PhD thesis

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The effect of financial development, financial agglomeration, and financial constraint on China's economic development

A thesis submitted for the Degree of Doctor of Philosophy

By

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Abstract

It has been generally acknowledged that financial development has been critical to economic growth for several decades. Nonetheless, the empirical evidence supporting the association between financial development and economic growth is inconclusive. The majority of existing studies mainly concerned developed countries such as the USA and the UK; there is only a few research focusing on this topic in the context of China. Thus, the main goal of our study is to fill the gap in the previous empirical research. We investigate the impacts of financial development on the economy from both the macro and micro levels in three different aspects: the impact of the informal financial sector (shadow banking sector) on the economic growth in Chinese provinces, the spatial effect of financial agglomeration spillovers on the economic growth among three different regions of China, and the financial constraint on firms' innovation activities.

Firstly, to better understand China's financial industry and the influence it has on the country's economic growth, we conducted an assessment of the present status of the development in China's financial sector. Based on endogenous growth theory, we have gathered data from more than 4000 enterprises to create a shadow banking index and employ a unique dataset from 30 provinces and municipalities during the period 2005 to 2016, which we use to estimate the impact of the financial sector on provincial economic growth in China. According to the findings, we find that the development in both the formal financial sector and shadow banking sector is positively affecting the economic development in China's provinces. Although the shadow banking coefficients are not as high as the formal financial sector, economic development in China's provinces is still supported to a large extent by the informal financial sector.

Secondly, we attempt to determine the indirect effect of financial agglomeration (also called the spatial spillover effect) on economic growth in different regions of China by adopting the spatial econometric approach with data collected from 30 provinces and municipalities between 2005 and 2016. We find out that the different spatial effects of financial agglomeration spillovers within regions could be believed as one of the reasons to explain the regional growth disparity in China. Specifically, the

spatial effect of financial agglomeration spillovers provided a significant favourable influence on economic development in the eastern region of China, which ties the local economic growth and development in the neighbouring areas together. By contrast, the spillover effect generated a depressing effect on provincial economic growth in the central region of China. At the same time, financial agglomerating has an insignificant spillover effect in China's western region.

Last, we examine how financial constraint impacts Chinese enterprises' innovative activities at a micro-level. We introduced the Euler equation to estimate the financial constraint on different types of firms in China. According to the Euler equation, the financial constraint is associated with the sensitivity of investment in innovation activities to cash flow. We believe that the firm's cash flow should not influence future investment if absent financial constraint; otherwise, the results can be interpreted as the financial constraint exists, the availability of capital flow has little effect on the innovative activities of State-Owned Enterprises (SOEs) and collective enterprises' assets, but it has the most significant impact on private firm.

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Chapter 1 Introduction

The major purpose of economic growth research is to uncover the factors that drive economic development to increase national wealth (Gurley and Shaw, 1955). In this context, economists have reached a degree of consensus over the last several decades on the relationship between financial development and economic growth. The majority of research has concluded that a well-functional and advanced financial system can stimulate a country's economic growth by channelling funds toward the most lucrative and productive projects (Schupeter, 1934; Goldsmith, 1969). Financial development may foster economic growth via several channels: providing more accessible payment services for trading products and services; aggregating and pooling funds from a vast number of investors; obtaining the project's information for allocating investor savings effectively; helping to monitor the investment to reduce investor risk. Each of these functions as a favourable economic growth driver (Greenwood and Smith, 1997; Levine. 2005). However, there are other studies that have produced opposing conclusions that financial development might generate a negative influence on economic growth, which is contrary to the findings discussed above. Although the development in the financial sector helps economic growth, it can also be a source of fragility (Beck, 2012). The shift of short-term savings from the investor into long-term investment is the key beneficial effect of financial development on economic growth, but the financial sector is susceptible to shocks. For instance, although the financial sector can provide credits as a lubricant to support the real economy, it also can amplify risks in the financial system and exacerbate instability in the real economy (Beck, 2012). Thus, the impact of financial development on economic growth is not yet been determined, and the discussion is still a critical topic that needs further debate and study.

In this case, based on the policy considerations and the existing literature with contradictory findings, this thesis will extend the previous literature and analyse the relationship between financial development on economic growth, we focus on the effect of financial development from both macro and micro levels in the context of China, and this thesis deals with three main research topics: 1. what's the effect of the growing

shadow banking sector on provincial economic growth; 2. what's the effect of financial agglomeration spillovers on the economic growth among the three different regions of China, and 3. what is the effect of the financial constraint on firms' innovation activities.

Recently, China has become an interesting case in the literature on financial development and economic growth. In general, the broad consensus remains that the Chinese government has continued to play a significant role in allocating resources, which are distorting various critical factor markets such as financial markets and directly resulting in a relatively undeveloped financial sector and preventing market forces from exercising dominance over resource allocation. the underdeveloped financial system in China could impede China's economic growth in the long run (Allen et al., 2012). However, the underdevelopment financial system has not impeded China's growth for the last three decades. The Chinese economy has developed at a tremendous pace over the last three decades and has risen to become the world's second-largest economy, which is frequently referred to as one of the biggest economic success stories since the Industrial Revolution (Eichengreen et al, 2011). More recently, the Chinese economy has been the major workhorse of global economic recovery, especially after the global financial crisis in 2008 (World Bank, 2018). Thus, considering the undeveloped and inefficient Chinese financial system, the Chinese economy's miracle growth speed is considered a puzzle, which provided contradictory findings regarding the relationship between financial development and economic growth (Allen et al, 2005). Thus, China is an interesting case to investigate the relationship between financial development and economic growth in China from different perspectives.

This thesis is organised into seven chapters. This chapter provides the background regarding each chapter. Chapter 2 provides background information by introducing economic and financial reforms in China, summarising their impacts, overviewing the status quo of the Chinese economy and financial industry, and discussing future challenges. Chapter 3 reviews the theoretical financial growth literature to provide a framework for the empirical research in this thesis. Chapters 4, 5 and 6, make a contribution to this research in the form of three essays that cover the three research

topics as outlined above. In particular, considering the importance of the shadow banking sector in China, chapter 4 analyses assess the current state of development in the financial sector to investigate its effect on the economic growth in China, paying particular attention to the impact of financial development in the emerging areas shadow banking sector. Chapter 5 has investigated the spatial effect of financial agglomeration spillovers on economic growth, and demonstrates the spillover effect differ varies from region to region. Chapter 6 is a micro-level study, which introduces the Euler equation to estimate the financial constraint on different ownership structures of Chinese firms. Chapter 7 draws conclusions

Chapter 4 is the first empirical chapter of this thesis. In Chapter 4, we try to answer the question above what's the effect of the growing shadow banking sector on provincial economic growth? Since several decades of market-orientated financial reform, a modern financial system has taken shape in China since the early 21st century. However, since the Chinese financial system is founded on a bank-based financial system, the liberalisation of the financial market in China has lagged significantly behind that of other developed countries, and the financial system is still deemed inefficient in allocating capital. as the state-owned banks are able to control the financing of firms, which has inefficiently misallocated the financial resources to SOEs (Allen et al, 2015; Allen et al, 2017). The financial demand of fast-growing SMEs that are with lack political connections has been largely ignored and has been crowed out from the formal financing channels, which are forced to raise funds through informal channels such as shadow banking (Poncet et al, 2010). In this case, credit rationing leads to the growth of shadow banking (Hachem and Song, 2016; Allen et al, 2017; Chen et al, 2017). The Financial Stability Board (FSB, 2013) defined shadow banking as: "A system of credit intermediation that involves entities and activities outside the regular banking system. These informal channels of shadow banking rapidly developed after the global financial crisis in 2008 (Allen et al, 2015). As a result of credit creation and capital allocation functions, shadow banks have become an essential part of financial markets. the loans originated by shadow banking accounted for about a third of the growth in total lending

and accounted for 69 percent of China's GDP (Allen et al, 2017; Chen et al, 2017). However, although shadow banking activities could benefit private enterprises, shadow banks operate outside of the conventional banking system, they generally lack the traditional safety nets such as guaranteed deposit insurance or lender of last resort facilities, which increases financial risk and reduces the stability of economic growth (FSB, 2013). Thus, there is no consensus regarding the effect of shadow banking on economic growth, which implies that policymakers have to make a tough trade-off between beneficial impacts that stimulate economic development favourably by making financial services more affordable and accessible, and concerns that the informal financial sector negatively affects financial stability by owing to lesser safety and less regulation (EconoMonitor, 2012). Besides, recent studies on financial growth have been widely discussed in the academic literature, suggesting that a functional and advanced financial system positively affects growth. The banks, equity markets, and bond markets are the main channels for the real economy to accumulate capital (BIS, 2013). However, these studies cannot explain the relationship between underdeveloped financial system and the steady economic growth in China and the effect of shadow banking has not yet been addressed (Cecchetti and Kharroubi, 2012; Samargandi et al, 2015; Durusu-Ciftci et al, 2017). With this backdrop, our study has extended the literature by paying particular attention to the role of shadow banking by using provincial-level aggregate data. We are motivated to discover the impact of financial development on economic growth and attempt to evaluate the scale of the shadow banking sector in China, as well as to examine its effect in China. The contribution of this chapter is that we have enriched the evidence regarding the effect of financial development on the economic growth in China, and also consider the contribution of shadow banking, as the shadow banking sector also plays an important role in the financial system. Besides, we have collected data from over 4000 firms from two stock exchanges in China to construct a shadow banking index. Moreover, we developed Pagano's (1993) endogenous growth model that allows us to examine the finance-growth relationship at the provincial level, considering the formal and the shadow

banking system.

In Chapter 5, we try to find out the effect of financial agglomeration spillovers on economic growth among the three different regions of China. Since regional capital flows have risen as economic integration has progressed, the movement of resources broadens the scope of the financial industry agglomeration effect, which has resulted in highly concentrated financial centres in some regions of China and thereby leads to the disparity resource and growth in different regions of China (Taylor et al, 2003). Financial agglomeration represents the distribution of financial resources geographically and spatially, which does not just refer to the geographic concentration of financial institutions and financial industries within an area, but also involves financial development and efficiency enhancement processes (Christophers, 2012). Financial agglomeration is critical to support regional economic growth, as a region's growth is not solely dependent on its financial resources, but also has a huge spatial spillover effect on neighbouring regions. Since the majority of financial resources and financial institutions in China have been agglomerated in the eastern coastal area, the developed financial institutions with substantial financial resources and the competent financial professionals can significantly increase the availability of financial resources, improve the effectiveness of the distribution of financial resources and obviously reduced financial costs. These advantages may eventually turn into a source of regional economic growth to influence the surrounding areas positively (Porteous, 1995; Crozet and Koenig, 2005). Financial institutions even can ignore the geographical barriers to offer more accessible financial services to surrounding areas, thereby reducing the growth disparity within the eastern region of China (Wang et al, 2019; Jung and Vijverberg, 2019; Ran et al, 2020). However, the financial system in China is typically undeveloped and financial development shows a significant disparity that varies from region to region, which leads to a severe imbalance in the distribution of financial resources across the country and causes further economic growth disparity (Taylor et al, 2003; Ye et al, 2018). The provinces in central and western regions of China, particularly in rural areas, face a short supply of financial resources. In order to generate

a greater competitive advantage, provinces in central and western parts of China need to plunder financial resources from neighbouring regions, resulting in increasing wealth disparities and a reduction in the capacity of finance to support the real economy in surrounding areas (Lee et al, 2012; Liu et al, 2013; Wang et al, 2019). In this case, financial development shows a significant disparity that varies from region to region, which leads to a severe imbalance in the distribution of financial resources across the country and causes further economic growth disparity. According to the available evidence, an issue has arisen in the trade-off between financial agglomeration and regional inequality, and there a little agreement regarding the impact of financial agglomeration on economic growth (Crozet and Koenig, 2005). Although there are many debates focused on financial Deeping in China, there are still fewer studies that have been concerned about the influence of financial agglomeration on the development of China's regional economy, in particular, the studies on the spillover effects of financial agglomeration. Thus, it is necessary for policymakers and researchers to take this issue into serious consideration, further investigation will be needed. We are motivated to discover the impact of agglomeration on the regional economic growth in China and attempt to evaluate the spillover effect of financial agglomeration on economic growth in three different regions. The contribution of this chapter is that we provide new evidence that focuses on the financial agglomeration's spillover impact on regional economic growth across China with three different regions and thus adds to the current discussion on China's regional economic growth. Firstly, our study employs the new indicator of regional location entropy to explore the financial agglomeration impact in three different regions of China. In addition, we also adopted the index of global Moran's I to measure the spatial distribution characteristics of agglomeration for each region of China. Last, we have adopted a spatial econometrics model to investigate the spatial effect of financial agglomeration on regional economic growth in the different regions of China. With the use of the Spatial Durbin Model, we enable to investigate the spatial spillover impact of financial agglomeration through interactions between provinces.

In Chapter 6, we try to deal with the last question what is the effect of the financial constraint on firms' innovation activities? From the microeconomic level, the financial resource constraint on firms' innovation activities has been a heated discussion. Financial constraints are generally defined as barriers to accessing external financing. A perfect capital market would exclusively allocate financial resources to enterprises based on their predicted future profitability, and no other considerations would be taken into consideration (Poncet et al, 2010). the development of innovation activities, which are commonly recognised as the primary driver of firm performance improvements, requires an amount of initial capital for the purchase of high-technology equipment and recruiting high-skilled workers (Poncet et al, 2010; Storey, 2000; Tourigny and Le, 2004; Galia and Legros, 2004). But, as a result of the uncertainty associated with innovative operations, asymmetric information and political reasons, financial constraints exist in a large number of firms (Stein, 2003; Hubbard, 1998). it may be difficult and expensive for firms to access external financing for innovative projects, which becomes an impediment for firms to invest and develop (Ferrando et al, 2020; Fu et al, 2018; Morris, 2018). In this case, the empirical evidence generally shows that financial constraint impedes the investment and development of firms' innovation activities, which could significantly affect economic growth (Stein, 2003; Hubbard, 1998).

Thus, access to financial markets is a critical factor in determining the development and survival of enterprises in China. The "political pecking order" means the state-owned banks have no incentive in lending to private firms, thus leads that slows down the development of firms and may hamper economic growth (Huang, 2003; Héricourt and Poncet 2009). However, Chinese private firms have grown fast in the last thirty years and become an engineer to stimulate economic growth in China, even though these firms have experienced financial constraints. As a result, it is critical to undercover the link between financial limits on firms and their development, how they have managed to do so under serious external finance constraints is quite puzzling. Besides the unique political environment, China contains different types of firms with

differing degrees of financial constraints, the state-owned enterprises and private corporations constitute the two extremes. As a result, the Chinese economy provided an ideal laboratory for investigating financial restrictions in China. Moreover, the majority of the available research on financial constraints has been conducted in developed countries such as the United States and the United Kingdom. There are only a handful of papers have tried to examine the effect of financial restraints on firms in China with firms-level data (Chow and Fung 1998; Chow and Fung 2000; Guariglia and Song, 2011; Héricourt and Poncet, 2008). Among the literature that focuses on China, studies are generally based on outdated and small sample decisions and have ignored the discussion on innovation activities (Guariglia and Song, 2011). The effect of financial constraints on firms' innovation activities is still unclear, especially on different ownership firms. In this case, we are motivated to investigate the extent of financial constraints on the different ownership firms' innovative activities in China. In this case, chapter 6 has made contributions to the literature in many ways, we have investigated the extent of financial constraints on the different ownership firms' innovative activities in China. Based on a large sample of Chinese firms from the years 2000 to 2010 (the latest official data from NBS), including 12604 different types of firms with 27492 observations covering the manufacturing sector, our study provides unique results regarding the effect of financial constraints on different ownership of firms. Besides, our study changes the perspective of research, and focus on firms' innovation activities, which is unlike the majority of studies that are only concerned with firms' investment in fixed asset.

Chapter 2 The history of China's economic development and recent challenges

2.1 The history of China's economic development

Since the beginning of economic reform in 1978, China's economy grew at an incredibly rapid pace, and it has risen to one of the world's fastest-growing economies. This chapter introduces the historical background regarding the experience of China's planned economy and provides the subsequent structural changes that occurred during the economic reforms phase. The chapter begins with the period of pre-reform in section 2.1. Section 2.1 will critically review China's reforms shaped by historical development and explain the changes during the reform period and its consequences. This section focuses on the essential economic reforms that the central government conducted to reach the objectives of economic development, which in terms of the reform process on the different ownership structures of Chinese firms and the reforms in the financial system. Section 2.2 have respectively discussed the three severe challenges in future China's economic development, which are in terms of shadow banking, financial resource disparity and financial constraint. Section 2.3 concludes this chapter by outlining the prospects of China's future economic growth.

2.1.1 Before economic reform in 1978

For centuries, the development of agriculture has mainly dominated China's economy. Since the establishment of the People's Republic of China in 1949, the pattern of China's economic growth has remained unchanged; China is still seen as an impoverished country in the world. More than 80 percent of the total population in China lives in rural areas, and a significant number of the rural population was living in poverty. Thus, the Department of Agriculture is the earliest reform implemented by the Chinese government (Brandt et al, 2014). The Chinese government has set a policy regarding the formatting of large agricultural communes in agriculture for the purpose of collectivization, which resulted in farmlands being distributed to farming communes that comprised many families.

The objective of reforms during this period in the agriculture department aimed to increase crop production and enable the entire economy to be self-sufficient, hence promoting industrialisation. In the early stages of the reforms, the planned production model was effective since agricultural production expanded swiftly, and the early adoption of Soviet technology-enhanced productivity, which prompted the government to concentrate its efforts on industrialisation (Naughton, 2006). However, as there was no incentive mechanism in place, hence led most of the farmers lacked the motivation to work

Therefore, the Chinese government chose a new economic development strategy and determined to concentrate on the improvement of heavy industry, as they believed this was a meaningful way to become a self-contained industrial economy and eliminate poverty. At the same time, the Chinese government was in strong opposition to trade and foreign investment. The Chinese government's statement was very explicit; they believed that importing and relying on foreign investment could be abandoning the foundation of China's industrial independence. Nevertheless, the Chinese government over-estimated its capability to produce all of the producer goods it needed and the unrealistic expectations that it would not rely on imports from other countries (Lardy, 1998).

Although China's government had a positive purpose of trying to introduce the successful development path from other developing countries to increase self-economic growth and eliminate poverty, the result was unsatisfactory. The development of heavy industry was defined as extremely capital-intensive; however, China was still a labour-intensive country, with almost 70 percent of the total labour force being agriculture-related employment (World Bank, 2017). Thus, China's government had to adopt the planned economy and establish a series of institutional arrangements such as lower interest rates, setting up production goals, controlled prices, and central resource allocation to reduce the requirement for the development of heavy industries. In this case, a relatively complete industrial structure was established quickly, which led to a large number of investments and further stimulated economic growth. Behind the

successful economic growth that had been achieved, the cost of the growth of economic inefficiency cannot be ignored. There is no correlation between firm growth and economic efficiency, which could severely suppress productivity and result in a lower level of economic efficiency. Thus, as shown in Figure 2.1, the apparent characteristics of China's planned economy can be described as there are some relatively large fluctuations in economic growth during the pre-reform era (the period of 1950 to 1978). It achieved success at an early stage, as a consequence of early agricultural reforms and technical assistance from the Soviets. However, with the issues that emerged from central planning, China's gross domestic product (GDP) per capita has experienced constantly fluctuated, which caused China to lag further behind other countries in the world.

Figure 2.1 Gross domestic product (GDP) per capita in China during the pre-reform era (1950–1978)
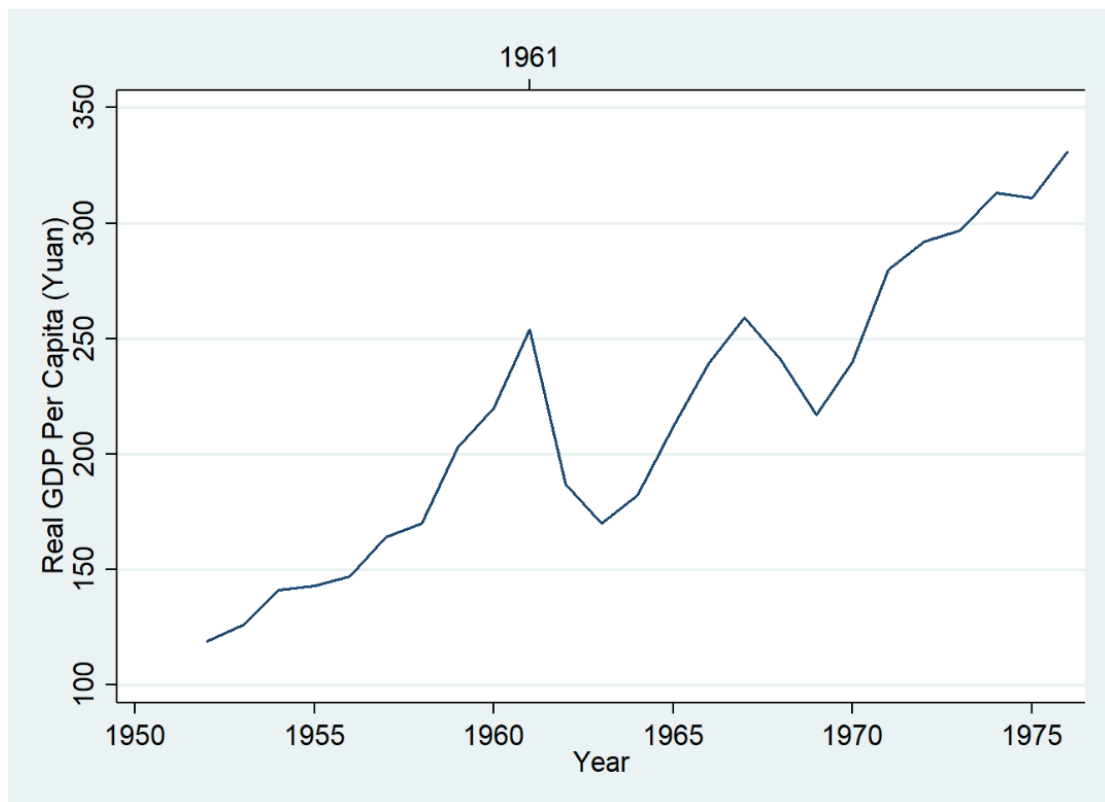
Source: China Statistical Yearbooks (Various Years)

2.1.2 Major parts of economic reforms after 1978

Since 1978, economic reforms have been progressive but hardly slow; China has transitioned from a centrally planned economy to a socialist market-orientated economy in less than three decades. Following the spectacular economic reform, China had unparalleled economic growth rates around the globe.

2.1.2.1 Reform in Agriculture

The reform in rural areas was prioritised in the first phase of China's economic reforms (during the period of 1978 to 1984). China's central government tried to improve workers' incentives to increase economic efficiency, as the agriculture department was the largest industry in China and the backbone of its economy. The main part of the reforms was introduced by two systems. The first was that the communes were abandoned, and the agriculture industry changed from organised production into household-based production. The household responsibility system addressed issues in agriculture policies; in the past, under the system of collectivisation of large farming communes, after they fulfilled the fixed quotas of farm produce, farmers' surplus grain would be shared with others, which greatly reduced farmers` incentive to produce more output. But now, the household responsibility system encouraged farmers to produce more output and permitted them to profit from the excess produce by selling it in the free market. In this case, individual incentives were restored.

Secondly, a new dual-track pricing system based on both the market system and planned system has been introduced, while giving farmers more autonomy as a means of incentivising them to increase production (Lin, 1992). With the implementation of a dual-track pricing system, the government would set prices for the fixed quotas of production and allow the market to determine prices for extra output.

Agriculture reforms effectively and successfully resolved the communal farming system's incentive problems, and families started increasing grain production. With

farms becoming more efficient, rural production increased rapidly, and grain output increased by 5 percent per year on average, which was 1.5 percent higher than the pre-reform period from 1949 to 1978 (Hofman and Wu, 2009).

Figure 2.2 The real GDP of China's primary Industry during the period of 1970 to 1985
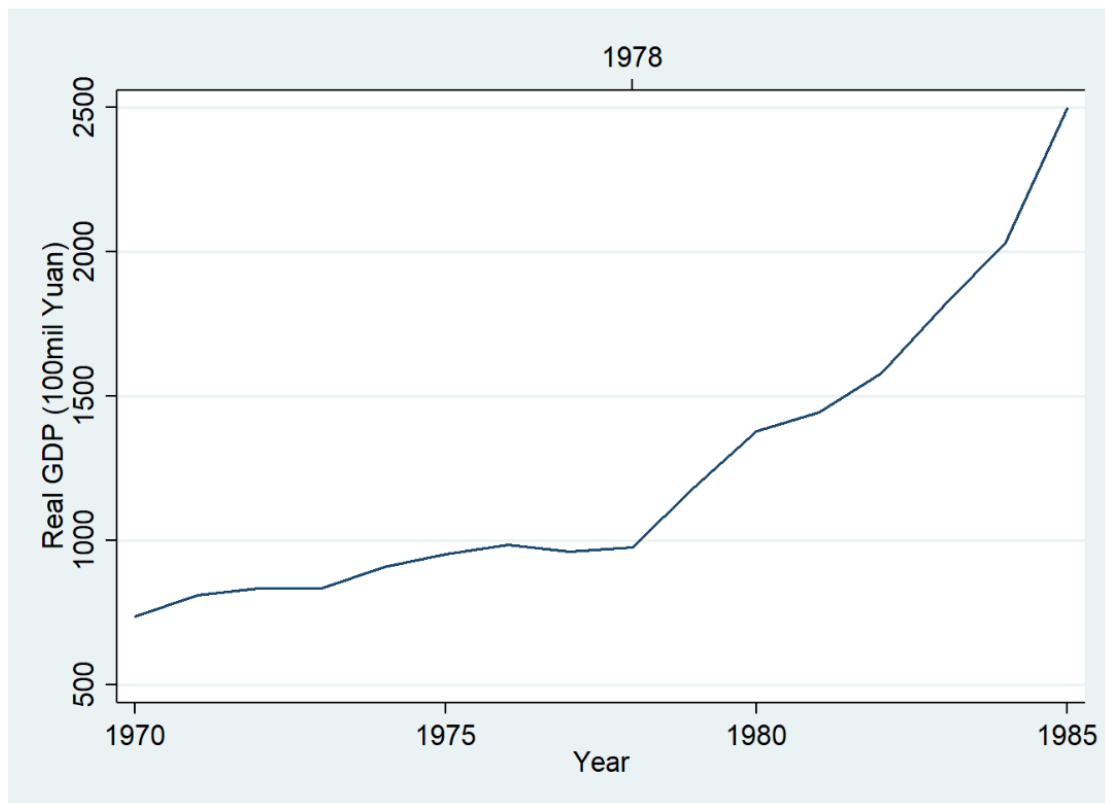
Source: China Statistical Yearbooks (Various Years)

The household responsibility system and dual-track pricing system have been implemented effectively and successfully and were important to further China's reforms in the future, as these changes have laid the groundwork for China's economy by ensuring a sufficient supply of sustenance and overcoming political resistance to the establishment of a market-based economy (Chow, 2004). (Chow, 2004).

Thus, with support from local governments, Village enterprises and collective enterprises have been re-established in rural areas. These enterprises were growing successfully and rapidly, as they created enormous wealth.

In addition, the reforms that were successful in the agricultural area also led to

positive feedback. Firstly, the reforms policy permitted the rural economy to amass financial resources, which would be used to reinvest into local economic growth and enterprise development (Chu and Song, 2015). With the support of a large amount of finance, the local economy and enterprises expanded quickly and offered local governments with greater tax revenue, which would have a favourable impact on the development of the whole economy.

2.1.2.2 Open-door policy

China's open-door policy is generally accepted as one of China's most outstanding economic growth policies. To assess the contribution of the open-door policy to China's economic growth, it is important to review the path China has taken in this direction.

Before the economic reform, China was a closed economy. It was ranked at 32 in world export volume, and the total volume of foreign trade only occupied 7 percent of national income. The government monopolised international trade through its stated trade enterprise. There were no firms and individuals who could import or export goods without the intermediation of a state-owned trade enterprise (Song, 2013). Besides this, there was no relationship between the trade goods and their price before 1978. The state-owned trade enterprise usually purchased the imported goods at the international price and sold goods at the domestic planned price. Thus, it was impossible to reflect the supply-demand relationship, which could influence the policy maker to formulate policy and affect economic growth negatively.

In 1979, China decided to open up and try to connect with the outside world. Since then, there has been a significant change in international trade. In 1989, China became the thirteenth largest exporting country, and the share of international trade almost doubled.

To apply an open-door policy, there are some important steps that were carried out. First of all, the Chinese central government decided to decentralise autonomy regarding import and export rights to the local governments and some international trade enterprises to promote international trade. For example, the local government provided

special treatment to the export company to stimulate them to export. International trade companies were given rights only to be responsible for their profit and loss. They have been permitted to retain a portion of their earned foreign exchange and acquire RMB-priced special loans (Chow, 2004). Secondly, numerous coastal provinces, including Guangdong and Fujian, have developed special economic zones, coastal open cities, and export processing zones to stimulate exports and attract foreign investment. In these special zones, foreign investors have been given a number of concessional terms. Foreign investors were encouraged to collaborate with Chinese enterprises in factories that processed imported or domestically produced commodities for export. Besides this, there are no import duties on materials that will be processed for export. Establishing a special economic zone is believed to be one of the most important steps in the open-door policy. This plan not only absorbed part of the labour that was laid off from the enterprise restructure but also leveraged foreign investors' capital and technological expertise to accelerate domestic economic growth (Chow, 2004). Thirdly, the Chinese government has replaced administrative restrictions on exports and imports with taxes, quotas, and licencing (Song, 2010).

