter to total assets (*Inv*)
2. Time-specific effects are controlled in all estimations by adding year dummies; industry effects are also controlled in all estimations by adding industry dummies
3. t-statistics are reported in the parentheses
4. J test of overidentifying restrictions is asymptotically distributed as chi-square under the null of instrument validity
5. * significant at the 10 per cent level; ** significant at the 5 per cent level; *** significant at the 1 per cent level
6. Explanatory variable definitions:
   Sales: quarterly growth rate of total operating revenue;
   Liquidity: ratio of cash and cash equivalents to total assets;
   Debt: ratio of short-term borrowing and long-term to total assets;
   Size: natural logarithm of total assets;
   Finasset: ratio of fair value of financial assets available for sale to total assets;
   Interest: ratio of interest payable to total assets, where interest payable is interests accrued from long-term borrowings, bonds receivable and other long-term liabilities for which interest is paid at regular intervals and principal is paid when due;
   State: ratio of state shares to total shares;
   FinCrisis: equals to 1 if the corresponding quarter is in or after January 2008, otherwise equals 0;
   Uncertainty2: difference between the quarterly average of the monthly 6-month Treasury bill secondary market rate and the quarterly average of the monthly yield of Moody's seasoned corporate bonds (Aaa).

7. Sectors regarded as export driven: Textile manufacturers; Manufacturers of clothes & other fibre products; Manufacturers of leather, fur, feather and other products; Timber and furniture producers; Paper and paper products manufacturers; Cultural, educational and sports products manufacturers; Chemical material and products manufacturers; Chemical fibres manufacturers; Rubber manufacturers; Plastic manufacturers; Electronics manufacturers; Metal related products manufacturers; Machinery, equipment and instrument manufacturers; IT products manufacturers
8. The instruments used in our GMM estimation include the lagged 2 terms or further of the dependent variable and independent variables. The time dummies as well as the industry dummies are also used as instruments in our estimations. The instruments for the interactions term also include the products of the components.

Finally, on our key explanatory variable, the financial crisis dummy (*FinCrisis*), the estimated coefficients are again showing to be negative and statistically significant in column (1) and column (2), verifying the financial crisis's damaging impact on investment in general and on firms in the more export driven industries.

Last but not least, concerning the model performances, all our estimation results presented above satisfy the requirements for the GMM post estimation tests. The m1 and m2 shown in the tables are the Arellano-Bond tests statistics. In all of the tables, m1 is significantly negative and m2 is insignificant from zero at the 5 per cent level, suggesting that the assumptions of no serial correlation in the error terms and no autocorrelation in the idiosyncratic errors are met. Moreover, the J tests statistics show no evidence that the null hypothesis of valid overidentifying restrictions can be rejected. Both outputs of the tests indicate our models are correctly specified and the instruments used in all our estimations are valid.

In summary, our estimation results have indicated that the financial crisis's effect on the investment behaviour of Chinese listed firms has been significantly negative. The impact is most noticeable via the output demand channel and it is most influential on firms in the more export driven industries.

These firms had to cut investments during the financial crisis and suffer from higher degree of financial constraints. The firms in the more domestic demand driven sectors, as suggested by our results, seem to be insulted from the global financial crisis.

4.8 Conclusion

In this paper we investigate the impact of the recent global financial crisis of 2008 on the Chinese economy from the perspective of the listed firms' investment behaviour towards the event. We examine how, via a number of channels, the global financial crisis affected the Chinese listed firms' investment decisions. From our panel data with quarterly observations for the period from the first quarter of 2006 to the third quarter of 2010 and using the advanced GMM estimations, we find that the financial crisis influenced the corporate investment in China in the following ways. First, we document that overall the effect of the financial crisis on investment spending by the Chinese listed firms has been negative. Second, the effect of the crisis was felt most strongly by the Chinese firms via the demand channel. The firms in the more export driven industries in our sample suffered more from the impact of the financial crisis as compared to the other firms. The results from our estimations show that these firms cut investment spending in response to the global financial crisis. These firms become much more cautious as the international demand for Chinese manufactured goods contracted during the financial crisis and economic downturn. Third, our results show that during the global crisis, the Chinese listed firms in general do not experience severer financial constraints than otherwise under the normal circumstances. However, the situation is different for firms in the more export driven sectors. These firms

actually faced a higher degree of financial constraints during the crisis period judging by the overall stronger sensitivity of investment to liquidity. It is partly because the government's economic policies at the time are mostly aimed at stimulating domestic demand. For example, a large portion of the stimulus package of the late 2008 by the Chinese government is directed at infrastructure improvement and transportation network construction. Firms in the more export driven sector in which manufacturing firms dominate were less favoured by the government schemes because of the concerns on overcapacity in the manufacturing industries. It can be expected that less resources have been directed to the more export driven sectors, and partly as a result, these firms have worse financial constraints on investment. At the same time, since the recent crisis affected the Chinese economy mostly via international trade/exports, these firms' net worth is likely to be depreciated, and therefore their credit situation is exacerbated. Fourth, we do not find tangible evidence that the financial crisis affected the investment behaviour of Chinese listed firms via the uncertainty channel. This result is based on using two alternative measures of uncertainty, i.e. the standard deviation of stock returns, and the difference between the rates of US Treasury bond and corporate bond, for our investment equations.

All in all, the effect of the global financial crisis on the Chinese corporate investment has been significant but limited. The firms in the more export driven industries suffered comparatively more than the other firms that are not international trade dependent. The origin and the nature of the recent crisis provided us some initial clues about how the Chinese economy may fare in the downturn. This paper offers a solid empirical analysis on how, during the

financial crisis, the investment behaviour of the Chinese listed firms adjusts accordingly as revealed by the mechanisms that convey the macroeconomic impact.

Chapter 5 China's elite SOE listed firms, the SASAC, and overinvestment in China

5.1 Introduction

China's economic performance in the last three decades since the 1978's reform and opening-up has been staggering, and even during the recent global financial crisis China continued to produce an average annual GDP growth rate of more than 10 per cent[17]. However, some have argued that China's impressive economic growth is driven too much by investment, with an average investment to GDP ratio of about 40 per cent for the past decade, a figure much higher as compared to other high growth economies such as Japan, South Korea and Taiwan in the past.[18] This phenomenon in China raises the question about whether the high investment ratio can be justified. It brings confusions about whether China has overinvested and whether the high investment ratio is sustainable for the economy during China's further economic expansion. Excessive investments in the economy may lead to the risk of industrial overcapacity and inefficiency, and ultimately it can hurt employment and profitability of firms. However, the issue about whether overinvestment in China exists is a matter of debate and depends on how overinvestment is defined. On the one hand, for example, a survey study by Rawski (2002) argues that substantial parts of China's vast investment spending generates virtually no meaningful returns and that the investment system poses a major threat to China's future economic growth. On the other

[17] According to the World Bank data, from 2007 to 2010 and during which time the global crisis has taken place, China has an average GDP growth of about 10.85 per cent.

[18] Japan in 1961-1970 had an average investment to GDP ratio of 32.6 per cent, South Korea in 1981-1990, 29.6 per cent, and Taiwan in 1981-1990, 21.9 per cent. Source: Research Institute of Economy, Trade and Industry (RIETI)

hand, Qu and Sun (2012) maintain that China has not overinvested and actually needs to invest more to sustain its growth. They point out that, for instance, (1) although the investment-to-GDP ratio is very high (46 per cent), it is still below its domestic savings-to-GDP ratio, suggesting that the savings resources have not been fully utilised domestically; (2) China's capital stock per worker is only about 8 per cent of the United States' and about 15 per cent of Korea's, arguing that China's capital accumulation is still far from the point of diminishing returns.

Nevertheless, one of the main reasons for the very high investment rates in China is that much of the earnings made by firms were reinvested rather than redistributed as dividends or used to strengthen the balance sheets. As noted by Mattlin (2007), almost 75 per cent of the corporate investments in China are funded by retained earnings, where the investments amount to about 20 per cent of China's GDP. A key factor for the high rate of corporate investments to be financed by internal funds is that Chinese firms have relatively low dividend payouts, and in particular for state-owned enterprises (SOEs), which since 1994 were exempted from paying any dividends or post-tax profits to the state until recently.[19] The state sector has been one of the major drivers of investment in China in recent years, and in which the so-called "central enterprises" dominates. The central enterprises are the largest and the most important SOEs in China. These firms are under the direct management of a

[19] The central SOEs until 2007 are not required to pay any dividends at all. Even after that, firms in the highly profitable industries are only required to pay 10 per cent of their profits and in the less profitable industries, firms only need to pay 5 per cent. For firms in the defence industry, the dividend payout rate remains zero per cent. Compared with the average dividend payout of 50 to 60 per cent for mature and established industrial firms in the United States, the dividend requirements for SOEs in China are very low.

government body created in the early 2000s known as the State-owned Assets Supervision and Administration Commission of the State Council (SASAC) (to be discussed in further details in the next section). These firms are the national champions of China and have been able to generate gigantic amount of returns largely because of their quasi-monopolistic positions in several industries. They account for approximately 70 per cent of the total profits of all SOEs. These central enterprises operate in key industry sectors and are either quoted on the stock exchanges or have public listed subsidiaries.

