THE IMPACT OF ECONOMIC STIMULUS PACKAGE ON THE CHINESE ECONOMY

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SUBMITTED IN FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY IN ECONOMICS

ADAM SMITH BUSINESS SCHOOL

COLLEGE OF SOCIAL SCIENCE

Abstract

China's stimulus package after the global financial crisis in 2008 rapidly boosted its GDP. However, it also raised concerns about its long-lasting and unintended consequences that have reduced China's growth potential. This thesis aims to explore the effect of China's stimulus package from macro-, industry-, and firm-level perspectives. The first topic investigates the growth effects of the stimulus package. Based on province-level high-frequency data and a "heterogeneous panel" econometric method - Pooled Mean Group (PMG), the results reveal a significant long-term negative association between the stimulus package and GDP growth in China, despite positive short-term effects. The second topic examines how the stimulus package, when interacting with government intervention, influences industry investment and its subsequent outcomes. Using province-industry observations from 2003 to 2016 and employing the Difference-in-Differences (DID) strategy, I find that government backup encourages industries to invest more, at the expense of worsening aggregate efficiency. The third topic studies how the stimulus-driven credit boom affects the bank loan financing of firms. Through Chinese listed firm data from 2003 to 2018, the finding indicates that political connections serve as an implicit guarantee, enabling firms with these connections to obtain and maintain favourable treatment from bank lending after the stimulus package. Overall, this thesis supports the view that the stimulus package led more resources to being allocated to industries and firms with government backup, which, in turn, contributed to the slowdown in Chinese growth in the recent decade.

Contents

List of Tables

List of Figures

Acknowledgements

First and foremost, I express my deepest gratitude to my supervisor team, Prof. Sai Ding, and Dr. Hisayuki Yoshimoto, for their unwavering support and invaluable guidance throughout my Ph.D. journey. Their encouragement and constructive feedback have been instrumental in shaping this thesis and supporting my academic growth.

I also would like to thank Prof. David Cobham, Prof. Campbell Leith, Dr. Shasha Li, Prof. Raphael Markellos, Prof. Stephen Millard, Prof. Charles Nolan, Dr. Kian Howe Ong, Dr. David Schindler, Prof. Kiril Tochkov, Dr. Mengying Wei, Dr. Junhong Yang, Prof. Javier Suárez, Dr. Rongrong Sun, Dr. Zhihong Yu, and Dr. Jiangteng Zhou. Although I did not have the opportunity to meet some of them in person, their invaluable insights and suggestions have greatly contributed to the improvement of this thesis and my Ph.D. study.

My sincere thanks finally go to my family and friends. Due to the challenges posed by the COVID-19 pandemic, I spent most of my time on my own, and their steadfast presence and warm words were an endless source of motivation for me. They are: Kerri Bates, Hengche Guo, Guo Li, Feiyu Wang, Rukang Wang, Yuyuan Wang, Yuting Wen, Jiatong Xin, Mengyuan Yue, Siqi Zhang, Xuelu Zhang, Shen Zhou.

Declaration

I declare that, except where explicit reference is made to the contribution of others, that this dissertation is the result of my own work and has not been submitted for any other degree at the University of Glasgow or any other institution.

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Signature: xx

Chapter 1

Introduction

1.1 Motivation and Main Objectives of the Thesis

In the fall of 2008, China's export-driven economy experienced a downturn following the global financial crisis that began on the 20th, of July 2008. Total exports fell by more than half, from 137 billion US dollars in September 2008 to 65 billion US dollars in February 2009. China's GDP growth rate declined from 9.5% in the third quarter of 2008 to 6.4% in the first quarter of 2009[1].

To expand domestic demand and mitigate falling GDP growth caused by the global financial crisis, in November 2008, the Chinese government announced an economic stimulus package of four trillion RMB, equivalent to 586 billion US dollars, to be spent in the next two years. This sum was equivalent to roughly 14% of China's GDP in 2008, and in relative terms, was the biggest stimulus program in the world, equal to about three times the size of the US effort[2]. It has been described as the most aggressive stimulus package in the world by Paul Krugman,[3] and is considered to have been one of the most significant economic events in China over the past decade.

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1. Source: China's National Bureau of Statistics.
2. In the United States, the American Recovery and Reinvestment Act (ARRA) of 2009 allocated around 800 billion US dollars, which was around 5 percent of the size of US GDP.
3. Source: https://archive.nytimes.com/krugman.blogs.nytimes.com/2010/07/24/keynes-in-asia

Existing discussions of China's 4-trillion Yuan stimulus package[4] have been twofold. On the one hand, after the stimulus package was implemented, China quickly got rid of the influence of the crisis, succeeded in achieving rapid growth, and became the main driver of world economic growth (Deng et al. 2015, Ouyang & Peng 2015, Wen & Wu 2019). On the other hand, the concern has arisen that the excessive government intervention may exacerbate the long-standing problems in China's economy, such as the crowding-out effects of private investment (Huang et al. 2020), and the misallocation of resources (Bai et al. 2016, Cong et al. 2019, **?**), thereby worsening the aggregate growth potential.

It has been extensively documented that with the implementation of the stimulus package, resources (bank lending, capital, etc.) flow from high-productivity private firms to low-productivity state-owned firms due to the latter's implicit government assistance (Deng et al. 2020, Liu et al. 2018). This trend did not end after the stimulus package (Cong et al. 2019), leading to the slowdown of China's economic growth in the past decade (Bai et al. 2016). However, this point of view is challenged by Lardy (2014) who argue that claims of discriminatory lending practices by Chinese banks may be overstated. Nonetheless, it's essential to acknowledge that they often ignore other forms of government involvement, other than state ownership, during the stimulus package.

This thesis focuses on the issues that have been so far overlooked by the recent wave of literature on China's 4-trillion Yuan stimulus package, and aims to provide a comprehensive analysis of this stimulus package by answering the following questions: How much of the growth slowdown was driven by the stimulus package? In addition to state connectedness, how did the government intervene in the allocation of resources during the implementation of the stimulus package? And what were the unintended consequences of this government-oriented allocation?

The main contribution of this thesis is to shed more light on the long-lasting and unintended consequences of China's stimulus package, to directly estimate differential growth effects in the short and long runs, to analyse the previously unexplored effects of industrial intervention bias on investment performance and outcomes, and to propose novel mechanisms

4. The "4-trillion Yuan stimulus package" referred to in this thesis is not only the 4-trillion yuan investment plan, but also a series of economic stimulus policies.

for the allocation trend of firms' bank loan financing. The findings enrich the new wave of research exploring the drivers and outcomes of China's 4-trillion stimulus package, which can be applied to the case of stimulus packages in emerging markets in response to the Great Recession.

1.2 Outline of Main Chapters of the Thesis

This thesis starts by describing China's institutional background in Chapter 2. First, the measures and consequences of China's 4-trillion Yuan stimulus package are introduced in detail. Second, China's long-term economic growth trends in the past four decades are discussed, showing the potential long-lasting effects of the stimulus package. Finally, a description of China's banking sector is presented, emphasising the crucial role of bank lending in the stimulus package and the Chinese economy.

Building upon the institutional background outlined earlier, the following three chapters explore the consequences of the 4-trillion Yuan stimulus package from various viewpoints.

Chapter 3 examines the growth effects of China's 2009-10 stimulus package from a macro perspective. Utilising a panel spanning 30 provinces over 56 quarters (14 years), recently developed regression methods, Error Correction Model (ECM) and Pooled Mean Group (PMG) estimator, are employed to explicitly account for heterogeneous short-run dynamics within a long-run framework. The results reveal a significant long-term negative association between government-driven fiscal stimulus/credit expansion and growth in China, despite positive short-term effects. It is argued that the stimulus plan was one of the factors behind the slowdown in Chinese growth, which is attributable to its uneven allocation of government expenditure and bank credit.

The subsequent chapters delve into the mechanism behind this phenomenon at the industry and firm levels, and discuss the role of government intervention in two forms: official government orders, and implicit government connections. Specifically, in Chapter 4, the focus shifts towards investigating the impact of China's economic stimulus package on industry investment performance and allocation trends across provinces. Industries are categorised

based on their intensity of government support, using keywords from official government documents to distinguish between extensively supported, narrowly supported, and unsupported industries. Using a panel dataset of Chinese 2-digit industries at the province level, the differential effects are estimated through the Difference-in-Differences (DID) strategy. The results indicate that industries with government backing witnessed increased investment post-2009. However, this resulted in less efficient investment, particularly in industries with strong government intervention, leading to poor allocation trends within provinces. Further analysis highlights that these effects are prominent in state-dominated sectors and regions characterised by high corruption levels or underdeveloped economic markets. Overall, the findings support the notion that the stimulus-driven credit expansion experienced in China directs resource allocation to sectors with weaker growth prospects, thereby worsening the aggregate growth potential.

Chapter 5 extends the exploration into the firm bank loan financing and political connections. By matching firm-level bank loan data with the government working experience of CEOs/chairpersons in publicly listed firms, the study reveals an allocation bias in bank loans towards politically connected firms, particularly those tied to local authorities or with less probity. Further analysis based on individual bank loan announcements suggests that the stimulus package was a “false hope” for firms lacking political connections, indicated by an increase in the number of bank loan applications associated with a decrease in granted contracts. Even when loans were secured by these firms, the cost of their loans was significantly higher compared to their politically connected peers. These findings suggest credit inappropriate allocation trends during and post-stimulus, potentially contributing to the subsequent slowdown of the Chinese economy over the past decade.

Chapter 2

Institutional Background

This section first provides a detailed introduction to China's 4-trillion Yuan stimulus package, including its measures and consequences, followed by a discussion on China's long-term economic growth trends over the past four decades. Finally, the description of China's banking sector is presented, emphasising the important role of bank lending in the stimulus package and the Chinese economy.