2.1.2.3 Reform of State-Owned Enterprises (SOEs)

SOEs were believed to be the main source of the Chinese economy as they employ a large portion of the population and provide one-third of China's GDP. Although SOEs have made more contributions to China's economy, the defects of SOEs are also obvious, which have been proven to be inefficient and coagulating debts. There are some SOEs that hold a staggering amount of debt, the bad debt even occupying 30 to 60 percent of the total amount of debt (Chow, 2004). In this case, SOEs even found it hard to pay wages, which was needless to expect for obtaining profits. Thus, in order to solve the problem of the overwhelmed financial burden, The Chinese government was willing to make changes from a planned economy toward a socialist market-orientated economy.

The reform of SOEs was taken as an experimental example of the gradual approach

to the reform in real economy sector. The institutional changes in the reform of SOEs were carried out step by step (Song, 2010). The first step of the reform was to try to give SOEs some autonomy to make decisions in business operations such as marketing and investment, rather than simply follow the orders from central planning. Six pilot enterprises were chosen in the first experiment in later 1978. The second step was to try to make SOEs financially independent. In other words, after paying taxes to the government, SOEs were permitted to retain their gains as their profits rather than remitting all of their income to the government. The third step was introducing a responsibility system that is similar to the household responsibility system in the reform of the agriculture industry. There is a further reform, namely the contract responsibility system, which has been carried out, giving SOEs greater rights. Once SOEs have paid the fixed tax to the government, they have the right to retain the remaining earnings for distribution to employees and making capital investments. There is a significant milestone in the reform of SOEs that occurred in the late 1990s; the ownership and management of small and medium-sized state enterprises have been given up by the government, while only large enterprises remain under government control. Small and medium-sized state firms issued their own shares, which could be purchased by their managers and staff. In this case, it would be helpful to restructure the enterprise for further growth and provide an incentive to the staff. The large SOEs could be restructured into different forms, depending on different circumstances; in general, most large SOEs become shareholding companies, and the state will control the majority of shares.

Although effective reform of SOEs has produced a result that leads to a positive influence on the economic growth in China by allocating resources efficiently and gradually over time, this positive influence could be offset. There is still a potential pitfall. Due to the large number of layoffs required from the SOE reform in the 1990s, consumer expenditure has declined, which has resulted in a detrimental impact on economic growth. In this case, the reform of SOEs is not only to stimulate economic growth and avoid further debt accumulation but also to pay attention to the political

instability caused by massive unemployment and rapid enterprise restructuring.

2.1.2.4 The growth in small and medium-sized enterprises (SMEs)

With the opening up of China to the international market in 1978, as a part of economic reform, SOEs have been heavily involved. With the deepening of reform, the majority of SOEs have been restructured. Some SOEs were divided into different-sized non-state-owned enterprises until the end of 2004. Due to SMEs presenting higher productivity with less capital and labour, private small and medium enterprises (SMEs) have been finally recognised as an important part of the country's economic development. Meanwhile, due to the Chinese government carrying out the implementation of a non-SOE promotion policy, SMEs have started to sprout; in this case, China's SMEs have grown at a quick and steady rate. This unprecedented growth in SMEs has become the main driver of economic growth in China, which has effectively accelerated economic growth. In 2007 there were 42,291 medium-sized enterprises (occupied 1.78 percent of total enterprises in China) and 2,327,969 small enterprises (occupied almost 98 percent of total enterprises in China) which contributed at least 60% of the nation's total domestic output, more than 65% of the imports and exports in the country and more than 48 percent of the total tax revenue received by the government, as well as more than 82 percent of employment opportunities in China (Xiang, 2007)

However, even if the government has realised the importance of SOEs for economic growth in China, and introduced new policies to gradually reduce the barriers to the development of SMEs to keep SOEs, there is still not enough to change the SMEs into a position of disadvantage in China. One of the most difficult problems for SOEs is usually facing obstacles in financing. Bank loans have been considered as a crucial source because not only can they finance any kind of company in the majority of nations, but also the duration and financing cost are less than the issue of equity. However, most SMEs have been restricted from obtaining bank loans in China, since the vast majority of commercial banks in China are state-owned institutions that have historically held

the majority of deposits and lending power in the country. These state-owned commercial banks often prefer to provide bank loans to the listed enterprises and large SOEs as they are backed by the government in case of loan defaulting.

Moreover, these commercial banks prefer to provide excessively large amounts of loans for higher returns that are much more than SMEs' needs. Therefore, state-owned commercial banks hold less interest in lending to SMEs. Furthermore, the credit ratings in the other requirement prevent the state-owned bank from providing loans to SMEs. Most SMEs have lower or no credit rating, which means it is possible to meet the rating requirements of state-owned banks (Garcia-Fontes, 2005). In this case, as a result of the difficulty in raising capital and securing loans during the start-up period, personal saving has become the main source of investment in a company, which could greatly hinder the SMEs' growth and economic development.

2.1.2.5 Reform of the formal financial sector in China

China has gone through a long period of financial development. The Chinese financial system was classified as a mono-bank system before the reforms of the 1980s. There was only one financial institution, the People's Bank of China (PBoC), which serves as both the central bank and the nation's commercial bank. However, PBoC performed the role is the settlement central and economy accounting at that time, rather than as the role of the financial intermediary (Hubbard & O'Brien, 2012). As the state budget funded the most of the fixed asset investments at that moment, the PBoC was only working on the allocation of capital to enterprises, which severely limited resource distribution. To create a socialist market-oriented economy, the Chinese government has been implemented economic reforms since 1978, and the reform in the financial sector also have been included (Zhao, 1987). As the Chinese financial system is a bank-based system, the lenders of funds from firms or households can be provided to ultimate borrowers through banks and other financial intermediaries, rather than directly through financial markets. Thus, banking reforms have an effective improvement in pooling and distributing financial resources and finally result in the promotion of economic

development. More specifically, from an investment perspective, an efficient banking system ensures higher levels of savings rates and efficiently allocates resources, which could promote effective investment to facilitate economic growth. Besides this, from the perspective of consumption, a healthy banking system could improve consumers' desire to consume, thereby maintaining growth in consumption. Figure 2.3 stated that the ratio of deposits to GDP was quite low in China before the reforms; however, after the development and reforms in the financial area were initiated, there was significant growth in the ratio of deposits to GDP as reforms and development in the financial sector continued, which resulted in high savings rates, therefore encouraging capital accumulation.

Figure 2.3 The ratio of total deposits to GDP during the period of 1950 to 2017
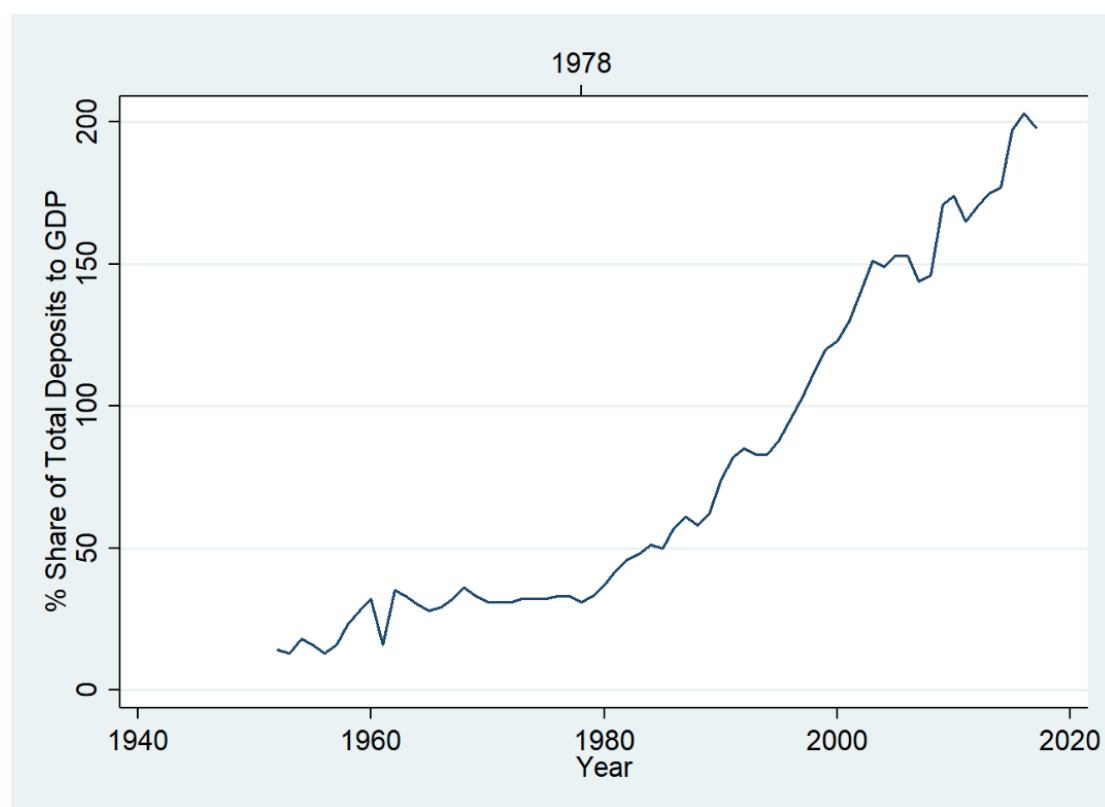
Source: China Finance Yearbooks (Various Years)

Since the high savings rate has led to fast development in the past, it was anticipated that the banking reform will keep generating a positive influence on economic growth in the foreseeable future. As a result, the reform in the banking sector was seen to be a

vital step in the process of economic reformation.

In the past 40 years, the reform in the banking sector may be simply classified into four phases. The first phase of financial development was giving more freedom of operation to the central bank for restructuring an efficient banking system. The PBoC has become formally independent and was given the same level of rank as the Ministry of Finance in 1978, becoming the Central Bank of China in 1984. As a result, the administrative function of the bank has been separated from the bank's commercial function; the PBoC has been defined as the government administrative organisation, which should be led directly by the stated council. The responsibility of the PBoC is to formulate suitable macro monetary policies, set up reasonable interest and exchange rates, regulate financial markets and establish loan plans.

The four state-owned commercial banks that have been established and operated independently in the 1980s can be defined as the second phase of financial development in China. The purpose of setting up these commercial banks was to serve a specific sector at the beginning, they have improved the ability to mobilise and allocate resources to the different sectors. These four state-owned commercial banks are the Bank of China, Industrial Commercial Bank of China, China Construction Bank, and Agriculture Bank of China respectively. The Bank of China is working for the foreign exchange business, the Construction Bank of China focuses on providing credit to domestic investment in fixed assets, and the Industrial and Commercial Bank of China was set up to serve business credit and savings for the industrial and commercial enterprises and the Agricultural Bank of China specialises in rural credit (Cargill and Parker, 2001).

The third phase of financial development in the banking sector took place in the 1990s. The mark of this phase of development in the banking sector was consolidation and austerity restructuring (He, 2007). During that time, there may have been a security risk in the management system, if banks took part in non-banking business, which could lead the bank system to be more unstable and unsustainable and eventually influence economic growth. For this reason, the People's Bank of China has created three policy

banks: China Import and Export Bank, State Development Bank, and Agriculture Development Bank, to reduce the security risk and perform the regularity function. In this case, the commercial banks could focus on the ordinary banking business and get less interference from policy matters. Moreover, two stock exchanges have been formed in the city of Shanghai and Shenzhen. Although the financial market was still at the initial development stage, the equity financing from the stock market only reached 11755 million Yuan, but it was still impressive growth in the financial market since 1945 (China Securities Regulatory Commission, 2017). Historically, the bond market was primarily used to raise funds for the central government; the enterprises are hard-limited to access this market. As a result, the scale of direct finance was still limited. Bank loans have been regarded as the dominant funding source for firms from the external way, financing via bond markets and stock markets only played a minor part.

China began the fourth phase of financial development in 1992, which realised the importance of financial liberalisation and tried to base the financial system on the market. Financial liberalisation advocates that government should not excessively intervene in the financial market and relax the restriction on interest, making the market reflect the real economy. In this case, there are some activities that have taken place to stimulate financial liberalisation. The PBoC is trying to transit away from the convoluted monetary regime that is characterised by currency management, capital account controlling and interest rate regulation. So far, Chinese policymakers have implemented financial liberalisation reforms in small steps on all three fronts simultaneously: gradually opening the capital account, deregulating most domestic interest rates with the exception of the official ceilings on benchmark bank deposit rates, and introducing two-way foreign currency volatility into the Chinese RMB.

Although it is not in doubt that financial development has taken place, China's bank-based financial system is inefficient and capital has been misallocated. Especially, As a result of political lending bias, the limited bank loans have been distributed far irrationally between state and non-state sectors as well as across provinces (Barth et al, 2009). A considerable percentage of bank loans may still be absorbed by the Chinese

stated sector, despite the fact that this sector is contributing less and less to the country's economic development. Under lending bias at all levels of banks, the majority of savings have been channelled by financial intermediaries, particularly the four state-owned banks going to the inefficient state sector, even loss-making SOEs. At the same time, the non-state sector that has been defined as the engineer of economic growth in China is hard limited to access to bank loans, which could stunt economic growth (Guariglia and Poncet, 2008). Bank loan distribution among provinces has also been impacted by the political considerations of the central government. The central government takes bank loans as a way to reduce the regional disparity, which indicates that provinces with a lower economic development level may benefit from preferential loan treatment. Thus, based on the consideration of central government politics, the actual allocation of bank loans may differ from the optimal allocation according to economic conditions. The financial intermediaries were unable to allocate financial resources to the most efficient sector (Park and Sehrt, 2001).

As a result, although it is not in doubt that China's economy has experienced rapid growth, financial constraints and limitations have to some extent impeded its speed. However, this problem has been alleviated in recent years. Since China's financial system is complex at the moment, it has not only inherited the features of China's traditional banking system but also included elements of frontier financial innovation, like the effective informal financing channels have appeared, which could convert the limited savings into investment in the more productive sector like the non-state sector. Hence, the gap in efficiency between SOEs and non-stated enterprises was going larger, the non-stated enterprises become the engine of China's economic growth. As a consequence, when the word "shadow banking" became popular after the financial crisis in the US, China's shadow banking activity was widely regarded as the essential component of informal financial operations that impacted the country's economic growth (FSB, 2013). The following subsection will introduce the informal financial intermediaries-the shadow banking sector in China.

2.2 China's recent challenges

Despite remarkable growth experiences over the past three decades, the Chinese economy is faced with a number of challenges in formulating future economic development strategies. It is important to gain an in-depth understanding of these challenges as well as the threats posed and potential opportunities brought about by these challenges in a rapidly changing domestic and international environment. Our thesis will focus on the following challenges and make our contribution to this aspect of research.

2.2.1 Development of the informal financial sector in China

The first challenge is the rapid rise of shadow banking activities after the global financial crisis in 2008. The Financial Stability Report (2013) points out that the shadow banking system in China is defined by PBoC as "financial intermediation that includes entities and financial activities outside the traditional banking system to offer liquidity and credit transformation, and has emerged as an essential aspect of the country's financial reformation and liberalisation". PBoC indicated that the rapid rise of shadow banking activities has stimulated heavy financial development over the past decade by working on aggressive regulatory arbitrage, encouraging financial innovation and capital market financing in the context of comprehensive financial reforms, but it has the potential to be a source of systemic risk or regulatory arbitrage (FSB, 2013). Because of the significance of shadow banking to economic development in China, it is important to understand how it works. Thus, this section will briefly introduce the growth of shadow banking in China

2.2.1.1 The Reasons for the Development of shadow banking in China

The growth of shadow banking in China has generated a substantial impact on the country's economic growth during the last decade. Although there still is controversy about the effect of shadow banking, its existence is inevitable and rational. There are three key factors driving the growth of shadow banking in China.

First of all, limiting credit to SEMs has seemed like an important reason to

stimulate shadow banking development. Banks dominate the Chinese financial system, which implies that banks are the primary credit providers in China. Compared with the banking sector, other traditional financial systems, like the bond market and stock market, are undeveloped and unable to provide credit as an important source of financing. According to Elliot and Yan (2013), the credit released by the banking sector accounts for almost 128% of GDP; simultaneously, the bond market and the stock market only provided credit equivalent to 41% and 44% of GDP, respectively. The status of the banking sector has determined the fast growth of shadow banking in China. Generally, shadow banking in China acts as an alternative source of funding to the mainstream formal financial sectors. Since a series of financial regression regulations were carried out on banking lending in the 1990s, the banking sector could not provide more credits to enterprises, except state-owned enterprises (SOEs). Compared with SMEs, SOEs have more advantages in financing, due to the Chinese government keeping at least half the shares of SOEs, and most SOEs employed a sizable workforce and provided a large amount of tax revenue for the government. Thus, China's government gives support to SOEs in terms of policy, capital, and resources to make sure SOEs operate regularly. The majority of banks and other formal financial institutions prefer to financially support SOEs as they are backed by the Chinese government in case of default. The limited credits will be provided mainly to a state-owned enterprise at first; even if SMEs were forced to pay a higher interest rate, there is still a shortage of capital that can be released to SMEs. Limited credit is a particularly severe problem for small and medium-sized enterprises (SMEs) as there are limited chances for SMEs to obtain external financial resources (Allison, 2015). Therefore, SMEs need to find alternative ways of financing to survive and grow. In this case, the rapid expansion of the shadow banking sector has resulted from the expectation that evaded the existing regulatory impediments.

Secondly, the low yield on deposit savings is another important driver resulting in the expansion of shadow banking in China (Lu et al, 2015). Interest rates were strictly controlled by the Chinese government during the last long period, the main purpose of

which attempt to artificially lower the relative cost of capital, particularly for some selected industry growth. However, as a consequence of the regulating interest rate, the real interest rates are going either near zero or negative, therefore leading firms and individuals to withdraw their savings from banks and seek a higher-yielding investment. To stop the deposit outflows and look for higher profits returns, commercial banks attempt to evade the interest rate limits imposed by the government. To achieve this purpose, commercial banking started to operate with the shadow banking system to avoid the regulatory oversight process (Dang et al, 2015). In particular, to circumvent the limitations of the deposit rate ceiling and the higher level of required reserve rate, commercial banks prefer to raise funds via issuing financial products such as wealth management products (WMPS); In addition, to bypass the lending quota restrictions, banks also act as intermediaries to receive capital from the cash-rich firms and provide entrusted loans to the cash-strapped firms. The shadow banking sector is outside of financial regulation, which means that it could be an easier way for banks to evade the restrictions on interest control and provide benefits to banks. For this reason, with the Deeping cooperation with banks, shadow banking has grown rapidly and an increase in coverage has occurred (He and Honglin, 2012).

The third reason driving the surge in the growth of shadow banking is the policy change, especially after the global financial crisis. The financial crisis struck the US in 2008 and presented a detrimental impact on the economic growth in other countries around the globe. China's foreign direct investment (FDI) and exports both witnessed a sharp contraction in 2008. In response, China government have employed a stimulus plan of almost 600 billion US dollars aimed at stimulating economic development via upgrading of public facilities, reconstructing infrastructure and other programmes. This stimulus package investment was funded 30 percent by the central government, and the rest part of the whole package was financed by local governments, However, after employing the stimulus plan, the economy presented signs of overheating, and the inflation rate rose above 5% in late 2010 (Lan, 2015). The Chinese government reduced the stimulus policy and limited banks to reduce lending. The unexpected policy changes

resulted in significant challenges for the banks. Although banks had lent massive credit to local government financing vehicles and large-scale credit-intensive infrastructure projects, these long-term projects need the ongoing credit infusions, which forces banks further expand their activities out of the balance sheet and more dependent on shadow banking for intermediate lending, in order to ensure the success of the widespread investment projects and the level of non-performing loans.

2.2.1.2 China's Shadow banking system

The China's shadow banking system in China has exhibited different forms from those in the US in terms of composition and players (Hsu and Li 2009). In the US, the shadow banking system is dominated by non-bank financial institutions, which included securitised loans, asset-backed commercial papers, repurchase agreements, and money market funds. The shadow banking system mostly borrows short-term funds from money markets and uses those funds to purchase the assets with longer-term maturities (Hsu et al, 2013). Compared with the system in the US, the structure of the shadow banking system in China is simpler and is not constructed from a series of complicated derivatives. In China, The development in the shadow banking sector is largely driven by credit lending, rather than driven by market mechanisms. It has consisted of a broader variety of forms, which are mostly targeted toward firms' financing. Some of them even have succeeded to integrate with Chinese traditional culture.

In general, the activity products of shadow banking in China mainly include five different aspects, which are in terms of, wealth management products (WMPs) issuance by a variety of institutions, entrusted loans, undiscounted bankers' acceptance, finance company loans, and informal lending. These activities also have been conventionally divided into three parts, which are bank-related part, non-bank financial intermediations, and non-financial part respectively(Allen and Gu, 2020). This section of the literature review will introduce these three different types of shadow banking in greater detail.

The bank-related shadow banking has included the functions of banks as financial

intermediaries, which mainly existed in lending in interbank, bond markets, and even stock markets (Financial Stability Report, 2012). Although the majority of commercial bank financial products, such as loan products, have been considered as a standard part in bank transactions, which carried relatively less risk. But, there are some parts of bank products that are highly risky and highly profitable. In general, these kinds of financial products are invested in the stock market, funds, foreign exchange, trusts, notes, and other higher-risk places to obtain higher profits. Although shadow banking directly involves activities, these transaction records will not be reflected in the bank's balance sheet, thus resulting in the regulation is not as tight as traditional banking activities. In this case, the off-balance-sheet financial production is included in China's shadow banking system statistics.

The second type of shadow banking in China is composed of non-bank financial intermediations, like trust companies, security firms, and insurance firms. Although some firms may be able to acquire capital directly from investors, most firms need help from banks, to obtain easing payment services and mobilise and pool savings from a large number of investors. However, banks tend to lend money to firms with a better credit rating and lower risk, to ensure the safety of their money; thus, it will be hard for firms with lower credit and higher risk on projects to borrow funds from banks. As a result, this type of shadow banking will typically lend to borrowers with higher risk, such as a real estate agency, or companies in the mining industry (Lan, 2015). Following the global financial crisis, the trust firm in China saw rapid growth, the assets under management (AUM) increased six times from 2007 to 2012 and reached 1.2 trillion US dollars at the end of 2012 (Li, 2014). Since 2012, the trust industry has surpassed the insurance industry to become the biggest of the non-banking financial sectors (Allen et al, 2017). The trust corporation was engaged in a variety of ventures activities, including financing and lending, private equity management, and real estate investing. Although trust companies in China hold high amounts of capital, they are not under scrutiny and regulation in the same way as banks. The CBRC has set limits on total bank lending to reduce the commercial banks' strong incentives for excessive

lending. Thus, to keep a high level of capital ratio and decrease the LDR level, banks started to conduct more off-balance sheet activities, cooperating with trust companies issuing non-standard debt assets, like trust products through trust companies. Trust companies could be able to play a role as intermediaries between banks and investors to participate in riskier investments that banks would be unable to engage in.

The third type of shadow banking is related to non-financial products, including private lending, credit guarantee companies, and Internet financing. Private lending is a transaction by an enterprise without a formal intermediary like a bank. The main roles of the lender in this type of shadow banking are a pawn, mortgage lender, and microlender in the black market. These shadow banking activities are the least transparent sector in China's shadow banking system, which is considered to be the most challenging sort of shadow banking to control.

2.2.2 The financial agglomeration and regional disparity in China

The second challenge is that the financial resources keep agglomerating in China's different regional financial centres. Following the expansion of the economy in the 1990s, financial resources gathering and financial institutions concentrating have become a general phenomenon in China, and Beijing, Shanghai, and Shenzhen have grown as representative financial centres in the eastern region of China (Chang et al, 2010). The financial centre has agglomerated a large number of financial institutions into a particular geographic region in order to create a financial trading platform, thereby offering comprehensive financial services, such as promoting local capital assemblage, accelerating financial depth, and enhancing the country's economic strength (Beck and Levine, 2004; Hu et al; 2019). However, at the same time, the inequality of financial resources caused by financial agglomeration among regions has emerged as one of the reasons to lead regional growth disparities in China. As the financial centre has been believed to be the central pillar influencing regional economic development, this section will introduce the current status of financial agglomeration in the different regions of China.

2.2.2.1 The Reasons for financial agglomeration in China

Nowadays, with the evolution of telecommunication technologies, capital and information have been quickly and efficiently transmitted by advanced networks of electronic communications, and the circulation of capital is less obstructed by distance (Castells, 1989). However, not all forms of capital and information can be transmitted at constant cost across long distances. Thus, financial agglomeration is still necessary for business. The formation of financial agglomeration in China can be concluded from three different reasons.

The first reason is that the expansion of scale economy plays a significant role in the formation of financial agglomeration. China's economy began to grow in the late 1970s and overtook Japan to become the world's second-largest economy in 2010, a large domestic market, the connection with the global commodities market, and attracting a massive inflow of FDI all need an efficient financial industry. In this context, the rapidly developing eastern area has drawn a considerable number of financial firms to move in, thus stimulating the formation of financial agglomeration. Collaboration between banks, sharing of infrastructure, and exchanging information within a region are all important factors to effectively promote local financial efficiency and further support regional economic growth.

Besides this, government policy has usually been issued in non-standardised and irregular formats, which need to vary from case to case. The wide range of unstandardized policy information has become an obstacle for firms to understand the policy and carry out business (Clark, 2005). Thus, to interpret this non-standardised policy information correctly, firms need to have intensive social contact with the information providers. In China's case, this is to overcome the problem of information asymmetry. Most financial firms prefer to place their headquarters near the functional departments of government (Bossone et al, 2003; Clark, 2005).

The last reason supports the idea that financial agglomeration could also be imposed by local protectionism. Due to the financial sector being an important taxpayer in China, all levels of the Chinese government tend to keep tax revenue locally. Thus,

to promote local economic development, local governments prefer to reallocate financial resources by intervening in financial activities. As a result of local protectionism restrictions, the financial industry exhibits characteristics that are specific to certain regions (Yuan et al, 2020).

2.2.2.2 The regional disparity of financial resources and economic growth in China

Since China began opening up in the 1970s, China's government has been dedicated to exploring ways to promote the continued growth of their economy. Nevertheless, the process of reform in China has led to some problems that cannot be ignored. The disparity across regions regarding economic growth and financial development has emerged as one of the most important characteristics of China's development in post-reform. The open-door policy was initially employed to establish special economic zones in the provinces of Fujian and Guangdong; after that, the policy was extended to the provinces in the eastern region of China and subsequently across the nation. Compared with the inland area, the eastern provinces were chosen to be reformed first because of their advantages of easier access to external transport connections with international waters. The geographical advantage and first move of policy advantage meant the provinces in the eastern coastal region had the benefit of being naturally attractive for foreign and domestic firms to invest in (Gallagher, 2002).

With the deepening of reform, the eastern coastal region kept the economic growth at a steady and rapid rate and thereby became an economically developed area in China. As the capital has grown over time and financial assets were enabled to be accumulated, development quickly expanded to the financial area. Since China's government officially established the Shanghai International Financial Centre as a national-level strategy in 1992, it has opened the prelude of building the new financial centres in the eastern coastal region of China. Both stock exchanges in China were established in the eastern region: Shanghai and Guangdong provinces in the early 1990s (Berger et al, 2009). After the World Trade Organization (WTO) accepted China as a member, Beijing, Tianjin, Guangzhou and other cities in the eastern regions proposed the idea of building

a financial centre.

In comparison, the provinces in central and western regions lack infrastructure and transportation links to international markets, and the pace of economic development and the distribution of financial resources are lagging behind those in the eastern region. Thus, the Chinese government aimed and hoped to develop eastern coastal China first; after that, the eastern region could subsequently use its advantages to help the development of the inland area. However, the objective of China's government has not yet been realised. Although the majority of provinces have experienced various degrees of growth, economic growth has been slow in the central and western regions of China and become relatively underdeveloped areas with fewer financial assets. As financial resources further agglomerate in the eastern region of China, the disparity among regions is widening with China's economic growth process (Lin and Liu, 2003).

2.2.3 Financial Constraints in China

The third challenge is that the financial resources are possibly misallocated across the different ownership structures of Chinese firms (Boyreau-Debray and Wei, 2005). Especially, Under China's state-controlled banking sector, there is a lending bias that has provided access for state-owned enterprises to obtain funds, while generating a political obstacle to impede private firms from obtaining finance from banks (Dollar and Wei, 2007). Huang (2004) stated that these financial constraints are caused by policy inducements for ownership structures of Chinese firms, which is also called the "political pecking order". This section will explore financial constraints in China and focus on how different types of firms have faced different levels of financial constraints.

2.2.3.1 Lending Bias in China

Lending bias has existed for a long time in China and is deeply embedded in China's financial system. The commercial banking system has been established in the 1980s. Since then, the four state-owned commercial banks were created and operating independently. In order to satisfy the growing demand for diversified financing options

from firms, the Chinese government has not only undertaken a series of reforms to the financial system to enhance the ratio of capital adequacy, broaden the scope of other banks' business operations and gradually remove sector barriers; but also set up several other financial institutions like stock exchange and trust companies. However, the top four state-owned banks still have absolute power to dominate the financial system in China (Pei, 1998).

Before 1998, the top four state-owned banks have employed credit quotas, and the majority part of bank loans was allocated to SOEs. Therefore, until China's central government abandoned the credit quota system in 1998, private firms were excluded and discriminated against by the formal financial system (Huang et al, 2013).

In the following years, the Chinese government introduced various rules and regulations trying to make private firms gain legal recognition in the formal financial system and improve access for private firms to obtain bank loans (Chen et al, 2013). Nevertheless, in comparison to the contribution that private enterprises provide to the economy, private firms still get a smaller percentage of overall bank credit. The banks still prefer lending funds to state-owned and collective-owned firms, and the problem of financial constraints for private firms still exists. Why do banks still discriminate against private firms? There are some explanations.