In Chapter 3, we provided evidence that having majority or higher presence of state ownership in the listed firms does not necessarily mean that these firms were given an advantage in operating in China's state capitalist economic environment, specifically in terms of financing constraints. Listed firms either with the state as the largest shareholder, or with higher ratio of state shareholding, do not by definition experience less or no financial constraints on investment. Similar results are also obtained by Firth et al (2012). In their study, they find that government controlled listed firms[20] do not have easier access to external finance, and no evidence has shown that banks discriminate against privately controlled firms or that the seasoned equity offering (SEO) approval process prefers government controlled firms. These findings are suggestive of an effective and successful reform of China's large SOEs through corporatisation. In this chapter, we investigate further along the line of the SOE evolution in China and dig deeper by examining the behaviour of the listed firms that are closely associated with the SASAC. At the same time, we

[20] A government-controlled firm is defined by Firth et al (2012) as one with a government institution or a SOE as the ultimate controlling shareholder.

assess the extent to which the high investment rate in China discussed earlier may be explained and justified by the behaviour of these firms. Specifically we look at the listed firms that are themselves the central enterprises or the listed arms of the central enterprises (the *SASAC listed firms* hereafter). There are two main reasons why we choose to focus on these listed firms. Firstly, the listed arms or firms in question are regarded as the forefronts of the central enterprises that represent an integral part of the Chinese corporate sector and rightfully of China's state sector. Secondly, the fact that they are publicly quoted means that they are subject to monitoring by the market despite being closely linked to the government. It is interesting to see if their behaviour deviates from the rest of listed firms.

The behaviour of the SASAC listed firms is a relatively fresh and fascinating topic to study. Firstly, these firms despite being legitimately public listed firms are de facto state-owned by most standards. The government not only continuously retains shares in these firms but also reinforces its ownership rights by placing these firms under the jurisdiction of the governmental organisation, the SASAC, whose responsibilities include managing and regulating as well as appointing top level personnel for these firms or the parent firms. Secondly, as China’s economy remains state capitalistic with a state-controlled banking sector, how these firms’ behaviour is any different from the traditional SOEs’ will provide a useful indication of whether the establishment of SASAC is justifiable or further privatisation is required.

This paper investigates whether the SASAC listed firms in which the state still maintain absolute controls are subject to conventional firm investment

behaviour with a focus on overinvestment. We compare the SASAC listed firms with the other listed firms to see if there are investment behaviour discrepancies between them. Firstly, whether the SASAC listed firms are less subject to liquidity constraints is examined. Secondly, we adapt the concept of overinvestment of free cash flow to our investment model to check the presence of overinvestment in the listed firms and if the SASAC firms are more likely to exhibit overinvestment behaviour considering these firms' special political and economic status and the environment they are operating in.

The next section discusses how the SASAC listed firms have evolved from and the implications of what these firms meant to the Chinese economy. Section 5.3 provides a review on the literature about overinvestment and whether overinvestment is seen as a problem in China. Section 5.4 provides the empirical specifications for our initial tests on possible overinvestment among the Chinese listed firms and on whether the SASAC firms overinvest more in comparison with the rest of the listed firms. In section 5.5 we discuss the data and summary statistics. Section 5.6 analyses the results from our tests in section 5.4. In section 5.7, we apply an alternative method that utilises direct measure of overinvestment to our research question. Section 5.8 concludes.

5.2 Review on the "SASAC listed firms"

China started the reform of its large state-owned enterprises (SOEs) in the early 1990s. Two stock exchanges were established in Shenzhen and Shanghai as part of the first and vital step to restructure some of China's largest and most important SOEs through corporatisation. Nonetheless, in order to retain the control over these important SOEs, the government has

maintained the majority or controlling stakes of these corporations. Initially, two different categories of the equity shares for the newly “corporatised SOEs” exist, as the so-called split share structure. The “non-tradable” shares are essentially held either directly by the government or indirectly through state-related legal persons or agencies. The rest of the shares are then floated on the two stock exchanges, which amount to about one-third of the total shares of all the listed firms. Over the years, China continues the reform of the system, such as the reform of the split share structure in 2005 that made the conversion of the non-tradable shares to tradable shares possible.

Nevertheless, for the listed state firms that are deemed to be too strategically important for the Chinese economy or national security, the government has not been shy away from holding a tighter grip on these firms. One example shows that, in terms of control through shareholding, the direct equity share in the publicly listed Sinopec Corp. held by its wholly state-owned parent Sinopec Group actually increased by about 20 per cent after the reform of the split share structure (Mattlin 2007). The companies considered to be too vital to let go by the state usually operate in key industries such as steel, machinery, energy, defence and etc., or that the companies are national champions in other industries. Apparently, the motivations for the government’s continuous effort to maintain state ownership in these firms also include the fact that the firms in question are mostly able to generate enormous returns and many of them still enjoy the monopolistic advantages in some industries. These profits are provided as a potential source of revenue for the government.

One key step to safeguard and manage the SOEs and the state-owned assets

as well as to facilitate further reforms of the state sector was the establishment of the State-owned Assets Supervision and Administration Commission (SASAC) in 2003. The creation of the SASAC can be viewed as the government's renewed effort to maintain the control of strategically important SOEs. The SASAC is the only special organization set up directly under the State Council in China. It represents the ownership interests of the central government and is regarded as the largest institutional investor in the world. The responsibilities of the SASAC include drafting laws and regulations regarding the state-owned assets. For instance, it defines which sectors were strategic and in which 100 per cent ownership or absolute control by the government has to be ensured, and which sectors were less strategic but in which the state influence still has to be maintained. One important and main responsibility of the SASAC involves managing and restructuring of the state assets such as consolidation of the SOEs under its direct administration. The companies that are under the direct administration of the Central SASAC are the so-called *zhongyang qiye* (central enterprises). These firms are the top and most important companies in China's corporate sector. They are considered as the best of the best. In terms of generating profits, for instance, the SASAC central enterprises' total profits account for about 70 per cent of the for the whole state sector.

The vast scope and scale of the SASAC central enterprises' influence in the Chinese economy primarily sets the research agenda of this paper. We focus on the listed firms that are under the wings of the central SASAC. The firms we consider in our research include the central enterprises listed on the two stock exchanges as well as the public listed arms of the central enterprises. We are

interested in whether these firms, which seemingly inherited the privileges of the traditional SOEs that enjoyed monopolistic powers and soft budget constraints, have higher tendency of overinvestment. These firms have been reported to exhibit behaviour of carrying out investments with the purpose of scale expansion, and it was only until recently that the issue was officially raised and curbed by the SASAC (Song 2012). It is possible that because of their special position economically and politically in China, the SASAC firms in question are less subject to monitoring in term of their conducts in the economy. The investment behaviour of these firms may differ from other listed firms under the assumption that the SASAC's supervisory role is ineffective.

Before we test whether amongst the Chinese listed firms the SASAC firms overinvest more, in the next section, we review the literature on overinvestment and some of other researchers' views on the situation in China.

5.3 Literature review

5.3.1 Theories of firm level overinvestment

As according to Jensen's (1986) free cash flow hypothesis, managers have a tendency to engage in empire building. They have the incentives to grow their firms beyond the optimal size because it increases the managers' power by increasing the resources under their control. Thus, there is a conflict of interests between managers and shareholders/owners. As when there is free cash flow available, managers in order to expand their powers tend to spend it on projects that do not necessarily generate positive net present value (NPV) rather than distribute the cash as dividends to shareholders. In essence,

Jensen (1986) argues that the empire building preference will lead managers to squander available funds on investment projects. Therefore, there is a positive relationship between free cash flow and investment as a result of the principal-agency problem. In order to prevent the managers from wasting the free cash flow on investments that do not generate future incomes, monitoring needs to be in place. Some market based monitoring and disciplinary mechanisms such as the use of external finances in general can help minimise the agency costs, i.e. restrain the mangers from spending the free cash flow and therefore avoid overinvestment. For example, Stulz (1990) argues that imposing external finance such as debt on firms could force managers to pay out cash flow and reduce the agency costs of managerial discretion, therefore restricts investments to be made by managers. This implication offers some sort of remedy for the overinvestment problem as debt and some other external financing obligate managers to give up at least part of profits to creditors or shareholders.

Other applications of the theory also include empirical studies offer direct evidence that firms with free cash flow overinvest. For instance, Bates (2005) finds that firms that retain cash tend to invest more relatively to an industry benchmark from a sample of 400 subsidiary sales between 1990 and 1998. Richardson (2006) also provides consistent evidence supporting Jensen's (1986) theory and demonstrates that overinvestment is concentrated in firms with the highest levels of free cash flow from a sample of non-financial firms during 1988 to 2002. Moreover, his study suggests that governance structures such as the presence of active shareholders would reduce overinvestment.