2.1 China's 4-trillion Yuan Stimulus Package

In response to the global financial crisis, on 9th November 2008, the State Council of the People's Republic of China announced a two-year 4-trillion Yuan (approximately 586 billion US dollars) investment plan spanning from 2009 to 2010. In subsequent months, the Chinese authorities continuously refined and enhanced their policy measures, forming a comprehensive stimulus plan to tackle the crisis, encompassing a series of fiscal stimulus and monetary expansion measures, described in detail as follows.

2.1.1 Measures of the Stimulus Package

Fiscal Expansion

The fiscal stimulus plan featured the government spending 4 trillion Yuan over the subsequent two years (2009-10) on a wide array of national infrastructure and social welfare projects.

According to the National Bureau of Statistics, more than half of the funds were allocated to public infrastructure projects, with 1.5 RMB trillion to be spent on railways, roads, airports, water conservation, and urban power grids; 1.14 RMB trillion on affordable housing, rural livelihoods, and infrastructure; and 1 trillion RMB on post-disaster reconstruction in response to the May 2008 Wenchuan earthquake (see Table 2.1).

Table 2.1: Components of the Fiscal Expansion (RMB Trillion)

Project	Planned Investment
Housing Security	0.40
Rural Livelihoods and Infrastructure	0.37
Railway, Road, Airport, Water Conservancy and Urban Power Grids	1.5
Health, Education and Culture	0.15
Environment Protection	0.21
Self-Independent Innovation and Structural Adjustment	0.37
Post-Disaster Reconstruction	1.00
Total	4

Source: Bai et al. (2016).

Unlike the standard fiscal stimulus programs in developed countries, such as the American Recovery and Reinvestment Act (ARRA) of 2009, which involved direct government spending at all levels, China's fiscal stimulus was unique in three regards.

Firstly, the fiscal stimulus was primarily implemented by local governments. Only about 1.18 RMB trillion came from the central government, including investment in the central budget, central government fund investment, and other public investment and post-disaster reconstruction funds. This meant that there was a financing gap of 2.82 RMB trillion from local government investment.

Secondly, the stimulus was financed by relaxing the financial constraints on local government. As a consequence of the 1994 tax-sharing reform, Chinese local governments were prohibited from borrowing or running deficits, and thus lacked the fiscal resources to increase spending. To address this issue, the central government issued 200 RMB billion in government bonds on behalf of local governments, and facilitated the establishment of local government financing vehicles (LGFVs). These LGFVs served as entities representing local

governments in the financing of investments, mostly through loans obtained from banks. As a result, commercial bank credit, rather than government spending, was the most important source of finance for proposed local government projects. According to Bai et al. (2016)'s estimate, approximately 90% of local government investments were financed via bank loans.[1]

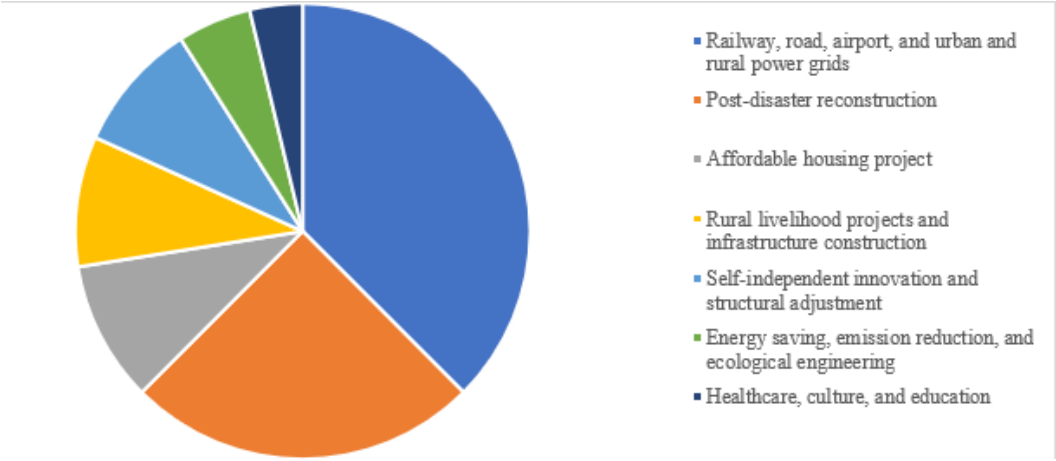

Figure 2.1: The Proportion of the 4-Trillion Package, May 21, 2009
Source: The official website of China's State Council

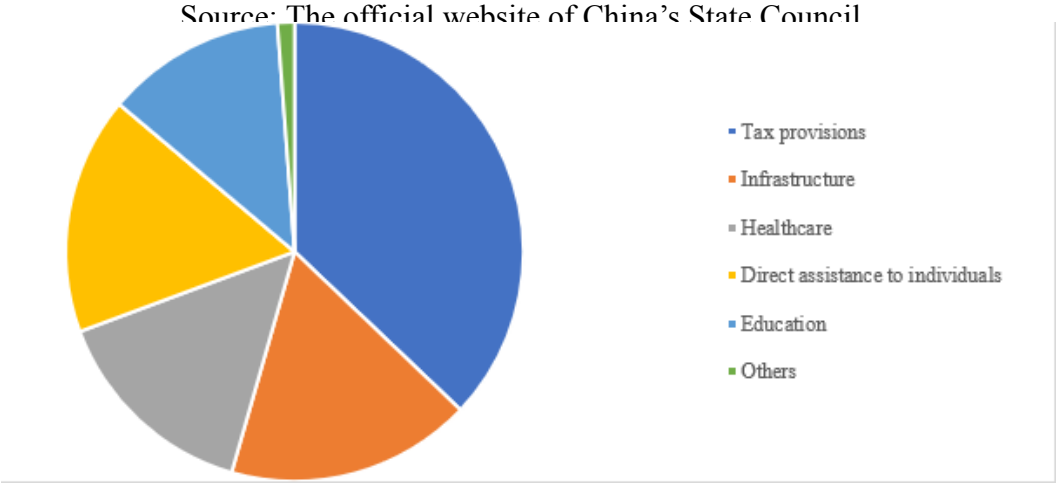

Figure 2.2: The Proportion of ARRA in the US, February 17, 2009
Source: The official website of the US Federal Transit Administration.

Thirdly, China heavily focused on infrastructure construction, allocating nearly 50% of its expenditure to this sector, while the US emphasized tax provisions, with less than 20% directed towards infrastructure. This reflects China's direct government intervention and over-concentration of resources and the US relied more on market mechanisms and diversified spending. This difference may impact long-term economic growth potential, as China's approach may hinder future growth prospects due to limited investments in education and research and development (R&D), compared to the US stimulus plan's emphasis on these areas.

1. It has been argued that the actual implementation size of China's stimulus package was even larger than the announced value due to the over-lending of the banks to local governments (Ouyang & Peng 2015).

Financial Deregulation

To relax financial constraints and encourage an increase in money injection into the real economy, the Chinese government carried out an expansionary monetary policy package by lowering its benchmark interest rate and the reserve requirement ratio in commercial banks. Between September and December 2008, the People's Bank of China, which is the central bank of China, cut its base 1-year lending rate from 7.47% to 5.31% in five consecutive decreases, and reduced the commercial banks' reserve requirement ratio in three consecutive waves from 17.5% to 15.5% for large banks and 13.5% for medium-sized and small banks (see Table 2.2)[2]. Meanwhile, the State Council office issued a call to banks aiming to increase total lending by 4 RMB trillion in 2008.

Table 2.2: Monetary Policy of China in 2008

Date	Action Taken
16th September 2008	Lowered one-year benchmark lending rate for RMB by 0.27%, while the benchmark deposit rate remains unchanged
25th September 2008	Lowered statutory reserve requirement ratio for small and medium-sized financial institutions by 1%, while large financial institutions remained unchanged
9th October 2008	Lowered one-year benchmark lending/deposit rate for RMB by 0.27%
15th October 2008	Lowered statutory reserve requirement ratio for all financial institutions by 0.5%
30th October 2008	Lowered one-year benchmark lending/deposit rate for RMB by 0.27%
27th November 2008	Lowered one-year benchmark lending/deposit rate for RMB by 1.08%
5th December 2008	Lowered statutory reserve requirement ratio for large financial institutions by 1%, for small and medium-sized 2%
25th December 2008	Lowered statutory reserve requirement ratio for all financial institutions by 0.5%

Source: Official website of the People's Bank of China.

As a result, bank credit in China more than doubled from 4.7 RMB trillion in 2008 to 9.6 RMB trillion in 2009, and continued to grow in the years that followed. Estimates suggest a total of 4.7 RMB trillion in "extra" new bank loans were extended to the Chinese economy in 2009 (**?**).

2. Large commercial banks are the Bank of China (BOC), China Construction Bank (CCB), Industrial and Commercial Bank of China (ICBC), Agricultural Bank of China (ABC), and Bank of Communications (BoCom); medium-sized and small commercial banks include the remaining 12 joint-equity commercial banks, urban and rural commercial banks, and urban and rural credit unions.

Figure 2.3 plots the annual new bank loans scaled by GDP together with the GDP growth rate from 2004 to 2017. While new bank loans had been about 15% in normal times, this number sharply increased to over 25% in 2009.