One possible explanation is that Chinese banks are mostly dominated by the Chinese government, the lending choices of bank loans have been historically and heavily impacted by government preference, which still has a strong bias in favour of SOEs and collective-owned enterprises until recently. For state-owned firms, this is because they play multiple roles in China's economy, which has always drawn much attention from the government. Although some smaller state-owned firms operating in the less important sectors are gradually being privatised, the larger or state-owned firms that operate in key industries remain under the central government's control and still dominate growth (Bai et al. 2006). Besides this, before an effective social security system was in place in China, state-owned firms also had significant responsibilities in ensuring the stability of the economy in terms of maintaining employment levels and

providing welfare and benefits to the public (Bai et al. 2006). Thus, in order to assist state-owned enterprises in carrying out their obligation to maintain social stability more effectively, the government must continue to give substantial external funds to state-owned firms.

Collective firms are usually industrial or commercial enterprises that are set up partly via the pooling community's resources and assets and partly through local government loans, which are owned by the community and administered by the local government (Tian, 2000). Collective firms created higher profits throughout the early stages of reforms, as collective firms took advantage of increased demand and hence resulted in significant revenue growth by filling the gap that the SOEs had left in the economy. Thus, collective-owned firms are another group that has been taken care of by the local government. Besides this, in general, the leader of collective firms is normally nominated by local government authorities, who monitor and participate in the decision-making process of collective firms. On account of the local government officials' future career development depending on the performance of collective-owned firms; the local government tends to provide extra support, such as bank loans and tax cuts. As a result, the unique status of collective firms has a guarantee of loans provided by the local government, which brings a position at the top level of the "political pecking order" in a financial constraint.

The second explanation for lending bias is that banks consider that lending funds to state-owned and collective firms is less risky than to private firms. Firstly, most state-owned and collective-owned firms present quite a strong financial performance, as they are operated in profitable and key industries (such as the telecommunication and oil industries) that restrict private firms from entry; thus, state-owned and collective-owned firms obtain special treatment from the bank in project investment, which provides a competitive advantage over private companies (Cheng and Wu, 2019). In addition, state-owned enterprises and collective firms hold an implicit guarantee from the government. If firms fail to repay their loans, The bank may anticipate that the government will employ fiscal resources to limit the bank's exposure and ensure the

banks have not sustained excessive loss from loan default. On the contrary, due to most private firms being established within a short period, having a shorter enterprise age, and being relatively smaller, the bank needs to take more risks to provide funds. In this case, private firms are facing more obstacles to obtaining external funds for their growth, despite the fact that they present a better performance (Cheng and Wu, 2019).

Those reasons discussed above not only affect firms' access to credit, but also may potentially affect firm's productivity by impeding firms' investments in R&D activities. Although private firms could use their earnings to invest, the existence of external limitations on financing may force firms to forego their optimum investment projects, resulting in a slowdown in productivity development.

2.3 Conclusion

It is not in doubt that reforms in China have been believed to be a successful case for economic growth around the world. However, a high proportion of China's economic development can be attributed to the accumulation of capital resources and the improvement of productivity as well as the structural adjustments caused by policy changes that lead to many one-off gains. China's economic growth has to face problems of capital accumulation diminishing over time and economic growth exhausted from structural changes. In order to sustain its present pace of economic growth in the future. The Chinese government must discover new ways to stimulate economic growth (Chow and Lin, 2002). Thus, authors have argued that, as the function of financial institutions in the economy has been estimated, it becomes possible to investigate the impacts of financial development on the economic growth in China, which can provide a more comprehensive understanding of what the function of the financial system provided to economic growth in China, and whether the Chinas financial system can boost its economy steadily growth. This investigation will also be helpful for a policymaker to make further reforms in the economic growth and financial system.

Chapter 3 Literature Review

The process of economic growth may be characterised as an increase in the level of output of commodities and services (Jalil and Ma, 2008). Conventional economics figure out that the factors of production such as capital, labour, and land are believed to be the main determinants to improve economic growth. After that, the new growth theories, such as the endogenous economic growth theories, noticed the benefits of technology innovation and started to add technology as another important determinant in the production function.

With the development of economic growth theories, the importance of financial development was also recognised. In general, financial development has been believed that can affect growth through two different channels: capital accumulation and the productivity of capital. This chapter will review the relevant theoretical studies on analysing the effect of financial development on growth. We start from the earlier theories that before 1960s (Schumpeter, 1911; Goldsmith, 1969; Patrick, 1966), these theories have acknowledged that financial development could have a favourable impact on economic growth. They believed that financial system helps to channel these savings to the productive sector as an investment. Since the 1970s, with the argument over financial repression and liberalisation at both macro and micro levels, McKinnon (1973) and Shaw (1973) argue that financial repression was seen to be harmful to economic advancement, the nation was recommended to liberate the financial sector. By the 1980s, McKinnon-theory Shaw's was criticised by Structuralism theory (Buffie, 1984; Taylor, 1983; and Wijnbergen, 1982, 1983) and Keynesianism theory (Khatkhate, 1988) in the 1980s due to various outcomes from different nations that implemented financial liberalisation reveal a partially negative influence.

Thus, it helps augment capital accumulation and increase output. Recently, finance-growth theories have been further developed by endogenous growth theories (Bencivenga and Smith, 1991; King and Levine, 1993; Pagano;1993; Lucas, 1988). They emphasized the importance of the role of innovation of financial technologies, in its role in improving the productivity of capital by reducing transaction costs,

information asymmetries and monitoring costs, which leads to higher economic growth. This section will briefly introduce these financial-growth theories.

3.1 Early theories

There has been a long discussion over the relationship between financial development and economic growth. Joseph Schumpeter (1911) is believed as the first economist who made a significant contribution to the integration of economic growth theory and financial development. Beginning in 1911, Schumpeter argued that economic growth could be positively affected by financial development. The fundamental argument of Schumpeterian growth theory is that long-term growth is the consequence of invention and innovations. Invention and innovation can stimulate the process of continuously substituting new procedures, products, and services for outdated industrial techniques and things, and financial intermediaries make this technical innovation possible (King and Levine,1993). Financial intermediaries encourage technical and economic growth by providing services like raising savings, risk management, simplifying transactions, and project evaluation.

Goldsmith (1969), who is the first person to empirically investigate the relationship between financial development and economic growth, holds a similar viewpoint with Schumpeter (1911). He has defined "financial structure" as the combination of financial instruments, markets, and institutions operating in the economy, and he infers there is a strong and positive relationship between financial development and economic growth. Additionally, Goldsmith (1969) also argues that the manipulation of the financial sector to achieve development goals was undesirable and that flows of saving and investment should be decentralized in an open capital market operating with market-determined interest rates.

Similar to Schumpeter's (1911) theory, Patrick's (1966) Supply-Leading hypothesis also emphasizes the importance of financial development on economic growth. Patrick (1966) contends that financial development is considered as an important factor that contributes to economic progress. The existence and development of the financial

markets are perceived as a source of the increased level of saving and investments and in turn, promote the efficiency of capital accumulation. With the finance sector developing, many financial services were supplied to the real sector, which could provide more convenient services to entrepreneurs or investments to keep firms' development and economic growth.

In opposition to this view of finance-led development, Robinson (1952) and Patrick (1966) clarify various different viewpoints. Robinson (1952) argues that financial development follows growth, and explains this causation by suggesting that "where enterprise leads finance follows". In Robinson's (1952) view, causation may be bidirectional; in either case, Schumpeter might thus not be `right'. The demand-following hypotheses (Patrick, 1966) assert that the high demand for financial sector services will arise from an increasing economy (real sector), and thus a developed financial sector is a result of the demands of the growing real sector of the economy. Patrick (1966) offers the demand for the following model with a different perspective once more. The demand following hypotheses asserts that development in the financial sector has been defined as the result of real sector growth. Patrick (1966) explained that the demand for financial services from the real sector had caused the development of financial and emerging financial intermediaries and financial instruments. This financial growth causality relationship existed more in emerging nations throughout the early stages of economic development.

3.2 Neoclassical growth theory

Neoclassical growth theory, with the Solow model (1956) as its core component, implies in a perfectly competitive economy, financial development and investment efficiency have a substantial positive connection. Financial development causes capital to flow from the surplus sector to the deficit sector, fostering industrial growth and assisting capital accumulation, driving technical innovation and encouraging economic growth (Solow, 1956; Thiel, 2001).

In the simple version of the Solow model (1956), savings and investments are the core sources of capital formation. Households, businesses, and governments save a portion of their earnings, which is used to fund investments by others. For instance, when a company purchases new machinery, GDP rises, which will also result in increasing future savings and investment. As the Solow model is based on the assumption of a closed economy in which all savings will be used for investment, the greater level of savings will directly result in a higher level of investment, which in turn will lead to an increase in capital accumulation. However, investments have not always resulted in capital growth, it is possible to decline as a result of depreciation. Thus, in order to maintain a steady level of GDP per capita, savings and investments must be equal to or greater than the rate of depreciation. Besides, labor is another component that contributes to the creation of products in an economy, since labour is required to put the capital to use. Capital and labour will collaborate to achieve a level of GDP per capita that is referred to as the stage of "steady-state" (Todaro and Smith, 2006).

Traditionally, financial development as a kind of technical progress has a strong effect on the efficiency of investment. The financial market makes capital flow from the surplus sector to the deficit sector, thereby helping capital accumulation, bringing technological changes, and promoting sector development (Thiel, 2001). But, according to the assumption of the neoclassical growth model, there is a diminishing return to capital, and the capital accumulation added to output per capita is limited. Persistent technical improvement and productivity growth are the only way to lead to an increase in output per worker over the long term. Nevertheless, the neoclassical growth model has not explained the role of technological progress in economic growth as technological progress has been assumed as exogenous; technological progress such as financial development can only explain why some countries grow faster than others in a certain period of time, but it cannot explain the existence of economic growth (D áz and Gonz ález, 2014).

3.3 Financial repression theories

With further exploration of the effect of financial repression on economic growth, the discussion on this topic expanded to the micro level to investigate the effect of financial constraint on firms' growth. The seminal work of Modigliani and Miller (1958) stated a firm's investment decision and financing choices should not be affected by each other in the perfect capital. Under this framework, firms' internal financing, such as retained earnings, and external financings, such as debt and new equity issues, should be perfectly substituted, which implies that investment decisions can be taken to make all profitable investments and focus on the projects with the high rate of return. Investment decisions should be independent of the way to obtain financing.

However, the perfect capital market does not exist. There are several factors such as taxes, transaction costs, and asymmetric information between lenders and borrowers that have caused an imperfect capital market. In this situation, both internal and external funding no longer serve as perfect substitutes for each other. There is a difference between internal and external finance that is referred to as the information cost, and it is positively connected to the degree of information asymmetry. (Stiglitz and Weiss, 1981b). Thus, the imperfect capital market will mean that firms need to take more cost to raise funding from external methods than from internal methods, and the firms with a higher-level problem of information asymmetry will tend to take more cost to raise external funds than the firm with the less problem of information asymmetric. Due to the limitation of external financing being high cost and not available for all firms, Firms' investment decisions are often hampered by financial constraints and unable to make the optimal investment. In this case, the importance of internal funds has been emphasized by financially constrained firms. The increase in internal funds can help firms to alleviate the limitation from financial constraints and therefore lead to firms' development by increasing investment. As a result, to estimate the financial constraint, examining the investment's cash flow sensitivity is a feasible method.

3.4 McKinnon-Shaw's theory

Since the beginning of the 1970s, scholars and decision-makers have engaged in

spirited arguments over financial repression and liberalisation. McKinnon-Shaw's school of financial theory mainly explained the effect of financial repression on economic growth. McKinnon (1973) and Shaw (1973) have developed two financial liberalization models respectively, each of which focuses on a different part of the effects of an increase in interest rates. McKinnon's model is based on the possible linkages between the deposit rate and investment rate, whereas Shaw's model is based on functional relationships between lending and borrowing activities. They claimed that financial repression might reduce the amount of available capital for investment; financial repression was believed to have a detrimental effect on economic progress. Countries should be advised to liberate the financial sector to keep economic growth.

McKinnon (1973) claimed that financial repression could be defined as government intervention in financial activities and results in artificially lower interest rates and exchange rates. Once the government sets the limit of interest rate on savings and loans, the market will follow the government's direction, and the true relationship between supply and demand for capital will be not reflected by the interest rate. Besides this, when a country's inflation rate is higher, Even if the nominal interest rate increases, the real interest rate may remain very low or even negative. As a result, there is no one would like to put their money in a bank, yet investors continue to rely on banks for funding, which will lead to the demand for capital exceeding supply. Thus, the financial regression will result in capital flow into the SOEs or other privileged organisations by rationing, and the SMEs will have no way to raise funds for growth. In this case, financial liberation is believed to be an important way for most developing countries to stimulate economic growth

Shaw (1973) held the same point of view as McKinnon (1973) and claimed that financial repression would prevent economic growth. Shaw summarised McKinnon's (1973) views and indicated that, generally, due to the fact that developing countries applying financial repression policy would lead to a high inflation rate, individuals and enterprises prefer to raise consumption expenditures or move money abroad, rather than saving money in the bank, to reduce their loss from inflation, which results in there not

being enough capital that can be loaned and invested. In this case, the high-efficiency small and medium enterprises could have no way to get capital to develop; on the contrary, the low-efficiency state-owned enterprise can still get the investment, which will slow down economic growth.

To sum up, the McKinnon-Shaw school theories agreed that financial liberalisation is an important way to stimulate economic growth. They suggested abandoning the interest-rate limit, giving up the planned loan, lowering the required reserve ratio, and ensuring a competitive environment for the financial sector.

3.5 Structuralism and Keynesianism Theory

Due to different results coming from different countries that carried out financial liberalisation policies, especially because the results show a partially negative effect, McKinnon-Shaw's theory was criticised in the 1980s. There are two main criticism arguments against McKinnon-Shaw's theory, which are Structuralism theory and Keynesianism theory, respectively.

The first kind of criticism is based on the theory of structuralism. In terms of structure, there are two different financial structures; one is the formal financial structure like a bank-based financial system and market-based financial system; the other one is the informal financial structure, According to the theory of structuralism, financial structuring is viewed as a dynamic process, the financial system should be endogenously determined by the demand for particular types of financial services. Buffie (1984), Taylor (1983), and Van Wijnbergen (1982, 1983) are the representative of researchers who have contributed to this field. They presented explanations based on the developing countries. They indicated that financial liberalisation in the financial system could not effectively affect economic growth in developing countries, but the informal financial sector does, which instead of Mckinnon and Shaw's point of view that financial liberalisation is an important way to stimulate economic growth. Although financial liberalisation in finance may cause the capital to relocate and direct capital flows from the informal financial sector to the formal

financial market, the amount of capital available for investment may be reduced as a result of this relocation. As the official financial market requires part of the capital as the fixed reserve ratio, the informal financial market does not need it.

The other criticism is based on Keynesian theories. The Keynesian school contends that low-interest rates encourage investment and income, which results in higher savings (Khatkhate, 1988; 1972). In fact, the major difference between the Keynesian perspective and the McKinnon-Shaw theory is the transmission mechanism between interest rates and economic growth. According to the Keynesian school of thought, a high-interest rate policy discourages saving since it has a negative impact on income and investment; While the McKinnon-Shaw school believes that high-interest rates encourage income, savings, and investment.

3.6 Endogenous economic growth theory

The literature on endogenous growth provided new impulses to studies looking at the relationship between financial development and growth in the 1990s (Bencivenga and Smith, 1991; King and Levine, 1993; Pagano;1993; Lucas, 1988). The central argument of endogenous growth is that the main driver for the economy to keep sustained growth, in the long run, is creativity and technological progress, which is in contrast to the school of thought based on the accumulation of physical capital (Schumpeter, 1911; Solow, 1956; Patrick,1966; McKinnon and Shaw, 1973). This concept was further developed through the seminal work of Romer (1990). Romer indicated that the financial system might stimulate economic growth through technological progress, where a developed and effective financial system is able to encourage innovation activities to take place. The endogenous theories offer a theoretical framework that financial intermediation provides an effect on the rate of technological progress and investment efficiency, which offsets the decrease in the marginal product of capital and thereby affects economic growth positively.

King and Levine (1993) developed the Schumpeterian model of technological progress, similar to Romer (1990) or Grossman and Helpman (1991), to emphasise the

fundamental functions of the financial system that promote capital accumulation and economic progress. They believed that the financial system might enhance the probability of successful innovation activities and accelerate the pace of technology advancement by allocating resources to the most productive sectors and diversifying the risks.

Pagano (1993) further developed the endogenous growth model and focused on the allocative role of the financial system on economic growth. He revealed that, As financial institutions get more involved in the intermediation process, they are likely going to improve in efficiency, thus resulting in the narrowing of the spread between lending and borrowing rates, which increases the percentage of savings that is channelled towards investment; besides this, with the expansion of financial intermediation, not only economic growth has potential to be impacted, the efficiency of capital allocating also has been improved. One of the important functions of the financial intermediaries is to direct funding toward those projects with the greatest marginal product of capital. Thus, in Pagano endogenous growth model, the improvement in the efficiency of capital allocation may result in economic growth, since it raises the total productivity of capital.

Chapter 4 Financial Development and economic growth at the province level

4.1 Introduction

After the significant reforms during the last thirty years, the Chinese economy has risen at a relatively steady and rapid pace and a modern financial system has taken shape in China in the early 21st century. However, the government has continued to play a significant role in allocating resources, which are distorting various critical factor markets such as financial markets and directly resulting in a relatively undeveloped financial sector and preventing market forces from exercising dominance over resource allocation (Elliot and Yan, 2013; Elliot et al, 2015; Allen et al, 2017). The liberalisation of the financial market in China has lagged significantly behind that of other developed countries, and the financial system is still deemed inefficient in allocating capital (Elliot and Yan, 2013; Elliot et al, 2015). Thus, considering the undeveloped and inefficient Chinese financial system, the Chinese economy's miracle growth speed is considered a puzzle, which becomes a fascinating case study for further investigating the effect of finance on growth (Allen et al, 2005). At the same time, the role of the informal financial sector (hereafter the shadow banking sector) in economic growth start to receive considerable attention. Due to the fact that the financial system in China is still undeveloped and remains restricted, for instance, the interest rates were tightly controlled; banks' lending capacity was constrained; capital markets remained underdeveloped (FSB, 2013; Allen et al, 2015; Allen et al, 2017). These activities resulted in an increase in both demand and supply of credit from outside of the traditional financial sector (Hachem and Song, 2016; Allen et al, 2017; Chen et al, 2017). Shadow banks are defined as financial entities that operate outside of the regulatory framework of the traditional banking system and also has been considered as an alternative source of financing to assist economic activities (Akinbami, 2011). Because of credit creation and capital allocation functions, the informal financial sector aspect of shadow banks has become an essential part of financial markets in China (Ehlers et al, 2018). However, although shadow banking activities could benefit private

enterprises, these activities are largely unregulated, which may generate significant threats to financial stability and economic growth sustainability. Thus, it is still not much known about the significance of shadow banking in the process of economic development. With this backdrop, an issue of particular importance that the current chapter seeks to shed light on is whether economic growth in China's provinces has been boosted by financial development. The innovative element of this chapter is extended literature by paying particular attention to the role of shadow banking by using provincial-level data and incorporating with a regional growth framework the role of the shadow banking sector, while, contrary to existing evidence (Ductor and Grechyna, 2015; Zhang et al, 2012), focusing primarily on official financial indices at the national level.

The impact of financial development on economic growth has been discussed extensively in the literature (Cecchetti and Kharroubi, 2012; Hassan et al, 2011; Ductor and Grechyna, 2015). Although the development of the financial sector is widely accepted as a growth driver, some scepticism has also been expressed among scholars (Beck et al, 2000; Cecchetti and Kharroubi, 2012; Samargandi et al, 2015; Durusu-Ciftci et al, 2017). On the one hand, the positive argument emphasises that financial intermediaries played a critical role in efficiently distributing financial resources among the different economic activities (Schumpeter, 1934). Accordingly, financial intermediaries assess investment projects and use individuals' savings to finance these projects (Greenwood and Jovanovic, 1991; Bencivenga and Smith, 1990; Pagano, 1993). Financial intermediaries are better placed to evaluate market risks and maximise returns from allocating available funds across different projects (Greenwood and Jovanovic, 1990; Saint-Paul, 1992). This process serves as a growth engine by encouraging investment in the economy (Greenwood and Jovanovic, 1990; Bencivenga and Smith, 1991; Levine, 1997). On the other hand, there is a view that financial development could often destabilise the real economy (Beck, 2012; De Gregorio and Guidotti, 1995; Cecchetti and Kharroubi, 2013). When financial institutions fail, the failure goes beyond the private cost of the sector with the contagion effects being

substantial and detrimental to the entire economy (Allen and Carletti, 2006). The fast-growing financial sectors can cause various risks that endanger the sustainability growth of other sectors that are competing for scarce resources (Cecchetti and Kharroubi, 2012). As there is no consensus on the relationship between financial development on economic growth, the puzzle of the Chinese economy's miracle growth speed can not be explained, and need to further investigate.

Besides, the role of the shadow banking sector on economic growth has also received considerable attention after the global financial crisis of 2008. China's shadow banking industry was extremely active from 2005 to 2015, particularly after the global financial crisis of 2007 to 2009. China's financial system is a bank-dominated financial system, was largely under central government control, and is still underdeveloped (add references). However, the non-bank financial sector recently has experienced rapid growth in recent years, which includes securities, insurance, and trust businesses, as well as other small-scale lending firms, the involvement of sectors are becoming the main component of the shadow banking system in China (Allen et al, 2015; Allen et al, 2017). According to Moody's report (2013), by the end of 2012, the annual growth rate of shadow banking products from 2010 to 2012 was 32% per year. Several recent studies have explored the reasons that have contributed to the rise of shadow banking in China (Hachem and Song, 2016; Allen et al, 2017; Chen et al, 2017). The fundamental reason is that the financial system in China is still undeveloped and remains restricted, for instance, the interest rates were tightly controlled; banks' lending capacity was constrained; capital markets remained underdeveloped, these activities resulted in an increase in both demand and supply of credit from outside of the traditional financial sector.

However, there is no general agreement on the link between shadow banking development and economic growth. Shadow banking proponents see it as a financial innovation activity that enriches the economy's funding channels and makes the financial system to be more market-oriented (Ehlers et al, 2018). However, despite the fact that China has a significant banking industry, until recently, bank loans were mostly

given to unproductive state-owned enterprises (Huang, 2013; Lu et al, 2015). SMEs are seldom to receive financing support from China's formal financial institutions. there are only nearly 15% of Chinese SMEs requesting loans are approved due to tight banking rules and collateral requirements (EconoMonitor, 2012). Therefore, shadow banking has evolved into a complement of the formal financial institutions to provide loans to firms that could have been difficult to obtain otherwise (Financial Stability Board, 2015). However, critics worry that it may result in increased debt levels and less transparency in debt, which has potentially posed severe risks to affect the security of the financial system and the stability of economic development (Lu, et al; 2015; Hsu and Collier, 2013; Elliott et al, 2015; Allen et al, 2017; Acharya, et al, 2020). Thus, the discussion on the impact of shadow banking on economic growth also provides mixed results.

From the previous discussion, financial development has emerged as a major factor in determining economic growth; however, the effect of financial development from both formal financial institutions and the shadow banking sector on the economic growth is not clear. Thus, we are motivated to discover the impact of financial development on the economic growth and attempt to evaluate the scale of the shadow banking sector in China, as well as to examine its effect in China.

We made several contributions to the literature: first, we enrich the evidence regarding the impact of financial development in the formal financial sector on the economic growth in China, taking into account the contribution of shadow banking, which is as important as the formal sector. We have collected data from over 4000 firms to construct a shadow banking index. Second, we developed Pagano's (1993) endogenous growth model that allows us to examine the finance-growth relationship at the provincial level, considering the formal and the shadow banking system. Although most recent research on the shadow banking sector in China has focused on its institutional features and its effect on financial stability, there is little attention has been paid to the relationship between the shadow banking sector and China's economic development of any sort. The disaggregated empirical work of this chapter is missing

from the literature. Last, we have conducted empirical research based on provincial data to estimate the impact of financial development on economic growth. The provincial data could benefit our results in many ways. Given that the amount of inter-provincial capital movement in China is extremely low, the provincial data could more effectively reflect the effect of financial development on the development of local economies (Cheng and Degryse, 2010). Therefore, the province-level analysis should be more meaningful. Also, as the time series of many variables, such as the variables of financial development and shadow banking, are not long enough to enable research at the national level, province data might be used to increase the size of the sample.

4.2 Literature review

Whether financial development actually contributes to economic growth has long been debated, and the empirical studies for the finance-growth literature have come up with different results. China attracts great interest as a unique case in this context, as China has enjoyed fast economic growth for more than 30 years while its financial sector remains under state control and relatively undeveloped. The empirical studies in China generally show results that the undeveloped financial sector still can stimulate economic growth, which differ from theoretical studies (McKinnon, 1973; Shaw, 1973; King and Levine, 1993; Beck, 2012; Allen et al; 2019) that the inefficient financial sector may hamper the development.

As the Sweeping reforms in China's financial system were initiated in the later 1990s, China become an interesting case to attract researchers' attention. There are some studies (Chen, 2006; Wen, 2009; Zhang, 2012; Liu and Li, 2001) that suggest the development of the financial sector can stimulate economic growth in China, there might be circumstances under which financial distortions do not hinder the economic growth in China. Liu and Li (2001) based on provincial data during the period from 1985 to 1998 to employ the four special financial indicators (state budget appropriation, national bank loans, self-raised funds, and foreign investment) to examine the relationship between economic growth and financial development. They found that the

financial indicators growth of national bank loans and self-raised funds are both positive for growth. specifically，the national bank loans still is the most important source of investment for interior regions, as there is a lack of investment alternatives in the interior region,   while self-raised funds are more significant in the coastal provinces. By employing the same dataset, Chen (2006) employs provincial data from 1985 to 1999 and the generalised method of moments (GMM) dynamic panel approach to examine how the development of financial intermediation influences China's economic growth after the reform period. Chen provided a similar result with Liu and Li (2001) that there is a positive relationship between financial intermediation and economic growth, which indicated that, although China financial system distorted, China's financial system still could rely on the two main parts of China's financial services: pooling savings and providing substitution of loans for budget appropriation to contribute to the economy. A similar result also can be found in Wen (2009), who used provincial-level data from 1978 to 2007 and time-series approach by using the vector autoregressive model (VAR) to investigate Granger causality of relationship between financial development and economic growth in the central region of China. Wen (2009) found that financial development in the central region of China has a significant effect on economic growth and pointed out that the Chinese government should further strengthen the reform of financial intermediation to break the monopoly of state-owned commercial banks, encourage effective competition, and make the development of financial institutions to match with the needs of central region's economic development. Zhang et al (2012) use city-level data also discovered comparable outcomes. Zhang et al (2012) employed data from 286 Chinese cities over the period 2001–2006, and adopted both first-differenced and system GMM dynamic panel methods to investigate the relationship between financial development and economic growth at the city level in China. They stated that there is a positive finance-growth relationship from 2001 to 2006, Since China entered WTO, the financial sector has been further liberalized and the domestic banks are forced to improve their efficiency to be more competitive, in order to gain more profits. This result runs

contrary to the existing conclusion that a state-ruled banking sector, such as that in China, hinders economic growth because of the distorting nature of the government.

However, some empirical studies also provide contrary results (Boyreau-Debray, 2003; Hasan et al, 2009). Boyreau-Debray (2003) found that financial intermediation has caused a negative influence on local economic growth in China by applying using a dataset of 26 provinces between 1990 and 1999 and system GMM dynamic panel methods. According to this study, the negative effect was attributed to the banking sector making support to loss-making state-owned enterprises. Hasan et al (2009) found similar results to Boyreau-Debray (2003), who stated that there is a negative financial growth relationship in China by employing the provincial level data during the period 1986 to 2002. They point out that the financial sector was mainly dominated by state-owned banks, which are the main source of providing loans in China. The majority of banks and other formal financial institutions prefer to financially support SOEs as they are backed by the Chinese government in case of default, even though these SOEs are inefficient, which harmed economic growth in China.

The emerging debate of finance–growth literature has focused on the effect of the informal financial sector on economic growth in China. Although the positive impact of shadow banking on economic development has mostly been shown from the limited debate at recent, there is a less empirical study to support it. Empirically, there are only a handful of studies have roughly estimated the effect of the informal financial sector on economic growth in China and they provided mixed results. Cheng and Degryse (2010) used a set of Chinese provincial panel data covering the period 1995 to 2003 and GMM dynamic panel methods to examine the impact of China's informal finance sector on economic development. The author determined that banks, rather than informal financial entities, play a key role in the distribution of local funds.

From the perspective of the micro level, Ayyagari et al (2008) give a comparable result to Cheng and Degryse (2010). Ayyagari et al (2008) employ a database with 2400 Chinese firms to examine the relationship between financing development and economic growth from firm-level data; they concluded that there is a positive effect of

a formal financial system on firm growth, whereas informal financing is not. They believed that informal finance based on reputation and relationships in supporting private sector businesses is limited and improbable replacement role for formal methods But, Allen (2019) gives the contrary view, Allen et al (2019) investigated the effect of shadow banking on economic growth in China by examining the effect of wealth management products. Allen et al (2019) stated that Wealth management products as one of the main parts of shadow banking are viewed as innovation activities that enrich the financial channels and assist in the creation of a more market-oriented financial system. Similar with Allen et al (2019), Acharya et al (2020) employ a dataset that covers the WMPs issued by 25 commercial banks in China during the period from 2008 to 2014 and a panel data method to investigate its effect on the stability of China's financial system. They stated that WMPs will impose a significant risk of rollover for issuers when they mature. And the central stimulus plan after 2008 financial crisis appears to be the catalyst for the rapid growth of shadow banking in China, which has increased the instability of the financial sector.