Nevertheless, the relation between free cash flow and (over-)investment may also be explained by the overconfident behaviour of managers. Without invoking the assumptions on the theories of agency cost and information asymmetry, Heaton (2002) demonstrates that optimistic/overconfident managers often overvalue their own investment projects and may overinvest (invest in negative NPV projects) with the available free cash flow. However, if there is a shortage of internal funds, optimistic managers are likely to forgo positive NPV projects because of the belief that their projects are undervalued by the market (and thus the cost of external funds is too high). A number of empirical studies have found that the behaviour of overconfidence can lead to distortions in firm investment decisions and that optimistic/overconfident managers display significantly higher sensitivity of investment to free cash flow. For instance, one of the most representative papers in this strand of researches is by Malmendier and Tate (2005), who find that investment of overconfident CEOs, especially in firms that are equity dependent, responds significantly more to cash flow[21].

Both theories discussed above could explain the possible overinvestment problem that may arise among the SASAC listed firms. Firstly, because of the SASAC firms' special relation with the government through not only shareholding but also official arrangements, these firms may still be regarded as outright state-owned even though they are public listed. Having this special status and at the same time operating in an economy where the banking sector is still very much state controlled, it is often the case that these firms are

[21] Malmendier and Tate (2005) measure cash flow as earnings before extraordinary items plus depreciation.

subject to improper monitoring and screening. Moreover, a well-functioned market for corporate control has yet to be developed in China. The appointments and promotions of top executives at the SASAC firms are heavily influenced by their central enterprise parents or the SASAC, i.e. the central government. Thus, it is likely that these executives would pursue politically motivated objectives which are not necessarily profit/value maximising. As a result, there are severe agency problems, and the interests of the minority shareholders are often forsaken. Secondly, it is very probable for the top executives of the SASAC listed firms to exhibit overconfident behaviour. These executives are often the “elite bureaucrats” who are appointed by the government to manage the best and most important corporations in the country, and many of these corporations enjoy monopolistic positions in several industries and command vast resources in the economy. It is logical that these top executives because of their backgrounds and political connections and the fact that the Chinese economy remains state capitalistic, i.e. in an environment that seems to give these executives enormous advantages, have the tendency to behave overconfidently when making investment decisions.

5.3.2 Overinvestment in China

In the case of overinvestment in China, there is no consistent view or gauge on the indication or definition of overinvestment in China in the literature. Bai et al (2006) by utilising macroeconomic data between 1978 and 2005 find that in spite of the very high investment rates, the return to capital remained high in China. They argue that the high investment rates have not brought low returns to capital because of rapid growth in total factor productivity and labour force in

China and because of the shift of China's economy to more capital intensive industries that require higher aggregate investment rates. Contrasting to Bai et al's (2006) findings, Rawski (2002) argues that low investment returns and excess capacity across many industries in China were rampant throughout the 1990s. Qin and Song (2009) using provincial level data for the period of 1989 to 2004 find that widespread overinvestment exists in China, and particularly for the coastal provinces, as according to their method of predicting the optimal investment level by estimating a production function.

At the microeconomic level, Liang (2007) utilising firm data demonstrates that the return on investment has been growing since the late 1990s owing to the declining share of investment by SOEs. He argues that the overinvestment problem raised is due to data quality issues and that China's investments remain profitable and sustainable. However, Hsieh and Klenow (2009) comparing the effect of misallocation of resources on aggregate manufacturing productivity among China, India and the US using firm level data find that resource allocation problem is severer in China than in the US. Ding et al (2010) based on a dataset of 100,000 firms for the period of 2000 to 2007, find evidence that corporate investment in China has become increasingly efficient but overinvestment exists across all types of firms in the private and state sector. In addition, they argue that overinvestment in the state sector is largely due to poor monitoring of firms by banks.

In essence, the questions about whether the Chinese economy as a whole overinvests or whether the Chinese firms and what types of firms overinvest more are inconclusive and are a subject of debate. At the macroeconomic

level, there seems to be no reliable or universal yardsticks to justify the high investment rate in China as a sign of overinvestment. At the firm level, most studies are based on industry level data or firm level data that include mostly non-listed firm, which bring concerns regarding the overall data reliability.

In this chapter, while we investigate the behaviour of the SASAC firms, we emphasise the possible overinvestment behaviour of the Chinese listed firms. In the next section, we follow the similar practices in the literature and lay out the specifications of our empirical models using free cash flow to detect possible overinvestment in Chinese listed firms.

5.4 Empirical specifications

For our investigations in this chapter, we utilise the investment equation employed in Chapter 3 (model (3.2)) with some modifications. The investment model is a combination of the accelerator model and the Q model that includes sales growth rate as well as Tobin's q to capture investment fundamentals. Considering possible measurement and representation problems of Tobin's q, and particularly for firms in emerging economies like China where market inefficiency may be more serious (Erickson and Whited 2000; Allen et al 2005), we believe that the combined model reflects better the investment behaviour of Chinese listed firms. The benchmark investment model for this chapter is as follows:

$$Inv_{i,t} = \beta_1 Inv_{i,t-1} + \beta_2 Sales_{i,t-1} + \beta_3 Q_{i,t-1} + \beta_4 Liquidity_{i,t-1} + \beta_5 Debt_{i,t-1} + \beta_6 State_{i,t-1} + \beta_7 Size_{i,t-1} + f_i + f_t + \varepsilon_{i,t} \quad (5.1)$$

The subscript *i* identifies each individual firm, and the subscript *t* represents current year. *Inv* is the ratio of change in fixed assets from the previous year to total assets. To take into account the dynamic nature of investment, we also include lagged-one term of *Inv* in the model. *Sales* is sales growth rate, measured as the annual growth rate of total operating revenues, which represents the accelerator effect. *Q* is Tobin's q, defined as sum of market value of tradable shares, net asset value of non-tradable shares and market value of debt divided by ending total assets. As discussed earlier, both *Sales* and *Q* represent investment opportunities for firms. We use both *Sales* and *Q* to control for investment fundamental as fully as possible. *Liquidity* is the ratio of cash and cash equivalents to total assets. The sensitivity of investment to liquidity measures such as cash flow or cash holdings a common proxy for financial constraints on investment. *Debt* is ratio of total liabilities to total assets, which controls the debt financing's effect on investment. *State* is ratio of state shares to total shares, where state shares include shares held by the government and government-related legal persons. *Size* stands for firm size measured as natural logarithm of total assets. Since current investment decision-making is based on past information, lagged one year (t-1) observations for all the variables on the right-hand side of the equation are used. Finally, f_i and f_t account for firm-specific and time-specific effects respectively. $\varepsilon_{i,t}$ is the idiosyncratic error term.

Prior to our investigations on the firm behaviour of the Chinese listed firms with respect to overinvestment, we first verify whether the SASAC listed firms, which apparently have a close relationship with and are of vital importance to the state and the economy, are subject to financial constraints on investment.

We follow the common empirical practice used in the literature i.e. the sensitivity of investment to liquidity as the proxy for financial constraints to examine the issue (e.g. Fazzari et al 1988; Hoshi et al 1991). In order to capture the possible discrepancy on the investment financial constraints between the SASAC listed firms and the rest of the listed firms, in the estimation equations we include an interaction term between the liquidity variable and an identity dummy variable that indicates whether or not the firm is of the SASAC.

The investment equation is shown as follows:

$$Inv_{i,t} = \beta_1 Inv_{i,t-1} + \beta_2 Sales_{i,t-1} + \beta_3 Q_{i,t-1} + \beta_4 Liquidity_{i,t-1} + \beta_5 Liquidity_{i,t-1} \times SASAC_i + \beta_6 Debt_{i,t-1} + \beta_7 State_{i,t-1} + \beta_8 Size_{i,t-1} + f_i + f_t + \varepsilon_{i,t} \quad (5.2)$$

where all the variables and terms in this equation are defined as previously. The key variables of interest here are *Liquidity* and the interaction term (*Liquidity*×*SASAC*), in which *SASAC* is an identity dummy variable that equals to one if the firm is identified as a listed firm affiliated to the central SASAC and zero otherwise. As in the previous chapters, we should expect that the estimated coefficient of the liquidity variable turn out to be positive and statistically significant, which would indicate the presence of financial constraints on investment for Chinese listed firms in general. For the SASAC listed firms to be less subject to financial constraints, we would expect to see the estimated coefficient of the interaction term (*Liquidity*×*SASAC*) to be negative and statistically significant, as it would result an overall less sensitivity

of investment to liquidity. However, we think that although the SASAC listed firms may be less subject to budget constraints, it is more likely they are endowed with abundant cash. In either of the aforementioned cases, it can be attributed to their special political and economic status in the Chinese economy. Regardless of the reasons, it would have provided the impetus for the firms to be less sensible about investment and lead to possible overinvestment.[22]

Hypotheses: Liquidity is positively related to firm investment; the interaction term between Liquidity and SASAC dummy is negatively related to firm investment.

For the test on overinvestment among the Chinese listed firms, we incorporate an additional variable, free cash flow, in our benchmark model (model (5.1)) in order to check whether the sample firms overinvest according to the available free cash flow after controlling investment opportunities, liquidity, i.e. financial constraints, and other possible factors affecting investment. This variable presents the freely available cash to managers after taking into account the expenditures required in maintaining or expanding the firm's asset base. We utilise the accounting-based variable of free cash flow that is available from the database we employed for this chapter, which is measured as the sum of net profit, interest expenses and non-cash charges minus working capital minus capital expenditure.

[22] Firms with abundant cash should be less responsive in terms of sensitivity of investment to liquidity as they are financially healthier and would depend relatively less on external finance.