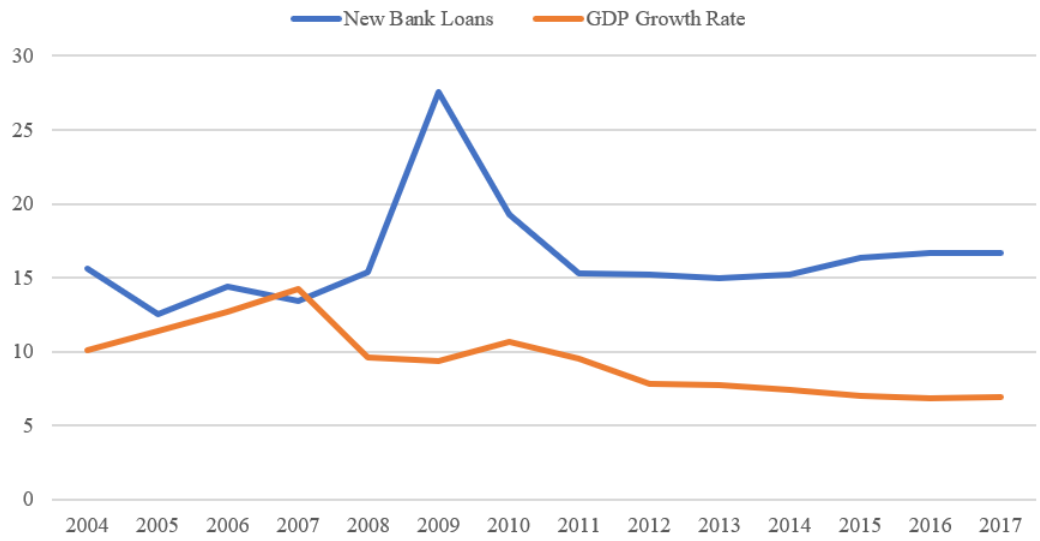

Figure 2.3: New Bank Loans as A Percentage of GDP in China (2004-2017) (%)
Source: China Macroeconomic Database (Annual).

The Top Ten Industrial Revitalisation Plan

To stimulate the economy and adjust the industry structure, on 26, November 2008, Jiabao Wen, the then Prime Minister of the State Council, put forward policies that strongly supported the development of key industries, including manufacturing industries (such as the automobile industry, equipment industry, shipbuilding manufacturing industry, non-ferrous metal industry, steel industry, textile industry, petrochemical industry, and light industry), the electronic information industry, and the logistics industry. In early 2009, the National Development and Reform Commission (NDRC) issued a series of industrial policies for those ten sectors, labelled "the Top Ten Industrial Revitalisation Plan", which was designed to cover three years, spanning from 2009 to 2011. This plan is considered one component of the massive 4-trillion Yuan stimulus package, guiding the allocation of bank lending and other resources (Naughton 2009).

These policy documents proposed an increased injection of government resources into many of these sectors. For instance, the electronic information plan set out an investment of 600 RMB billion in the build-out and integration of the "three networks": next-generation Internet, third-generation wireless, and digital television. While most of this investment came from government-run corporations rather than from the government itself, there was an increase in the flow of credit resources into these sectors.

The policies described in Table 2.3, presenting the specific release time and related financing and credit measures for each industry, reflect a mixture of responses to the global financial crisis and long-term structural strategies aimed at supporting sustained growth in key sectors. The government issued various financing and credit measures for most sectors, but the specific language used reveals a biased approach that distinguishes between immediate cyclical responses and long-term structural policies.

Table 2.3: Related Measures of the Top Ten Industrial Revitalisation Plan

Sector	Release Time	Financing and Credit Measures
Logistics	13 Mar 2009	N.A.
Steel	20 Mar 2009	"Continue to implement the policy of financing with retention and pressure."
Automobile	20 Mar 2009	"Promote and regulate auto consumption credit."
Electronic information	15 Apr 2009	"Improve investment and financing environment."
Textile	24 Apr 2009	"Increase financial support for textile enterprises."
Non-ferrous metal	11 May 2009	"Promote and regulate auto consumption credit."
Equipment manufacturing	12 May 2009	N.A.
Petrochemical	18 May 2009	"Strengthening credit policy support."
Light	18 May 2009	"Increase financial support."
Shipbuilding	9 Jun 2009	"Increase credit financing support for production and operation."

Source: The official website of the Central People's Government of the People's Republic of China.

Several policies in the table serve as cyclical responses designed for immediate economic stabilization, increasing liquidity, and supporting industries to prevent a severe downturn. For instance, the textile sector's policy to "increase financial support for textile enterprises" and the shipbuilding sector's directive to "increase credit financing support for production and operation" reflect straightforward financial aid to ensure their stability and growth during the economic downturn. Similarly, the automobile sector's policy to "promote and regulate auto consumption credit" is a direct stimulus measure intended to boost demand in the short term. The petrochemical sector's policy to "strengthen credit policy support" also reflects

a clear intention to provide substantial financial backing to ensure continuous development and stability in this critical industry. These policies exemplify cyclical responses designed to stabilize the economy rapidly by ensuring key industries could continue operations and maintain production capacities.

However, the biased attitude of the government is obvious in the different expressions used for the steel industry, a traditionally government-supported sector in China. "Financing with retention" appears to provide loan discount support to avoid the risk of a chain disconnection of funds for large backbone enterprises, ensuring liquidity without broadly extending new lines of credit. On the other hand, "financing with pressure" involves implementing financing restrictions for projects that violate laws and regulations, projects approved beyond their authority, and enterprises with backward production capacity. This dual approach indicates a selective support strategy, where financial aid is carefully controlled and directed only towards compliant and strategically significant projects, while discouraging non-compliant or inefficient enterprises. This selective strategy suggests a focus not only on immediate crisis response but also on enforcing compliance and promoting efficiency within the industry, aligning with long-term structural goals.

In addition to immediate crisis response, some measures clearly align with China's long-term strategic objectives, such as supporting export-led growth, technological advancement, and industrial upgrading. For example, the electronic information sector's policy to "improve investment and financing environment" reflects a broader and long-term strategy aiming to promote growth and innovation.

2.1.2 Consequence of the Stimulus Package

The direct foreseeable consequence of these actions is a substantial increase in investment. The growth rates of fixed asset investment peaked in the middle of 2009 and 2010. The cumulative year-on-year growth rate of fixed asset investment completion rose from 27% at the end of 2008 to 34% in mid-2009. In 2010, influenced by the high base of 2009, the growth rate declined slightly but remained around 25%. Figure 2.4 illustrates that the investment rate remained higher even after the end of the stimulus package in 2010 and was probably the highest investment rate of any country in the world. [3]

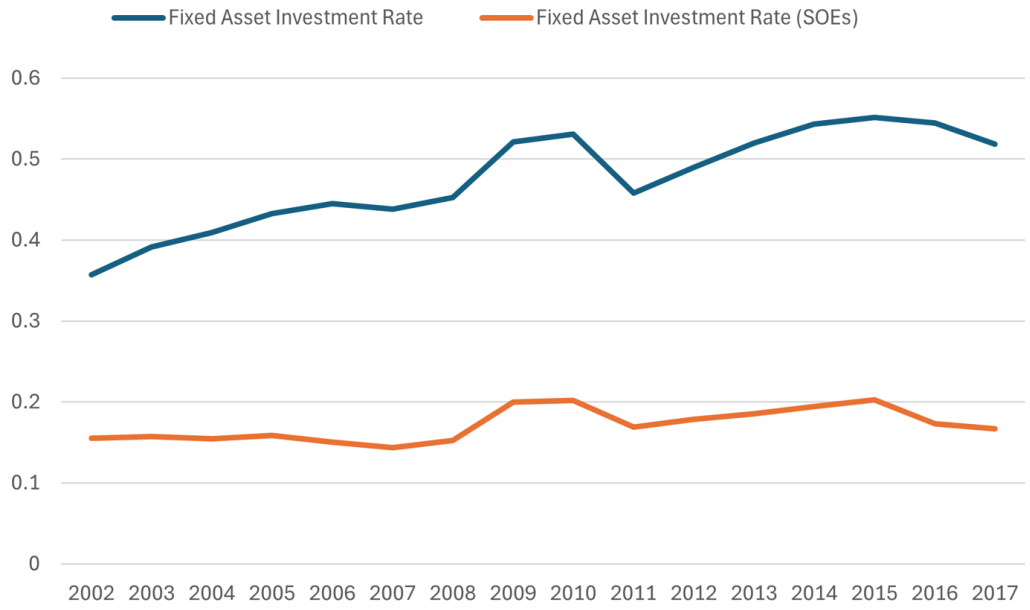

Figure 2.4: Fixed Asset Investment as A Percentage of GDP in China (2002-2017) (%)
Source: China Macroeconomic Database (Annual).

The surge in investment significantly boosted the Chinese economy. In the first quarter of 2009, China's GDP growth rate bottomed out at 6.1%. Subsequently, with the implementation of the 4-trillion stimulus package, the GDP growth rate rebounded to 7.9% in the second quarter and 8.9% in the third quarter. By the fourth quarter, GDP growth had surged to 10.7%. From this perspective, the 4-trillion Yuan package successfully led to the swift recovery of China's economy from the impact of the financial crisis.

3. In comparison, according to the World Bank, the investment rates for the UK and the US were significantly lower, at 18% and 22% of GDP, respectively. The global average rate was around 22%.