To sum up, although many studies have examined the financial growth relationship in China in many ways, the results in the literature are ambiguous. The data that have been employed by the most of studies are out of date, which has not accurately provided results for the current status of China, and needs to update. In addition, the majority of studies only considered the effect on economic growth from the formal financial sector, and the effect of the informal financial sector has been ignored, Thus, compared to previous studies, we make some improvements to fill gaps by assessing the impact of shadow banking on growth in China. We take into consideration the hypothesis that both formal financial institutions and the informal financial sector (shadow banking) can be beneficial for Chinese economic growth. To verify the validity of this hypothesis, we have included the effect from both the formal financial sector and shadow banking sector in the endogenous growth model as the theoretical basis and applied system GMM.

4.3 Methodology

Following the review of the finance growth literature in Chapter 3, the empirical analysis in this chapter is based on the endogenous growth model developed by Pagano (1993) within the context of Chinese provinces.

4.3.1 Theoretical background

Recently, Neoclassical and endogenous growth models have both been used to explain the relationship between financial development and economic growth, although both theories seem to be valid for examining how financial intermediation affects economic growth, the endogenous growth viewpoint has dominated the analysis in recent years (Benhabib and Spiegel, 2000).

In the context of the neoclassical framework, financial intermediation has not a value-adding function as the market is perfect, there is no private information and the allocation of resources is Pareto optimal. by contrary, the endogenous growth models, it is assumed that the relationship between finance and the economy is non-neutral, as there is asymmetric information, agency problems and moral problem, which may cause misallocations of funds (Carbó et al; 2007; Kjosevski, 2013). According to endogenous growth models, the contribution of financial intermediation to economic growth results from functions that pool resources and allocate resources effectively. This role of financial intermediation is particularly relevant when capital markets are not sufficiently developed (Pagano,1993; Bencivenga and Smith, 1991; Kjosevski, 2013). Thus, endogenous is more suitable for our research in this chapter.

Within this context, Pagano (1993) has developed the endogenous growth model that takes financial development into account as a growth determinant. Pagano (1993) suggests the basic AK endogenous growth model can incorporate the effect of financial development into the growth process via three channels: savings (S), the fraction of saving that is converted to investment (θ), and the efficiency of investment (A).

The production function of the Pagano model is as follows:

$$g = A \left(\frac{I}{Y}\right) - \delta = A\theta S - \delta \tag{4.1}$$

Where: S denotes the savings rate. Equation (4.1) indicates that the growth rate

depends on three channels: quality of intermediation θ, savings rate s, and productivity A.

In order to capture the effect of both the formal financial sector and informal financial sector on economic growth in China, we extend the Pagano (1993) model to incorporate the effect of the shadow banking sector. The transmission mechanisms of these three channels in our study are explained below. Starting with parameter θ, the financial sector collects savings and directs them into investment. Financial intermediaries normally cannot convert savings fully into investments since financial intermediaries absorb a portion of funds as transaction fees to obtain profits. Thus, there is a portion of savings $(1 - \theta)$ have been remained out of the investment. Therefore, the higher the value of θ, the more efficient the financial market is.

Since the financial system in China dominated by banks and is still underdeveloped, there is a strong credit demand from businesses that could not be met by the traditional banking system in China (caused by loan quotas and sector regulations), and the banks support the state-owned enterprises far more than they do on private firms by providing a massive scale bank loans (Elliott et al, 2015).

Thus, the development of the shadow banking sector has been critical in sustaining the private firm's development, which eventually led to the growth of private firms much faster than state-owned enterprises. Shadow banking provides financial products that do not appear on the balance sheets and efficiently supplies financial services without being subject to regulations. Thus, the private sector has benefited greatly from the funding supplied by shadow banking in recent years (FSB, 2013; Elliot and Yan, 2013; Lu et al, 2015). In this case, the shadow banking financial sector becomes a complement of the formal financial institution. Since shadow banking promotes the function of financial intermediations, financial systems are anticipated to become more efficient, and thus lead to reduce the spread between the lending rate and borrowing rate, which has increased the share of savings directed toward investment. The increase in θ, which essentially means a higher rate of investment, stimulates growth (Pagano, 1993; Jalil and Feridun, 2011). The structural equation for θ is written

as follows:

$$\theta_{it} = \varphi_0 + \varphi_1 Credit_{it} + \varphi_2 SB_{it} + \mu_{it} \qquad (4.2)$$

Where $Credit_{it}$ represents the development of financial intermediaries in the formal financial sector (the ratio of credit issued by the formal sector to GDP), and SB_{it} represents the financial development in the informal financial sector (the ratio of credit issued by shadow banking to GDP).

The second way is that financial development may generate an impact on growth through changing savings rates. As McKinnon's (1973) and Shaw's (1973) hypotheses anticipated, financial development in the form of a higher savings rate provides a higher rate of return, which makes more contribution to economic growth. The equation for the saving ratio is:

$$S_{it} = s_0 + s_1 Savings_{it} + \mu_{it} \qquad (4.3)$$

Where $Savings_{it}$ represent the ratio of saving to GDP.

Thirdly, the improvement in capital allocation can translate into higher growth, as it increases capital productivity, A. Financial intermediaries generally influence productivity through improvement in investment efficiency and human capital. One of the important functions of financial intermediaries is to direct funds toward the projects with the highest marginal product of capital. The higher level of investment efficiency could effectively increase the stock of physical, and thus result in economic growth (Solow, 1975; Hu et al, 2019). In addition, Romer (1990) and Aghion and Howitt (1992) jointly stated that human capital has a significant influence on growth, mostly via its effect on productivity, since a higher level of human capital can improve a country's capacity of innovation activities and adapt to currently available technology.

Hence, the equation of productivity can be written as follows:

$$A_{it} = A_0 + A_1 INV_{it} + A_2 HC_{it} + \mu_{it} \qquad (4.4)$$

Where INV_{it} is investment efficiency and can be defined as Marginal capital productivity, and HC_{it} is human capital.

Besides, we also included the variables of net export ratio and population growth as control variables in our estimated model. The variable of population growth rate can

be used as an indication of the growth of the labour force; the net export ratio can be used to the importance of international trade in economic growth in China.

To sum up, we use Pagano's (1993) framework as base to illustrate how financial development impacts regional growth in China. Substituting equations (4.2), (4.3), and (4.4) into (4.1), we obtain the following reduced form equation:

$$lng_{i,t} = \alpha_0 + \alpha_1 lnCredit_{i,t} + \alpha_2 lnFE_{i,t} + \alpha_3 lnSB_{i,t} + \alpha_4 lnSavings_{i,t} +$$
$$\alpha_5 lnINV_{i,t} + \alpha_6 lnHC_{i,t} + \alpha_7 lnTrade_{i,t} + \alpha_8 lnPop_{i,t} + \eta_i + \lambda_t + \varepsilon_{i,t} \qquad (4.5)$$

Where subscript i indicates province and t indicates time. $lng_{i,t}$ is the dependent variable, which indicates economic growth. Our main independent variables included two financial indicators for the formal financial sector: Credit $lnCredit_{i,t}$, Financial efficiency $lnFE_{i,t}$; financial development in Shadow banking sector $lnSB_{i,t}$; Provincial savings rate lnSavings$_{i,t}$. Investment efficiency $lnINV_{i,t}$, Human capita $lnHC_{i,t}$; We also add two control variable: Net export ratio $lnTrade_{i,t}$; Population growth rate $lnPop_{i,t}$. Last, provincial fixed effects can be expressed by η_i and time fixed effects are indicated by λ_t and the error term is $\varepsilon_{i,t}$. Table 4.1 provides an overview of the variables and definition of all variables

Table 4.1 Overview of variables and definition

	Variable	Description
$lng_{i,t}$	Economic growth	The provincial GDP growth in logarithm
$lnCredit_{i,t}$	Financial development in the formal financial sector	The ratio of credit issued by the formal sector to GDP for each province in logarithm
$lnFE_{i,t}$	Financial efficiency of formal financial institutions	The ratio of credits issued by the formal sector to deposits in formal financial sector for each province in logarithm.
$lnSB_{i,t}$	Financial development in shadow banking sector*	The ratio of credit issued by shadow banking to GDP for each province in logarithm
$lnSavings_{i,t}$	Savings rate	The provincial savings rate in logarithm

$lnINV_{i,t}$	Investment efficiency	The ratio of investment in fixed assets to GDP for each province in logarithm
$lnHC_{i,t}$	Human capital	The proxy of average schooling year's indicator for each province in logarithm
$lnTrade_{i,t}$	The net export ratio	The ratio of new export value to GDP for each province in logarithm
$lnPop_{i,t}$	The population growth rate	The provincial population growth rate for each province in logarithm

4.3.2 The method of estimation

This study adopts the system GMM methods to conduct the empirical analysis for several reasons. From the economic perspective, system GMM allows us to include the lagged term of the outcome variable GDP. Given that it has been proved that GDP can have some lagged effects (Bond et al; 2001; Roodman, 2006; Roodman, 2009), this should be considered in estimations. From the econometrics/statistical perspective, system GMM has the advantages: firstly, the GMM method is able to control for time-fixed effects and provincial-specific effects, which can reduce the biased and inconsistent OLS estimator caused by the unobserved cross-specific effect in the equation (Hsiao, 1986; Arellano and Bond, 1991). According to Hsiao (1986), ordinary least squares (OLS) estimator will be biased and inconsistent, if the individual fixed effects are omitted. The fixed effect within groups estimator although takes into account individual fixed effects, it is estimated to be downward biased in short panels (Nickell, 1981). Secondly, the GMM method can deal with the problem of endogeniety that has been ignored by OLS estimator and the fixed effect estimator. As the endogeneity bias derived from feedback effects between growth and financial developments as well as other omitted variables that matter for growth but are excluded from the right-hand side of (4.10). GMM estimator may incorporate suitable lags of variables as instrumental variables to address endogenous problems in the regression caused by omitted variables and the feedback effect from the dependent variable (Arellano and Bond, 1991). Thus,

to reduce the influence of biased for the estimation of (4.10), we employed a generalised method of moments (GMM) estimator with the dynamic panel data (Arellano and Bond, 1991; Arellano and Bover, 1995).

Specifically, we rewrite equation (4.5) as follows (4.6),

$$Y_{i,t} = \alpha Y_{i,t-1} + \beta X_{i,t} + \eta_i + \lambda_t + \varepsilon_{i,t} \tag{4.6}$$

Where: $Y_{i,t}$ is the logarithm of GDP growth, and $X_{i,t}$ is a set of explanatory variables in the logarithm including our two financial indicators in the formal sector ($lnCredit_{i,t}$, $lnFE_{i,t}$) Shadow banking ($lnSB_{i,t}$); Saving rate ($lnSavings_{i,t}$); investment efficiency ($lnINV_{i,t}$); Human capital ($lnHC_{I,t}$); and two control variables: The net export ratio ($lnTrade_{i,t}$), and Population growth rate ($lnPop_{i,t}$). We also import the lagged dependent variable $Y_{i,t-1}$ as instrument variable. Consequently, we can more accurately assess the impact of financial development on the economic growth in China.

However, in equation (4.6), as there is a province-specific effect η_i existed in the equation, and it also correlated with the instrument variable $Y_{i,t-1}$, the results will still be inconsistent, even though the error term $\varepsilon_{i,t}$ is not serially correlated. As a result, to eliminate the province-specific effect η_i, Arellano and Bond (1991) introduced the first difference GMM estimator by employing the first difference for the equation and also using appropriate lags of the right-hand side variables as instruments.

Also, since the valid instrumental variables are the keys to dealing with the possible endogenous problem and with the correlation between $(Y_{i,t} - Y_{i,t-1})$ and $(\varepsilon_{i,t} - \varepsilon_{i,t-1})$. Thus, the instrumental variables in the first-difference GMM estimators need two assumptions: $\varepsilon_{i,t}$ is not serially correlated, and the independent variables included inside the set of $X_{i,t}$ are weakly exogenous (meaning that they have not uncorrelated with future realisations of the error term).

But, there is a serious problem with the first-differenced GMM estimator. Blundell and Bond (1998) demonstrated that when the explanatory variables are

consistency over time, lagged value of variables could express the weak instruments in the regression equation with the first differences. Consequently, the coefficients are likely to be biased and this problem generally will be exacerbated in small samples. Arellano and Bover (1995) and Blundell and Bond (1998) have further optimised the first difference GMM estimators by adding additional moment conditions for equations expressed in levels to reduce the potential biases and imprecision in first difference GMM estimators. When the estimators based on the moment conditions integrated the equation in differences and the equation in levels as a system, this system is referred to as system GMM estimators. Thus, our study will employ the system GMM estimator.

Besides this, we have employed the one-step estimator as a different variant of system GMM estimators in this chapter. The one-step estimator, as described in Arellano and Bond (1998), assumes homoskedastic errors, while the two-step estimator uses the first-step errors to create heteroskedasticity-consistent standard errors (e.g., White, 1982). Because of system GMM estimator has employed a large number of instruments, the asymptotic standard errors from the two-step panel estimator could have a problem of overfitting in a small sample to guide for hypothesis testing, which is not a concern for the one-step estimator. Consequently, the one-step panel estimator is more suitable for our chapter

Last, to ensure the accuracy and reliability of the results, the system GMM estimator has been required to be consistent with two validity of the assumptions: there is no serial correlation in error terms and instruments have to be valid. Firstly, the Arellano–Bond test was employed to determine whether the error term of regression is serially correlated. Under the null hypothesis, the error terms in the first differences specification should have no second-order serial correlation. Next, we test instrumental validity by using the Hansen test for over-identifying restrictions[1]. This test will determine the validity of instrumental variables under the null hypothesis that there is no correlation between instrumental variables and residuals from the respective regression. Thus, system GMM estimators are valid, since both tests failed to reject the

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[1] The Sargan test has low efficiency when applied to panels with a short cross-sectional dimension (Baltagi et al., 2007).

null hypothesis for (4.6).

Moreover, the instrument variables count easily grows larger as the length of time T increases and the number of explanatory variables rises while performing GMM estimators. Roodman (2009), Windmeijer (2005), and Arellano (2003) indicated that endogenous variables may be potentially overfitted by numerous instruments, resulting in biased estimates. In order to address the issue of ''too many instruments'', Roodman (2009) provided two technique suggestions that have also been embraced by a number of scholars (Beck et al, 2000; Giedeman and Compton, 2009; Demir and Dahi, 2011). The first method is to employ only one or two lags for instruments rather than all possible lags. This method significantly reduced the number of instruments created by GMM estimators. The second way is to collapse the instruments through additions into smaller sets. According to the suggestions from Roodman (2009), combining the two strategies can effectively address the issue caused by instrument growth. As a result, our study follows Roodman's (2009) suggestions that both mothed the restriction in lag depth and collapsed instruments will be employed in the system GMM estimator.

4.3.3 Data and variable definition

This section discusses the data that was used in this chapter. To conduct the empirical study, we collected panel data from 30 provinces and municipalities between 2005 and 2016[2]. These data have been directly taken from China Statistical Yearbook, and Province Statistical Yearbook for various provinces and years, and manually collected data from both the Shanghai and Shenzhen stock exchange. Besides, in order to empirically analyse the effect of financial development on economic growth in different provinces of China, we base the Pagano growth model (1993) to employ a number of variables in our study.

In this chapter, we have employed two different indicators to measure the influence of the formal financial sector in China. Financial efficiency ($lnFE_{i,t}$) is the first

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[2] China is divided into 31 administrative divisions, each of which is known as a province. Tibet has been removed from our sample owing to data availability issues.

financial indicator, which can be expressed as the ratio of credits to deposits. This indicator stands for the financial efficiency of the formal financial institutions, which has been previously used by Hao et al (2018), Lardy (1998), Dayal-Gularti, and Xue (2020). A greater ratio means that the formal financial institution can play an effective role in converting deposits into loans Hussain (2002). On the other hand, a lower ratio means distortion of the Chinese formal traditional financial sector (Guariglia and Poncet, 2008; Xue, 2020). Credits ($lnCredit_{i,t}$) is the second indicator of financial development, which is expressed as the ratio of total credits issued by the formal financial institutions to GDP (*Credits*), which measures the depth of financial intermediation. The higher ratio of indicators means the financial institutions can effectively provide credits and support local economic growth.

Besides, to check the impact from the whole financial industry, we also take into account the ratio of credits issued from formal financial institutions and the shadow banking sector to GDP (*Total credits*) to assess the overall depth of the financial industry in China, and the ratio of credits issued from formal financial institutions and the shadow banking sector to deposits (*Total financial efficiency*) to estimate the financial efficiency of the whole financial industry.

Shadow banking ($lnSB_{i,t}$). The variable of shadow banking can be represented as the ratio of the total credit issued by shadow banking sector to GDP. This study follows Ayyagari et al (2010); Allen (2015); Wu et al (2019) and Acharya et al (2020) to create new shadow banking indicator as the informal financial sector indicator in Chinese provinces and calculated it as the total credit issued of shadow banking. Due to the fact that the majority of shadow bank activities are hidden, makes it is difficult to calculate the scale of their influence. Thus, our study has created a new indicator to include the two largest shadow banking activities that provided credit in China, which are entrusted loans and wealth investment products, respectively. According to Moody's report (2017) and Allen et al. (2017), shadow banking activities that issue credits in China have traditionally been dominated by entrusted loans and wealth investment products, which together accounted for 77 percent of the total assets of the

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country's shadow banking industry in the end of 2016. Thus, we use two primary components of shadow banking activities as indicators of shadow banking in this research.

Although only a few studies such as Ayyagari et al (2010); Allen (2015); Wu et al (2019) and Acharya et al (2020) have measured the credit issued by shadow banking in China, they only investigated one shadow banking activities in their study. Compared with these studies, our indicator included 3472 wealth investment products and 2590 entrusted loans, which may be closer to the actual value of the shadow banking sector in China.

For the category of wealth investment products, our research covers 3472 wealth investment products from public information issued by a total of 68 trust companies and banks from 2005 to 2016, which updates the data set created by Franklin Allen in 2015. The detailed information on trust companies and products is from the iFind database which is one of China's most widely used databases for financial market research. As CBRC requires trust companies to publish annual financial reports and shareholder information, this research based on the trust issuance report to identify the borrower's industry, and headquarters location and classified the different trust companies into the province as a part of credit issued by shadow banking at the province level, according to the trust company's location.

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Concerning entrusted loans, according to the general rule on loans in China, enterprises have no right to issue loans to other enterprises, and the funds to be borrowed between enterprises can only be realised through the intermediary of the bank; The disclosure of entrusted loans granted by publicly traded firms is mandatory. In this case, Data for entrusted loans have been gathered manually by running a keyword search for different variations of "entrusted loan" in public announcements from both the Shanghai and Shenzhen stock exchanges. According to public announcements shown on both these stock exchanges, 2590 entrusted loans were made by listed firms during the period 2005 to 2016. This research has also hand-collected information on firms that borrowed entrusted loans through public announcement reports. In addition, in order to collect the data on entrusted loans at the provincial level, this research also identifies the borrower firm's location, and classifies the different borrower firms into provinces, according to their firm's location.

Savings rate ($lnSavings_{i,t}$). This variable can be estimated as the ratio of the total amount of savings in banks and financial institutions to GDP.

Investment efficiency ($lnINV_{i,t}$). This variable characterises the efficiency with which fixed investment is used for economic growth, which can be calculated by the incremental GDP growth to investment in fixed investment (Ghatak, and Siddiki, 1999; Kothe, 2013).

Human capital ($lnHC_{i,t}$). This variable serves as a proxy for the human capital value. However, compared with physical capital, human capital is intangible, which means it is hard to measure. Thus, we employ an average schooling year's indicator method to measure human capital at the provincial level (Hall and Jones, 1999). According to Hall and Jones (1999), the level of education can measure the stock of human capital in individuals and economies. Thus, the human capital-augmented labour can be estimated from $L_{it} = L_{it}^0 E_{it}$, where L_{it}^0 represents the total size of the labour force (in millions), E_{it} is the average years of schooling of the labour force and $E_{it} = 6e_1 + 9e_2 + 12e_3 + 16e_4$ (e_i is share of the number of graduates from primary school (6 years spent on the study), secondary school (9 years spent on the study), high

school (12 years spent on the study), college or above to the total population (16 years spent on the study), respectively (Hall and Jones, 1999).

Moreover, in order to capture the impact of factors other than the financial indicators on the economic growth in the Chinese province, two control variables that have typically been employed in the finance-growth literature were identified and data were gathered in this chapter. As for the control variables, we have included the variable of trade ($lnTrade_{i,t}$) in our estimated models to highlight the relevance of trade influences on the economy, which is calculated as the ratio of the total trade value (the sum of export value and import value) to GDP[3]. We also included the variable of population growth ($lnPop_{i,t}$) as an indicator for the growth of the labour force, which can be estimated by the population growth rate.

4.4 Results

4.4.1 Descriptive Statistics and Correlations

Table 4.2 presents descriptive statistics for the dependent variable and independent variables. As shown in Table 4.2, the standard deviation of *Financial efficiency* has been highlighted as the lowest among variables (0.099), which means there is no significant difference cross-province during the period 2005 to 2016; the variables of *Shadow banking* has the highest standard deviation (0.719), indicating that there is variation across provinces; but other variables present a considerable variation across provinces; especially, the variable of *Trade* shows the greatest gap between the lowest and maximum values and exhibits the highest variation among the variables (13.670), which means the data of these variables vary from province to province. Thus, there is an unobserved cross-specific effect in the provincial level data; to avoid the result from being biased by the individual fixed effects is an important issue in our study.

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[3] The variables of *Trade* is calculated as the value in current prices (in US$) by statistic yearbook. In this chapter, we use the reference exchange rate (year average) between USD and RMB to describe the value of *Trade* in RMB.

Table 4.2 Descriptive Statistics

Variable (In logarithm)	Sample	Mean	Std, dev	Min	Max
GDP growth ($lng_{i,t}$)	360	-0.057	0.027	-0.121	0.110
Credits ($lnCredit_{i,t}$)	360	0.029	0.143	-0.333	0.412
Financial efficiency ($lnFE_{i,t}$)	360	-0.142	0.099	-0.410	0.856
Total credits ($ln\ Total\ Credit_{i,t}$)	360	0.030	0.144	-0.333	0.414
Total financial efficiency ($ln\ Total\ FE_{i,t}$)	360	-0.141	0.099	-0.409	0.857
Shadow banking ($lnSB_{i,t}$)	286	-3.087	0.719	-5.461	-1.326
Savings ($lnSavings_{i,t}$)	360	0.171	0.163	-0.834	0.747
INV ($lnINV_{i,t}$)	351	0.031	0.369	-2.536	1.512
Human capitcal ($lnHC_{i,t}$)	360	4.272	0.366	3.255	4.817
Trade ($lnTrade_{i,t}$)	360	2.148	2.786	0.116	13.670
Pop ($lnPop_{i,t}$)	330	-2.228	0.457	-3.642	-1.238

The correlation matrix among these variables has been provided in Table 4.3; the correlation coefficients might contribute to our analysis to understand the relationship between the variables. As can be seen from Table 4.3, the variable of investment efficiency ($lnINV_{i,t}$) and population growth ($lnPop_{i,t}$) are negatively related to GDP growth, while the correlation of other variables are generally positive to GDP growth. In particular, we discover that the financial variables of *Savings*, both financial indicators for the formal financial sector ($lnCredit_{i,t}$ and $lnFE_{i,t}$), *Shadow banking*, and *Total credit* are correlated at 1% significance level. the variable of human capital ($lnHC_{i,t}$) is also positively correlated to GDP growth at 5% significance level. but, the variable of financial efficiency for the whole financial industry ($ln\ Total\ FE_{i,t}$) and $lnTrade_{i,t}$ lose its significance for economic growth. In the next section, we will present formal evidence for the impact of our financial indicators on GDP in deta.

Table 4.3 Correlation matrix

Variables	$lng_{i,t}$	$lnCredit_{i,t}$	$lnFE_{i,t}$	$lnTotalCredit_{i,t}$	$lnTotalFE_{i,t}$	$lnSB$	$lnSavings$	$lnINV_{i,t}$	$lnHC_{i,t}$	$lnTrade_{i,t}$	$lnPop_{i,t}$
$lng_{i,t}$	1.000										
$lnCredit_{i,t}$	0.371	1.000									
	(0.000)										
$lnFE_{i,t}$	0.021	0.115	1.000								
	(0.687)	(0.030)									
$lnTotalCredit_{i,t}$	0.372	0.813	0.115	1.0000							
	(0.000)	(0.000)	(0.029)								
$lnTotal FE_{i,t}$	0.0242	0.118	0.809	0.118	1.0000						
	(0.648)	(0.025)	(0.000)	(0.025)							
$lnSB_{i,t}$	0.322	0.470	-0.001	0.475	0.0087	1.000					
	(0.000)	(0.000)	(0.992)	(0.000)	(0.883)						
$lnSavings_{i,t}$	0.310	0.802	-0.502	0.802	-0.4986	0.413	1.000				
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)					
$lnINV_{i,t}$	-0.511	0.053	-0.116	0.052	-0.117	-0.060	0.117	1.0000			
	(0.000)	(0.319)	(0.030)	(0.329)	(0.028)	(0.317)	(0.028)				
$lnHC_{i,t}$	0.114	-0.347	-0.235	-0.348	-0.236	-0.222	-0.161	0.032	1.0000		
	(0.031)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.002)	(0.554)			

$lnTrade_{i,t}$	-0.041	0.407	-0.193	0.406 (0.000)	-0.194	0.093	0.323	0.513	0.039	1.0000	
	(0.444)	(0.000)	(0.002)		(0.002)	(0.116)	(0.000)	(0.000)	(0.459)		
$lnPop_{i,t}$	-0.054	0.411	0.052	0.411	0.053	0.160	0.471	0.195	-0.228	0.483	1.0000
	(0.333)	(0.000)	(0.343)	(0.000)	(0.333)	(0.009)	(0.000)	(0.001)	(0.000)	(0.000)	

Note: (1) All the variables are in logs; (2) The P-value have been represented in parentheses.

4.4.2 Empirical results

In this section, we give the results of this chapter regarding the impact of financial development on economic growth in both formal and shadow banking sectors in China at the provincial level from 2005 to 2016.

Table 4.4 reports the impact of the formal financial sector on economic growth by employing two financial indicators. Both results show that there is a statistically and economically significant relationship between the formal financial sector and economic growth.

Specifically, our first financial indicator in the formal financial sector ($lnCredit_{i,t}$) has been displayed in column (1) of Table 4.4, presenting that the financial depth in the formal financial sector is positively associated with growth. The coefficient of *Credits* is 0.180 at 1% significant level, which shows that a one-unit increase in financial efficiency will cause a 0.180 increase in economic growth. For other variables, the result of human capital is similar to general studies that the accumulation of human capital could support economic growth. One unit of growth in $lnHC_{i,t}$ can promote the economic growth of 0.073 at the province level. In addition, the result for the variable of $lnINV_{i,t}$ shows that inefficient investment hinders economic growth in China's provinces (-0.059 at 5% significant level). Besides, as the variables of $lnSavings_{i,t}$, $lnPop_{i,t}$ and $lnTrade_{i,t}$ lose their significance in terms of economic growth, we did not discuss their effect in this section.

Moreover, after the GMM estimator, the test for instrument validity and the serial correlation also have been provided in column (1) of Table 4.3. As can be seen in Table 4.4, there is no evidence of second-order serial correlation in the first-differenced residuals. The Arellano-bond test has rejected AR1 at a significant level (0.019 < 0.100) and the test for the second-order correlation of the first-differenced residuals shows insignificant (0.390 > 0.100), suggests that the error term is not serially correlated. The Hansen test cannot be rejected a null hypothesis (0.200), which means instruments are

exogenous.

Our second financial indicators have been represented in column (2) of Table 4.4, and are also positively associated with economic growth. the coefficients of $lnFE_{i,t}$ are 0.214 at 5 percent significant level, which shows that a one-unit increase in financial efficiency will cause a 0.214 increase in economic growth. Besides this, the other variables $lnSavings_{i,t}$ and $lnHC_{i,t}$ present a positive effect on economic growth, hich are 0.104 at 1% significant level and 0.069 at 5 percent significant level, respectively. But, the variable of $lnINV_{i,t}$ still provided a negative effect on economic growth, and the variables of $lnPop_{i,t}$ and $lnTrade_{i,t}$ lose their significance on economic growth.

The Hansen test of overidentifying restrictions points out that the null hypothesis cannot be rejected at the significance level (0.368> 0.100). Besides, The Arellano-bond test has rejected AR1 at a significant level (0.009＜0.100) and the test for the second-order correlation of the first-differenced residuals shows insignificant (0.299＞0.100), suggests that the error term is not serially correlated. Thus, we do not reject the null hypothesis that the instruments are appropriate.

Table 4.4 The impact of the formal financial sector on the economic growth in China provinces

Dependent variable GDP growth	(1)		(2)	
	Coefficients	P-value	Coefficients	P-value
$lng_{i,t}\_lag$	-0.062	0.028	-0.055	0.048
	(0.028)		(0.028)	
$lnCredit_{i,t}$	0.180	0.004		
	(0.063)			
$lnFE_{i,t}$			0.149	0.020
			(0.064)	
$lnSavings_{i,t}$	-0.081	0.104	0.104	0.008
	(0.049)		(0.039)	
$lnINV_{i,t}$	-0.059	0.000	-0.062	0.000
	(0.009)		(0.009)	
$lnHC_{i,t}$	0.073	0.040	0.069	0.030
	(0.035)		(0.032)	
$lnTrade_{i,t}$	0.002	0.285	0.002	0.297
	(0.002)		(0.001)	
$lnPop_{i,t}$	-0.001	0.996	0.001	0.905
	(0.013)		(0.012)	
Constant	-0.365	0.004	-0.353	0.003
	(0.129)		(0.117)	
Number of observations	323		323	
Number of groups	30		30	
Number of instruments	24		29	
AR(1)	0.019		0.009	
AR(2)	0.390		0.299	
Hansen test	0.220		0.368	

Note: (1) All the variables are in logs; (2) AR(1) test and AR(2)test, are the Arellano–Bond test for serial correlation of orders 1

and 2, respectively. (3) The robust standard errors have been represented in parentheses.