The model is shown as follows:

$$Inv_{i,t} = \beta_1 Inv_{i,t-1} + \beta_2 Sales_{i,t-1} + \beta_3 Q_{i,t-1} + \beta_4 Liquidity_{i,t-1} + \beta_5 Debt_{i,t-1} + \beta_6 State_{i,t-1} + \beta_7 Size_{i,t-1} + \beta_8 FreeCF_{i,t-1} + f_i + f_t + \varepsilon_{i,t} \quad (5.3)$$

where all the variables and terms are defined as previously, and *FreeCF* is the accounting definition of free cash flow described earlier deflated by total assets. Investment is defined as the increase in net fixed assets from the previous period, and it encompasses a part of the level of investment driven by the investment fundamental variables and a part of the investment that may be considered as overinvestment. After controlling the investment fundamentals and other standard variables for investment, presence of any positive sensitivity between the investment and the free cash flow variable should provide an indication of overinvestment. As the incentives of mangers are not always aligned with the shareholders', the presence of excess cash, i.e. free cash flow, is likely to encourage managers to expend the funds on projects not necessarily beneficial for the firm or shareholders. We would expect to see that the estimated coefficients of the free cash flow variable (*FreeCF*) to be positive and statistically significant if there is overinvestment.

Hypothesis: free cash flow is positively related to investment.

To test if the SASAC listed firms respond to free cash flow differently from the other firms, i.e. either having higher or lower tendency towards overinvestment, we include in the estimation equations an interaction term between the free cash flow variable and a dummy variable that identifies the SASAC firms.

The model is demonstrated as follows:

$$Inv_{i,t} = \beta_1 Inv_{i,t-1} + \beta_2 Sales_{i,t-1} + \beta_3 Q_{i,t-1} + \beta_4 Liquidity_{i,t-1} + \beta_5 Debt_{i,t-1} + \beta_6 Size_{i,t-1} + \beta_7 FreeCF_{i,t-1} + \beta_8 FreeCF_{i,t-1} \times SASAC_i + f_i + f_t + \varepsilon_{i,t} \quad (5.4)$$

where the interaction term is made up of the free cash flow variable and the identity dummy *SASAC* that equals to one if the firm is classified as a SASAC listed firm, and zero otherwise. All other variables have the same definitions as previously. For the SASAC listed firms to show a higher tendency to overinvestment, we should expect positive and statistically significant estimated coefficients for both the free cash flow variable (*FreeCF*) and the interaction term (*FreeCF*×*SASAC*), which would then indicate an overall stronger responsiveness of investment to free cash flow for the SASAC firms. If it is the case, it would mean that the SASAC listed firms having the legitimate connection with the government and operating in an economic environment where the banking sector is still state-controlled, i.e. a state capitalist economy, have not been properly restrained or monitored by the market (either via active shareholders or loan interest repayments) or supervised by the authority. The result would suggest that the SASAC's function in this regard does not perform adequately well.

Hypotheses: free cash flow is positively related to investment; the interaction term between free cash flow and the SASAC dummy is positively related to investment.

5.5 Data and descriptive statistics

The data for this study are obtained from the GTA Research Service Center based in Shenzhen, China. The databases we employed include the *CSMAR China Stock Market Financial Statements Database*, *China Stock Market Financial Database – Financial Ratios*, and *China Listed Firm's Shareholders Research Database*. Our dataset covers yearly observations from 2003 when the SASAC was officially established, to 2010. It contains 1,535 publicly listed firms on the Shanghai Stock Exchange and the Shenzhen Stock Exchange (A share). Financial firms such as banks and insurance companies are omitted from the dataset as they have different investment behaviour fundamentally, and in addition, financial firms are not under the jurisdiction of the SASAC, and therefore do not fit for the purpose of this paper. All the firms included in our dataset have at least 4 years of observations, as sufficient lagged terms are required as instruments for our choice of the estimation method, the Generalised Method of Moments (GMM) estimator. The top 0.5 per cent and the bottom 0.5 per cent of the observations for our variables in our sample are deleted so as to reduce the possible impact of outliers on our estimations. The final unbalanced panel consists of 11,365 firm-year observations.

As the focus of this paper is on the "SASAC listed firms" and identifying which public listed firms are under the wings of the SASAC may not always be straight forward, we explain in details on how the SASAC listed firms are selected. Although there were 120 central enterprises listed on the official website of the SASAC[23], not every one of them is public listed and many of them have multiple public listed arms. Firstly, we check with all the official

[23] At the time of writing (mid-2011), there were 120 central enterprises.

websites of the 120 central enterprises that are available, and from the investor relations section (or equivalent) on each of the websites, we identify if the firm itself is a wholly public listed firm, otherwise we obtained the list of names of the firm's subsidiaries that are publicly listed on the two stock exchanges in mainland China if it is shown. Secondly, we consult with GTA Research Service Center's *China Listed Firm's Shareholders Research Database*. We look at each listed firm's shareholders' background and check if the Central SASAC is the ultimate controlling shareholder of the listed firm at the end of 2010 or has been the ultimate controlling shareholder for a significant period of time. Thirdly, we verify and add any missing legitimate SASAC listed firms by utilising the *Sina Finance* website as it provides some information not covered entirely by the central enterprises' websites or the GTA database. In summary, there are 215 SASAC listed firms identified in our sample. These firms, are either publicly listed central enterprises themselves, or are claimed by central enterprises as their listed arms, or directly have the Central SASAC as the ultimate owner.

Table 5.1 provides the descriptive statistics of the variables for our sample of 1,535 firms. We first look at the part of table with the summary statistics for the whole sample. The average ratio of net investment in fixed assets to total assets (*Inv*) is 0.017. The mean annual growth rate of total operating revenue (*Sales*) is 0.472 indicating strong growth opportunities for Chinese listed firms during the sample period. The average Tobin's q (*Q*) for the sample is about 1.7 and again suggesting good prospects for the Chinese firms. The mean of *Liquidity* that is defined as ratio of cash and cash equivalents to total assets is 0.157. *Debt* is measured as ratio of total liabilities to total assets and has a

sample average of 0.543, showing generally the Chinese listed firms' overall high dependency on debt financing. The mean ratio of free cash flow to total assets (*FreeCF*) is 0.041.

Table 5.1 Summary Statistics

	Whole sample			Non-SASAC firms			SASAC firms			t
	N	Mean	σ	N	Mean	σ	N	Mean	σ	mean(0) -mean(1)
Inv	11074	0.017	0.055	9491	0.016	0.055	1583	0.023	0.050	-4.301***
Sales	11023	0.472	0.455	9437	0.470	0.462	1586	0.480	0.416	-0.816
Q	11199	1.696	1.211	9591	1.721	1.247	1608	1.553	0.953	5.141***
Liquidity	11270	0.157	0.117	9658	0.155	0.115	1612	0.166	0.131	-3.446***
Debt	11256	0.543	0.346	9639	0.547	0.364	1617	0.516	0.202	3.333***
Size	11251	21.397	1.149	9685	21.325	1.112	1566	21.842	1.267	-16.735***
FreeCF	10814	0.041	0.155	9264	0.039	0.157	1550	0.050	0.138	-2.538**

Notes:

1. N: number of observations; Mean: variable sample average; σ: standard deviation
2. t: t-test statistics;
   mean(0)-mean(1): mean(non-SASAC firms)-mean(SASAC firms)
3. Definition of variables:
   Inv: ratio of investment to total assets, where investment is the increase of net fixed assets from previous year;
   Sales: annual growth rate of total operating revenue;
   Q: Tobin's Q measured as: sum of market value of tradable shares, net asset of non-tradable shares and market value of net debt divided by the ending total assets;
   Liquidity: cash and cash equivalents scaled by total assets;
   Debt: total liabilities divided by total assets;
   Size: natural logarithm of total assets;
   FreeCF: sum of net profit, interest expense and non-cash charges minus the sum of working capital and capital expenditure, then scaled by total assets;
4. ** significant at the 5 per cent level; *** significant at the 1 per cent level

In the same table we draw a comparison between the non-SASAC firms and the SASAC firms. We can see that the SASAC listed firms have a higher average ratio of net investment to total assets (*Inv*) of 0.023 as compared to the non-SASAC firms' average ratio of 0.016 (the t-test statistics is -4.301). Looking at the investment fundamental variables, while the average annual

growth rate of total operating revenue (*Sales*) seems to be indifferent between the two groups of firms (as the t-test is statistically insignificant), the non-SASAC firms have a higher average figure of Tobin's q (1.721 as compared to 1.553 and the t-test statistics is 5.141). Averagely speaking, the SASAC firms have higher ratio of cash and cash equivalent to total assets (*Liquidity*) than the non-SASAC firms (0.166 as compared to 0.155 with the t-test statistics of -3.446). This may be indicative of the SASAC firms' inclination to retain earnings. Interestingly, the average ratio of total liability to total assets (*debt*) is higher for the non-SASAC listed firms with a figure of 0.547 as compared to the SASAC firms' 0.516 (the t-test statistics is 3.333). In some ways it demonstrates the higher dependency for the non-SASAC firms on debt financing. Finally, the average ratio of free cash flow to total assets (*FreeCF*) is higher for the SASAC listed firms (0.050 as compared to 0.039 and the t-test statistics is -2.538).