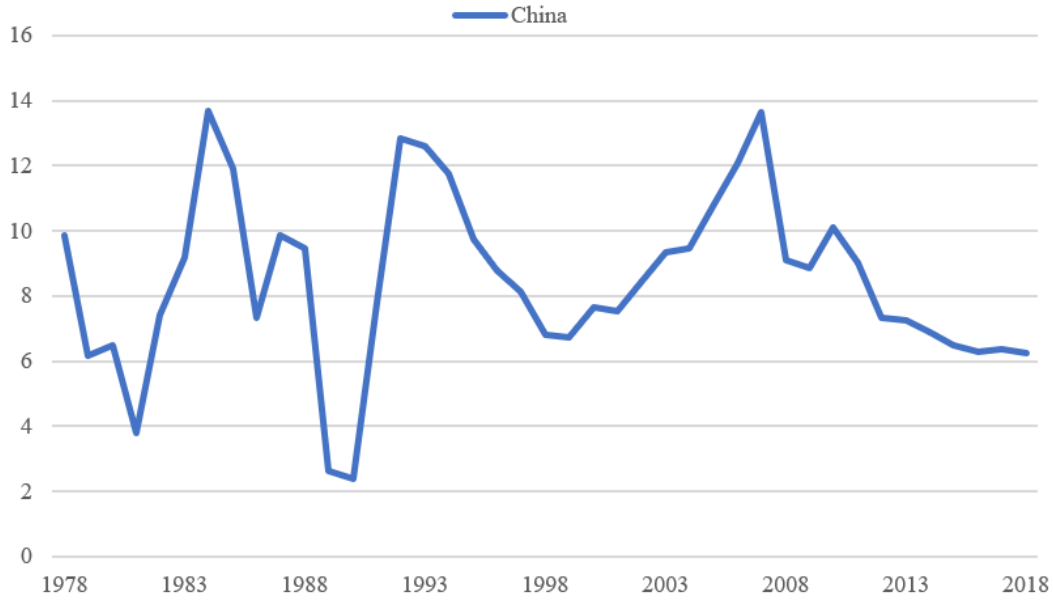

Figure 2.5: GDP Per Capita Growth in China (1978-2018) (%)
Source: China Macroeconomic Database (Annual).

However, there still is some concern about the long-lasting consequences of the massive one-off stimulus package. Firstly, the relaxation of financial constraints made it possible for local governments to channel financial resources towards commercial projects favouring certain state-owned or private firms. This potentially worsened the overall efficiency of capital allocation (Bai et al. 2016, Cong et al. 2019, **?**), thereby lowering aggregate productivity and GDP (see Figure 2.5).

Secondly, the credit boom also sowed the seeds for the shadow banking surge several years later. It has been estimated that provinces with greater bank loan growth in 2009 experienced higher municipal corporate bond issuance during 2012-15 (**?**).

2.2 China's Long-term Economic Trends

Since its economic reforms in 1978, China has been among the world's fastest-growing economies, with annual GDP growth averaging 10% through 2018. This section is mainly concerned with Chinese economic policy and performance from 1978 onwards, which has encompassed major institutional changes and swings in growth.

In general, China's high average growth rate shows a marked cyclical pattern. These "cycles" in growth have tended to coincide with or follow major periods of economic reform. As Figure 2.5 shows, there have been three peaks, in 1984-85, 1992-93, and 2007-08. Therefore, China's growth trend is discussed following the four growth cycles.

The first stage of reforms (1978-1984) was to reverse the policy of collectivisation in the countryside, and reintroduce markets (and market prices) for agricultural goods. This proved crucial in increasing agricultural productivity, especially in relation to grain production (Garnaut & Guonan 2010). Due to China's economic and political instability during the early period, its economic growth experienced fluctuations from 1978 through 1982, followed by a strong and significant rebound.

Subsequent reforms (1985-1991) aimed to incentivise managers in the corporate sector to make state-owned enterprises (SOEs) more efficient and profitable, and relax controls on the prices of many goods and services that had been relatively stable under central planning. However, the dangers of rapid price reform soon became apparent as after a period of strong growth, there was a sharp slowdown in parts of the economy in the late 1980s (Brandt & Zhu 2000).

In a bid to reinvigorate the reform agenda, Deng Xiaoping, the former Paramount leader of China, visited several locations in southern China in 1992, during which time more radical reforms were introduced. The most important milestone in the 1990s was the reform of SOEs. By encouraging the forced layoffs of unproductive workers, and allowing smaller SOEs to be privatised, the government was able to markedly improve the efficiency of the corporate sector. Firms were forced to become profitable to survive, reducing the burden on state finances previously imposed by unprofitable enterprises. These efforts contributed to a quick recovery in growth.

While the late 1990s were a turbulent period for the economy for other reasons (e.g., the Asian Financial Crisis in 1997 and a non-performing loan crisis in the banking sector), in the aftermath of these problems, the Chinese economy received a major boost from its accession to the World Trade Organisation (WTO) in 2001. WTO entry required China to remove more restrictions on exports, imports, and foreign investment, which enhanced its access to overseas markets and increased the flow of trade and foreign investment through the 2000s.

The global financial crisis (GFC) in 2008 magnified a slowing in growth that was already becoming apparent as the positive effects of earlier reforms started to wane. The GFC led to a sharp fall in advanced economies' demand for Chinese exports, which weighed heavily on domestic manufacturing. The Chinese Government's economic stimulus response to the crisis temporarily boosted GDP growth, largely by supporting investment in housing and infrastructure and loosening financial constraints to increase bank lending. These policies enabled China to counter the shock of the sharp global fall in demand for Chinese products. From 2008 to 2010, China's GDP growth rate averaged 9.9%.

China's GDP growth rate declined slowly in the decade after the 4-trillion Yuan stimulus package, falling from 10.6% in 2010 to 5.9% in 2019 (although it rose in 2017). The International Monetary Fund's April 2019 World Economic Outlook predicted that China's real GDP growth would slow each year over the next six years, falling to 5.5% in 2024.[4]

A horizontal contrast between China's regions gives a clearer understanding of the role of the 4-trillion Yuan stimulus package. According to Figure 2.6, before 2007, the economic growth rate of the coastal areas was higher than that of the inland areas.[5] This was the consequence of the state's relaxation of restrictions on foreign trade and investment. Due to their geographical advantages, coastal areas received more policy support and achieved more rapid development.

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4. IMF, World Economic Outlook, April 2019.
5. China's coastal provinces comprise Tianjin, Hebei, Liaoning, Shanghai, Jiangsu, Zhejiang, Fujian, Shandong, Guangdong, Guangxi, and Hainan. The inland provinces are Beijing, Shanxi, Neimenggu, Jilin, Heilongjiang, An'hui, Jiangxi, Henan, Hubei, Hunan, Chongqing, Sichuan, Guizhou, Yunnan, Shanxi, Gansu, Qinghai, Ningxia, Xinjiang, and Tibet.

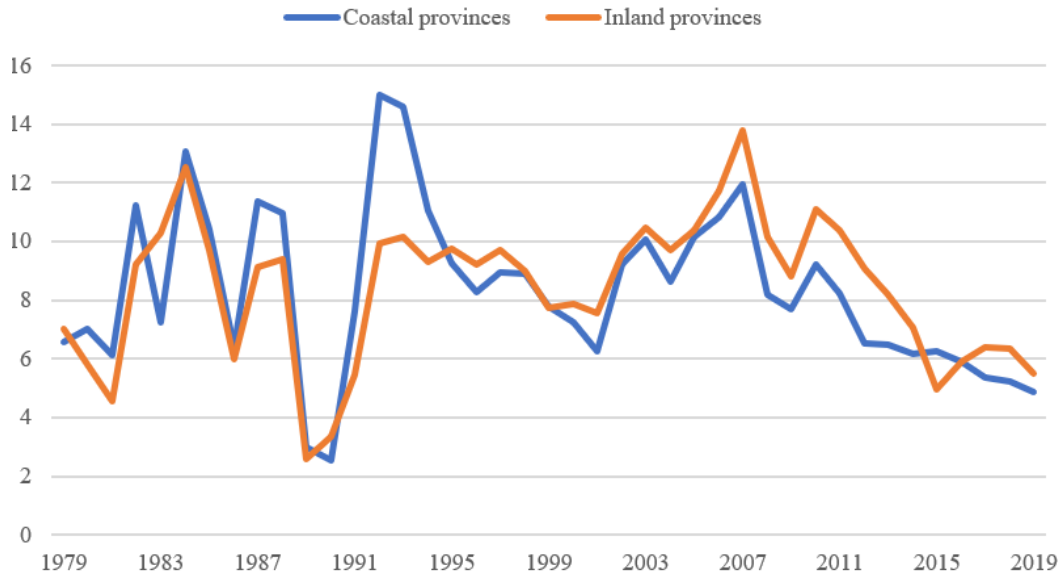

Figure 2.6: GDP Per Capita Growth in China's Coastal and Inland Provinces (1979-2019) (%)

Source: China Macroeconomic Database (Monthly).

China's Western expansion policy, which started in 1999, narrowed this gap to a certain extent. Since the 4-trillion Yuan stimulus package, which provided most of the funds to support the infrastructure construction in the inland provinces, this gap has widened in the opposite direction - inland provinces have exceeded the coastal provinces in economic growth.

There are many drivers behind the slowdown and convergence in China's economic growth (Bai et al. 2016). However, the 4-trillion Yuan stimulus package driven by the government is widely believed to have been an important force. This thesis will discuss how much of the growth slowdown was driven by the stimulus plan later in Chapter 3, and investigate the mechanism of government involvement in Chapters 4 and 5.

2.3 China's Financial Institutional Structure

China's financial system presents a distinctive structure compared to many Western countries, particularly in terms of its central banking and banking sector characteristics.

2.3.1 Non-independent Central Bank

The non-independence of the Central Bank of China, the People's Bank of China (PBC), is a significant distinction from many central banks in Western countries (Zagoria & Lardy 1998). According to Chinese central banking law, the PBC works under the State Council's leadership, and the appointment of the governor is decided by the central government (Zhao et al. 2023). This means that, unlike independent central banks that primarily focus on controlling inflation and maintaining price stability, the PBC's policies are formulated to support the comprehensive economic and social strategies of the government.