In contrast to the findings of the formal financial sector's influence on the economic growth presented in Table 4.4, Table 4.5 shows the findings regarding the analysis of the influence of the shadow banking sector on economic development. The coefficient of $lnSB_{i,t}$ is significant and positive (0.011 at 0.05 significant level), which means every unit increase in the shadow banking sector can stimulate 0.011 provinces' growth in China. Although $lnSB_{i,t}$ provided a positive effect on economic growth, the coefficient of shadow banking is less than other variables.

Besides this, it has also been proved that $lnSavings_{i,t}$ have a positive influence on China's economic development. A one-unit savings of increased in the formal financial institutions will lead to a 0.294 unit of economic growth.

Other variables are similar to Table 4.4, the variables of $lnHC_{i,t}$ provide a favourable effect on the process of economic development in Chinese provinces. In contrast, $lnINV_{i,t}$ has a detrimental effect on the province's economic growth.

Also, the Arellano-bond test and Hansen test have been applied to measure the appropriateness of instruments in Table 4.5. The Arellano-bond test has rejected AR1 at a significant level (0.070 < 0.100) and the test for the second-order autocorrelation of the first-differenced residuals all shows as insignificant (0.105 > 0.100), which suggests error term is not serially correlated. The Hansen test has taken the null hypothesis (0.451), which means instruments are the instruments are appropriate.

Table 4.5 The effect of shadow banking sector on the economic growth in Chinese provinces

Dependent variable GDP growth	Coefficients	P-value
$lng_{i,t}\_lag$	-0.325	0.009
	(0.124)	
$lnSavings_{i,t}$	0.294	0.003
	(0.098)	
$lnSB_{i,t}$	0.011	0.096
	(0.006)	
$lnINV_{i,t}$	-0.049	0.001
	(0.014)	
$lnHC_{i,t}$	0.084	0.075
	(0.047)	
$lnTrade_{i,t}$	-0.004	0.212
	(0.003)	
$lnPop_{i,t}$	-0.002	0.830
	(0.011)	
constant	-0.455	0.020
	(0.195)	
Number of observations		259
Number of groups		30
Number of instruments		24
AR(1)		0.070
AR(2)		0.105
Hansen test		0.451

Note: (1) All the variables are in logs; (2) AR(1)test and AR(2) test, are the Arellano–Bond test for serial correlation of orders 1 and 2, respectively. (3) The robust standard errors have been represented in parentheses.

Last, for the purpose of making comparisons between various estimation methods, we also give the results of the influence of the development in the whole financial

industry on the economic growth by using the OLS estimator, fixed effect estimator with time dummy, and GMM estimator in Table 4.6.

Firstly, we have employed two financial indicators for the whole financial industry and adopted the ordinary least squares (OLS) to estimate the impact of these variables on economic growth respectively. The results have been provided in the column of OLS in Table 4.6.

Consistent with previous studies, the development of the financial industry is favourably connected with economic growth in China provinces. The coefficient of $ln\,Total\,Credit_{i,t}$ and $ln\,Total\,FE_{i,t}$ are 0.057 at 1% significant level and 0.059 at 1% significant level respectively. Besides, We also discovered that the variables of $lnSavings_{i,t}$, $lnSB_{i,t}$, $lnHC_{i,t}$, and $lnTrade_{i,t}$ all have a positive influence on economic growth while the variables of $lnINV_{i,t}$ and $lnPop_{i,t}$ have the opposite impact.

Although the findings of the OLS suggest that the development financial industry can drive economic growth in China, the findings seem not reliable. It appears that the OLS estimator produces biased results, which conforms to the theoretical arguments of Arellano and Bond (1991) and Blundell and Bond (1998). Since the OLS estimator ignores the effect of the unobserved cross-specific effect in the equation and suffers biases induced from the endogeneity problem in the equation, the OLS estimator is not satisfied in our study.

Secondly, the column of fixed effect estimator in Table 4.6 provides results regarding the impact of the financial industry on economic growth by using a fixed-effect estimator. The fixed-effect estimator, also known as within estimator, has the advantage of controlling provincial characteristics. However, the fixed-effect estimator still suffers the biases in our study, as the fixed effects estimator has not provided a cure for the problems of omitted variables and the time-variant characteristics have also been ignored.

Although the result of the fixed effect estimator satisfies our expectations, both indicators of the whole financial industry ($ln\,Total\,Credits_{i,t}$ and $ln\,Total\,FE_{i,t}$) demonstrated that they have a favourable impact on the process of economic growth in

China's provinces (0.073 and 0.077 at 1% significant level, respectively), and the results of other variables are consistent with those obtained from OLS estimators. but the fixed effect estimator has not controlled the endogeneity of variables and capture any time-related effects to avoid potential biases.

Thirdly, the column of system GMM in Table 4.6 has contained the results obtained by employing the system GMM estimator. The GMM estimator has successfully controlled the unobserved cross-specific effect as well as the endogeneity problem, allowing for the production of reliable results. By using two separate financial variables, the column of system GMM in Table 4.6 reports the impact of the whole financial industry on economic growth in China provinces. Both of these findings indicated that there is a statistically and economically association between the development of the financial industry and economic development.

In particular, the first financial indicator ($ln\,Total\,Credits_{i,t}$) has been given in column (1) of column SYS-GMM in Table 4.6, demonstrating that the overall financial depth of the financial industry is positively related to economic growth in China provinces. $ln\,Total\,Credits_{i,t}$ is 0.207 at the 10% level of significance, which indicates that a one-unit gain in $ln\,Total\,Credits_{i,t}$ would result in a 0.207 rise in economic growth. $lnSB_{i,t}$ also positive related to China provincial economy growth shows 0.010 at the 10% level of significance, which indicated that shadow banking influence China economy positively. In terms of the other factors, $lnHC_{i,t}$ shows positive to associate with economic growth, which indicates that the improvement in human capital can help to spur economic progress. One unit of increase in $lnHC_{i,t}$ may result in 0.096 units of economic growth at the provincial level. Furthermore, with the variable of $lnINV_{i,t}$, the inefficiency of investment may be seen as a barrier to economic advancement (-0.049 at 1 percent significant level). Apart from that, we did not address the variables of $lnSavings_{i,t}$, $lnTrade_{i,t}$, and $lnPop_{i,t}$ since they have lost their significance in terms of economic growth.

Moreover, the Arellano-bond test has rejected AR1 at a significant level (0.042 < 0.100) and the test for the second-order correlation of the first-differenced residuals

shows insignificant (0.152 > 0.100), which suggests there is no evidence of second-order serial correlation in the first-differenced residuals. The Hansen test cannot be rejected a null hypothesis (0.298), which means instruments are exogenous. Thus, we do not reject the null hypothesis that the instruments are appropriate.

Similarly, our second financial indicator $ln\,Total\,FE_{i,t}$, which has been represented in column (2) of column SYS-GMM in Table 4.6, is positively related to economic growth as is our first one. The coefficients of $ln\,Total\,FE_{i,t}$ are 0.258 at 10 percent significant level, indicating that every one-unit increase in financial efficiency will result in a 0.258 percentage point increase in economic growth. Aside from this, the variables of $lnSavings_{i,t}$ (0.323), $lnHC_{i,t}$ (0.100) both have a positive impact on economic growth and all at a significant level. However, the variables of $lnINV_{i,t}$ (-0.048) on the other hand, have a negative impact on economic growth. The variables of $lnTrade_{i,t}$, and $lnPop_{i,t}$ have lost their significance in terms of economic growth.

In addition, The Arellano-bond test has rejected AR1 at a significant level (0.068 < 0.100) and the test for the second-order correlation of the first-differenced residuals shows insignificant (0.149 > 0.100), and the Hansen test cannot be rejected a null hypothesis (0.395), thus, the instruments are appropriate for this estimation.

Table 4.6 The impact of whole fianancial inductry on the economic growth in China's provinces

Dependent variable GDPgrowth	OLS				Fixed effect				SYS-GMM			
	(1)		(2)		(1)		(2)		(1)		(2)	
	Coef.	P-value	Coef.	P-value	Coef.	P-value	Coef.	P-value	Coef.	P-value	Coef.	P-value
$\ln g_{i,t}$lag									-0.336 (0.119)	0.005	-0.370 (0.129)	0.004
$\ln SB_{i,t}$	0.057 (0.001)	0.001	0.057 (0.001)	0.001	0.005 (0.001)	0.002	0.005 (0.001)	0.002	0.010 (0.005)	0.056	0.001 (0.011)	0.960
$\ln Savings_{i,t}$	0.014 (0.012)	0.238	0.072 (0.009)	0.000	0.015 (0.012)	0.213	0.089 (0.010)	0.000	0. 268 (0.068)	0.000	0.323 (0.082)	0.000
$\ln Credit_{i,t}$	0.057 (0.014)	0.000			0.073 (0.015)	0.000					0.258 (0.140)	0.065
$\ln FE_{i,t}$			0.059 (0.016)	0.000			0.077 (0.015)	0.000	0.207 (0.113)	0.066		

$\ln INV_{i,t}$	-0.040	0.000	-0.040	0.000	-0.040	0.000	-0.041	0.000	-0.049	0.000	-0.048	0.001
	(0.003)		(.003)		(0.003)		(0.003)		(0.013)		(0.014)	
$\ln HC_{i,t}$	0.020	0.000	0.020	0.000	0.023	0.000	0.023	0.000	0.096	0.001	0.100	0.004
	(0.003)		(0.003)		(0.003)		(0.003)		(0.029)		(0.035)	
$\ln Trade_{i,t}$	0.001	0.017	0.001	0.017	0.001	0.180	-0.007	0.180	0.002	0.355	-0.003	0.275
	(0.001)		(0.001)		(0.001)		(0.005)		(0.003)		(0.003)	
$\ln Pop_{i,t}$	-0.008	0.009	-0.008	0.000	-0.008	0.004	-0.008	0.004	-0.004	0.659	-0.005	0.554
	(0.003)		(0.003)		(0.003)		(0.003)		(0.009)		(0.009)	
Constants	-0.151	0.000	-0.151	0.000	-0.168	0.000	-0.168	0.000	-0.481	0.000	-0.535	0.000
	(0.016)		(0.016)		(0.018)		(0.018)		(0.124)		(0.147)	
Number of observation	323		323		323		323		323		323	
R-squared	0.558		0.558		0.689		0.689					
Number of instruments									29		29	

Number of groups		30	30	30	30
AR(1)				0.042	0.068
AR(2)				0.152	0.149
Hansen test				0.298	0.395

Note: (1) All the variables are in logs; (2) AR(1)test and AR(2) test, are the Arellano–Bond test for serial correlation of orders 1 and 2, respectively. (3) The standard errors have represented in parentheses.

4.4.3 Discussion

To summarise the results discussed above, the result of this chapter contrasts with the typical conclusion of most studies (Boyreau-Debray, 2003; Guariglia and Poncet, 2008; Hasan et al, 2009) that analyzed the finance-growth nexus, we find there is a positive link between financial development and growth in China provinces. The results may be interpreted based on the literature previously discussed.

Firstly, for the formal financial sector, the credits provided by formal financial institutions to SOEs and government-sponsored projects can result in the creation of jobs, the adoption of new technology, the assimilation of supportive policies, and productivity improvement, which in turn results in economic growth (Maswana 2006). For example, policy banks as a part of formal institutions are ultimately controlled by the government, which may imply the allocation of bank loans is inefficient (Dang et al, 2015; Financial Stability Report, 2013). The profitability of policy banks is relatively low, but policy banks maintain a significant proportion of non-performing loans (Lu et al, 2015; He and Honglin, 2012). However, The fact that policy banks have had a favourable influence on China's economy can be taken as evidence of the government's policies regarding the formal financial sector and economic growth has been effective and successful.

Secondly, this outcome of shadow banking is consistent with our anticipation that, the shadow banking sector, being an important component of the financial system, generates a substantial beneficial influence on the economic growth of the country's provinces, and also supports studies by Allen and Carletti (2006); Allen et al (2019); Elliot and Yan (2013); Dang et al (2015) and Lu et al (2015). The shadow banking sector may help boost economic growth by providing financing to companies, especially SMEs, that have effective productivity because these kinds of companies have a strong demand for loans, which cannot be met by the traditional banking system in China due to loan quotas and bank regulations (Dang et al, 2015; Lu et al, 2015). Besides, due to interest rates in China being lower and regulated, private investors would like to diversify away from deposits to other vehicles of financial investment that could offer higher returns, which results in increased inflows into the shadow banking sector (Dang

et al, 2015). Thus, the shadow banking sector in China serves as a complementary to the formal financial sector for allocating resources and promoting economic development (Allen and Carletti, 2006; Allen et al, 2019).

Besides this, Savings also has been proven can generate a positive influence on China's economic development. This outcome is consistent with the predictions of Pagano's (1993) endogenous growth model that maintaining a greater level of savings may make a substantial contribution to the rise in investment, which could be a trigger for economic growth (Becsi and Wang, 1997).

For other variables, the inefficacy of investment hinders economic growth and could be caused by the consequences of Chinese laws and regulations. The main objective of most local governments is not to maximise the efficiency of investment but to help to reduce poverty. Thus, the policy has promoted inefficient investments in impoverished and underdeveloped areas (Boyreau-Debray, 2003). The result could also be caused by the state-banking sector inefficiently allocating resources. In order to avoid higher-level unemployment and SOEs bankruptcy, the government usually directs loans via state-owned banks toward inefficient SOEs and unproductive projects (Boyreau-Debray and Wei, 2005).

For human capital, the result could be explained based on the endogenous growth theories of Lucas (1988) and Romer (1990). Accumulating human capital may boost the generation of new ideas and technological innovations, as well as technological advancements, hence increasing overall productivity and efficiency. As a result, human capital is considered to be more than just an input variable in this context; it may even serve as an improvement to other input variables. The more human capital is accumulated, the more technology and innovation are generated, which has the potential to raise productivity, resulting in more output being produced from the same amount of input.

4.5 Conclusions

To summarizes, in this chapter, a new point of view was provided on the current

debate regarding the impact of the development in the financial sector on economic growth in China's provinces, particularly focusing on the shadow banking sector which has been largely disregarded by the finance and growth literature for a long period. Thus, our study allows further insights to be gained on the impact of both the formal financial sector and shadow banking sector, respectively. Beyond the current literature, we have collected data from 30 provinces and municipalities during the period of 2005 to 2016 and manually collected data to create a shadow banking index at the provincial level, as well as adopted the system-GMM estimator to explore finance-growth relationship in China.

The results of this research can have some important implications. Firstly, this research reveals that the development in the formal financial sector has a positive tendency on the economic growth in China's provinces, which suggests formal financial institutions stimulate economic growth, even though the state-controlled banking sector distorted the financial market. We believe that increasing the efficiency of financial institutions has tremendous potential to transform the financial system into an effective growth engine. Therefore, in order to achieve this objective, deep reform in China's financial system is always required and needs to be further implemented; for example, all financial institutions make their loans need to be based on commercial criteria rather than political preference, and it is also essential to increase the availability of bank loans for SMEs. Secondly, the shadow banking sector serves as an efficient channel for distributing financial resources, supporting SMEs' growth, which consequently achieves higher productivity and growth rates in China. We believe that the shadow banking sector in China has the ability to contribute positively to economic growth if it is subjected to efficient and tight supervision. However, although the shadow banking sector may contribute positively to China's economic development, the existence of regulatory impediments needs to be considered, which could still cause financial risk. Shadow banking has been prevalent in China over the past decade, and there is no indication that the upward trend will come to a halt; the cost of surveillance of shadow banking and preventing financial risk keeps increasing, which could have

the potential to be detrimental to economic growth. As this chapter focuses on the financial growth relationship in China, this problem has not been included, but its needs to be considered by further studies. Lastly, human capital savings can also effectively stimulate China's economic growth. As human capital accumulates, there are more chances to improve and innovate technology that could obtain more results from the same inputs.

Besides, based on the results and discussion, this research has provided some important policy recommendations as follows. According to the finding from this chapter, the development of the financial sector has a favourable impact on economic growth. The Chinese government should continue to strengthen its reform of the financial sector in order to more effectively promote economic development in the country, for example, all financial intermediaries approve loans should base on commercial criteria; financial institutions should increase the availability of bank loans to support the non-stated sector of the economy. Besides this, while the shadow banking industry is an efficient channel for distributing financial resources and, as a result, has the potential to contribute to economic development in China, regulatory impediments also exist in the shadow banking sector. Thus, the Chinese government needs to provide effective and strict supervision to prevent potential risks from the shadow banking sector, such as default risk, maturity mismatch, and liquid risk.

Last. as in other research, findings from this thesis also have several limitations, and consideration of the study of the impact of financial development on economic growth is still an interesting topic for both theoretical and empirical researchers. Thus, this section tries to provide a summary of the limitations of the thesis and some suggestions for future study directions to extend our research.

Our study has been limited by data restriction. Firstly, although we have applied two main parts of shadow banking activities: entrusted loans and wealth investment products to create a new shadow banking indicator, but the other part of shadow banking, such as undiscounted bankers' acceptances and private lending, is unknown. Thus, to obtain a more accurate measurement for the shadow banking sector in China,

further research could involve these activities that have been ignored in our study, if data is possible. Besides this, we only select the data from traditional financial institutions like banks, insurance and securities to represent formal financial institutions. Although traditional financial institutions have been the most important part of the financial system until now, the effect from other financial institutions such as the Internet financial sector and foreign financial institutions has been ignored. These emerging financial institutions are entering the capital market and are going to provide strong competition, which will also play an essential role in Chinese economic growth in the future. Thus, in order to acquire a more precise result concerning the impact of financial development on economic growth in China, the effect from these financial institutions needs considering by future research. In addition, there is a problem that needs to be further considered by future research: although the shadow banking sector could contribute to economic growth in China, shadow banking is an existing regulatory impediment that still could cause financial risk. Shadow banking has been prevalent in China over the past decade and there is no indication that the upward trend will come to a halt. The cost to monitor shadow banking and prevent financial risk keeps reaching a higher level, which could have a negative impact on the development of the economy. As this chapter focuses on the financial growth relationship in China, this problem has not been included, but its needs to be considered by further studies.

Chapter 5 Financial Agglomeration, regional economic disparity in China

5.1 Introduction

The increasing regional growth disparity in China has recently attracted a lot of attention since the market liberalization initiatives implemented in the late 1970s. Finance is a core sector in modern economies, which plays an important role in the regional disparity in China (Lee et al, 2012; Chen and Chen, 2015). A massive local market, a significant impact on the global commodity market, and significant foreign direct investment all need to develop an efficient financial sector, which can only be accomplished via the expansion of domestic financial centres (Ye et al, 2018; Zhao et al, 2004). In this case, with the reform in China's financial industry, the country's financial regulation has been reduced and the emergence of financial centres in the country's coastal regions and the spatial agglomeration in the financial sector is building up (Ye et al, 2018; Zhao et al, 2004; Chen and Chen, 2015). The financial centre has agglomerated a large number of financial institutions into a particular geographic region in order to create a financial trading platform, thereby offering comprehensive financial services, such as promoting local capital assemblage, accelerating financial depth, reducing asymmetric information, and enhancing the country's economic strength (Porteous, 1999; Beck and Levine, 2004; Hu et al; 2019). However, at the same time, as a result of the financial centre creation, income distribution has deteriorated, resulting in significant regional differences in the country's income distribution. Provinces in the east coastal region have substantial financial resources and have undergone rapid economic expansion, allowing them to become economically developed areas of the country. In contrast, economic growth has been slower in the central and western parts of China, particularly in rural areas, and these regions with fewer financial assets have become comparatively undeveloped areas of the country. The disparity between regional economic growth and the distribution of financial resources has emerged as the main characteristic of China's post-reform development. (Lee et al, 2012; Chen and Chen, 2015; McCauley and Chan,

2009; Mu and Seng, 2010; Taylor et al, 2003; Ye et al, 2018; Zhao et al, 2004).

The influence of financial agglomeration on regional economic growth has been addressed extensively in the current literature. While some studies claim that financial agglomeration has given income to disadvantaged places (Agnes, 2000; Cortés 2015; Guillain and Huriot, 2001; Storper and Venables, 2004; Henderson and Wang, 2007; Yang et al, 2017), others have raised scepticism about this claim (Lee et al, 2012; Liu et al, 2013; Wang et al, 2019; Yang et al, 2006).

On the one hand, financial agglomeration benefits not just the local economy but also neighbouring areas (Audretsch and Feldman, 1996; Baldwin et al, 2001). Financial agglomeration ensures the smooth operation of the financial system by providing a reliable payment system (Nahashi & Stannics, 2007). Areas that have benefitted from financial agglomeration have gained initial advantages by decreasing information asymmetries[4] and financing costs (Agnes, 2000; Cortés 2015; Guillain and Huriot, 2001; Storper and Venables, 2004), generating a large pool of financial professionals (Agnes, 2000; Hanson and Pratt, 1992; Porter, 1998) and promoting the improvements in industrial structure (Ye et al, 2018). As the financing environment improves, financial agglomeration may increase locals' incomes by attracting capital flows into areas with high capital returns (Nahashi, Stannics, 2007; Yang et al, 2017). The initial advantages, which include the financial resources accumulation, improvement in the specialised knowledge and skills, employment of competent financial experts and the availability

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[4] In the different contexts, there are some distinct forms of information asymmetry that might occur.

Asymmetry of regulatory information is where an administrative department on one side of the market knows and participates in the regulations, but the other side the of market does not.

Asymmetry of local market regulations - this asymmetry particularly relevant to China as the operation of China administration is approval-intensive. A financial firm will not be able to precisely understand the local market regulations.

The problem of non-transparent administration is that the authoritative interpretation usually comes out in non-standardised and irregular formats, which need to vary from case to case.

of policy and market information, all have a positive spillover impact over time (Porteous, 1995; Crozet and Koenig, 2005). In the long term, these advantages may eventually turn into a source of regional economic growth, which influences the surrounding areas positively.

On the other hand, financial agglomeration also highlights the issue of inequity at the same time (Lee et al, 2012). As financial agglomeration could generate two fragmented financial markets in a country, the organised and modernised financial market located mostly in the financial agglomeration area, and the unorganised financial market with a large number of traditional and informal financial activities. Because of the fragmentation of the two markets, capital cannot flow between them effectively (Shaw, 1973; McKinnon, 1973). The financial agglomeration area will eventually generate a greater competitive advantage and plunder financial resources from neighbouring regions, resulting in wealth disparities and a reduction in the capacity of finance to support the real economy in surrounding areas (Liu et al, 2013; Wang et al, 2019; Yang et al, 2006).

To sum up the discussion above, according to the available evidence, an issue has arisen in the trade-off between financial agglomeration and regional inequality, and there a little agreement regarding the impact of financial agglomeration on economic growth (Crozet and Koenig, 2005). Thus, it is necessary for policymakers and researchers to take this issue into serious consideration, further investigation will be needed. we are motivated to discover the impact of agglomeration on the regional economic growth in China, and attempt to evaluate the spillover effect of financial agglomeration on economic growth in three different regions.

Although there are many debates focused on financial Deeping in China, there are still fewer studies that have been concerned about the influence of financial agglomeration on the development of China's regional economy, in particular, the studies on the spillover effects of financial agglomeration. Thus, the purpose of this chapter is to determine the effect of financial agglomeration on economic development in China. The innovative element of this chapter is that we employed the spatial

econometrics technique to analyse the spatial effect of financial agglomeration spillovers on the economic growth across the different regions of China, and explained the regional disparity in China from the perspective of financial aggregation. There are four ways in which our work contributes to the literature: firstly, since there is a limited amount of literature on assessing the impact of financial agglomeration, especially in terms of indirect effect (spillover effect), and those research only focuses on a special area of the countries (Groenewold et al, 2008). Our study provides new evidence that focuses on the financial agglomeration's spillover impact on regional economic growth across China with three different regions and thus adds to the current discussion on China's regional economic growth. Secondly, our study employs the new indicator of regional location entropy to explore financial agglomeration's spillover impact in three different regions of China. In addition, we also adopted the index of global Moran's I to measure the spatial distribution characteristics of agglomeration for each region of China. Thirdly, since Tobler (1979) demonstrated the significance of the "first law of geography" (Everything is related to everything else, but near things are more related to each other), the spatial correlation was commonly assumed to exist in the most of variables and the traditional econometric approach. Thus, the traditional econometric approach used to explore the spatial effects will be less efficient, but the spatial econometric approach has largely been neglected in recent studies. In this case, this study will employ a spatial econometrics approach to investigate the spatial effect of financial agglomeration on regional economic growth in the different regions of China. Lastly, this chapter contributes by quantifying the spillover effects of financial agglomeration on economic growth. With the use of the spatial Durbin model, we enable to investigate the spatial spillover impact of financial agglomeration through interactions between provinces.

5.2 Literature review

Financial agglomeration has been discussed in the past to determine its influence on economic development. But, there hasn't been a clear agreement formed in the literature, the empirical studies focused on China in this context are quite limited and

shown conflicting findings

Most of the studies believed agglomeration of the financial industry generally has a crucial impact on economic development (Ran et al, 2006; Tian et al, 2021; Wang et al, 2021; Ye et al, 2018; Yuan et al, 2019, 2020). Ran et al (2006) use the fixed panel method with the data from 31 provinces in China during the period of from 2002 to 2013 to examine differences in the relationship between finance and the economy in the eastern and western regions of China. According to their study, financial development led to economic growth in the long term in the Western region of China. Nevertheless, in the East, the causality relationship between financial agglomeration and economic growth has been both confirmed significantly in the long-term and short-term. Wang et al (2021) employed the Granger causality method at the provincial level in China from 2000 to 2017 to outline the characteristics of the regional disequilibrium of China's financial asset allocation and examine the relationship between financial resources and economic growth. Their findings demonstrate that economic growth in the central area and nationwide was Granger caused by financial development. Financial development was a direct result of economic progress in the Northeast, but there is no evidence of a causal relationship in the West. Tian et al (2021) also give a similar result to support this view. Tian et al (2021) employed the Spatial Durbin method with regional data from ten major urban agglomerations proposed by the National Development during the period of 2008 to 2017 to investigate the effect of financial agglomeration on urban agglomerations. They stated that the financial agglomeration is beneficial to the urban agglomeration in China and support them growth

A similar result also can be found in city-level studies, Ye et al (2018) employ the Spatial Durbin model with 77 cities in YREB (Yangtze River Economic Belt region) of China from 2006 to 2016 to investigate the effect of financial agglomeration to urbanisation. The findings demonstrate that the YREB has the features of financial agglomeration and that financial agglomeration significantly enhances both population and economic urbanisation. Yuan (2019, 2020) also provided evidence for the positive

effect of financial agglomeration on China's economy. They employ different data sets and methods to discuss the effect of financial agglomeration on the green transition of China's economy. Yuan et al (2019) employed the spatial Durbin model and panel data set with 285 Chinese cities during the period from 2003 to 2015 to explore the relationship between financial agglomeration and green development. The results show that both financial agglomeration and green economic development have demonstrated a trend of spatial convergence, and financial agglomeration can promote the green development of both focal and surrounding cities. Yuan et al (2020) employed the threshold regression model over 272 prefectural-level cities in China from 2003 to 2014 to investigate the threshold effect on the regional boundary of financial agglomeration. They found that the promotion of local green development is greatly supported by financial agglomeration and the financial agglomeration level affects the spillover effect's regional boundaries.

There are still some studies that are sceptical about this argument (Wang et al, 2019; Lee et al, 2012). Wang et al (2019) employ the Spatial Durbin Model and 174 counties within 13 cities in the region of Beijing-Tianjin-Hebei over the period 2007–2016 to examine the relationship between regional financial development and economic growth. They stated that once an area has developed into an economic and financial agglomeration area, the inevitable consequences include the plundering of financial resources from surrounding areas, and a reduction in the ability of finance to serve the real economy in neighbouring regions, in order to increase the degree of considerable competitive advantage. Lee et al (2012) use the VAR (vector auto regression) with both regional-level and provincial-level data during the period of 1987 to 2004 to examine the relations among national economic growth, economic disparity, and financial disparity in China. they find that financial resource agglomeration makes financial disparity and also has a significant negative effect on economic growth.

To sum up, since the available research is mostly concerned with the theoretical study of financial agglomeration, the empirical process has yet to reach a consensus on the effect of financial agglomeration on regional economic growth. Besides, with the

reform of China's financial industry and the deregulation of finance, the spatial agglomeration characteristics of the financial industry are obvious. But, there are only a few research focus on the effect of financial agglomeration from a spatial perspective, it is difficult to have a confirmation of the effect of financial agglomeration in China. As a result, Compared to previous studies, we make some improvements to fill this gap by estimating both a direct effect and spatial spillover effect from financial agglomeration on the economic growth in different regions of China. Firstly, we employ location entropy to quantify the financial agglomeration in China's three regions and examine the spatial distribution of financial agglomeration features using the Moran I index, which demonstrates the spatial autocorrelation of financial agglomeration. Besides, we analyse the spatial differences in the impact of financial agglomeration in three different regions by employing the spatial econometric model. Then, we further test for the presence of intraregional spatial spillovers using the decomposition results of direct and indirect effects, and we identify the effect of financial agglomeration on economic growth. In the following sections, we describe the empirical methodology in detail.