In sum, Table 5.1 demonstrates that the SASAC listed firms in general have better financial positions than the non-SASAC listed firms. The SASAC firms on average invest more, are stronger in terms of liquidity, have lower debt ratio, and have higher ratio of free cash flow as compared to the non-SASAC firms. These figures and descriptive statistics provide us some preliminary information about how the SASAC listed firms may behave. However, whether the SASAC firms as a result of their seemingly economic strength have higher tendency to overinvest more than the other listed firms is analysed in the next subsection.

5.6 Results and interpretations

Considering the prevalent endogeneity problems when estimating investment equations, we employ the advanced Generalised Method of Moments (GMM) estimator for all our estimations. Specifically we conduct the difference GMM estimations for our models using the *xtabond2* command developed by Roodman (2009) for the statistical software package *Stata*.[24] The GMM estimator uses lagged terms of the variables on the right-hand side of equations as instruments. In addition, we include time dummies and industry dummies to control for the macroeconomic effects and industry effects respectively, and they are also used as additional instruments.

Table 5.2 presents the difference GMM estimation results for model (5.2), which tests whether the SASAC listed firms have less sensitivity of investment to liquidity. The estimated coefficient for the sales growth rate variable (*Sales*) turns out to be positive but insignificant statistically. However, we can see that the estimated coefficient of Tobin's q (*Q*) is positive and statistically significant, and therefore consistent with the standard literature that suggests increase in market-based measures of investment opportunities such as Tobin's q prompts further investment. The estimated coefficient on *Q* is 0.005, and from Table 5.1, the standard deviation for *Q* is 1.211. Hence a one standard deviation increase in *Q* leads to a 0.006 increase in *Inv* (defined as change in net fixed assets scaled by total assets). In other words, one standard deviation increase in Q leads to an increase of *Inv* by 35 per cent (the mean value of *Inv* is 0.017).

[24] We conducted the same test as described in footnote 14 to determine whether the use of difference GMM is justifiable. The test results conclude that our choice of difference GMM estimator over system GMM estimator is appropriate.

Table 5.2: difference GMM estimation results for model (5.2)

	Model (5.2)
Inv_{t-1}	-0.022 (-0.97)
$Sales_{t-1}$	0.016 (1.09)
Q_{t-1}	0.005* (1.73)
$Liquidity_{t-1}$	0.071* (1.75)
$Liquidity_{t-1} \times SASAC_i$	-0.261** (-2.28)
$Debt_{t-1}$	-0.041 (-1.20)
$State_{t-1}$	0.007 (0.94)
$Size_{t-1}$	-0.011 (-0.64)
m1 [p value]	-13.72 [0.000]
m2 [p value]	-0.98 [0.327]
J [p value]	47.99 [0.278]
Number of observations	7436
Number of firms	1511

Notes:

1. Dependent variable: *Inv* as the ratio of investment to total assets.
2. Year dummies are added in all estimations to control for time-specific effects; industry dummies are also included in all estimations to control for industry effects.
3. t-statistics are reported in the parentheses.
4. Hansen test of overidentifying restrictions is asymptotically distributed as chi-square under the null of instrument validity.
5. * indicates statistical significance at 10 per cent level; ** indicates statistical significance at 5 per cent level; *** indicates statistical significance at 1 per cent level.
6. See notes to table 5.1 for explanation of variables.
7. *SASAC* is a dummy variable = 1 if the observation is a SASAC listed firms as defined in the paper, otherwise *SASAC* = 0.
8. The instruments used in our GMM estimation include the lagged 2 terms or further of the dependent variable and independent variables. The time dummies as well as the industry dummies are also used as instruments in our estimations. The instruments for the interaction terms also include the products of the components.

For the liquidity variable, the estimated coefficient turns out to be positive and statistically significant, thus indicating the presence of financial constraints judging by the investment-liquidity sensitivity as the proxy. This result implies that an average firm in our sample experiences some degree of financial

constraints on investment. The coefficient on *Liquidity* is 0.071, and Table 5.1 shows that the standard deviation for *Liquidity* is 0.117. Hence, a one standard deviation decrease in *Liquidity* leads to a reduction of 0.008 in *Inv*. That is to say, a one standard deviation decrease of *Liquidity* yields a 49 per cent reduction in *Inv* (the mean value of *Inv* is 0.017). Most importantly for this test, the estimated coefficient for our key variable of interest, the interactive term between *Liquidity* and the SASAC identity dummy variable (*Liquidity*×*SASAC*), is negative and statistically significant. This is an interesting finding as it suggests that being a SASAC listed firm is less sensitive or insensitive to liquidity when it comes to investment decisions. This result can be explained as that either these firms may be less bounded by the financial constraints on investment or may be financially healthier with abundant liquidity at hand because of their superior/monopolistic position in the Chinese economy. This initial finding regarding financial issues being less of a concern for the SASAC listed firms as compared with other listed firms provides the foundation for our subsequent test on overinvestment. Whether the firms are less subject to financing constraints or are financially healthier with abundant liquidity, the fact that they have the potential or reserved liquidity provides them the ammunition to engage on investments that may not be necessarily productive.

Table 5.3 demonstrates the GMM estimation results for the test on whether free cash flow would have a profound effect on investment following the concept of overinvestment of free cash as discussed (model (5.3)). The estimated coefficients for the main factors in the investment model, i.e. Tobin's q and liquidity, are again positive and statistically significant, showing our estimation results are consistent.

Table 5.3: difference GMM results for model (5.3)

	Model (5.3)
Inv $_{t-1}$	-0.112
	(-0.61)
Sales $_{t-1}$	0.011
	(0.52)
Q $_{t-1}$	0.008*
	(1.84)
Liquidity $_{t-1}$	0.180***
	(2.71)
Debt $_{t-1}$	0.110
	(1.47)
State $_{t-1}$	0.013
	(1.51)
Size $_{t-1}$	-0.004
	(-0.15)
FreeCF $_{t-1}$	0.077*
	(1.82)
m1	-2.37
[p value]	[0.018]
m2	-0.46
[p value]	[0.648]
J	26.04
[p value]	[0.762]
Number of observations	7052
Number of firms	1501

Notes:

1. Dependent variable: *Inv* as the ratio of investment to total assets.
2. Year dummies are added in all estimations to control for time-specific effects; industry dummies are also included in all estimations to control for industry effects.
3. t-statistics are reported in the parentheses.
4. Hansen test of overidentifying restrictions is asymptotically distributed as chi-square under the null of instrument validity.
5. * indicates statistical significance at 10 per cent level; ** indicates statistical significance at 5 per cent level; *** indicates statistical significance at 1 per cent level.
6. See notes to table 5.1 for explanation of variables.
7. *SASAC* is a dummy variable = 1 if the observation is a SASAC listed firms as defined in the paper, otherwise *SASAC* = 0.
8. The instruments used in our GMM estimation include the lagged 2 terms or further of the dependent variable and independent variables. The time dummies as well as the industry dummies are also used as instruments in our estimations. The instruments for the interaction terms also include the products of the components.

The estimated coefficient on the free cash flow variable (*FreeCF*) appears to be positive and statistically significant. The free cash flow coefficient is 0.077, and the standard deviation for *FreeCF* shown in Table 6.1 is 0.155. Hence, a one standard deviation increase in free cash flow leads to an increase of 0.012

in *Inv* (change in net fixed assets scaled by total assets), i.e. a one standard deviation increase in free cash flow leads to an increase of *Inv* by about 71 per cent (the mean value of *Inv* is 0.017). The result suggests that in our sample an average Chinese listed firm responds to free cash flow and possibly overinvest, judging by the sensitivity of investment to free cash flow that may be a result of the agency problem or overconfidence behaviour of managers as discussed in the previous section. Since free cash flow is the excess cash after taking into account the current investment spending/capital expenditure, any sensitivity between the investment and free cash flow should indicate overinvestment triggered by the misuse of freely available cash.

The estimated results for model (5.4) are presented in Table 5.4. Here we wish to test, via the free cash flow variable and the interaction term (*FreeCF*×*SASAC*), whether the SASAC listed firms are more inclined to overinvestment than the rest of the Chinese listed firms because of their financial and economic and inherent political dominance as well as the state capitalist economic system they are operating in, which may cause the monitoring mechanisms less effective as discussed in the earlier section. The key interaction term should exhibit a positive and statistically significant coefficient if there is such a tendency for the SASAC listed firms. As we can see from Table 5.4 that the estimated coefficient of the interaction term (*FreeCF*×*SASAC*) turns out to be statistically insignificant, we therefore do not observe any evidence that the SASAC listed firms are more likely to overinvest than the non-SASAC firms in terms of fixed asset investments.