For instance, as discussed above, during the 2008 global financial crisis, the Chinese government implemented a massive fiscal stimulus package amounting to 4 trillion Yuan to counteract the economic downturn. The PBC complemented this effort by lowering interest rates and reducing the reserve requirement ratio for banks, thereby injecting liquidity into the economy and encouraging lending and investment. Conversely, in times of overheating, such as the rapid economic growth period in the early 2010s, the PBC tightened monetary policy by raising interest rates and increasing the reserve requirement ratio to control inflation and prevent asset bubbles, working in concert with fiscal measures aimed at cooling down the economy.

2.3.2 Reliance on (State-owned) Banks

China's financial system is dominated by the banking system due to its underdeveloped capital market (Allen et al. 2005, Deng et al. 2015, Firth et al. 2008). As shown in Figure 2.7, bank lending has been the largest external source of financing in China. On average, from 2002 to 2015, bank loans accounted for 72% of the total credit flow to the real economy. In recent years, due to significant growth in corporate bond market and shadow banking, this proportion has been declining - but it still accounts for more than half of external finance.

Another unique characteristic of the Chinese banking sector is the high level of state ownership and control. Table 2.4, below, provides the number and assets of different types of banks in China at the end of 2009, classified by their ownership structure.

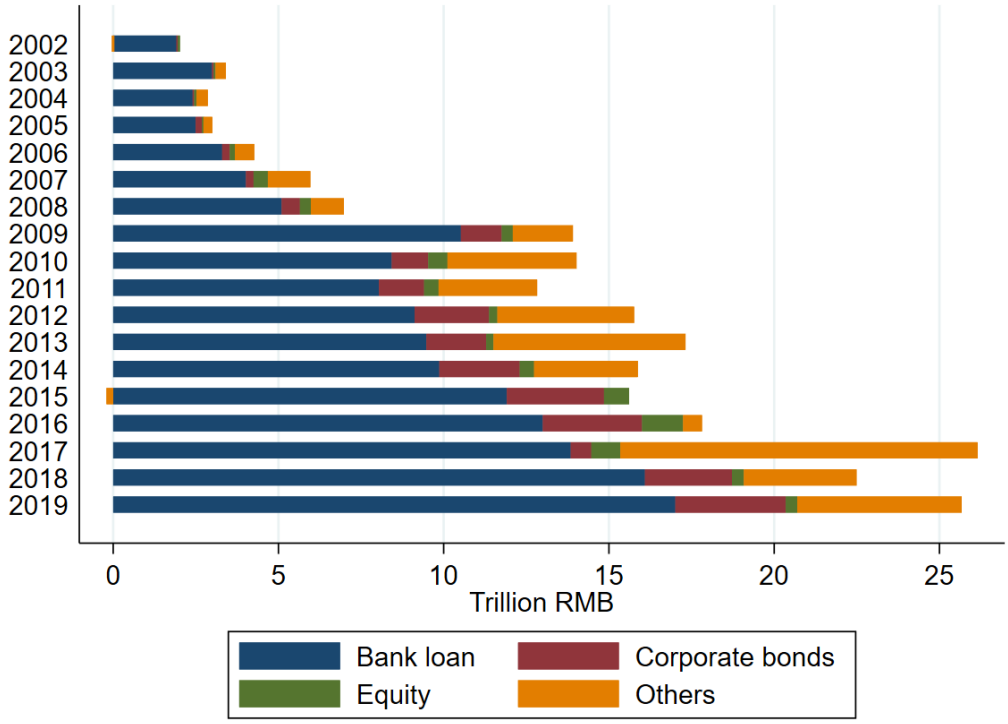

Figure 2.7: Sources of External Finance in China (2002-19)
Source: China Banking Regulatory Commission.

Three "policy banks" - China Development Bank, Export-Import Bank of China, and Agriculture Development Bank of China - are fully and directly owned by the state and act as instruments for state intervention in the economy. Four "state-owned commercial banks" - Industrial and Commercial Bank of China, China Construction Bank, Agricultural Bank of China, and Bank of China - were corporatised and subsequently listed in 1995, but are still wholly or partially owned by the state. They operate under the guidance and supervision of regulatory authorities such as the Ministry of Finance and the China Banking and Insurance Regulatory Commission (CBIRC). Among thirteen other "joint stock commercial banks", eleven have an SOE or subnational government organ as their largest shareholder.[6] Thus, 18 of the 20 largest banks in China are directly state-controlled, and, at the end of 2009, they accounted for 58.58 RMB trillion, or about 73% of total bank assets.

6. The central government, either directly or via C-SOEs, is the largest shareholder in five of these: the Bank of Communications, China Citic Bank, China Everbright Bank, Huaxia Bank, and China Merchants Bank. The other six, with local governments as the largest shareholder, are the Industrial Bank, Guangdong Development Bank, Shanghai Pudong Development Bank, Evergrowing Bank, China Zheshang Bank, and China Bohai Bank.

Table 2.4: China's Banking Financial Institutions at the End of 2009

	Number		Asset (RMB Trillion)	
	Amount	Share (%)	Amount	Share (%)
Policy banks	3	0.05	6.95	8.63
State-owned commercial banks	4	0.07	39.04	48.47
Joint-stock commercial banks				
State as largest shareholder	11	0.20	12.59	15.63
Others	2	0.04	2.01	2.50
Others				
City commercial banks and credit union	158	2.80	5.71	7.09
Rural commercial banks and credit union	5,241	93.02	8.64	10.73
Postal savings bank	1	0.02	2.70	3.35
Foreign banks	32	0.57	1.35	1.68
Nonbank institutions	182	3.23	1.55	1.92
Total	5,634	100.00	80.53	100.00

Source: Deng et al. (2015).

In sum, China's banking sector is characterised by a dominant position in financial markets and active government involvement. This explains why the bulk of the 4-trillion Yuan economic stimulus is provided by the banking sector. Therefore, examining the allocation trend of bank lending is crucial to analysing the effects of the stimulus package. Furthermore, the heavy reliance of Chinese sectors and firms on bank lending provides an excellent environment in which to explore the effects of a bank loan supply shock since they are sensitive to the changes in bank loan supply.

Chapter 3

The Impact of the Stimulus Package on China's Economic Growth

3.1 Introduction

In response to the global financial crisis in 2008, China introduced an economic stimulus program, known as the 4-trillion Yuan package. This initiative, described by Paul Krugman as a "much more aggressive stimulus than any Western nation",[1] involved fiscal stimulus through large government spending and credit expansion via relaxing the financial constraints on traditional banks.

Following the implementation of the stimulus package, China became the first major economy to recover from the recession. China's GDP growth rebounded to its double-digit pre-crisis rate in late 2009, reaching 11.4% per year. Moreover, GDP growth surged significantly above its long-run average in the first quarter of 2010, reaching 12.2% per year[2].

Several studies have explored the impact of China's stimulus package, highlighting its significant role in driving economic recovery (Ouyang & Peng 2015, Wen & Wu 2019). However, there is scarce direct empirical evidence on the long-lasting consequences of the 4-trillion Yuan package, particularly concerning its implications for medium- to long-term growth effects.

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1. Source: https://archive.nytimes.com/krugman.blogs.nytimes.com/2010/07/24/keynes-in-asia
2. Source: China's National Bureau of Statistics

The present chapter aims to fill this research gap by answering a broad and important question: What role has the 4-trillion Yuan package played in determining economic growth in China? How much of the growth slowdown has been driven by the stimulus package?

Based on a quarterly panel of 30 provinces in China from 2004 to 2017 and panel macro regression analysis, this research is grounded in the general equilibrium principle. It's important to note that this analysis does not aim to establish causal relationships. Instead, the focus is on estimating conditional correlations, which represent the coefficients in the regression equation.

By employing panel time-series regression methods that treat heterogeneous short-run dynamics explicitly within a long-run model, I find that both fiscal stimulus and credit expansion caused by the stimulus package temporarily boosted the economy in China, but at the expense of a medium- to long-run growth slowdown due to the inappropriate allocation of resources (explained in the next two chapters). [3] This effect is more prominent in less developed inland provinces where economic activities are seen to be controlled by the government.

This chapter contributes to the existing literature in two dimensions. First, it builds upon the investigations by Bai et al. (2016) and Ouyang & Peng (2015) of the aggregate effects of China's economic stimulus package. While Bai et al. (2016) find that local governments play a crucial role in allocating financial resources during the stimulus period, suggesting potentially declining effects on the aggregate growth and productivity, Ouyang & Peng (2015) find that the stimulus package temporarily boosted the economy based on treatment-effect estimation. This chapter extends these findings by directly estimating how much the slowdown in China has been driven by the 2009 stimulus package using high-frequency provincial data.

Second, methodology-wise, this study explicitly distinguishes between long-term effects and short-term dynamics by employing a recently developed Error Correction Model (ECM) and Pooled Mean Group (PMG) estimator suggested by Pesaran & Smith (1995) and Pesaran et al. (1999). Previous literature testing for aggregate short-term or long-term growth impacts of fiscal policy has utilised quite different methodologies (Gemmell et al. 2011). The former

3. These negative changes may come from the long-term slowdown in the global economy caused by the financial crisis, and the empirical model attempts to disentangle the two effects.

generally focuses on the temporary fiscal "shocks" and output (Arin et al. 2009, Blanchard & Perotti 2002, Burnside et al. 2004), while the latter pays more attention to "persisting" government expenditure and ignores short-term dynamics or assumes homogeneity (Bleaney et al. 2001, Devarajan et al. 1996, Gupta et al. 2005, Romero-Ávila & Strauch 2008). Consequently, how consistent the empirical evidence from the different frameworks has been unclear. This chapter offers an alternative approach by employing a panel regression but allowing for heterogeneous short-run dynamics, aiming to discuss the temporary and persistent growth effects of China's massive one-off stimulus.