5.3 Methodology

Financial agglomeration is a typical industrial spatial layout pattern that exhibits strong spatial correlation properties (Martin, 1999; Feng and Chen, 2018). Since the substantial externality associated with financial agglomeration, the possibility that financial agglomeration has an effect on its surroundings and to be influenced by its surroundings needs to be considered. As the existence of the spatial interaction, failing to take into account spatial autocorrelation might result in biased and ineffective parameter estimations (Arbia, 2014). Thus, in order to investigate the spatial spillover effect of financial agglomeration, we need to incorporate the spatial effect into the classic economic growth model to analyse the spatial effect of financial agglomeration. The spatial econometrics methodology has always been accepted as an effective way to estimate the regional effect. In this case, we have employed the index of global Moran's

I first to estimate the spatial dependence and spatial distribution pattern of China's provinces, and then adopted the spatial econometrics approach to estimate the spatial effect of financial agglomeration spillovers on economic growth in the three different regions, respectively (Ertur and Koch, 2007).

5.3.1 Economic growth model

The theoretical background of our research relates to the neoclassical growth theory and the Solow model augmented with human capital and financial agglomeration (Mankiw et al., 1992; Solow, 1956; Ductor and Grechyna, 2015; Lucas, 1988; Romer, 1986). The augmented Solow model is based on the Cobb-Douglas production function specification whereby the output is a function of physical and human capital, labour and financial agglomeration. In this framework, the neoclassical model assumes that capital is subject to diminishing returns, and economic growth tends to converge in steady states. Because the factors of production move across regions for the highest return and factor prices have perfect flexibility, the different prices of factors among regions will automatically be removed (Harris, 2011). In this case, in the long run, there would be no substantial disparities in the factors of production across different regions; the gap in technological development becomes the primary source causing the regional growth disparities (Harris, 2011). Compared with endogenous growth theories, the augmented Solow model relies on the strong assumption that all regions need to converge to their steady state at the same speed, which is a benchmark to assess cross-regional structural differences and analyse cross-country/regional differences in economic performance (Mankiw et al., 1992; Hall and Jones, 1999; Bernanke et Gurkanyak, 2001). Thus, the augmented Solow model is more suitable for our research in this chapter to investigate the effect of financial agglomeration on different regional economic growth in China.

Within this context, we have employed Solow's (1953) growth model augmented with human capital (*HC*) and financial agglomeration (*FA*). We assumed the exogenous technical development can be affected by financial agglomeration and human capital

(Durusu-Ciftci et al, 2017; Harris, 2011,Yang, 2019).

Financial agglomeration (*FA*) and human capital (*HC*) could affect economic growth through improvements in technological development (*A*). To be more specific, financial agglomeration encourages speed up regional economic growth by providing funds for the development of innovation in infrastructure construction, improving social production efficiency and transaction efficiency (Karltorp et al, 2016; Szirma, 2012; Yin, 2013). A country's potential for economic development is influenced by the level of human capital it has since more innovative ideas are generated when people have a greater level of human capital (Solow, 1956; Ductor and Grechyna, 2015; Lucas, 1988; Romer, 1986).

The model specification in this chapter is expressed as follows:

$$lny= \beta_0 + \beta_1 lnFA + \beta_2 lnHC + \beta_3 lnk + \varepsilon_i \qquad (5.1)$$

Where: y is GDP per capita, FA is financial agglomeration. HC is human capita; k is capital per capita.

5.3.2 Spatial econometrics methodology

As the main objective of this chapter is to investigate the spatial spillover effect of the financial agglomeration on economic growth, thus, the spatial econometric approach has been considered in this chapter to conduct the empirical analysis for several reasons. From the economic perspective, the spatial econometric approach includes the spatial lagged term. As the substantial externality associated with financial agglomeration, the possibility that financial agglomeration has an effect on its surroundings and to be influenced by its surroundings needs to be considered (Arbia, 2014). From the econometrics/statistical perspective, Since Tobler pointed out the "First Law of Geography" in 1979, the spatial dependence was commonly assumed to exist in the most of variables and the traditional econometric approach. The spatial dependence can be considered "the existence of a functional relationship between what happens at one point in space and what happens elsewhere". As the spatial dependence could lead to the dependence of the error in the linear regression model, which would

break the hypothetical conditions of ordinary least squares (OLS) estimator that is independent and identically distributed, which will cause biased estimation results under the hypothesis (Elhorst, 2014a). In this case, to reduce biases from this potential spatial dependence, an appropriate spatial econometric method is required to employ.

To estimate the spatial effect of financial agglomeration on regional economic growth in China, we need to prove the existence of spatial dependence to decide whether to employ a spatial econometric model as the first step, and then to choose an appropriate spatial econometric method to employ.

The Moran's I test is typically employed as the first test in spatial estimation in practise to evaluate spatial dependence. The index of global Moran's I is an index that refers to the spatial association, which quantifies the similarity of observations across geographical units, as well as measures (Moran, 1950).

The index of Moran's I can be defined as follows:

$$I = \frac{\sum_{i=1}^{n}\sum_{j=1\ i\neq j}^{n} w_{ij}(x_i-\overline{x})(x_j-\overline{x})}{\left(\sum_{i=1}^{n}\sum_{j=1}^{n} w_{ij}\right)\left(\frac{1}{n}\sum_{i=1}^{n}(x_i-\overline{x})^2\right)} \tag{5.2}$$

Where: $i, j = 1, 2 \ldots, n$, $\overline{x} = \frac{1}{n}\sum_{i=1}^{n} x_i$ The variables x_i and x_j represent the values of the observed variable at the locations i and j, respectively. $\overline{x}$ represents the mean value of the observed variable across all locations, n denotes the total number of provinces and w_{ij} is a binary spatial weight matrix with dimensions n x n.

The binary spatial weight matrix has long been recognised as one of the widely utilised spatial contiguity-based weight matrices (Anselin, L,1988;Anselin, L,1996; Sgrignoli et al, 2015). The matrix can describe the spatial relationship between location i and location j as follows:

$$W = \begin{cases} 1 & \text{When areas i and j are adjacent} \\ 0 & \text{When areas i and j are not adjacent} \end{cases}$$

Generally, the index of Moran's I falls within a certain range (-1, 1). If the index closes to 1, this suggests that the observed variables have a positive spatial dependency, which means that variables in different locations tend to cluster. If the index closes to -1, it means variables in different locations tend to be spatially separated. If the index equals 0, variables show a random spatial pattern.

After confirming the existence of spatial dependence using Moran's I index, the proper spatial econometric models should be chosen to control for spatial dependence. The spatial lag model (SLM), the spatial error model (SEM), and the spatial Durbin model (SDM) are the three most often used models. The model selection among these three different models will be determined by the different spatial interactions between the dependent variable and independent variables.

These three spatial methods have been used under different conditions. First, whenever the dependent variables interact endogenously, the SLM will be used, and it is well-suited for detecting and quantifying spatial interaction's existence and degree, as SLM is capable to capture this impact of the spatial lag term of the dependent variable from the neighbouring region on the local area's observed value y in both direction and amplitude. Next, whenever the variables interact exogenously and cause spatial dependency, the SEM will be used. The SEM utilises errors from the variables in neighbouring locations to display spatial covariance.The third SDM has been widely employed to explore the effects of different spatial interactions. This model expands previous panel models by adding a spatial dimension that controls for spatial spillovers (Elhorst, 2014). The SDM integrates the SLM and the SEM to capture spatial interactions from both the endogenous interaction effects and the exogenous interaction effect. The inclusion of the spatial lag dependent variable and spatial lag independent variables helps in reducing the endogeneity bias associated with the omitted variables and the unobservable exogenous interaction effect between independent variables. (LeSage, 2008; Elhorst, 2012;).

The test of spatial lag (LR-lag) and the test of spatial error (LR-error) to determine whether SDM may be simplified into an SLM or SEM. If both tests are all at a significant level, which means that SDM is more appropriate for study, we should reject the null hypothesis that the SDM can be simplified into the SLM and SEM; in contrast, if the statistics are non-significant, the SDM can be simplified into the SLM or SEM (Ramos, 2005).

As the advantage of the SDM has not only in its ability to produce consistent and unbiased estimates by overcoming the omitted variables and ignored spatial heterogeneity in the spatial lag and error model (Huang, 2018), but also in the fact that it does not impose prior restrictions on the magnitude of the potential spatial effects (Elhorst, 2014). This chapter will employ SDM as the econometrics method. The model is expressed as follows:

$$Y_{it} = \alpha + \rho W y + \varphi X_{it} + \theta W X_{it} + \varepsilon \tag{5.3}$$

where: Y_{it} is the dependent variable; y is the lag of the dependent variable; Wy represents the spatial lag term of the dependent variable, which captures the endogenous interaction effect; X_{it} is the independent variables set, which included the $lnFA_{it}$, $lnk_{i,t}$ and $lnHC_{i,t}$; W is a binary spatial weight matrix with dimensions n by n; $\theta W X_{it}$ represents the spatial lag term of independent variables (also called Durbin component) and denotes the exogenous interaction effect between independent variables. ε is a random error term.

In order to investige the spatial financial spillover on regional economic growth in China, the equation of 5.3 can be rewrite as follow:

$$lng_{i,t} = \alpha + \rho \sum_j^i W\, lng_{i,t} + \varphi_1 lnFA_{it} + \varphi_2 lnk_{i,t} + \varphi_3 lnHC_{i,t} + \vartheta_1 \sum_j^i W lnFA_{i,t} +$$

$$\vartheta_2 \sum_j^i W lnk_{i,t} + \vartheta_3 \sum_j^i W lnHC_{i,t} + \varepsilon \tag{5.4}$$

where: $lng_{i,t}$ is the growth GDP per capita in logarithm; $W lng_{i,t}$ represents the spatial lag term of the growth GDP per capita in logarithm; $lnFA_{i,t}$ represent the variable of financial agglomeration in logarithm; $lnk_{i,t}$ is the indicator of capital per capita in logarith $lnHC_{i,t}$ is human capital in logarith. W is a binary spatial weight matrix with dimensions n by n; $W lnFA_{i,t}$, $W lnk_{i,t}$ and $W lnHC_{i,t}$ are the spatial lag term of independent variables for variable of $lnFA_{i,t}$,$lnk_{i,t}$ and $lnHC_{i,t}$ respectively; ε is a random error term.

However, there's an econometric issue regarding employing the SDM to estimate the equation of (5.4). When spatial econometric models are used to explore the effect of independent variables on the dependent variable, the changes of independent

variables not only provide a direct effect on the dependent variable in the local area, but also a feedback effect (spillover effect) from the changes of the dependent variable in the neighbouring area will loop back into the dependent variable in the local area. Since the traditional point estimation approach is not able to capture this feedback effect, the coefficients of variables have been resulted biased, therefore making it impossible to assess the influence of independent variables on the dependent variable effectively and accurately (Elhorst, 2010). As a result, in order to more clearly comprehend the effect from independent variables in the local area and neighbouring regions in SDM, Lesage and Pace (2009) derive through the partial differential matrix decomposition to divide the effect from the changes of independent variables in the local region as the direct effect, and effect from the variables' changes in neighbouring regions on the local area as the indirect effect (spillover effect). The matrix diagonal elements and non-diagonal elements represent direct and indirect impacts, respectively (Lesage and Pace, 2009; You and Lv, 2018). Accordingly, this chapter will follow this approach to investigate the effect of financial agglomerations on economic growth in the different regions of China by analysing the direct and indirect effects.

Since the spatial econometrics model takes the spatial lag term of variables as an independent variable, there could be an endogeneity problem caused by the correlation between the independent variables and residuals. The ordinary least squares estimator no longer provides consistent results. Besides, the GMM method can be used to estimate high-order autoregressive models, but the maximum likelihood estimation (MLE) is more efficient if the residual term follows a normal distribution. Thus, we applied the maximum likelihood estimation (MLE) to address endogeneity bias (see Besley and Case, 1995; Bordignon et al, 2003; Caldeira et al, 2015; Lee and Yu, 2010 for the use of MLE within a spatial econometrics context).

5.3.3 Variable definition

This section contains information on the variables we used in this chapter to evaluate the effect of financial agglomeration on economic growth in three different

regions of China. In order to conduct empirical research, the spatial panel regression model is set up with a dependent variable measured by the growth of GDP per capita at the provincial level. We use explanatory factors that are widely used in the empirical growth literature: physical capital and human capital. Besides this, our study has also applied the location entropy index to measure financial agglomeration in different regions.

Regional economic growth ($lng_{i,t}$)

In order to explore the exogenous component that affects the regional economy via financial agglomeration, we employ the indicator of the growth of GDP per capita in logarithm ($lng_{i,t}$) for regional economic growth in each province.

Financial agglomeration ($lnFA_{i,t}$)

$lnFA_{i,t}$ represent the variable of financial agglomeration in logarithm in this chapter, Due to the fact that there are large differences between regions and provinces in China, the traditional financial index cannot accurately provide spatial distribution. In this case, we refer to the recent literature (Du and Zhang, 2018; Yuan et al, 2020) to create a new location entropy index measured by the number of financial practitioners to determine an area's financial agglomeration, since the location entropy index has the advantages to making an accurate representation of financial agglomeration distribution by minimizing the influence from different regional sizes (Xiao et al, 2018). The greater amount of the location entropy index implies the agglomeration is at a higher level, and vice versa.

The calculation formula for *FA* is expressed as:

$$FA_{it} = \frac{E_{it}/W_{it}}{E_t/W_t} \tag{5.5}$$

Where: E_{it} represents the number of employees in the financial industry at the time t in the province i; W_{it} denotes the total number of employees employed in the whole industries at the time t in province i; E_t represents the number of employees in the financial industry at the time t in nationwide; W_t denotes the total number of employees employed in the whole industries at the time t in nationwide.

Physical capital ($lnk_{i,t}$)

The indicator of capital per capita in logarithm ($lnk_{i,t}$) is set up to represent the variable of physical capital. To estimate the capital stock, we choose 1978 as the base year to create the provincial capital stock series by following the perpetual inventory approach. The perpetual inventory method was created by Goldsmith in 1951, who pointed out that the current capital stock can represent the previous period of capital stock deducting depreciation plus the current investment. The basic formula is the following description:

$$K_t = I_t + (1 - \delta_t)K_{t-1} \tag{5.6}$$

Where: K_t stand for the capital stock in the year t; K_{t-1} represents the capital stock in the year t-1, I_t is capital investment in the year t, δ_t represents the depreciation rate (the depreciation rate δ_t can be calculated in the equation of 5.7).

Capital investment (I_t) can be defined as the stream of past investments to the capital stock in a certain period. We employ fixed capital formation as an indicator for incremental capital. The fixed capital formation excludes all kinds of financial assets, inventories stocks, other operating costs, as well as land sales and purchases (Holz, 2006).

To calculate the depreciation rate δ_t, we follow the study of Huang et al (2002) to assume the relative efficiency of capital goods presents geometric diminishing. The formula for the geometric age-efficiency decline of the asset can be expressed as:

$$d_\tau = (1 - \delta)^n \tag{5.7}$$

$$\delta = 1 - \sqrt[n]{d_\tau} \tag{5.8}$$

Where: d_n indicates the relative efficiency of capital products; the depreciation rate is represented by the symbol δ; n refers to the age.

Following OECD (2009); Huang et al (2002); Holz and Yue (2018); the relative efficiency of capital goods d_τ can be represented by the ratio of residual value of capital goods to the total value of capital goods, which is 4% on average. It also implied the capital products reach the end of their useful lives, their relative efficiency is only 4 percent of the newly manufactured capital products.

Besides, according to the NBS yearbooks, capital goods have been divided into

three categories: buildings and facilities, equipment and materials, and other investments. Because capital goods in different categories have different depreciation rates, for instance, the depreciation rate of capital goods in the manufacturing industry is expected to be substantially higher than in other industries, capital goods in three different categories have been assumed with different durations of life (Holz and Yue, 2018). Thus, in this chapter, we have calculated the rate of depreciation for the capital goods in three different categories separately and then taken a weighted average of the rates to determine the depreciation rate of capital goods at the provincial level. Following the experiences of other nations (as described in the OECD, 2009) and the research of Zhang (2008), Huang et al (2002), Holz and Yue (2018), the average service lives of capital goods in the category of buildings and facilities is 40 years, in the category of equipment and materials is 16 years, and in the category of other investments is 25 years. Accordingly, the depreciation rates for each category of capital goods are 6.9%, 14.9%, and 12.1% respectively.

To determine the depreciation rate of fixed capital formation, it is necessary to consider the relative weights of the three different categories of capital goods. Since the Statistical Yearbook of China has not released the provincial data for these categories of capital goods until recent years, We firstly compute the relative weights of these three different categories of capital goods at the national level, and then assumed that the relative weights at the national level are approximately the same the relative weights at the provincial level. According to the study by Zhang (2008) and Huang et al (2002), the relative share of these three different categories of capital goods in the total fixed capital formation is 63% occupied by investment in buildings and facilities, 29% occupied by the equipment and instruments purchases, and other investments occupied 8%. As a result, under the assumption of the relative efficiency of capital goods presents geometric diminishing, the depreciation rate of fixed capital formation in each province will be set at 9.6%.

Last, to measure the capital stock in the base year 1978, we base our study on the method applied by Hall and Jones (1999) through the investment in the base year

1978 divided by the sum of the geometric average growth rates of investment in fixed capital formation and the depreciation rate of capital goods. The equation can be represented as

$$K_0 = \frac{I_0}{g + \delta} \tag{5.9}$$

Human capital ($lnHC_{i,t}$)

The average schooling year's indicator in logarithm ($lnHC_{i,t}$) will be used in this chapter to measure human capital (Hall and Jones, 1999). According to their study, the years of schooling can be used to determine the stock of human capital. Thus, the human capital-augmented labour can be estimated from $L_{it} = L_{it}^0 * E_{it}$, where L_{it}^0 represents the total number of the labour force (in millions), E_{it} is the average number of years of labour force spent in education and $E_{it} = 6e_1 + 9e_2 + 12e_3 + 16e_4$ (e_i is the share of the number of graduates from primary school (6 years spent on the study), secondary school (9 years spent on the study), high school (12 years spent on the study), college or above to total population (16 years spent on the study), respectively. (Hall and Jones, 1999)

5.3.4 Data

In order to explore the effect of financial agglomeration on economic growth in three different regions of China, we collected data from 26 provinces and 4 municipalities during the period of 2005 to 2016. All of the data was collected from the Chinese Statistical Yearbook, each province's statistical yearbook, and China's Finance and Banking Yearbook, all of which were released by the Chinese National Bureau of Statistics.

We divided mainland China into three regions: the Eastern region includes eight provinces (Fujian, Guangdong, Hainan, Hebei, Jiangsu, Liaoning, Shandong, and Zhejiang) and three municipalities (Beijing, Shanghai, and Tianjin). The Central region includes eight provinces (Anhui, Henan, Heilongjiang, Hubei, Hunan, Jiangxi, Jilin, and Shanxi) and the Western region includes six provinces (Gansu, Guizhou, Qinghai, Shaanxi, Sichuan, Yunnan), one municipality (Chongqing), and five autonomous

regions (Inner Mongolia Ningxia, Tibet, Guangxi, and Xinjiang). Table 5.1 has displaied the descriptive statistics for each variable.

Table 5.1 Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
$lnFA_{i,t}$	360	-0.072	0.325	-0.743	1.031
$lnk_{i,t}$	360	4.210	0.318	3.444	5.024
$lnHC_{i,t}$	360	4.270	0.365	3.254	4.817

5.4 Results

5.4.1 Spatial-temporal characteristics analysis

Before conducting the empirical study, we use software of ArcGis to visualise the spatial-temporal distribution characteristics of financial agglomeration and regional economy across 30 provinces and municipalities in China. As described in Figure 5.1, the value of variables has been classified into five levels based on the Jenks natural breaks algorithm. Higher levels of agglomeration and economic growth are indicated by a darker colour. If a province is at the middle level (orange colour) or above (going to dark colour), which means this province's performance is above the average level of the surrounding area, thus may have spillover effects on its neighbouring provinces. On the other hand, if the province is at the lower level (going to yellow colour), which means this province was in a competitive disadvantage position, and cannot produce positive spillover effects on economic growth.

Figure 5.1(a) shows the spatial distribution of economic growth in China at the province level measured by $lng_{i,t}$. As can be seen from Figure 5.1(a), provinces with a high level of $lng_{i,t}$ tend to concentrate on the east coastal part of China, and provinces with low-income levels are also contiguous in the west and central part of China, which demonstrates there is a spatial effect on the neighbouring provinces.

Figure 5.1(b) shows the spatial distribution of financial agglomeration measured

by $lnFA_{i,t}$. Figure 5.1b, clearly shows that the distribution of financial employees varies across regions and years. Over time, the financial employees gradually migrated to provinces in central areas and the eastern part of China, which keep a relatively higher distribution density than other provinces.

Overall, there was a tendency toward agglomeration on the variable of $lnFA_{i,t}$ and $lng_{i,t}$ among regions, which demonstrated those variables have exhibited obvious spatial dependence.

Figure 5.1(a) The spatial distribution of GDP per capita at the province level

2005	2008	2010
2012	2014	2016
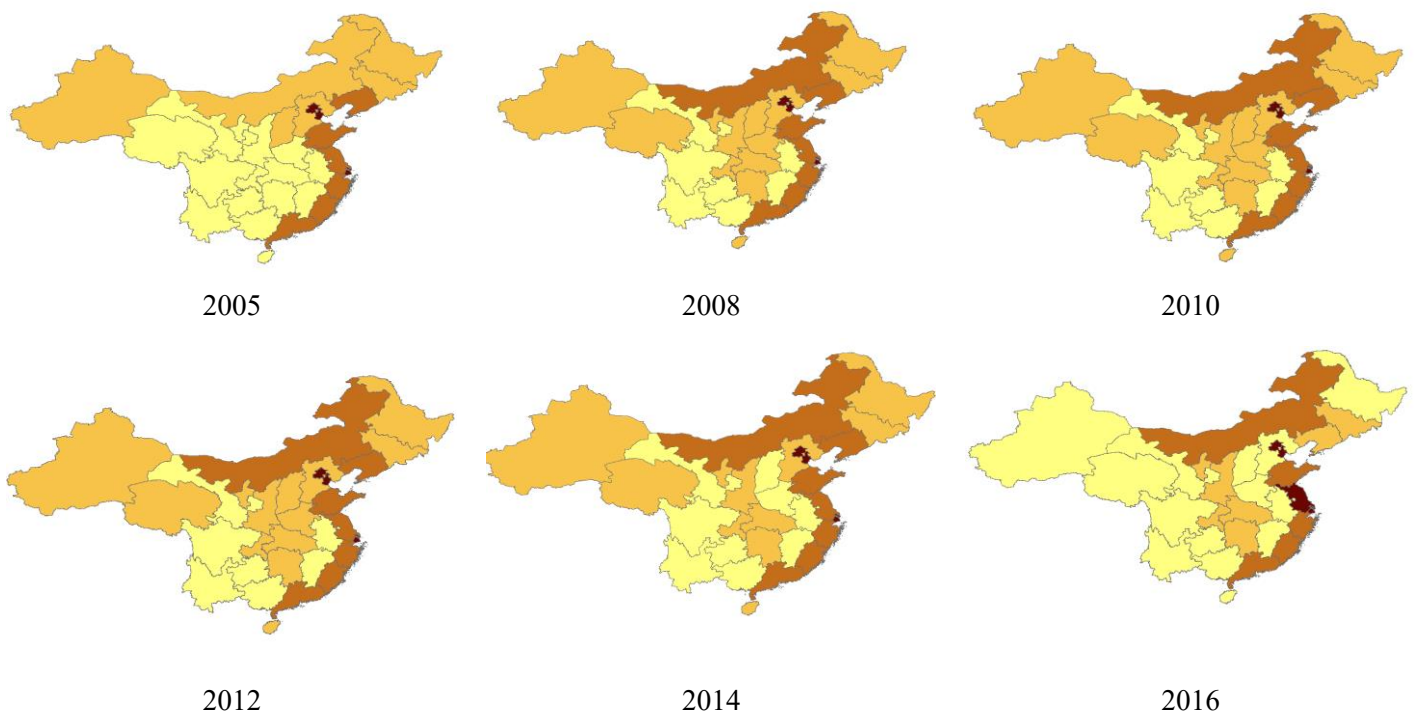
Figure 5.1(b) The spatial distribution of financial employees at the province level

2005	2008	2010

2012	2014	2016
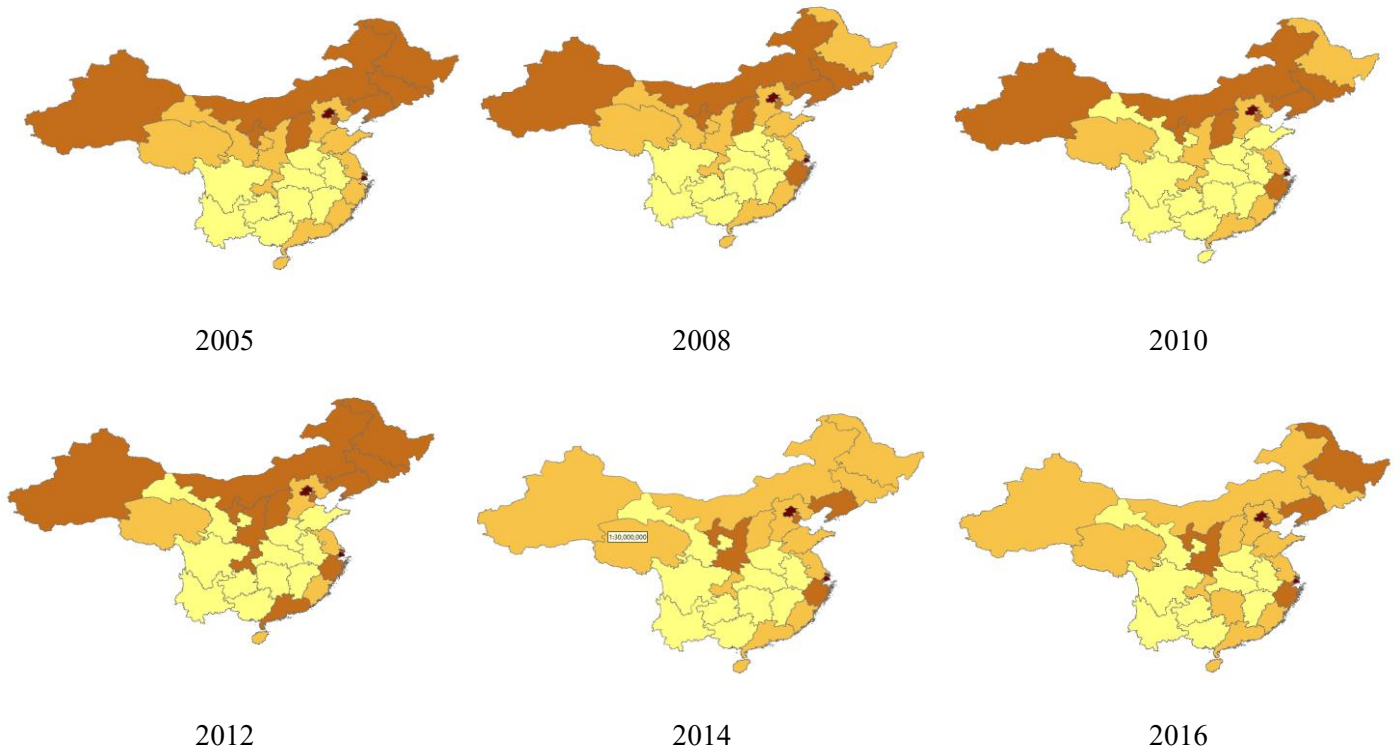
5.4.2 The spatial autocorrelation analysis

To further investigate the degree of spatial dependence and the pattern of variables' spatial distribution in our study, the global Moran's I index has also been applied. The results of Moran's I index are summarised in Table 5.2. The results show that $lng_{i,t}$ is positive at all significant level in all years. Besides, the variables of *financial agglomeration* $lnFA_{i,t}$ presented the failure to pass the significance test from 2011 to 2014, but $lnFA_{i,t}$ has not been completely randomly distributed, there are still obvious geographical agglomeration features among regions. These results support the analysis of the spatial-temporal characteristics above and indicate that variables of $lng_{i,t}$ *and* $lnFA_{i,t}$ have spatial dependence, and both variables generally have exhibitted a spatial agglomeration trend.

Table 5.2 Moran's I index

	$lng_{i,t}$		$lnFA_{i,t}$	
Year	Moran's I	P-Value	Moran's I	P-Value
2005	0.442	0.001	0.215	0.022
2006	0.449	0.001	0.1945	0.033
2007	0.442	0.001	0.174	0.047
2008	0.446	0.001	0.185	0.037
2009	0.446	0.001	0.173	0.042
2010	0.453	0.001	0.143	0.079
2011	0.447	0.001	0.114	0.136
2012	0.433	0.001	0.088	0.209
2013	0.423	0.001	0.087	0.208
2014	0.406	0.002	0.105	0.125
2015	0.407	0.001	0.169	0.026
2016	0.423	0.001	0.233	0.005

5.4.3 The spatial econometric estimation results

As discussed in Table 5.3, it is found that the variable of financial agglomeration has spatial dependence, which suggests that the spatial econometric model may be used to investigate the spatial effect of financial agglomeration on economic growth. Given the enormous difference in economic development across China's provinces, and the disparity in financial resources among these provinces, we split the 30 provinces and municipalities throughout the country into three sub-sample sets: eastern region, central region, and western region, then proceed to the estimation by using the spatial econometrics model.

Table 5.3 Spatial Durbin Model estimation and test results

Variable	Eastern region		Central region		Western region	
	Coefficients	P-value	Coefficients	P-value	Coefficients	P-value
Main						
$lnFA_{i,t}$	0.184	0.000	0.593	0.000	0.714	0.000
$lnk_{i,t}$	0.461	0.000	0.171	0.000	0.473	0.000
$lnHC_{i,t}$	-0.217	0.000	0.316	0.000	0.108	0.000
Wx						
$lnFA_{i,t}$	0.271	0.015	-0.377	0.147	-0.031	0.820
$lnk_{i,t}$	-0.421	0.000	-0.351	0.041	-0.223	0.087
$lnHC_{i,t}$	0.420	0.000	-0.554	0.000	0.0.134	0.028
rho	0.099	0.360	-0.309	0.196	-0.209	0.252
LR test spatial lag	76.69	0.000	26.58	0.000	64.34	0.000
LR test spatial error	76.37	0.000	26.26	0.000	112.27	0.000

Table 5.3 summarizes the results of the spatial Durbin model of equation of 5.3, which was used to quantify the spatial effect of financial agglomeration on economic development in each of the three regions. By analysing the spatial lags of variables, we have investigated the spatial effect of financial agglomeration spillovers on neighbouring regions.