Table 5.4: difference GMM estimation results for model (5.4)

	Model (5.4)
Inv_{t-1}	-0.172 (-0.94)
$Sales_{t-1}$	-0.011 (-0.56)
Q_{t-1}	0.012** (2.01)
$Liquidity_{t-1}$	0.249*** (3.44)
$Debt_{t-1}$	0.041 (0.63)
$State_{t-1}$	0.017 (2.03)
$Size_{t-1}$	-0.025 (-0.98)
$FreeCF_{t-1}$	0.069* (1.67)
$FreeCF_{t-1} \times SASAC_i$	-0.051 (-0.61)
m1 [p value]	-2.09 [0.036]
m2 [p value]	-0.89 [0.371]
J [p value]	19.21 [0.981]
Number of observations	7052
Number of firms	1501

Notes:

1. Dependent variable: *Inv* as the ratio of investment to total assets.
2. Year dummies are added in all estimations to control for time-specific effects; industry dummies are also included in all estimations to control for industry effects.
3. t-statistics are reported in the parentheses.
4. Hansen test of overidentifying restrictions is asymptotically distributed as chi-square under the null of instrument validity.
5. * indicates statistical significance at 10 per cent level; ** indicates statistical significance at 5 per cent level; *** indicates statistical significance at 1 per cent level.
6. See notes to table 5.1 for explanation of variables.
7. *SASAC* is a dummy variable = 1 if the observation is a SASAC listed firms as defined in the paper, otherwise *SASAC* = 0.
8. The instruments used in our GMM estimation include the lagged 2 terms or further of the dependent variable and independent variables. The time dummies as well as the industry dummies are also used as instruments in our estimations. The instruments for the interaction terms also include the products of the components.

With regard to whether our models are correctly specified and the instruments used in our estimations are valid, all our results shown in the tables meet the requirements for the GMM post estimation tests. In all the tables, m1 is

significantly negative and m2 is not significant from zero at 5 per cent level. The results indicate that the assumptions of no serial correlation in the error terms and no autocorrelation in the idiosyncratic errors for the GMM estimator are satisfied. On the J test for overidentifying restrictions in all the tables, the results show no evidence that the null hypothesis of valid overidentifying restrictions can be rejected, therefore the instruments selected for our estimations are legitimate.

Nevertheless, in the next section we adopt an alternative approach developed by Richardson (2006). We utilise the predicted estimates of fixed asset investments from our benchmark model to calculate firms' overinvestments so as to test directly on overinvestment of free cash flow for our sample firms.

5.7 Robustness test using model predicted estimates of overinvestment

5.7.1 Methodology

According to Richardson (2006), overinvestment can be defined as the investment spending that is beyond the required expenditures on maintaining assets in place and on expected level of investment on new projects.

A firm's total investment can be described by the following equation:

$$I_{total,it} = I_{maintainance,it} + I_{new,it}$$

where total investment expenditure of a firm ($I_{total,it}$) is the sum of investment spending on maintaining its existing assets in place ($I_{maintainance,it}$) and new investment projects carried out by the firm ($I_{new,it}$). Richardson (2006) explains

that any new investment ($I_{new,it}$) can then be described as composed of two parts, the first part is the expected investment on new projects ($I^*_{new,it}$), and the second part is the overinvestment in new projects ($I^{\varepsilon}_{new,it}$), which is described by the equation below:

$$I_{new,it} = I^{*}_{new,it} + I^{\varepsilon}_{new,it}$$

The expected investment on new projects ($I^*_{new,it}$) can be represented by an investment equation. We employ the benchmark investment equation in this chapter (model (5.1)), which takes into account the common determinants of investment as well as the state ownership variable that represents the special characteristic of Chinese listed firms, to predict the expected new investments for our samples firms.

The predicted value of investment from the expectation model (5.1) corresponds to $I^*_{new,t}$ and with the observed value of investment from our data as $I_{new,t}$, the positive residual between the two values, $I^{\varepsilon}_{new,t}$, which represents overinvestment can then be approximated. This approach to directly measure overinvestment has been applied in several recent research papers on overinvestment (e.g. Ding et al 2010; Huang et al, 2011).

Table 5.5 presents the GMM estimation results and test results of the model performance for equation (5.1).

Table 5.5: difference GMM estimation results of model (5.1)

Dependent Variable: Inv_t	
Inv_{t-1}	-0.017 (-0.71)
$Sales_{t-1}$	0.028* (1.72)
Q_{t-1}	0.007* (1.85)
$Liquidity_{t-1}$	0.107* (1.82)
$Debt_{t-1}$	-0.010 (-0.23)
$State_{t-1}$	0.000 (0.04)
$Size_{t-1}$	0.030 (0.74)
m1	-10.97
[p value]	[0.000]
m2	-0.25
[p value]	[0.804]
J	26.31
[p value]	[0.239]
Number of observations	7436
Number of firms	1511

Notes:

1. Dependent variable: *Inv* as the ratio of investment to total assets.
2. Year dummies are added in all estimations to control for time-specific effects; industry dummies are also included in all estimations to control for industry effects.
3. t-statistics are reported in the parentheses.
4. Hansen test of overidentifying restrictions is asymptotically distributed as chi-square under the null of instrument validity.
5. * indicates statistical significance at 10 per cent level; ** indicates statistical significance at 5 per cent level; *** indicates statistical significance at 1 per cent level.
6. See notes to table 5.1 for explanation of variables.
7. *SASAC* is a dummy variable = 1 if the observation is a SASAC listed firms as defined in the paper, otherwise *SASAC* = 0.
8. The instruments used in our GMM estimation include the lagged 2 terms or further of the dependent variable and independent variables. The time dummies as well as the industry dummies are also used as instruments in our estimations.

Concerning the model performance, Table 5.5 demonstrates that the estimates meet all the required tests. Firstly, the results of m1 and m2 tests of serial correlation in first differenced residuals indicate that no serial correlation in the residuals (with m1 test result showing to be negative and statistically significant and m2 test result being insignificant statistically). Secondly, for the

J test of overidentifying restrictions, which verifies the validity of instruments used in the estimations, the results shows that all instruments employed are valid (the null hypothesis of valid overidentifying restrictions cannot be rejected as shown by the insignificance test result).

Applying the approximations of overinvestment from the above approach developed by Richardson (2006) in the equation set up below, we are able to test whether there is any direct association between overinvestment and being a SASAC listed firm. The estimation equation is as follows.

$$Overinv_{i,t} = \beta_0 + \beta_1 FreeCF_{i,t} + \beta_2 FreeCF_{i,t} \times SASAC_i + \beta_3 SASAC_{i,t} + f_i + f_t + \varepsilon_{it} \quad (5.5)$$

where *Overinv* is the estimates of overinvestment (positive residuals between observed investment and predicted investment) from the method described earlier. The descriptive statistics of our estimated overinvestment data are presented in Table 5.6. *SASAC* is a dummy variable that equals to one if the firm is identified as a SASAC listed firm, and zero otherwise. *FreeCF* is free cash flow, and for robustness, we utilise two different measures of free cash flow. First, as in the previous section, we use the database/accounting defined free cash flow, which is measured as sum of net profit, interest expense and non-cash charge minus sum of working capital and capital expenditure. Second, we apply Richardson's (2006) method on the Chinese firms to calculate free cash flow, and utilise the estimates of free cash flow in our equation. Richardson (2006) approximates free cash flow by subtracting

maintenance expenditure ($I_{maintenance,it}$) and expected new investment ($I^*_{new,it}$) from net cash flow from operating activities and research and development expenditure.[25] f_i and f_t are individual firm fixed effect and time effect respectively. ε_{it} is the idiosyncratic error term.

Table 5.6 Descriptive statistics for overinvestment

Group	Observations	Mean	Standard Deviation
Non-SASAC firms	3740	0.045	0.050
SASAC firms	544	0.048	0.055
Combined	4284	0.045	0.051

Notes:
t-test statistics between two groups of firms:
mean(Non-SASAC firms)-mean(SASAC firms)=-0.03
t=-1.305*
* significant at the 10 per cent level

We again conduct the estimations using the GMM estimator to limit any endogeneity issues that may arise. We should expect to see that the estimated coefficient for *FreeCF* to be positive and statistically significant if free cash flow does induce overinvestment by managers as according to the free cash flow hypothesis (e.g. Jensen, 1986; Stulz, 1990). Most importantly, for the SASAC listed firms to exhibit a higher propensity to overinvest, the estimated coefficient for the interaction term between free cash flow and the SASAC firm dummy (*FreeCF*×*SASAC*) should show to be statistically significant with a positive sign. If the result turns out to be the case, it would suggest that because of the SASAC firms' economic dominance and official connection with the government together with the state capitalist economic environment these

[25] Richardson (2006) uses the item "amortisation and depreciation" from the *Compustat* database as a proxy for the maintenance expenditure. Because the yearly observations of depreciation and amortisation are not available until 2007 from the database we employed, we approximate this free cash flow measure as net cash flow from operating activities minus expected new investment estimated from our benchmark model in this chapter.

firms are operating in, which either escalated the agency problem or promoted overconfident behaviour of SASAC firms, these firms have a higher tendency to overinvest. Moreover, it could also mean that because of the firms' entrenched political affiliation, these firms' investment decisions may be intervened by the government and these firms may embark on investment projects that do not aim to maximise firm value. In other words, they may be more likely to undertake investments favoured by the government to achieve political goals. The availability of free cash flow would prompt them to do so, therefore leads to more investment.