Throughout this chapter, the definition of "short-term" and "long-term" arises in the framework of an Error Correction Model. "Short-term" represents the period of transitional changes in output growth to the equilibrium following a one-off change in policy and "long-term" describes the steady-state equilibrium.[4]

This chapter starts by reviewing the literature on the relationship between fiscal policies and economic growth in Section 3.2. Data and methodology issues are described in Section 3.3. Empirical analyses and robustness checks are set out in Section 3.4. The conclusion is provided in Section 3.5.

3.2 Literature Review

3.2.1 Economic Theory

There have been numerous theoretical studies on the determinants of economic growth (Temple 1999). Two main analytical frameworks through which the determinants of growth, including fiscal policy, have been analysed in the literature: the neoclassical growth model, and the endogenous growth model.[5] However, the debate on which theory best fits in terms of countries seeking positive significant changes in their growth rates has not reached a consensus.

4. More explanations can be found in Pesaran (1997).
5. While there are other growth theories, such as the institutional framework factors, they are not focused on in this research.

Solow Growth Model

The Solow growth model, with its assumption of a constant savings rate, provides a framework for understanding how economies grow over time through capital accumulation, labour force growth, and technological progress (Solow 1956). A key insight is that while increasing the savings rate can boost capital accumulation and, consequently, output per worker in the short term, the effect diminishes over time due to diminishing returns to capital. This results in a once-off increase in output per worker, after which the growth rate of output per worker returns to a steady-state level determined by the rate of technological progress. In the Solow model, sustained growth is possible but it is driven by exogenous technological advancements, not by capital accumulation alone.

The Solow model predicts that a policy of encouraging growth through more capital accumulation will tend to tail off over time producing a once-off increase in output per worker. In contrast, a policy that promotes the growth rate of TFP can lead to a sustained higher growth rate of output per worker.

Neoclassical Growth Model

The neoclassical growth theory, which builds on the Solow model, offers deeper insights into long-term economic growth by emphasising capital accumulation, labour or population growth, and increases in productivity. Unlike the Solow model's assumption of a constant savings rate, the neoclassical model often considers the savings rate as endogenously determined by economic agents. Central to this theory is the role of technology in the economic growth process (Cass 1965, Swan 1956). Diminishing returns in the accumulation of inputs implies that increasing the amount of any input does not lead to sustained growth in output in the long term. However, continuous technological improvement can offset these diminishing returns, allowing persistent positive rates of per capita growth (Arvanitidis et al. 2007).

In the neoclassical framework, fiscal policy primarily influences economic growth in the short and medium term by shaping incentives for investment in human and physical capital (Chamley 1986, Judd 1985). A one-off policy change induces a transitional shift in output growth. As the economy adjusts and capital stock and output levels rise, growth returns to the steady-state rate, determined primarily by technological progress (Cass 1965, Swan 1956).

In the long term, fiscal policy alters the equilibrium factor ratio, impacting the level of the output path without changing its slope. Transitional growth effects arise as the economy transitions to its new path, but ultimately, long-term growth is dictated by exogenous technological progress (Cass 1965, Swan 1956). When countries share comparable long-term growth rates, the long-term effects of fiscal policy become less significant (Gwartney et al. 1998).

Endogenous Growth Model

New endogenous growth models have proposed that fiscal policy could have much more substantial or "permanent" effects on income levels and growth rates. One of the first attempts is the public-policy endogenous growth model proposed by Barro (1990).

Barro (1990) makes several key contributions regarding the relationship between government spending and economic growth. Barro extends the endogenous growth models by incorporating government services financed through taxation. He distinguishes government expenditure into productive and non-productive categories. Productive expenditure is defined as spending that enhances the marginal productivity of private capital, such as infrastructure development and property rights protection. This categorization lays a significant theoretical foundation for subsequent research. By allowing for productive public expenditure, he identifies a positive correlation between government expenditure and long-run economic growth. This implies that government expenditures on infrastructure, education, and other public goods that improve the productivity of the private sector can lead to higher economic growth rates. Unlike exogenous growth models where technological progress is the primary driver of growth, Barro's model shows that governments can enhance growth by investing in productive public services while maintaining efficient taxation systems.

Building on Barro's insights, subsequent literature has further explored the relationship between fiscal policy and economic growth within endogenous growth frameworks.

Jones & Manuelli (1990) develop a convex model of equilibrium growth that incorporates fiscal policies such as taxes on capital and labour. Their model extends the endogenous growth framework by allowing for interactions between fiscal policy, capital accumulation, and technological progress. In their model, fiscal policy affects the economy's long-term growth path through its impact on savings, investment, and human capital accumulation. They show that the design of fiscal policy, particularly tax policies, can significantly influence the economy's growth rate and welfare outcomes. For instance, high taxes on capital may discourage investment and hinder capital accumulation, thereby slowing down economic growth in the long run. Conversely, well-designed tax policies that incentivize savings and investment can promote higher long-term growth rates.

Rebelo (1991) extends previous models by considering the role of government spending and taxation in influencing capital accumulation and technological progress. In his model, Rebelo examines how various fiscal policies, such as taxes on capital and government spending on infrastructure and education, impact the economy's long-term growth rate. He finds that well-designed fiscal policies can enhance capital accumulation and promote technological progress, leading to higher sustainable growth rates. Specifically, by investing in infrastructure, education, and research, governments can create an environment conducive to innovation and productivity growth. Moreover, Rebelo's model underscores the need for efficient tax policies that encourage savings and investment while minimizing distortions in resource allocation.

In summary, in the endogenous growth framework, fiscal policy can have long-run effects by affecting (1) factor accumulation (e.g. capital income taxes, public expenditure), (2) technical progress, or/and (3) long-term growth rates. By highlighting the importance of productive government expenditure and efficient tax policies, the endogenous growth theory underscores the role of fiscal policy in promoting sustained economic growth and welfare.

3.2.2 Cross-country Evidence

Since one objective of this chapter is to determine the effects of the fiscal stimulus package on economic growth based on high-frequency data, it is crucial to outline the structure of the data and associated methodologies employed in the analysis. This section classifies the main empirical studies into four types: (1) cross-sectional analyses, (2) short/standard panel data analyses, and (3) panel time-series data analyses, then briefly presents their methodology and findings.

Cross-sectional Analyses

The studies developing a cross-sectional analysis of fiscal policy and economic growth, such as Barro (1991) and Easterly & Rebelo (1993), offer valuable insights into the relationship between government expenditure components and economic performance across different countries.

Barro (1991) examines data from 98 countries over the period 1960-1985 and finds a negative association between the ratio of government consumption expenditure to GDP and the growth rate of real GDP per capita. This suggests that non-productive government spending, which introduces distortions like high tax rates, may hinder investment and economic growth. On the other hand, there is a positive relationship between public investment and economic growth rate, indicating that productive government expenditure can stimulate growth. However, the author acknowledges the difficulty of isolating the effect of fiscal policy due to the high correlation between fiscal variables and income levels at the beginning of the period.

In a similar vein, Easterly & Rebelo (1993) conduct cross-sectional analyses of 119 countries from 1970 to 1988. They find a positive relationship between the share of public investment in transport and communication and economic growth, suggesting a supernormal return on public spending in infrastructure. Additionally, general government investment is found to have a positive effect on growth. However, they note the need for more comprehensive data on infrastructure to address causality from infrastructure to growth and the high magnitude of coefficients on public infrastructure expenditure.

While cross-sectional analyses provide some understanding of the association between fiscal policy and economic growth across countries, they also have limitations. Firstly, omitted variable bias may affect the estimates due to unobserved factors influencing both fiscal policy and economic performance. Secondly, traditional OLS regression analyses may not adequately control for causality and endogeneity issues. As a result, alternative analyses based on time series data are explored to complement cross-sectional findings.

Standard Panel Data Analyses

Given that government expenditure is often increased during periods of slowdown to stimulate the economy, the estimated effect of government expenditure on economic growth can vary significantly depending on the selection of countries and the time period analysed (Bergh & Henrekson 2011). Therefore, the observed positive or negative effects of fiscal policy on economic growth in cross-sectional and time-series analyses may reflect correlation rather than causation. In panel-data analyses, some measures, such as Instrumental Variables (IVs) and Generalized Method of Moments (GMM) estimation, are taken to address the endogeneity issues.

Kneller et al. (1999) investigate the effect of fiscal policy on economic growth using a sample of 22 OECD countries from 1970 to 1995. They emphasise the importance of considering both sides of budget constraints and classify government spending based on its participation in the private production function. Their result reveals a positive relationship between productive government expenditure and economic growth, while non-productive expenditure shows no impact on the growth rate. This contrasts with the findings of previous studies and supports the endogenous growth models proposed by Barro (1990).

Bleaney et al. (2001) build on the work of Kneller et al. (1999) and examine whether five-year averaged data adequately capture long-run economic growth rates, and whether dynamic responses and the endogeneity of fiscal policy affect static results. They use original annual data with long lags of independent variables and find that both approaches yield consistent evidence, suggesting that period averaging may not fully capture fiscal effects on long-term growth. Their results remain robust even when accounting for potential endogeneity in fiscal regressors.

Fölster & Henrekson (2001) examine the relationship between public expenditure and economic growth in a sample of rich countries covering the 1970-1995 period. They apply the Two-stage Least Square (2SLS) method where the government expenditure and taxes are instrumented by their lagged levels, and find that an increase of the expenditure ratio by 10 percentage points is associated with a decrease in the growth rate of 0.7-0.8 percentage points. They further argue that the more the econometric problems are addressed, the more robust the results appear.