Additionally, we also conducted the LR test in Table 5.3, which was used to determine if the spatial Durbin model could be reduced to either spatial error model or spatial lag model. As determined by the LR lag test, the null hypothesis, which states that SDM model can be reduced to the SLM model, has been rejected in each of the three regions at 1% significance level. Similarly, the LR error test also rejects the null hypothesis, which states that SDM model can be reduced to SEM model in all eastern, central, and western regions at 1% significance level. The results presented above demonstrate that the SDM model is more relevant than the SLM and SEM models in

our study.

Besides this, due to the traditional point estimation approach is not able to capture the feedback effect of variables, and makes the coefficients estimated by SDM to be biased (Elhorst, 2014). Therefore, in order to more clearly understand the spatial effect from independent variables in the local area and neighbouring regions, we have applied the partial derivative approach to further decompose the variables' coefficients estimated by SDM to the direct effect and the spillover effect. The results for the eastern region, central region, and western region are presented in Tables 5.4, 5.5, and 5.6, respectively.

Table 5.4 Estimation results of SDM in the eastern region of China

	Direct effect		Indirect effect	
Variable	Coefficients	P-value	Coefficients	P-value
$lnFA_{i,t}$	0.310	0.000	0.192	0.001
$lnk_{i,t}$	0.296	0.000	-0.250	0.000
$lnHC_{i,t}$	-0.039	0.083	0.267	0.000

From Table 5.4, it can be seen that from 2005 to 2016, the coefficient of $lnFA_{i,t}$ in the provinces of China's eastern region is 0.310 considered significant at the 1% level, which indicated that the economic growth of eastern provinces can be benefited from financial agglomeration. At the same time, the results from Table 5.3 also show that the coefficient of $lnFA_{i,t}$ for spillovers effect was 0.192 at the 1% significant level, which implied that increasing financial agglomeration in the provinces of China's eastern region also benefits the economic development of their neighbouring provinces. Financial agglomeration networks in eastern region of China can effectively minimise the cost of financial transactions by the sharing infrastructure, exchanging information, and convenient communication; accelerating the knowledge spillover by cooperating networks, forming a knowledge-sharing mechanism; thus, the eastern region of China

has achieved the best economic performance region of China.

In addition, the increasing the $lnk_{i,t}$ in the provinces in the eastern region of China will significantly increase (0.296 at 1% significance level) the local economic growth and will significantly decrease (-0.250 at 1% significance level) economic growth in adjacent provinces. Moreover, for $lnHC_{i,t}$, with the 1% increase in human capital in the eastern region of China, the local economy will decrease by 0.039 while that in adjacent provinces will increase by 0.267.

Table 5.5 Estimation results of SDM in the central region of China

	Direct effect		Indirect effect	
Variable	Coefficients	P-value	Coefficients	P-value
$lnFA_{i,t}$	0.445	0.00	-0.286	0.050
$lnk_{i,t}$	0.065	0.347	-0.198	0.018
$lnHC_{i,t}$	0.146	0.001	-0.329	0.000

On the other hand, financial agglomeration generates an adversely spatial effect on economic growth in the provinces of China's central region. Table 5.5 demonstrates that financial agglomeration and economic growth are significantly correlated in the central region of China. The economic growth in the provinces of China's central region has been favourably influenced by the improvement of $lnFA_{i,t}$ (0.445 at 0.01 significant level), which can be concluded that improving the level of financial agglomeration in the provinces of China's central region is a more obvious way to stimulate the local economic growth in the central region of China. At the same time, the coefficient of the spillover effect from $lnFA_{i,t}$ is −0.286 at 5% significant level, which shows that increasing financial agglomeration in the provinces of China's central region will have a detrimental influence on the economic development of neighbouring provinces to a certain level, as it is partly caused by the limitation of the financial resources in the central region of China. Once a province has formed a financial

agglomeration area, this province will always plunder financial resources from the surrounding area and diminish the surrounding area's the capacity of finance to serve the real economic sector, in order to maintain its competitive advantage.

For control variables, the $lnk_{i,t}$ provided a favourable effect on economic growth in the provinces of China's central region with an estimated coefficient of 0.065, but, since it fail to pass the significant test at all levels, there is no statistic meaning on the economic growth. Besides, it has a negative effect in neighbouring provinces with an estimated coefficient of -0.198 at a 5% significant level, which means that, $lnk_{i,t}$ cannot provide a contribution to the development of the central region of China. For $lnHC_{i,t}$, the improvement in human capital in the provinces of China's central region generated a contribution to stimulate the local economy and a negative effect on neighbouring provinces (0.146 and -0.329 at 1% significant level respectively). The result indicates that improving the human capital level by attracting talented and skilled immigrants can create benefits for the regional economic growth in the central region of China.

Tables 5.6 provides the results of SDM for the western region of China. According

Table 5.6 Estimation results of SDM in the western region of China

	Direct effect		Indirect effect	
Variable	Coefficients	P-value	Coefficients	P-value
$lnFA_{i,t}$	0.680	0.000	-0.115	0.132
$lnk_{i,t}$	0.410	0.000	-0.203	0.007
$lnHC_{i,t}$	0.130	0.000	0.070	0.010

to the results from Table 5.6, the $lnFA_{i,t}$, $lnk_{i,t}$ and $lnHC_{i,t}$ all exhibit a positive effect on economic growth in the western region of China and the coefficients of those variables are highest among the three regions (0.680, 0.410, and 0.130 at 1% significant level respectively). The results have confirmed that the same input will obtain obviously and the highest benefits for the provinces of China's western region. However, we also found that the spatial effects of financial agglomeration spillover in the western region of China are not at a statistically significant level. It could be explained that due to the

limitation in financial resources, the financial agglomeration in the west region cannot even create influence on neighbouring provinces. Besides this, the variable of $lnk_{i,t}$ provides a negative effect on the surrounding provinces (-0.203 at 0.001 significant level), which means that economic growth in provinces of China's western region still needs capital support from the neighbouring area. Compared with the variable of $lnk_{i,t}$, the spillover effect of $lnHC_{i,t}$ is positive, but it is not obvious (only 0.070 at 1% significant level).

5.4.4 Discussion

To sum up, the result of this chapter similar with the typical conclusion of most studies that focus on effect of financial agglomeration in China. We have used the spatial econometric model with the regional data to provide the new evidence for previous studies to prove the effect of financial agglomeration on different regions of China. The results may be interpreted based on the literature previously discussed.

For the variable of financial agglomeration. Our conclusion based on the findings presented above is that financial agglomeration can generate a spatial effect on the economic growth in provinces and their neighbouring area over three different regions in China. Thereby financial agglomeration believed as the is one of the reasons to cause the regional economic disparity in China, which is the consistent with previous studies (Fan et al, 2011; Chen and Chen, 2015; Lee et al, 2012; Hu et al, 2019;Ye et al, 2018; Zhao et al, 2004). According to results, we believed that financial agglomerations can significantly stimulate local economic growth, and the higher level of the financial agglomeration will effectively promoting effect on local economic growth. but the spillover effect of financial agglomeration differs from one region to another, which is consistent with our anticipation and provided the new evidence to support the former studies (Lee et al, 2012; Hu et al, 2019;Ye et al, 2018;).

As the eastern region of China an economically developed area in China with the steady and rapid rate, the capital has grown over time and financial assets were enabled to be accumulated. Financial agglomeration in the eastern region of China not only

benefits local provinces, but can also positively stimulate the adjacent provinces, which can make all provinces in the eastern region of China take positive steps towards development, which is consistent with our anticipation and results from previous studies (Lee et al, 2012; Chen and Chen, 2015, Hu et al, 2019). As the eastern region of China an economically developed area in China with the steady and rapid rate, the capital has grown over time and financial assets were enabled to be accumulated (Ye et al, 2018; Lee et al, 2012). In this case, the fast growing eastern region has attracted a sizable number of financial enterprises, which lead to the financial agglomeration. Collaboration between banks, sharing of infrastructure, and exchanging information within a region are important factors to effectively promote local financial efficiency and further support regional economic growth (Lee et al, 2012; Chen and Chen, 2015). Thus, financial agglomeration in the eastern region of China not only benefits local provinces, but can also positively stimulate the adjacent provinces, which can make all provinces in the eastern region of China take positive steps towards development (Lee et al, 2012; Chen and Chen, 2015, Hu et al, 2019).

In comparison, in the central region of China, provinces need to take financial resources from the surrounding area to keep a fantastic growth rate; economic growth based on scarifying from neighbouring provinces. This outcome is consistent with the Liu et al, 2013; Wang et al, 2019; Hu et al, 2019. Although the majority of provinces have experienced various degrees of growth, the provinces in central regions lack infrastructure and transportation links to international markets, the pace of economic development and the distribution of financial resources are lagging behind those in the eastern region and become relatively underdeveloped areas with fewer financial assets (Hu et al, 2019;Ye et al, 2018).

In contrast with the eastern and central regions, the provinces in the western region of China cannot generate an effective spillover effect to influence its surrounding provinces, which is not consistent with our anticipation and different from the former studies. This result might be explained by the fact that the western region of China has the quite limited financial resources and the relatively lower level of financial

agglomeration (Wang et al, 2019; Liu et al, 2013; Wang et al, 2019; Yang et al, 2006). Although financial agglomeration in the western region has the highest coefficient on the local economic growth among the three regions, but it cannot provide a spillover effect on the surrounding area.

5.5 Conclusion

In conclusion, based on the spatial panel data from 30 provinces and municipalities during the period of 2005 to 2016, this chapter has investigated the spatial effect of financial agglomeration spillovers on economic growth in three regions of China. We firstly provided the analysis of spatial-temporal characteristics for variables of financial agglomeration and economic growth in China, and then the global Moran's I index has been applied to detect the spatial dependence of variables; finally, the spatial Durbin model has been employed to investigate the spatial effect of financial agglomeration spillovers on economic growth in three regions of China.

The findings reveal that, although financial agglomeration had a substantial role in the acceleration of local economic development in all three China regions, the spillover effects of financial agglomeration varied from region to region, which could be one of the reasons to explain the regional disparity. Specifically, the eastern region of China with a higher level of financial agglomeration has benefits in sharing of infrastructure, information exchange, reducing the costs of financial transactions, and accelerated knowledge spillover, and all of those are enabling the eastern region to become a fast economic growth region in China. However, financial agglomeration in China's central region provided a detrimental spatial spillover impact on the economic growth of the surrounding area. Because financial resources in China's central region are limited, the provinces of China's central region must rely on financial resources from neighbouring regions to maintain their competitive advantages. At the same time, the financial agglomeration in the western region of China cannot even provide an effective spillover effect to affect surrounding provinces, which implied that the spatial effect of financial agglomeration in the western region of China is not as significant as its in the eastern

and central regions of China

Besides, this chapter has offered the following crucial policy suggestions based on the findings and analysis. Given the finding from Chapter 5, financial agglomeration is believed to be not only a factor that influences the local economy and surrounding area but also one of the causes of regional disparity (Fan et al, 2011; Chen, & Chen, 2015; Lee et al, 2012; Ye et al, 2018; Yang et al, 2017; Zhao et al, 2004). In this case, it is necessary for the Chinese government to take the use of regional comparative advantages and execute a regional differentiation strategy in order to effectively utilise the spillover effect of financial agglomeration for the reduction of inequality (Fan et al, 2011; Hu et al, 2019; Yuan et al, 2019; Ye et al, 2018; Yang et al, 2017). On the one hand, as the eastern area contains the greatest concentration of financial resources, the economy in the local and adjacent areas is able to obtain benefits from financial agglomeration (Chen and Chen, 2015; Ye et al, 2018; Yuan et al, 2019; Hu et al, 2019). Thus, the regional financial centres are suggested to build appropriately. On the other hand, as the central and western regions are relatively backward in terms of financial agglomeration, the local government should integrate financial resources, standardise service functions, and broaden the scope of business to raise the level of financial agglomeration and take advantage of the positive effects of the spillover effect (Yuan et al, 2019; Hu et al, 2019).

Last, The conclusions of this chapter, like those of previous studies, contain a number of limitations, but it is nevertheless worthwhile for theoretical and empirical research to investigate how to analyse how financial agglomeration affects regional economic growth. As a result, this part aims to summarise the shortcomings and offer some recommendations for further research to further our work.

Our findings are limited to certain conditions. Firstly, as the economic disparity is a complex phenomenon, in this analysis, we are solely interested in the impact of a spillover effect from financial agglomerations, and we have not conducted a comparative study from other industries; accordingly, the insights of this chapter cannot be utilised to extend the link between other industries and regional economy disparities

in China. Besides, the empirical analysis conducted in our study is limited to Chinese provinces. As the extent of financial agglomeration varies from country to country, our findings could not be generalised to other countries as a common result. Thus, to draw more general scientific conclusions on the spillover effect of financial agglomeration, future research needs to enlarge the sample scale, especially in different countries for comparative analysis.

Chapter 6 financial constraint and Firms's innovation Activities

6.1 Introduction

Recently, literature on financial growth has drawn attention to the relationship between finance and firms' performance. The investigation in this nexus has mainly to do with the role of financial constraint in the development of innovation activities. Financial constraints are generally defined as barriers to accessing external financing like "lending bias" and "political pecking order". A perfect capital market would exclusively allocate financial resources to enterprises based on their predicted future profitability, and no other factors like: net worth, capital cost, internal funds, firm's capital structure, policy consideration would not be taken into consideration (Poncet et al, 2010). However, for asymmetric information and political reasons, financial constraints exist in a large number of firms and become an impediment for firms to invest and develop, which could significantly affect economic growth (Stein, 2003; Hubbard, 1998). However, the development of innovation activities, which are commonly recognised as the primary driver of firm performance improvements, requires an amount of initial capital for the purchase of high-technology equipment and recruiting high-skilled workers (Poncet et al, 2010; Storey, 2000; Tourigny and Le, 2004; Galia and Legros, 2004). But, as a result of the uncertainty associated with innovative operations and the existence of asymmetric information in the financial markets, it may be difficult and expensive to access external financing for innovative projects (Ferrando et al, 2020; Fu et al, 2018; Morris, 2018). In this case, empirical evidence generally shows that financial constraint impedes the investment and development of firms' innovation activities, which could significantly affect economic growth (Stein, 2003; Hubbard, 1998). However, some cases show contrary results; one of the most notable is that Chinese private firms have grown fast in the last thirty years and become an engineer to stimulate economic growth in China, even though these firms have experienced financial constraints. How they have managed to do so under serious external finance constraints is quite puzzling. As a result, it is critical to

undercover the link between financial limits on firms and their development. This chapter provides further insights to determine the effect of financial constraints on the different ownership firms in China.

It is well recognised that firms' continuous pursuit of innovation activities to develop new products and processes is considered crucial for their survival and growth (Heunks, 1998; Cefis and Marsili, 2006; Bournakis, 2013). The influence of innovation activities on a firm's development may happen through many channels, and innovation may increase a firm's efficiency of resource use and lead to firms continuing to form sustainable competitive advantages (Hall, 2011). Investment in innovation activities can also lead to firms increasing the capacity of absorptive knowledge, and catching up with others (Crespi and Zuniga, 2012). Moreover, innovation activities could stimulate structural change to the formation of new sectors, and specialisation, and make knowledge-intensive activities are gradually expanding (Alvarez et al, 2015).

However, innovation activities commonly bear high risks and uncertainty as the costs are substantial in the short term, while profits are gained in the long term, and the technical and commercial success is extremely uncertain. In the absence of sufficient internal resources, firms generally have to raise the necessary funds from the capital market to finance their innovation activities. However, intangible assets, such as patents and expertise, make up a major portion of innovation activities, and firms are unable to utilise these assets as collateral to get external funding. Thus, firms are often confronted with significant and insurmountable financial limitations to support their innovation projects. (Hall and Lerner, 2010, Ughetto, 2008; Almeida and Campello, 2007). As a result, firms' investments in innovation activities are particularly sensitive to external finance. Accordingly, restricted access to external sources of financing implies that firms are forced to reduce spending on innovation, undermining the potential capacity of the firm to enhance their performance (Carpenter and Petersen, 2002).

Raising external funding is a challenging task in imperfect financial markets that is more likely to exist in developing countries like China (Ayyagari et al, 2010; Moretti, 2004). In China, the financial resources are possibly misallocated across the different

ownership structures of Chinese firms (Boyreau-Debray and Wei, 2005). the majority of loans (over 75% of the total credit) are issued by the "Big Four" state-owned banks (Guariglia and Song, 2011; Li et al, 2018). Credit can more easily be offered to large state-owned enterprises that fulfil socio-political criteria alongside standard economic goals (Bai et al, 2006). The State-owned financial institutions typically tend to discriminate against private firms in China, thus forcing them to turn to expensive lenders that offer interest almost four times higher than the regular rate offered by the state-owned banks (Brandt and Li, 2003)[5]. there is a lending bias that has provided access for state-owned enterprises to obtain funds while generating a political obstacle to impede private firms from obtaining finance from banks (Dollar and Wei, 2007). Huang (2004) stated that these financial constraints are caused by policy inducements for ownership structures of Chinese firms, which is also called the "political pecking order"

Overall, the two types of firm ownership, state-owned enterprises and private firms, are subject to varying degrees of financial constraints. In this context, China serves as a representative case for future investigation into the implications of financial constraints on firms' innovative activities. Although the financial system in China is still in its early phases, private firms have exhibited rapid growth during the previous three decades, which is quite puzzling given the serious external finance constraints.

The majority of the available research on financial constraints has been conducted in developed countries such as the United States and the United Kingdom (Agca and Mozumdar, 2008; Cleary,1999; Cleary et al, 2007; Fazzari, Hubbard and Petersen, 2000; Guariglia and Carpenter, 2008; Gatti and Love, 2008; Nanda and Nicholas, 2014; Amore et al, 2013). Only a handful of papers have tried to examine the effect of financial restraints on firms in China with firms-level data (Chow and Fung 1998; Chow and Fung 2000; Guariglia and Song, 2011; Héricourt and Poncet, 2008). Among the

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[5] Although the official credit restriction against private firms in China alleviated in 1998, there is still casual evidence suggesting severe credit constraints (Huang, 2003).

literature that focuses on China, studies are generally based on outdated and small sample decisions (Guariglia and Song, 2011) and have ignored the discussion on innovation activities. The effect of financial constraints on firms' innovation activities is still unclear, especially on different ownership firms.

Thus, this chapter aims at investigating the extent of financial constraints on the different ownership firms' innovative activities in China. We have broadened the scope of literature in three ways. Firstly, our study has provided the results regarding the effect of financial constraints on firms by using evidence from a developing country with a rather underdeveloped financial system. Based on a large sample of Chinese firms from the years 2000 to 2010 (the latest official data from NBS), including 12604 different types of firms with 27492 observations covering the manufacturing sector, our study provides a unique chance to conduct in-depth research on finance constraints in Chinese firms. Second, unlike Poncet et al (2010) and Héricourt and Poncet (2009), who are only concerned with firms' investment in fixed asset, our study changes the perspective of research, and focus on firms' innovation activities. Third, we hypothesise that access to credit is dependent on the different ownership structures of Chinese firms. We test the ownership effects on credit, distinguishing between three different types: SOEs, collective, and private firms. We assume that a firm's decisions for investment in the future should not be affected by its present cash flow availability, if there are no financial limitations; otherwise, the results might be seen as a reflection of the financial restrictions that exist in the investment of firms (Harrison et al, 2004).

To conclude, we discover that the results for the China case are different from previous research. Firstly, the innovation activities of SOEs are not influenced by cash flow availability, but collective firms and private firms have been adversely impacted, which means the financial constraint in private and collective firms has been proven, and they have a competitive disadvantage to access bank loans. Besides, considering private firms occupied about 68.66% of the observations in our sample, we can draw the conclusion that Chinese innovation activities are mainly dominated by private firms. Last, although financial constraint on private firms seriously affects their innovation

activities, compared with collective firms, the influence in private firms is not fatal, since higher operational efficiency means private firms have sufficient internal funds to support innovation activities.

6.2 Literature review

To better understand this puzzling phenomenon that China firms are hard to get finance from a fragile financial system and still grow quickly over the decades, studies recently turned to a micro perspective and use firm-level data to investigate the financial constraint and firms' growth in China for answers. These studies point out that the availability of cash flow is a critical factor to affect firms' investment, which could affect firms' productivity and ultimately be transmitted to firm-level growth.

Chow and Fung, 1998, Chow and Fung and 2000 Ding et al, 2013 has discussed the effect of financial constraint on fixed asset investment

Chow and Fung (1998) used a fixed panel of 5825 enterprises in Shanghai from 1989 to 1992 to test the financing constraint hypothesis by estimating the link between a firm's cash flow and investment activities. According to their results, private firms have exhibited the most obvious sensitivity of investment activities to its internal cash flow, while SOEs and collective firms also give similar results; but the investment in foreign-owned firms is affected lowest by cash flow. Besides this, the results also indicated that there is a lending bias exists, where financial institutions like commercial banks prefer to provide credit to SOEs rather than private firms. Chow and Fung (2000) employ the dynamic panel method (GMM) with the same data set to make a further study on the investment of different sizes of firms. They show that small and medium-sized firms display much lower cash flow sensitivity to investment activities than larger-sized firms, which contrasts with results from developed countries. They explained this conclusion is a result of the small and medium-sized firms can easily and low-costly work the capital adjustment to smooth their fixed investment and enable them to grow successfully. the results also can be supported by the study of Ding et al (2013). Ding et al. (2013) use the dynamic panel method (GMM) based on a sizable

panel of 374,000 unlisted enterprises during the period of 1998 to 2007 to explore the relationships between fixed and working capital investment and the access of external credit. They discover that effective working capital management may assist businesses in lessening the negative consequences of financing restrictions on fixed investment.

The similar results can be found in the study of the effect of financial constraints on firms' productivity (Li et al (2018) and Jin et al (2019). Li et al (2018) use a GMM method with over 600,000 Chinese firms (1998–2009) to investigate the effects of external credit supply on the different kinds of firm productivity. They found that both internal finance and external credit supply can effectively stimulate firms' productivity and productivity growth rates. But internal finance is more important for firms in those financially vulnerable industries. Jin et al (2019) adopted the dynamic panel method GMM estimator with an unbalanced panel including 312,534 Chinese manufacturing firms during the period 1998–2007 to investigate the link between financial constraints and productivity. They stated that there are around 90% of firms experiencing a lack of access to external credit in China. The stated enterprises are substantially less constrained than the non-state firms are.

Following the previous discussion, the empirical literature regarding the effect of financial constraint on firm development focuses on either the cash flow on investment in fixed assets or the firm's productivity. They have overlooked the effect of financial restrictions on firms' innovative activities, even though firms' innovative activities is one of the most important factors to keep firm surviving and growing. Besides, the most of studies discussed above have ignored the heterogeneity of firms' different ownership; the result can not accurately reflect the impact of financial constraints. Thus, compared with the previous studies, the primary purpose of this chapter is to employ a relatively large dataset, compiled by the Chinese NBS over the period 2003–2013, to analyse the financial constraint hypothesis that credit constraints disproportionately affect firms with different ownership, which provides the evidence regarding the influence of financing constraints on firms' innovation activities in China. To test this hypothesis, we also introduce the Euler equation that links the sensitivity of the investment in

innovation activities to the firms' internal cash flow. We described the theoretical framework in the following sections.

6.3 Empirical Specifications and estimation methodology

To investigate the impact of financial restrictions on the growth of firms from the viewpoint of firms' innovation activities in China, We draw on the literature regarding the degree to which firms' investments are dependent on its internal finance resources. Since the seminal contribution of Stiglitz and Weiss (1981); Fazzari et al (1988) and Cleary (1999), firms' internal cash flow has become the key to identifying firms' financing constraints. The capital market imperfections (i.e. informational asymmetries, costly monitoring, contract enforcement) make the cost of external funds are more expensive than firms' internal finance, with the two not being perfect substitutes for each other. The financially constrained firms have restricted to access external capital, and firms' internal financial resources are the only way to support its investment projects. As a result, the sensitivity of firms' investment to its internal cash flow is a sign of financial constraints.

Our study introduces a framework based on the Euler equation following related literature (Bond and Meghir, 1994; Chan et al, 2012; Gilchrist and Himmelberg, 1998; Harrison, Love, and McMillan, 2004; Harrison and McMillan, 2003; Love, 2003; Whited, 1992). Based on the theoretical framework of the Euler equation, we derive the empirical specification that allows us to investigate the influence of financial limitations on investment in innovative activities.

6.3.1 Theoretical background

To create the measurement of financial constraints, our research is based on the literature on investment sensitivity to internal finance. Empirically, The Tobin q model and Euler equations are the two most used methods to explore the investment sensitivity to internal finance (Poncet et al, 2010 and Lerskullawat, 2019). The Tobin q model, which was formerly utilised as the investment estimation model, has a measurement

issue as the model's q value can only be accurate in the ideal assumptions where the presence of perfect market competition, fixed capital homogeneity, and there is no correlation between financial structure and investment decisions (Rungsomboon, 2005; Agca and Mozumdar, 2008). As these are highly restrictive hypotheses, the Tobin q model is an inadequate approach to estimate in this chapter. In comparison to the Tobin q model, the Euler equation has a number of advantages (Héricourt and Poncet, 2009; Howell, 2016; Poncet et al, 2010; Lerskullawat, 2019). Firstly, the assumption of the Euler equation is not as restrictive as Tobin q model (Moreno-Badia andSlootmaekers, 2009). Besides, all expectation impacts on the investment decision can be controlled via the Euler equation. Last, the firms' market values are typically used to derive proxies for financial constraints based on Q theory and are not required in the Euler equation, as China's stock market is not well-function, the firm's value may not be reflected in the financial market, this Euler equation is a more suitable approach in this chapter (Héricourt and Poncet, 2009; Howell, 2016).

In this case, to investigate the impact of financial constraints on innovation activities, the theoretical framework of this chapter is based on an Euler equation. The Euler equation outlines the firms' optimal investment path and establishes the relationship between it and marginal adjustment costs in adjacent periods, which has derived from a dynamic optimization problem under the assumption of symmetric, quadratic costs of adjustment. It relates current investment to the last period's investment and the marginal product of capital and has the advantage of controlling for all expectation influences on the investment decision. Our model described below has closely followed the specification of Gilchrist and Himmelberg (1998), Harrison et al (2004), Love (2003) and Chan et al (2012).

The empirical specification of the Euler equation is as follows:

$$1 + \frac{\partial C(I_t, K_t)}{\partial I_t} = \beta_t E_t \left[\Omega_t \left[\frac{\partial \Pi_{t+1}}{\partial K_{t+1}} + (1 - \delta)(1 + \frac{\partial C(I_{t+1}, K_{t+1})}{\partial I_{t+1}}) \right] \right] \qquad (6.1)$$

Where $\frac{\partial C(I_t, K_t)}{\partial I_t}$ represents the marginal adjusted cost of investment in innovation activities, $\frac{\partial \Pi_{t+1}}{\partial K_{t+1}}$ represents the marginal profit of capital that the contribution of an

additional unit of capital in the firm's profits (hereinafter MPK), $\Omega_t = \frac{1+\lambda_{t+1}}{1+\lambda_t}$ represents the relative shadow cost for external funds in the period t+1 to period t as a proxy for the degree of financing constraints.

If the capital market is perfect and without financial friction, $\lambda_{t+1} = \lambda_t = 0$, $\Omega_t = 1$, there is no firm that is affected by financing constraints for all periods. If the shadow cost of external finance at time t is higher than the cost at time t+1, then $\Omega_t < 1$, the firm will be regarded as financially constrained. When firms are experiencing higher expenses on external funding in the current period, firms will tend to defer investment. There is another possibility that if $\lambda_{t+1} = \lambda_t \neq 0$, then $\Omega_t = 1$, but firms still are constrained in both periods of t and t+1. As the shadow cost is also affected by a variety of different factors such as: ξ_t productivity shock, thus, the $\lambda_{t+1} = \lambda_t \neq 0$ results in $\Omega_t = 1$ is unlikely to exist in all periods, although this is possible for certain firms at specific periods (Love, 2003).

To achieve an empirical model that can be tested, the variables $MPK_{i,t}$, $\frac{1+\lambda_{t+1}}{1+\lambda_t}$, $C(I_t, K_t)$ in 6.1 need to be linearized.

Firstly, we follow Gilchrist and Himmelberg (1999), and Harrison et al. (2004) in using that production takes the form of a Cobb-Douglas function. Accordingly, MPK can be calculated as follows:

$$MPK_{i,t} = \Upsilon_0 + \Upsilon_1 (\frac{sales}{K})_{i,t} \qquad (6.2)$$

Where: Υ_0 is the firm-specific effect from different firms, Υ_1 is the additional unit of capital that contributes to capital's share in production, and Sales refer to the income revenue generated by a sale.

Secondly, to make the Euler equation estimable, the shadow cost λ_t needs to be identified with some observable firm characteristics.

To address this issue, Myers and Majluf (1984) provided a theoretical basis regarding the application of the usage of cash stock. Accordingly, cash holdings can directly affect investment when the capital market is not perfect and informational asymmetries still exist. Firms with sufficient external funds would take all investment

projects with a positive net present value (NPV); on the other hand, if firms are forced to rely on expensive external financing, firms with financial constraints have to miss some opportunities. Therefore, firms' cash stock has positively associated investment decisions. Denis and Sibilkov (2010) suggest that firms with high levels of cash holdings allow investment in positive NPV projects; otherwise, the project could be bypassed.