Hypotheses: free cash flow is positively related to overinvestment; the interaction term between free cash flow and the SASAC dummy is positively related to overinvestment, resulting overall higher sensitivity of free cash flow to overinvestment for SASAC firms.

5.7.2 Result and Analysis

Table 5.7 presents the system GMM estimation results of our tests on the free cash flow hypothesis using the alternative approach. Column (1) shows the results from using database/accounting defined free cash flow and column (2) shows the results from using estimated free cash flow following Richardson's (2006) method. As expected, we can see from the table, the estimated coefficients on both the free cash flow variables are positive and statistically significant. The results seem to be consistent and reinforce Jensen's (1986) theory and suggest that as the benchmark group, the non-SASAC listed firms, which consist of the majority of our sample firms, exhibit overinvestment behaviour. Nonetheless, we do not find that the SASAC listed firms are more

inclined to overinvestment. This is indicated by the poorly determined and insignificant coefficients on both the interaction term and the SASAC dummy variable as shown in columns. Both the results from using alternative measures of free cash flow do not show that the SASAC listed firms have higher propensity to overinvest.

in our equation that utilises the direct measurement of overinvestment.

Table 5.7: system GMM estimation results for model (5.5)

Dependent variable: $Overinvetment_{i,t}$		
$FreeCF_{i,t}$	0.131* (1.75)	0.179** (1.99)
$FreeCF_{i,t}\times SASAC_i$	-0.095 (-1.15)	0.061 (0.32)
$SASAC_i$	0.005 (0.32)	0.0146 (0.63)
m1	-10.27	-12.26
[p value]	[0.000]	[0.000]
m2	-0.28	0.12
[p value]	[0.777]	[0.901]
J	56.42	30.89
[p value]	[0.280]	[0.667]
Number of Observations	4216	4284

Notes:

1. Dependent variable: *overinvestment*
2. t-statistics are reported in the parentheses.
3. * indicates statistical significance at the 10 per cent level; ** indicates statistical significance at the 5 per cent level; *** indicates statistical significance at the 1 per cent level.
4. *SASAC* is a dummy variable equals to one if the observation is a SASAC listed firms as defined in the paper, otherwise *SASAC* is taken as zero.
5. The instruments used in our GMM estimation include the lagged 2 terms or further of the dependent variable and independent variables. The time dummies as well as the industry dummies are also used as instruments in our estimations.

So far as demonstrated by our tests and analyses either indirectly or directly based on the overinvestment of free cash flow hypothesis, in terms of fixed asset investments, the firms in our sample in general overinvest, however, these is no evidence showing that the SASAC listed firms have a higher

tendency towards overinvestment because of their special status in the Chinese economy. In other words, we do not find that the SASAC listed firms overinvest more than other firms in our sample. Our findings suggest that as being the elites of the state sector with vast resources and powers in China's state capitalist economy, the SASAC listed firms do not seem to abuse their privileges in term of the overinvestment behaviour. There are two possible explanations. First, the fact that these firms are publically listed means, to some extent, they are still subject to checks and balances by the market like the rest of the listed firms, therefore although these firms may be considered as still outright state-involved, their behaviour do not necessarily deviate (significantly) from other corporations. Second, the SASAC's functions as a shareholder and at the same time as a government agent that oversees these firms' operations and directly appoints top level personnel in these firms seem to work effectively on the SASAC listed firms. It also suggests that the special status of the SASAC firms may represent high ownership concentration that implies owners can better monitor and stabilise firm behaviour.

5.8 Conclusion

In this chapter we investigate the investment behaviour of China's elite SOE listed firms with an emphasis on overinvestment. We first examine the financial situation of these firms by making use of the sensitivity of investment to liquidity. We find that the sensitivity of investment to liquidity for these firms is weaker than the non-SASAC listed firms. An indication suggests either that the SASAC firms are less or not subject to financial constraints on investment or that the SASAC firms are much financially healthier and endowed with abundant cash because of their superior economic position in the economy

(another reason for this is that they are only required to pay minimal dividend and it only started recently). We then utilise free cash flow to test whether the Chinese listed firms overinvest and specifically whether the SASAC firms with their special status overinvest more. We extend the test using direct measurement of overinvestment. Our test results show that although the Chinese listed firms in general overinvest, there is no evidence of the SASAC listed firms being more inclined to overinvestment than the rest of the listed firms. We argue that despite these firms' unique status of being closely and legitimately linked to the state that traditionally entails economic inefficiency, they are still subject to the monitoring and discipline by the market via their public listed firm status and by the elite bureaucracy via the central SASAC of the State council. Moreover, the result may also indicate that the unique status of the SASAC listed firms represents the high ownership concentration in a publicly traded company, which allows owners to better monitor and stabilise firm behaviour.

Chapter 6 Conclusion

6.1 Introduction

In this thesis, we investigate what China's hybrid economic system means to its corporate sector, and how the economic reforms in the past decades may have transformed the behaviour of the Chinese firms with respect to corporate investment. Three main themes are explored. First, we look at whether the state ownership in the Chinese listed firms would have an effect on the firms' investment behaviour in relation to financial constraints. Second, we examine the influence of the recent global financial crisis of 2008 on the Chinese listed firms' investment behaviour. Three possible channels, namely the demand channel, the financial constraints channel and the uncertainty channel, via which the impact of the financial crisis may be conveyed to the firms are evaluated. Third, we assess to what extent the consolidation of the state ownership in some of the most important firms in China may be justified, with an emphasis on the overinvestment behaviour. Specifically we look at whether the behaviour of China's elite state firms, i.e. the SASAC listed firms, would deviate significantly from other listed firms because of their strong positions in the Chinese economy.

6.2 Summary of main findings

In chapter 3, we provide evidence that the listed firms with higher or majority state ownership do not necessarily experience less or no financial constraints on investment. The results are based on two main tests using different methodologies. We first employ the conventional proxy for financial constraints, i.e. the sensitivity of investment to cash flow, to test whether firms having

higher or majority state ownership face less financial constraints on investment. We then verify our findings by utilising the more recently developed alternative proxy for financial constraints, the KZ index. A further test that directly checks the relation between state ownership and leverage also shows evidence that state ownership does not lead to more borrowing from the Chinese banking sector, which is dominated by state banks. These findings are significant as they show that the traditional view that argues state ownership induces soft budget constraints for firms does not apply to the listed firms in China. Our overall results suggest that the reform of the large Chinese SOEs through corporatisation since the earlier 1990s has been effective in a way that soft budget constraints once enjoyed by the former SOEs have been removed along with the corporatisation progress. Although many of these firms are still state-involved, they can be taken as modern corporations.

In chapter 4, we document that the effects of the recent global financial crisis and the following downturn on the Chinese listed firms' investment decisions have been moderate. Three transmission channels, namely the output demand channel, the financial constraints channel and the uncertainty channel, via which the impact of the financial crisis may affect the firms, the demand channel prevails. The credit constraints situation does not have much impact on the Chinese corporate investment in general. Only the firms in more export driven sectors felt the pinch of the financial crisis via the financial constraints channel, most likely due to their declined market value, i.e. net worth, as a result of the disturbance in international trade, which exacerbated these firms' financial conditions. On the uncertainty channel, although we confirm the negative effect of uncertainty on investment decisions of Chinese firms in

general using two alternative proxies for uncertainty (standard deviation of stock returns, and difference between US Treasury bond rate and corporate bond rate), we do not find evidence that uncertainty is an important factor influencing the Chinese firms during the global financial crisis. All in all, our results show that the impact of the crisis on the Chinese corporate investment is significantly negative but limited, and it is the firms in the sectors that rely more on exports are hit relatively harder by the financial crisis. The credit crunch that severely affected firms' financing in other economies did not entirely occur in China as the impact of the financial crisis on Chinese firms was mostly via the contraction in international trade.

In chapter 5, we find that the Chinese elite SOE listed firms, i.e. the SASAC listed firms, firstly, exhibit less sensitivity of investment to liquidity than the non-SASAC listed firms. We argue that the SASAC listed firms are either less subject to financial constraints or rich in cash, and this result is indicative of these firms' special and advantageous status in the Chinese economy. Most of these firms operate in China's several key industries where the government still maintains its controls, and they often still enjoy their monopolistic positions in these industries. Secondly, further investigations reveal that the Chinese listed firms in general overinvest, judging by our applications of free cash flow on detecting overinvestment behaviour. However, no evidence shows that the SASAC listed firms overinvest more than the rest of the listed firms. Our findings imply that the SASAC listed firms' unique status and their strong positions in the Chinese economy do not necessarily lead to these firms abusing their privilege. These firms can be seen as being well managed and disciplined. The roles of the SASAC, a special commission directly under the

State Council, as the administrator and supervisor for China's elite SOE listed firms are proving to be effective in a sense that the investment behaviour of these firms do not deviate significant from the other listed firms with respect to overinvestment.

6.3 Implications

Our overall findings suggest that China's reforms on its large and important SOEs have been effective and successful. The Chinese listed firms of which the majority evolved from former SOEs are becoming more mature and behaving more in line with modern corporations, and even for the firms in which the state still retains considerable control. As shown by our results from chapter 3, state ownership no longer guarantees complete preferential treatments in China's still state dominated economic environment, at least in terms of financing for the listed firms. This finding demonstrates the government's commitments in improving the corporate governance (hence the performance) of the firms that are important to the Chinese economy, but at the same time, in retaining at least a certain degree of control over these firms.