Similarly, Afonso & Furceri (2010) analyse the effects in terms of size and volatility of government revenue and spending on growth in OECD and EU countries. They instrument government expenditure (revenue) and tax revenues by their lagged values, trade openness and country population, and instrument the volatility of government expenditure (revenue) by their lagged values and country population to address endogeneity and reverse causality concerns. Their results report that both dimensions tend to hamper growth in both country samples.

Gupta et al. (2005) discuss the effects of fiscal consolidation and government expenditure composition on growth in a panel dataset of 39 low-income countries from 1990 to 2000. To capture both the long- and short-run effects of fiscal policy on growth, the models they use are estimated separately in levels and first differences of real per capita GDP growth. They find that both reducing selected current/non-productive expenditure and increasing capital/productive expenditure can raise growth rates in these countries. Their study addresses endogeneity concerns by employing static and dynamic GMM estimators, with dynamic specifications yielding better results compared to static models.

Christie (2014) re-examine the relationship between government size and long-run economic growth using panel data from 136 countries over the period 1971-2005. Their findings suggest a negative impact of government size on growth, although this effect diminishes when productive government spending is singled out. Their study employs a dynamic panel system GMM estimation to address endogeneity concerns.

Afonso & Jalles (2014) analyse the relationship between fiscal composition and long-term growth using panel data from 155 developed and developing countries for the period 1970 to 2008. To fully control the effects of short-term fluctuations, as well as cumulative 5-year nonoverlapping averages, they also include the unemployment rate as a control in the model because it mostly varies from the business cycle. They find that total government expenditures have a negative effect on output growth, particularly in emerging economies. Their results are robust across different econometric specifications.

Overall, panel data analyses address the endogeneity concerns to some extent, but are subject to several limitations. One limitation is that the analysis is typically performed by averaging data over long time periods, normally five years, to control for business cycle fluctuations. This approach may result in a loss of information, and risks failing to accurately capture short-term dynamics.

Another limitation involves the choice of estimation techniques. Dynamic fixed-effect estimators (DFE) and GMM estimators assume the homogeneity of all slope coefficients across countries. This may not hold in reality, leading to potential bias in estimates, especially in large cross-country variability.

Panel Time-series Analyses

Panel time series combines the advantages of both standard panel data and time series data, allowing for the analysis of a large number of observations over a long period of time, and therefore has drawn some attention in empirical studies in recent years.

Romero-Ávila & Strauch (2008) utilise data on general government expenditure and revenue in 15 EU member states from 1960 to 2001 to examine the potential impact of fiscal policy on growth. Employing a distributed lag approach to control for real business cycle effects and reverse causality, they find that public finance provides policy instruments which contribute to higher trend growth in the short run. Their analysis indicates that the expenditure side of

the budget consistently impacts long-run growth over the business cycle. More specifically, government size and consumption negatively affect growth, while public investment has a positive effect, highlighting potential gains in economic performance from reallocating welfare expenditure to productive investment.

Afonso & Alegre (2011) investigate the reallocation of government budgetary components and its impact on economic growth in a panel data set of 15 EU countries over the period 1971-2006. Their dynamic panel data model with lagged explanatory variables captures long-term relationships and addresses the endogeneity issue and omitted variable concern. Their empirical findings reveal that government consumption and social security contributions expenditures have a negative effect on long-run growth, while public investment expenditure positively impacts growth.

Arnold et al. (2011) explore tax policy design to facilitate economic recovery and contribute to long-run growth. Using a panel regression approach with annual data for 21 OECD countries from 1971 to 2004, they introduce tax structure indicators into their models. The results indicate that short-term tax concessions aiming at alleviating crises may compromise long-run growth, emphasising the importance of carefully designed tax policies. Additionally, robustness checks confirm the consistency of their findings across different lag structures.

Gemmell et al. (2011) present new evidence for 17 OECD countries regarding the long-run GDP impacts of changes in the size and composition of public expenditure from 1972 to 2007. Employing the PMG method and considering the appropriate lag structure to address endogeneity, they analyse both short-run dynamics and long-run equilibrium relationships among variables of interest. Their findings suggest robust long-run positive effects on economic growth from government spending on transport and communication, education, and possibly also housing and health, while spending on welfare is found to have negative effects.

In summary, panel time-series analyses offer several advantages over standard panel data approaches. These include the use of original data with long lags of independent variables to greater retain information, the application of the distributed lag model and the PMG approach to distinguish short-run and long-run effects, making results more reflective of the real economy.

Fiscal Shock and Growth

In addition to the long-term effects of fiscal policy discussed earlier, recent literature has examined how short-term fiscal shocks can influence growth over the long run.

Fatás (2000) investigates the link between short-run phenomena and the long-run technological trend of output in a cross-section of 120 countries. Focusing on the aggregate demand effects of cyclical shocks such as employment, fiscal policy, or technology on the growth process, the author finds that there exists a positive and significant correlation between these two variables, suggesting the persistent effects of exogenous cyclical shocks.

Focusing on the global financial crisis, Fatás & Summers (2018) provide support for the presence of strong hysteresis effects of fiscal policy. By using IMF forecasts of both actual and potential GDP, they find that fiscal consolidations in 2010–11 have a negative impact on output that extended over a long horizon, as the long-term performance of GDP as well as the estimates of potential output were both negatively affected. Moreover, attempts to reduce debt via fiscal consolidations have very likely resulted in a higher debt-to-GDP ratio through their long-term negative impact on output.

Overall, the literature on short-term fiscal shocks and long-run growth dynamics highlights the potential persistent effects of fiscal policy on economic growth. Motivated by this, I will discuss how fiscal shocks aimed at stimulating a downturn affect economic growth in the Chinese context.

3.2.3 China-specific Evidence

The sources or influencing factors of economic growth in China have long been actively debated. The existing literature can be roughly divided into two groups: one focusing on analysing the sources of China's economic growth, and the other testing its influencing factors or determinants. The former group debates whether the rapid growth in China is primarily driven by productivity growth or factor accumulation (Wang & Yao 2003). Meanwhile, the

latter group explore various potential influencing factors, including fiscal decentralisation and public spending (Zhang & Zou 1998, Yang 2016), international trade (Chen & Feng 2000), financial development (Guariglia & Poncet 2008), and institutional development (Hasan et al. 2009).

Focusing on the recent global financial crisis and 4-trillion Yuan stimulus package, Ouyang & Peng (2015) study its macroeconomic effects by estimating counterfactuals in their analysis. Their results indicate that the fiscal stimulus plan temporarily boosted the annual real GDP growth and various economic activities such as trade, consumption, and investment in China for approximately two years. This suggests that the stimulus policy may have had differential effects in the short and long runs.

Many studies have further explored the reasons behind the success of the 4-trillion Yuan stimulus package, generally attributing it to China's unique institutional framework. The co-ordinated efforts of state-controlled banks, local governments, and SOEs played a crucial role in the effectiveness of the stimulus measures.

Bai et al. (2016) provide a comprehensive investigation of the 4-trillion Yuan package and its resulting inefficiencies. They argue that the fiscal stimulus was primarily financed by local government financing vehicles (LGFVs), leading to off-balance sheet spending by local governments. These resources could have been beneficial if they were allocated to high social return projects previously deprived of funding. However, according to estimates, in addition to funding infrastructure projects, the relaxation of financial constraints made it possible for local governments to channel financial resources towards commercial projects favouring certain private firms. This potentially worsened the overall efficiency of capital allocation, thereby lowering aggregate productivity and GDP.

Although several studies, such as Biggeri (2003), have found a growth-declining role of SOEs, Wen & Wu (2019) argues that SOEs act as an automatic fiscal stabiliser for the Chinese economy. In normal times, SOEs are supposed to work like privately owned enterprises; but during the 2009 stimulus period, they are able to generate a significant countercyclical force to boost production and investment spending. This duality allows SOEs to support economic stability during downturns while contributing to growth (although in a less efficient way) during normal periods.

Deng et al. (2015) discuss that the success of the stimulus package is largely facilitated by the state control over its banking and corporate sectors. The increased investment from non-financial SOEs lead to the rebound of GDP in 2009, but these funds primarily go to the real estate sector. This causes distortionary inflation of real estate prices in some cities after the stimulus, with a major misallocation breaking future growth.

Overall, while the 4-trillion Yuan stimulus package successfully mitigated the immediate impacts of the global financial crisis, there is scarce empirical evidence on its long-term effects on efficiency and sustainable growth. This chapter aims to offer a comprehensive understanding of the broader implications of China's stimulus package within a growth model, revealing the potential role of the stimulus package in driving the Chinese economy over a long period.

3.3 Data and Methodology

3.3.1 Data and Variables

Seasonal Adjustment of the Original Data

The quarterly data used in this paper comes from *China Macroeconomic Database (Monthly)*, covering 30 provinces, municipalities, and autonomous regions (except Tibet) in mainland China between the first quarter of 2004 and the fourth quarter of 2017 (in short, from 2004Q1 to 2017Q4). All monetary variables are deflated to the base time (2004Q1) according to the province-level Consumer Price Index (CPI).

As illustrated in Figure 3.1, the original data reveals some seasonal trends. Therefore, seasonal adjustment is required to remove variation associated with the time of the season and eliminate the fluctuation of monetary variables. This facilitates comparisons between consecutive time periods.