Thus, we follow the literature and let shadow cost be the function of cash stock:

$$\frac{1+\lambda_{t+1}}{1+\lambda_t} = \mu_0 + \mu_1 (\frac{cash}{K})_{it} \tag{6.3}$$

If the market is perfect, $\frac{1+\lambda_{t+1}}{1+\lambda_t}=1$ for all periods, firms' investment will not relate to cash holdings, $\mu_1=0$. Otherwise, the greater the severity of the market imperfections, the higher the sensitivity of firms' investment to its cash holdings.

Lastly, we also adopted the most common form of the adjustment cost function - the quadratic cost of adjustment function (Summers, 1981; Hayashi, 1982). The adjustment function is assumed as follows:

$$C(I_t, K_t) = \frac{o_1}{2} \left[(\frac{I}{K})_t - o_2 \left(\frac{I}{K}\right)_{t-1} - o_i + o_t \right]^2 K_t \tag{6.4}$$

Where o_1 and o_2 are constant, o_i denotes the firms' specific effect; o_t denotes the time effect. Like the previous literature of Harrison and Love et al. (2004); Love (2003) and Poncet (2010), we include the lagged investment-to-capital ratio $\left(\frac{I}{K}\right)_{t-1}$ to allow for a correlation between the previous and current investment decisions. The lag term accounts for persistence in investment exhibited in the data.

Eq. (6.4) denotes the investment's marginal cost of adjustment:

$$\left(\frac{\partial c}{\partial I}\right)_t = o_1 \left[(\frac{I}{K})_t - o_2 \left(\frac{I}{K}\right)_{t-1} - o_i + o_t \right] \tag{6.5}$$

A first-order Taylor approximation around the means is used to linearise the Euler equation 6.1. The derived linearised form of function will be used to measure the impact of financing constraints:

$$(\frac{I}{K})_{i,t} = \psi_0 + \psi_1 (\frac{I}{K})_{i,t-1} - \psi_2 \left(\frac{I}{K}\right)^2_{i,t-1} + \psi_3 \left(\frac{sale}{K}\right)_{i,t-1} - \psi_4 \left(\frac{cash}{K}\right)_{i,t-1} + f_{i,t} +$$

$$\varepsilon_{i,t} \tag{6.6}$$

Where: $(\frac{I}{K})_{i,t}$ is the ratio of expenditure of a firm's investment in innovation activities to the firm's total assets at time t. $\left(\frac{sale}{K}\right)_{i,t-1}$ denotes the firm's turnover at time t-1, measured by the ratio of sales revenue to the firm's total assets. $\left(\frac{cash}{K}\right)_{i,t-1}$ denotes the firm's internal financial position, measured by the ratio of the stock of liquid assets at time t-1. $f_{i,t}$ represents the firms' specific effect; and $\varepsilon_{i,t}$ is the error term.

The implication of this equation is that the greater the investment's sensitivity to cash ($\left(\frac{cash}{K}\right)_{i,t-1}$), the more severe the financial restriction on firms. Although cash stock could also be an indicator to predict the firms' potential earnings, it would only be the case under the assumption of financial constraint, since it is costly to hold liquid assets (Love, 2003; Harrison et al, 2004). Therefore, only if financially constrained firms believe that they are able to make a profitable investment, firms will accumulate liquid assets.

The structural equation (6.6) is derived under the assumption of a perfect financial market; the firms' optimal investment path has not been financially constrained. From equation (6.1), firms' future investment is negatively associated with the ratio of current cash flow to assets ($\psi_4 < 0$). Bond and Meghir (1994) and Harrison and McMillan (2003) indicated that when the coefficient of cash flow has responded positively to future investment ($\psi_4 > 0$), the firm is financially constrained in a sense, and therefore firm needs to hold a large amount of cash flow to fund finance investment. In contrast, if firms are able to access external capital whenever investment opportunities arise, they have no need to hold cash stock and the investment should be not affected by its cash stock.

6.3.2. The method of estimation

This study adopts the system GMM methods to conduct the empirical analysis for several reasons. From the firm growth perspective, system GMM allows us to include the lagged term of the investment in innovation activities, Given that it has been proved

that investment can have some lagged effects (Du and Girma, 2007;). this should be considered in estimations. From the econometrics/statistical perspective, there might still exist the possibility of firms' capital structure correlated with unobserved factors that also affect firm investment. In this case, the problem of endogeneity would arise. To avoid these issues, the system generalised method of moments (sys-GMM) estimator was used to estimate our equations. The GMM estimator provides advantages over using other estimators. We can remove the unobserved effect from time-invariant and firm-specific by using the first differenced GMM and applying appropriate lags on variables as instrumental variables to eliminate potential endogenous problems caused by feedback effect and omitted variables in the estimation.

Besides, the system GMM estimator corrects the possible biases and imprecision results that may have been created by first differenced GMM estimator through making additional moment conditions expressed in levels (Arellano and Bover, 1995; Blundell and Bond, 1998). Since when the explanatory variables are persistent over time, the lagged values of variables may lead to the weak instruments problem that exists in the process of assessing the regression equation, which is likely to cause coefficients biased.

Moreover, the consistency of the GMM estimator is dependent on two validity of assumptions that the error term does not display serial correlation and that instruments are valid. To test whether error terms are serially correlated, The Arellano–Bond test has been used in our study. The statistic is asymptotically distributed and under the null hypothesis, the first differences specification does not have the second-order serial correlation. Next, we test instrumental validity by using the Hansen test for over-identifying restrictions. Hansen test estimates the validity of instruments under the null hypothesis that there is no correlation between instruments and residuals from the respective regression. Once both tests are failed to reject the null hypothesis, indicating the validity of the GMM estimator.

6.3.3 Variables definition

The value of new goods to the total assets $\left(\frac{I}{K}\right)_{i,t}$: I represents the intensity of firms' investment in innovation activities. As the Annual Reports of Industrial Enterprise Statistics database lacks a precise assessment of the firm's investment in innovation activities, we follow recent research papers (Criscuolo et al 2005; Girma et al, 2008; Howell, 2016) to define innovation activities as the value of new products. According to the definition from the Nation Bureau of Statistics, The term "new products" refers to products that are newly introduced to the market, which employ brand new theoretical concepts, designs, technologies, and the improvement in products' performance and function that by major modifications in structure, materials, design, or manufacturing techniques in compared to the existed products (China Statistical Yearbook, 2006). The new products of firms also need to be certified by the government, which is typically valid for up to three years. We therefore use the value of new products to measure firms' innovation activities.

The asset turnover ratio $\left(\frac{sale}{K}\right)_{i,t-1}$: Sale represents the firm's operational efficiency and has been measured by net revenue received from the sales of products, goods, and services, i.e. measured by sale income minus sale cost.

The liquidity stock ratio $\left(\frac{cash}{K}\right)_{i,t-1}$: cash is the primary independent variable in our study. Cash flow generated by firms, as measured by its liquidity stock, is defined as the difference between a firm's current assets and its current liabilities. Theories and empirical studies suggest that, if firms struggle to raise funds, they will be forced to depend on their internal resources. Thereby firms could restrict the firms' investment capacity and give up profitable investment opportunities; on the contrary, once firms can easily access to the external finance resources, they can optimise their investment activities and growth (Chen and Guariglia, 2013).

6.3.4 Data

Our firm-level data for all variables come from Annual Reports of Industrial Enterprise Statistics compiled by the National Bureau of Statistics. Annual Reports of

Industrial Enterprise Statistics have covered all sorts of firms whose annual turnover is at least five million RMB and also issued information about a firm's characteristics from the firm's balance sheet, income statement, and cash flow statement during the period 2000 to 2013. We mainly focus on state-owned, collective-owned and private firms in the manufacturing sector with more than 30 categories, including handicrafts, agricultural and sideline food processing, food manufacturing, and other manufacturing, waste resources, and waste material recycling and processing industries. Our sample period ranges from 2000 to 2010, excluding the years 2004 and 2008 (the years 2004, 2008, 2011, 2012, and 2013 are missing in our study, since the variable of the value of new products and firms' sales are not available in these years).

To compare the different ownership structures of Chinese firms in access to financing, we split our sample into three sub-samples based on their ownership structure: state-owned, collective, and private firms. Private firms refer to profit-making firms that are privately owned and operated. State-owned enterprises refer to firms in which the government owns at least a quarter of the stock. SOEs are operated by either the totally state-owned entity or the state-owned entity in partnership with another. Collective firms are firms whose production and property belong to communities in urban or rural areas, but collective firms are managed by local governments.

Despite Annual Reports of Industrial Enterprise Statistics are widely considered as the most comprehensive and biggest Chinese company database, it also suffers from several shortcomings, such as issues of accounting errors, sample selection, and missing information. To reduce the influence of shortcomings and control the potential effect of outliers, we dropped observations with the negative value on sales, the observations with the negative value on the total assets minus total fixed assets, the observations with the negative value on the total assets minus liquid assets as well as the value of the new product is zero (we have discovered that there are only around 5 percent of the firms engaged in innovation activities, i.e. the new products with a non-zero value). Firms that had not yet completed data on our key regression variables and the firms with less than 5 years existence were also removed from consideration. Finally, we obtained an

unbalanced panel with 28971 observations.

6.4 Results

6.4.1 Summary statistics

Table 6.1 Distribution of observations by ownership type (percentage in parentheses)

	Sample size	SOEs	Collective	private
2000	1245 (100)	844 (67.79)	165 (13.25)	236 (18.96)
2001	1531 (100)	825 (53.89)	193 (12.61)	513 (33.51)
2002	1857 (100)	894 (48.14)	200 (10.77)	763 (41.09)
2003	1805 (100)	673 (37.29)	152 (8.42)	980 (54.29)
2005	5299 (100)	1026(19.36)	385 (7.27)	3888 (73.37)
2006	6472 (100)	900 (13.91)	334 (5.16)	5238 (80.93)
2007	5138 (100)	732 (14.25)	223 (4.34)	4183 (81.41)
2009	2254 (100)	465 (20.63)	106 (4.70)	1683 (74.67)
2010	3392 (100)	743 (21.47)	218 (6.43)	2431 (71.67)
Total	28971 (100)	7095(24.47)	1968 (6.79)	19908 (68.66)

Table 6.1 displays the distribution of observations by different types of ownership in different years. Only a few Chinese firms (28971 observations in total) engaged the innovation activities (the value of new products is non-zero). This might be reflected in Chinese firms maintaining a relatively low degree of innovation capability, as well as the fact that the vast majority of Chinese firms cannot afford to engage in innovation activities, as innovation participation needs firms to take high adjustment costs and risk from the uncertainty innovation activities. In the ownership of representation, the private firms occupied 68.66% of total firms in our sample, SOEs and collective firms, representing 24.47% and 6.79% of our sample respectively.

Since the purpose of this chapter is to investigate the impact of financial constraints on the different ownership Chinese firms, our sample has also been divided into three parts according to ownership. As can be seen in Table 6.1, the composition of our sample in this chapter has been changed significantly during the period from 2000 to 2010. To be specific, The percentage of SOEs in our sample dropped from 67.79 % in

2000 to 13.91 % in 2006, then slowly increased to 21.47 in 2010, while the proportion comprised of private firms grew from 18.96% in 2000 to 81.41% in 2007, Despite a slight decrease in the share of private firms over the next two years to 71.67 %, the innovation activity of private firms takes the largest share of the sample in the whole group. Compared with the other two ownership firms, the collective firms that participated in the innovation activities is visibly low (the largest share of collective firms was 13.25% in 2000). The share comprised of collective firms showed a steady decline from 13.25% in 2000 to 6.43% in 2010.

The considerable changes in the ownership composition of observations reveal that the composition of China's firms has experienced a significant ongoing restructuring in the last 10 years. Considering that private firms occupied 68.66% of the sample in total, private firms have gradually become the majority players in innovation activities. The higher share of private firms reflects private firms' enthusiasm for innovation activities; but private firms also faced more hindrances created by financing constraints in their innovation activities.

Table 6.2 Sample summary statistics

	Observations	Mean	Standard deviation	Minimum	Maximum
Full sample	28,968				
I/K		0.913	2.390	0.001	226.4
$Sale/K$		0.426	0.792	-8.817	26.84
$Cash/K$		0.529	1.33	-134.8	49.82
State-owned enterprises	7,094				
I/K		0.372	0.731	0.001	19.38
$Sale/K$		0.245	0.451	-1.378	22.72
$Cash/K$		0.495	1.752	-122.4	44.00
Collective-owned enterprises	1,967				
I/K		1.036	3.238	0.001	66.77
$Sale/K$		0.539	1.257	-3.45	26.84
$Cash/K$		0.471	1.331	-7.97	49.82
Private firms	19,907				
I/K		1.094	2.636	0.001	226.4
$Sale/K$		0.479	0.818	-8.81	22.19
$Cash/K$		0.548	1.144	-134.8	20.54

Table 6.2 presents the summary statistics of our sample for the different ownership firms in terms of means, standard errors, minimum values, and maximum values. Table 6.2 shows that independent variables vary considerably across ownership groups.

Firstly, the ratio of the value of new goods to the total assets (I/K) reflects the intensity of firms' investment in innovation activities. If the ratio goes higher, it indicates that the firms are substantially investing in innovation activities. According to measurements in Table 6.2, the investment of private firms and collective firms in innovation activities is relatively larger (1.094 and 1.036 respectively). In contrast, SOE firms are investing weakly (only 0.372), which is even less than the sample average of 0.913.

Secondly, collective and private firms perform with better operational efficiency than SOEs. Among all ownership firms, the largest ratio of sales to total assets ($Sale/K$)

is found in collective businesses (0.539), while SOEs are the lowest (0.245) and less than the sample average (0.426).

Lastly, considering the ratio of cash flow to total assets ($Cash/K$), both SOEs and collective firms have relatively lower ratios (0.495 and 0.471, respectively), which is less than the sample average (0.529). This result may be reflected that SOEs and collective firms have a better ability to access external finance and have no need to hold a large amount of cash. On the contrary, private firms represent relying on internal finance and keep the highest ratio (0.548).

6.4.2 Empirical result

Table 6.3 Euler equation estimation for the full sample

Dependent variable I/K	OLS	Fixed effect with time dummy	SYS-GMM
$(I/K)_{i,t-1}$	0.495***	-0.043***	0.483***
	(0.000)	(0.000)	(0.001)
$(I/K)^2_{i,t-1}$	0.050***	0.001	0.003
	(0.000)	(0.831)	(0.978)
$(Sale/K)_{i,t-1}$	0.347***	0.039***	0.310**
	(0.000)	(0.000)	(0.017)
$(Cash/K)_{i,t-1}$	0.132***	0.012	0.493***
	(0.000)	(0.180)	(0.001)
Time Dummy year 2001		0.022	
		(0.234)	
Time Dummy year 2002		0.023	
		(0.107)	
Time Dummy year 2003		0.069***	
		(0.000)	
Time Dummy year 2005		0.083***	
		(0.000)	
Time Dummy year 2006		0.094***	
		(0.000)	
Time Dummy year 2007		-0.601***	
		(0.000)	
Time Dummy year 2009		-0.242***	
		(0.000)	
Time Dummy year 2010		-0.520***	
		(0.000)	

Constant			-0.065
			(0.367)
number of observations	27492	27492	27492
R-squared	0.434	0.307	
Number of instruments			21
Number of groups			12604
AR(1)			0.000
AR(2)			0.439
Hansen test			0.125

Note: (1) All the variables are in logs; (2) AR(1)test and AR(2) test, are the Arellano–Bond test for serial correlation of orders 1 and 2, respectively. (3) The p-values of the coefficient estimates are reported in parentheses. (5) ***, **, and * denote statistical significance at 1, 5, and 10 percent levels.

In Table 6.3, we give the estimate of equation 6.13 for the whole sample without taking ownership into consideration by employing the different estimators: OLS, fixed-effect with time dummy estimator, and system GMM estimator.

We start by reporting OLS results in column 1. The total four independent variables have significant coefficients. Particularly, the variable of $(Cash/K)_{i,t-1}$ is positively associated with dependent variables (0.132 at 1% of significant level). However, OLS estimators suffer biases from the unobserved heterogeneity and the endogeneity problem of variables.

Column 2 reports the results by employing fixed effect estimator with time dummy variables. According to Table 6.2, the coefficient of the lagged value variables of $(Sale/K)_{i,t-1}$ and $(Cash/K)_{i,t-1}$ in the fixed effect estimator (0.039 and 0.012 respectively) are much smaller than the corresponding coefficient in the OLS estimator (0.347 and 0.132, respectively), the lagged value of the variable $(Cash/K)_{i,t-1}$ shows a statistically insignificant coefficient. Although fixed effect estimator with time dummy variables has controlled the biases from the unobserved firm-specific characteristics and time-related effects, it still has not considered the potential biases that come from the endogeneity of variables.

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Column 3 provides the results by employing the system GMM estimator. The system GMM estimator can adopt first-differenced transformation to control heterogeneity bias and apply the lagged of the dependent variable as instruments to control for endogeneity problems to provide the reliable results. In column 3, the variable $(Sale/K)_{i,t-1}$ and $(Cash/K)_{i,t-1}$'s lagged value are all positive and statistically significant (0.310 and 0.493, respectively). Also, the Arellano-bond test and Hansen test have been applied to measure the appropriation of instruments. As seen in Table 6.3, The Arellano-bond test has rejected the first-order correlation at significant level (0.001 < 0.05) and the test for the second-order correlation of the first-differenced residuals shows insignificant (0.439 > 0.05), which suggests that the error term is not serially correlated. The Hansen test has also not rejected the null hypothesis (0.125), which means instruments are exogenous. Both tests have proved the reliability of the result.

To sum up, in accordance with the guidelines of the Euler equation model, we should be able to determine the lagged value of variable cash flow negatively related to dependent variables under the assumption of perfect capital markets without financial constraints. However, the results from the different estimators all show that the lagged value of variable cash flow is consistently positive at 1% significant level. This result implies that firms' investment in innovation activities has been subjected to financial constraints. We next look at the effect of financial constrain on different ownership firms' innovation activities.

Table 6.4 Euler equation estimation for different ownership firms

Dependent variable *I/K*	SOEs Coefficients	P-value	Collective firms Coefficients	P-value	Private firms Coefficients	P-value
$(I/K)_{i,t-1}$	0.936	0.000	0.973	0.000	1.158	0.000
$(I/K)^2_{i,t-1}$	0.087	0.064	0.184	0.111	0.469	0.000
$(Sale/K)_{i,t-1}$	0.015	0.833	-0.539	0.018	0.373	0.005
$(Cash/K)_{i,t-1}$	-0.177	0.000	0.388	0.009	0.242	0.065
constant	-0.228	0.000	-0.331	0.003	-0.048	0.521
Number of observations	6236		1787		19467	
Number of groups	1844		813		9964	
Number of instruments	11		81		61	
AR(1)	0.000		0.005		0.000	
AR(2)	0.727		0.514		0.926	
Hansen test	0.630		0.655		0.145	

Note: (1) All the variables are in logs; (2) AR(1) test and AR(2)test, are the Arellano–Bond test for serial correlation of orders 1 and 2, respectively.

Table 6.4 shows the outcomes of estimating the Euler equation 6.6 for different ownership SOEs, collective firms, and private firms respectively by applying the system GMM estimator.

Firstly, we have employed the tests for instrument validity to prove the reliability of the results. As can be seen from Table 6.4, the Arellano-Bond and Hansen tests can be found in different firms' estimations. According to Table 6.4, the Arellano-Bond test has rejected first-order correlation at 1% significant level for SOEs, collective firms and private firms (0.001, 0.005, and 0.001 respectively), and the test for the second-order correlation of the first-differenced residuals all shows insignificant (0.727, 0.514, and 0.926 respectively), which suggests that error term is not serially correlated. The Hansen test has taken the null hypothesis for all three ownership firms (0.630, 0.655, and 0.145 respectively), which means the instruments are exogenous. Both tests have indicated the reliability of results for different ownership firms from Table 6.4.

After that, we adopted the system GMM estimator to investigate the effect of internal cash flow on different ownership firms separately. The coefficient of the lagged variable $(Sale/K)_{i,t-1}$, and lagged variable $(Cash/K)_{i,t-1}$ in different ownership, firms are different from results by using the full sample. Specifically, the coefficient of the lagged variable $(Sale/K)_{i,t-1}$ is significantly positive for SOEs (0.015) and private firms (0.373), but not for collective firms (-0.539). Private firms display the highest operational efficiency to support their innovation activities (0.373 at 1% significant level), which means one unit of rising innovation activities can be effectively supported by 0.373 percent of the increase in operational efficiency in private firms. In contrast, collective firms' operating efficiency has been negatively and significantly affected on innovation activities (-0.539 at 1% significant level). These results reflect that private firms operate more efficiently than SOEs and collective firms, which can more effectively support innovation activities. The innovation activities have been negatively affect by collective firms' operation efficiency indicating that these firms fulfil mainly political and social objectives, with innovation being viewed as a residual activity.

Besides this, by closely examining the indicator of financing constraints in different ownership firms, we find out that innovation activities in SOEs have displayed the lowest sensitivity to its cash flows. The coefficient of the lagged variable $(Cash/K)_{i,t-1}$ is 0.177 at 0.01 significant level, which follows the assumption of the Euler equation that firms' future investment negatively associates the ratio of current cash flow to assets. However, innovation activities in collective firms have oppositely present the highest sensitivity to cash flows; the coefficient of the lagged variable $(Cash/K)_{i,t-1}$ s 0.388 at 0.1 significant level, which is slightly higher than private firms. Private firms also show a higher sensitivity of investment in innovation activities to cash flow. The coefficient of lagged variable $Cash/K$ in private firms is 0.242 at 10% significant level, which suggests that innovation activities in private firms and collective firms are subjected to financing constraints, whereas SOEs firms are not.

6.4.3 Discussion

In summary, the results confirm that, even although financial constraint on private firms has been alleviated, and the "lending bias" and "political pecking order" still existed in China's financial market and affect the development of private firms. This conclusion is consistent with our expectations and in line with the findings of previous studies (Huang, 2004; Guariglia and Song, 2011; Li et al, 2018).

According to our results, SOEs are believed to be relatively easy to access external capital to support their innovation efforts, which provided new evidence to support the findings of the majority of previous research (Huang, 2004; Guariglia and Song, 2011; Howell, 2016; Li et al, 2018). We believed SOEs are still at the top of the "political pecking order" in China, the banks in China prefer to issue bank loans to the SOEs (Bai et al, 2006; Guariglia and Song, 2011; Li et al, 2018).

However, we provided a contrary result from the literature regarding the effect of financial constraint on collective firms. Our results show collective firms in China were suffering to access external funding, as they are also subjected by financing constraints, even if they have a connection with the local government, which is different with previous studies (Guariglia and Song, 2011; Howell, 2016; Li et al, 2018). We also found that there is a negative effect of collective firms' operation efficiency on innovation activities, which means that it is difficult for the innovative efforts of collective firms to be funded by their own financial sources. Thus, we believed the collective firms show the highest sensitivity of investment in innovative activities to cash flow.

Moreover, we based on the results from Table 6.6 to found that private firms in China are still subjected to political lending bias, which is consistent with the majority of previous studies (Huang, 2004; Boyreau-Debray and Wei, 2005; Guariglia and Song, 2011; Howell, 2016; Li et al, 2018). However, private firms in China rely on their own to create a huge amount of internal funds, which provided a large amount of investments to support their innovation activities. Considering that private firms occupied about 68.66% of the observations in our sample, it indicated that Chinese private companies are not only becoming the most active segment of the country's economy, but they are

also demonstrating a strong desire to participate in innovative activities.

6.5 Conclusion

In light of the critical role that innovation plays in driving economic development, this chapter has extended the literature on financial constraints to investment in innovation activities. We have enlarged the sample size by employing the dataset from Chinese NBS during the period 2000 to 2010, including 28971 observations covering all firms with innovation activities in the manufacturing sector. Besides, in order to analyse the impact of financial constraints on different ownership firms' innovation activities, we also employ Euler's equation specifications and GMM estimation techniques.

According to our findings, the innovative activities of SOEs have not shown sensitivity to cash flow, indicating that SOEs are not financially restricted. In contrast, private firms and collective firms have a high sensitivity to cash flow for innovative activities, which reflected the fact that private and collective firms suffer from financial constraints. Those results demonstrate that there is still a "lending bias" and a "political pecking order" in the Chinese financial industry, despite the reforms. Private firms are the most active participants in investment in innovation activities over the period examined, but they are still discriminated against since they do not have preferential policy treatment from bank and government support as SOEs often receive. Collective firms bear both the financial constraint and negative effect of operational efficiency, the innovation activities as residual activities are not able to be supported by collective firms.

Besides, there are some crucial policy suggestions made by this research based on the findings and debate. According to the findings from Chapter 6, since the "lending bias" and "political pecking order" still exist in China's financial market, there is a significant financial constraint in China financial market to impede the growth of private firms. Private firms are widely believed as the engine of economic growth for China, and it also been described as an important part to promote technical innovation.

However, due to lack of financial support, most private firms are hard to survive and some of them close down. Thus, the Chinese policymakers need to speed up China's financial market development and end the lending bias to satisfy private firms' financial demand.

Last, the results of this chapter, like those of previous studies, have certain limits, but the investigation of how financial constraint affects economic growth remains a fascinating area of study. In this case, this section aims to summarise shortcomings and offer some recommendations for other study areas to further our research.

The limitations of this chapter are on data that is missing and relatively outdated. Firstly, despite the Annual Reports of Industrial Enterprise Statistics having been believed to be the largest and most comprehensive Chinese firm database, it also suffers from several shortcomings, such as issues of accounting errors, sample selection, and missing information. Our sample period ranges from 2000 to 2010, excluding the years 2004 and 2008 (the years 2004, 2008, 2011, 2012, and 2013 are missing in our study as the variable of the value of new products and sales are not available in these years). Thus, our study has been limited in obtaining data. Besides this, as the Annual Reports of Industrial Enterprise Statistics have stopped updating since 2013, the finding of Chapter 6 can only explain firms' activities during the period of data applied in our study, and the recent economic phenomenon could not be explained fully and comprehensively. Thus, to gain a more precise estimation of the impact of financial constraints on a firm's innovation activities, future research is recommended to apply updated data for empirical analysis, if this is possible.

Chapter 7 Conclusion

In conclusion, this thesis makes a contribution to the literature by conducting empirical research regarding the impact of financial development on China's economy from three different perspectives. Our study has extended the study beyond using the normal financial index to investigate the impact of financial development on economic growth from both the macro and micro levels. Consequently, our empirical findings provide some insights into the impact of the shadow banking sector on provincial growth, the spatial effect of financial agglomeration spillovers on regional economic growth, and the sensitivity of investment in innovation activities to the internal cash flow of firms. Specifically, in this chapter, we will present a summary of the key results from each empirical chapter.

Firstly, Chapter 4 employs a novel insight from different angles to re-examine the impact of financial development on the economic growth in China. Specifically, we are particularly interested in the impact of the informal financial sector (shadow banking sector) that has long been overlooked in research on finance and development. Moving beyond the existing literature, we based this study on endogenous growth theory to employ a unique dataset that covers 30 Chinese provinces and municipalities from 2005 to 2016 and has manually collected data to create the variable of shadow banking at the province level as well as to adopt GMM estimator to examine the finance-growth relationship. Findings suggest that there is a favourable correlation between economic growth and development in formal financial institutions, which contradicts the existing conclusion that state-owned financial institutions hinder economic growth in China since the financial resource has been distorted by China's financial system. Moreover, we also found that financial development in the informal sector (shadow banking sector) positively related to economic growth in China. The informal financial sector, which serves as a complementary part of the formal financial sector, plays an essential role in terms of providing financial resources to promote economic development.

Secondly, Chapter 5 makes a contribution to the recent debate regarding the effect of financial agglomeration by estimating the spatial effect of financial agglomeration

spillovers on regional economic growth among the three different regions of China. For this study, we have created the new regional location entropy to estimate the regional financial agglomeration, employed the index of global Moran I to test the spatial distribution characteristics of regional financial agglomeration, and adopted the spatial econometric estimator to investigate the spillover impact of financial agglomeration on the economic development of three different regions in China. The findings suggest that, although financial agglomeration can stimulate the local province's economy in all three regions, the spillover effect differs from region to region, which may be one of the reasons to cause regional economy disparity. The higher level of financial agglomeration in the eastern region of China is conducive to the sharing of infrastructure between financial institutions, convenience information exchange and communication, and reducing the costs of financial transactions, all advantages can accelerate knowledge spillover to promote the economic growth of neighbouring provinces in the region; while because of the limited financial resources available in the central area of China, the spillover impact of the financial agglomeration generated a lowering effect on the local province economy to a certain degree, and it also provided an adverse influence on the economic growth of the neighbouring area. At the same time, the impact of financial agglomeration on Western China is insignificant.

Thirdly, chapter 6 gave updated findings on the influence of financial restrictions on the different ownership structures of Chinese firms. With regard to innovation providing a significant contribution to economic growth, we have extended the literature by changing the research perspective to focus on financial constraints to firms' investment in innovation activities. In this study, we have enlarged the sample size by employing the dataset from Chinese NBS from the period 2000 to 2010, including 12604 firms of different types with 27492 observations covering all firms with innovation activities in the manufacturing sector. We also have adopted the specification of the Euler equation and system GMM estimator to investigate the impact of financial constraints on SOEs, collective firms, and private firms' investment in their innovation activities. The finding suggests that SOEs have not shown the sensitivity of

investment in innovative activities to their cash flow, while private and collective firms are affected, which means that the financial constraint still affects private firms. Even though the financial constraint on private firms has been alleviated, the "lending bias" and "political pecking order" still exist in the Chinese financial market. Besides this, the finding of Chapter 6 has supported that of Chapter 4 to prove the importance and necessity of the effect of shadow banking.

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