In addition, as implied by our results from chapter 6, the consolidation of state ownership in the most important and profitable listed firms does not necessarily mean that the consolidated elite listed state firms can abuse their power in the economy freely. It seems to suggest that the Chinese corporate sector is going to a direction of an economic system where powerful state elite firms dominate but checks and balances will be placed on these firms by both the market (as being public listed corporations) and their lawful and direct superior administrator (the SASAC) as opposed to further and outright

privatisation of these firms in the Chinese economy. However, an important issue remains for the policymakers is whether the government should revise the dividend policies of the SASAC firms. So far the highest rate required for the SASAC firms (in the highly profitable industries) to contribute their profits to the government (the ultimate owner) is still only 10 per cent. This is very low as compared to average dividend payout of 50 to 60 percent for mature and established industrial firms in the United States. Although in chapter 6 we do not find evidence that the SASAC firms overinvest more than other firms, increasing the dividend payout requirement could prevent potential future misuse of the abundant cash that these elite state firms were able to generate.

Moreover, with the Chinese economy only moderately affected directly by the recent global crisis largely because of the tight controls and regulations by the government, state ownership and increasing oversight by the government in the economy seems to be gaining more ground. Whether the trend would become a hindrance for further economic reforms in China or whether it would evolve and develop into a new paradigm remains to be seen. Nevertheless, the policymakers should be cautious about how far state control in the Chinese economy can go and whether the strength of the state firms in some industries and in the economy as a whole would discourage competitions and stifle innovations and ultimately prevent further economic growth in China.

6.4 Limitations

There are a number of limitations for the studies in this thesis need to be addressed. First, the findings in our thesis are only limited to the public listed firms on the two stock markets in mainland China. We have not considered the

firms that are incorporated in mainland China but have their stocks listed in Hong Kong or overseas. Chinese firms listed in Hong Kong or overseas (e.g. New York and London) are presumably under more scrutiny as they are required to meet often more stringent rules in these more mature and developed markets. Thus, the behaviour of these firms may differ from the mainland listed Chinese firms as the standards of corporate governance between them could vary. It would be interesting to take these firms into account in our future researches. Second, with regard to our estimations in the thesis, although we have employed the advanced GMM estimator that substantially reduces the problem of endogeneity in our estimations, it remains inevitable that to some degree, endogeneity cannot be prevented. Moreover, the problem caused by omitted variables is difficult to avoid.

Appendix

Chapter 3

The data used in this chapter are obtained from China Center for Economic Research (CCER) at Peking University, except for the state ownership data, which are obtained from GTA Research Service Center (www.gtarsc.com).

Structure of the panel data (unbalanced):

Year	Number of observations	Per cent	Cumulative
1999	875	7.45	7.45
2000	1,005	8.56	16.01
2001	1,083	9.22	25.23
2002	1,151	9.80	35.04
2003	1,212	10.32	45.36
2004	1,302	11.09	56.45
2005	1,290	10.99	67.43
2006	1,284	10.94	78.37
2007	1,270	10.82	89.18
2008	1,270	10.82	100.00
Total	11,742	100.00	

Definitions of variables:

Inv: Ratio of change in fixed assets from the previous year plus depreciation to total assets.

Sales: Annual sales growth rate.

Q: Sum of year-end market value of tradable share, book value of non-tradable shares, and book value of long-term and short-term debts, divided by year-end total assets.

CashFlow: Ratio of net profit plus depreciation to total assets.

Debt: Ratio of total debt to total assets.

$\triangle WC$: Ratio of change in working capital (WC) to total assets. Working capital is calculated as current assets minus current liabilities.

Dstate: A dummy variable that takes the value of one if the firm's largest shareholder is the state* and zero otherwise.

State: Ratio of shares held by the state* to total shares.

* The state is defined to include the government and government legal persons.

Size: Natural logarithm of total assets.
SEO: A dummy variable that takes the value of one if the firm has conducted seasoned equity offerings during the sample period (1999-2008) and zero otherwise.
NDTS: Non-Debt Tax Shield measured as ratio of depreciation to total assets.

Chapter 4

The data used in this chapter and the subsequent chapter are obtained from the GTA Research Service Center (www.gtarsc.com). The databases used in chapter 5 include *CSMAR China Stock Market Financial Statements Database*, *China Stock Market Financial Database – Financial Ratios*, and *China Listed Firm's Shareholders Research Database*. Quarterly data are used in this chapter.

Structure of the panel data (unbalanced):

Quarter	Number of observations	Per cent	Cumulative
2006Q1	1,336	4.62	4.62
2006Q2	1,347	4.65	9.27
2006Q3	1,365	4.72	13.98
2006Q4	1,420	4.91	18.89
2007Q1	1,418	4.90	23.79
2007Q2	1,435	4.96	28.74
2007Q3	1,472	5.08	33.83
2007Q4	1,522	5.26	39.09
2008Q1	1,522	5.26	44.35
2008Q2	1,560	5.39	49.73
2008Q3	1,575	5.44	55.17
2008Q4	1,576	5.44	60.62
2009Q1	1,574	5.44	66.06
2009Q2	1,576	5.44	71.50
2009Q3	1,600	5.53	77.03
2009Q4	1,664	5.75	82.78
2010Q1	1,662	5.74	88.52
2010Q2	1,662	5.74	94.26
2010Q3	1,662	5.74	100.00
Total	28,948	100.00	

Definitions of variables:

Inv: Ratio of change in net fixed assets from the previous quarter to total assets. We resolve to this definition of investment partly because quarterly observations of depreciation are not available (yearly observations of depreciation are only available from 2007). This definition of investment can be explained as to only account for new investment project. Conventional definition of investment often takes account of depreciation, which is usually used as the proxy for maintenance expenditure.

Sales: Quarterly growth rate of total operating revenue.

Liquidity: Ratio of cash and cash equivalents to total assets. We use cash and cash equivalents as an alternative liquidity measure. Lack of depreciation data prevents us from using the popular proxies for internal funds (or net worth), such as cash flow (normally calculated as net profit plus depreciation).

Debt: Ratio of short-term borrowings and long-term debts to total assets.

Size: Natural logarithm of total assets.

Finassets: Ratio of the fair value of financial assets available for sale to total assets.

Interest: Ratio of interest payable to total assets, where interest payable is interests accrued from long-term borrowing, bond receivable and other long-term liabilities for which interest is paid at regular intervals and principal is paid when due.

State: Ratio of state shares to total shares, where state shares include shares held by the government and government legal persons.

Uncertainty: Quarterly average of standard deviations of daily stock returns.

FinCrisis: A dummy variable that equals to one if the current quarter is within the defined period of the global financial crisis and the subsequent economic recession and zero otherwise. The crisis period is defined as from the first quarter of 2008 to the third quarter of 2010.

Uncertainty2: Difference between the quarterly average of the monthly 6-month Treasury bill secondary market rate and the quarterly average of the monthly yield of Moody's seasoned corporate bonds (Aaa).

Chapter 5

The data used in this chapter are obtained from GTA Research Service Center (www.gtarsc.com). The databases employed include *CSMAR China Stock Market Financial Statements Database*, *China Stock Market Financial Database – Financial Ratios*, and *China Listed Firm's Shareholders Research Database*.

Structure of the panel data (unbalanced):

Year	Number of observations	Per cent	Cumulative
2003	1,226	10.79	10.79
2004	1,324	11.65	22.44
2005	1,335	11.75	34.18
2006	1,419	12.49	46.67
2007	1,522	13.39	60.06
2008	1,521	13.38	73.44
2009	1,511	13.30	86.74
2010	1,507	13.26	100.00
Total	11,365	100.00	

Definition of variables:

Inv: Ratio of change in net fixed assets from the previous year to total assets. Since the data on depreciation are only available from 2007 with the database we employ, for consistency, we only take account of new investment spending by not including depreciation (maintenance expenditure) for the whole sample period. We believe this measure of investment is also more appropriate for our study. Free cash flow is more likely to induce new investment spending than maintenance spending.

Sales: Annual growth rate of total operating revenues.

Q: Sum of market value of tradable shares, net asset value of non-tradable shares and market value of debt divided by ending total assets.

Liquidity: Ratio of cash and cash equivalents to total assets.

Debt: Ratio of total liabilities to total assets.

State: Ratio of state shares to total shares. State shares include shares held by the government and government-related legal persons.

Size: Firm size measured as natural logarithm of total assets.

SASAC: A dummy variable that equals to one if the firm is identified as a listed firm affiliated to the central SASAC and zero otherwise.

FreeCF:

(1) (net profit + interest expenses + non-cash charges – working capital – capital expenditure)/total assets

(2) (net cash flow from operating activities – expected new investment)/total assets; where expected new investment is the predicted value of investment in new projects from using the benchmark model in chapter 5 (model (5.1)). This measure of free cash flow is

employed in the overinvestment of free cash flow test that adapted Richardson's (2006) method.

Overinv: positive residuals between observed *Inv* from our dataset and the predicted *Inv* from using the benchmark model in chapter 5 (model (5.1)).

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