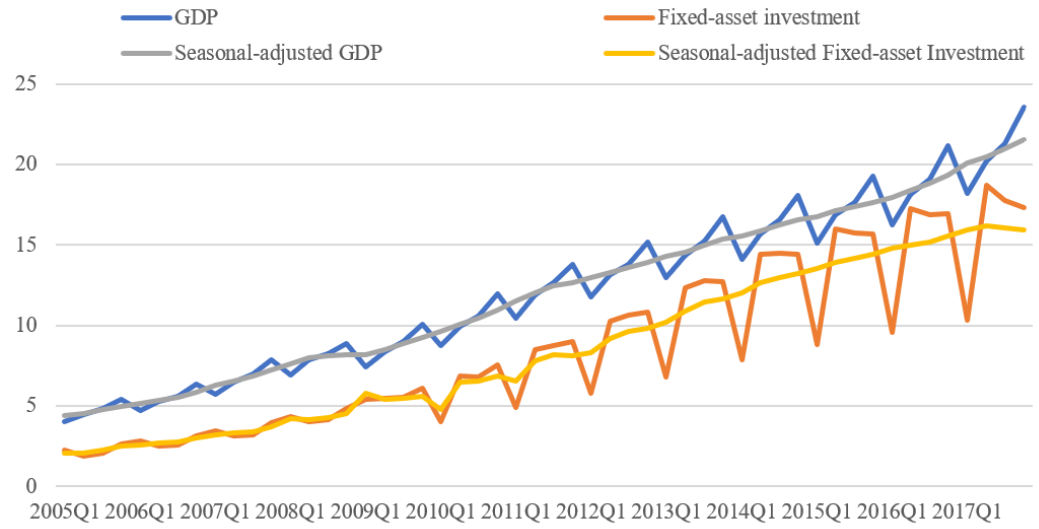

Figure 3.1: Seasonal-trend and Seasonal-adjusted Monetary Variables (2005Q1-2017Q4) (%)
Source: Original data comes from *China Macroeconomic Database (Monthly)* and the seasonal-adjusted data comes from the calculation based on X-13ARIMA-SEATS.

Seasonal adjustment is a statistical technique used to remove the effects of seasonal calendar influences from time series data, providing a clearer view of the underlying trends and cyclical movements in economic indicators (Wooldridge 2013). In this chapter, I employ the X-13ARIMA-SEATS method developed by the US Census Bureau to eliminate seasonal fluctuation. This method models the time series as a combination of trend, seasonal, and irregular components, providing a more detailed decomposition, and has been widely accepted in economic research and policy analysis.

X-13ARIMA-SEATS uses a non-parametric method, namely, moving average calculations, to extract seasonal components. The process involves decomposing the original series through multiple moving averages and automatically adjusting outliers to ensure more accurate results at each step. The process comprises three main steps, with the first two steps constituting the pre-adjustment phase before moving average calculations:

(1) Conduct exogenous variables regression on the original series y_t. Exogenous regression variables may include constants, holiday effects, various outliers, and other self-defined variables that solely impact the original series for the current period. The residual is calculated as: $\alpha_t = y_t - \sum_{i=1}^{m} \beta_i x_{it}$. This step corrects for identifiable external influences, isolating the intrinsic variation in the time series.

(2) Establish an Autoregressive Integrated Moving Average (ARIMA) model for the regression residual α_t. This step aims to effectively fit the regression residuals for the accurate forecasting and backcasting of observations at both ends of the original series, thereby extending the length of the original series to enhance the accuracy of subsequent moving averages.

(3) Perform moving average calculations on the predicted expanded residuals obtained in step (2). This involves separating the trend component, seasonal factor, and irregular component to ultimately obtain the adjusted series. By applying moving averages, the method smooths out short-term fluctuations and reveals the underlying long-term trends and cycles.

Figure 3.1 demonstrates that the curves of the series after X-13ARIMA-SEATS's seasonal adjustment appear smoother, with fluctuations during and after the implementation of the 4-trillion Yuan package, consistent with the expectations.

Measure of Key Variables

As discussed in Chapter 2, the 4-trillion Yuan stimulus package involves fiscal stimulus through large government spending and credit expansion via relaxing the financial constraints on traditional banks. This paper applies two variables, fiscal stimulus ($fiscal\_GDP$) and credit expansion ($credit\_GDP$), to control for the stimulus package. Fiscal stimulus ($fiscal\_GDP$) is defined as the ratio of primary government expenditure[6] to GDP, while credit expansion ($credit\_GDP$) is defined as the ratio of changes in the loan balance to GDP.

6. Instead of examining the relationship between economic growth and various subcategories of government expenditure, as other papers have done, this study focuses solely on overall primary expenditure. While the dynamics of different categories of government expenditure are undoubtedly influenced by different factors, the focus here is directly on this broad aggregate, because what ultimately matters in the determination of government deficit and debt, and consequently in the overall sustainability of public finances is overall government expenditure.

As a temporary plan, interaction terms between fiscal stimulus/credit expansions and a post-2009 dummy *post*, equaling 1 after 2009 and 0 otherwise, are introduced to isolate the differential effect of fiscal stimulus and credit expansion in the post-stimulus period relative to the pre-stimulus period.

3.3.2 Methodology

Model Specification

The policy-augmented growth equation is derived from a growth model based on constant returns-to-scale technology. Following a standard approach (Mankiw et al. 1992), the standard neoclassical growth model is derived from a constant returns to scale production function with two inputs (capital and labour) paid their marginal products. The basic production function is expressed as follows:

$$Y_{it} = K_{it}^{\alpha} H_{it}^{\beta} (A_{it} L_{it})^{1-\alpha-\beta} \tag{3.1}$$

Where Y, K, H, and L are defined as output, physical capital, human capital, and labour, respectively. α and β denote the partial elasticity of output with respect to physical capital and human capital, respectively, and A_{it} represents the level of technological and economic efficiency. The output is modelled as a function of capital, employment, the efficiency with which they act together, and the level of technology.

In a steady state, growth equations can be expressed in the form of Equation 3.1, representing the relationship between steady-state output and its determinants. However, actual data may include dynamic changes (Mankiw et al. 1992). Output growth in any given period can be attributed to three different factors: (1) technological progress, which is assumed to be exogenous; (2) a convergence process towards the country-specific steady-state path; and (3) shifts in the steady-state levels or growth rates due to changes in policy, institutions, investment rates, and population growth rates.

The neoclassical growth model (Equation 3.1) can express the economy's output production by incorporating other factors (X_j) affecting the output level, such as fiscal policy. The augmented production function model can be rewritten as:

$$Y_{it} = A_{it} K_{it}^{\beta_1} H_{it}^{\beta_2} L_{it}^{\beta_3} \prod_j X_{j_{it}}^{\beta_{3+j}} \tag{3.2}$$

Assuming constant returns to scale, the augmented production function model in per capita terms can be written as:

$$y_{it} = \frac{Y_{it}}{L_{it}} = a_{it} k_{it}^{\beta_1} h_{it}^{\beta_2} \prod_j x_{j_{it}}^{\beta_{2+j}} \tag{3.3}$$

where y_{it} is per capita output, Y_{it} is total output, L_{it} is population, $k_{it} = \frac{K_{it}}{L_{it}}$ is per capita physical capital, $h_{it} = \frac{H_{it}}{L_{it}}$ is per capita human capital, a_{it} is the level of technology, and $x_{j_{it}}$ are other factors affecting output.

Next, taking the natural logarithm (ln) of both sides of Equation 3.3 to eliminate the differences in the units of measurement for the variables:

$$\ln y_{it} = \ln a_{it} + \beta_1 \ln k_{it} + \beta_2 \ln h_{it} + \sum_j \beta_{2+j} \ln x_{j_{it}} \tag{3.4}$$

Assuming the level of technology a_{it} is constant over time, Equation 3.4 simplifies to:

$$\ln y_{it} = \beta_0 + \beta_1 \ln k_{it} + \beta_2 \ln h_{it} + \sum_j \beta_{2+j} \ln x_{j_{it}} + \varepsilon_{it} \tag{3.5}$$

where $\beta_0 = \ln a_{it}$, and ε_{it} represents the error term.

Based on conditional convergence, the generic functional form derived from an extended version of the neoclassical growth model is:

$$\Delta \ln y_{it} = \beta_0 + \beta_1 \ln y_{it-1} + \beta_2 \ln k_{it} + \beta_3 \ln h_{it} + \sum_j \beta_{3+j} \ln x_{j_{it}} + \varepsilon_{it} \tag{3.6}$$

where y_{it} is per capita output, k_{it} is per capita physical capital, h_{it} is per capita human capital, $x_{j_{it}}$ are a set of conditional variables affecting economic efficiency, consistent with more general growth models or practical considerations.

The above model is the growth regression commonly used in standard panel data analysis, which ignores short-term dynamics or assumes homogeneity across units (countries, regions, etc.). Pesaran & Smith (1995) argue that if this assumption does not hold in reality, the estimation results from Equation 3.6 are likely to be biased.

Instead, Pesaran (1997) and Pesaran et al. (1999) suggest using an Autoregressive Distributed Lag (ARDL) model, parameterized in error correction form, to overcome the bias. The conditional error correction version of the ARDL (p,q) model for per capita GDP growth and other characteristics is:

$$\Delta \ln y_{it} = \alpha_0 + \sum_{l=1}^{p} \alpha_{il} \Delta y_{it-l} + \sum_{l=0}^{q} \beta_{il} \Delta x_{it-l} + \beta_i' x_{it-1} + \varepsilon_{it} \tag{3.7}$$

where the vector x_{it} represents all independent variables, including k_{it}, h_{it} and other factors. ε_{it} is the error term. p is the lag length of the dependent variable, and q is the lag length of the independent variables. This approach allows for the identification of both short-run dynamics and long-run equilibrium relationships between economic growth and variables of interest.

Finally, I rearrange the equation and introduce the error correction term $\varphi_i \ln y_{it-1}$:

$$\Delta \ln y_{it} = -(\varphi_i \ln y_{it-1} + \sum_j a_{ji} x_{it}^j - a_{it}) + \sum_j b_{ji} \Delta x_{it}^j + \varepsilon_{it} \tag{3.8}$$

In this equation, $\varphi_i \ln y_{it-1}$ is the error correction term, reflecting the difference between the current period's logarithm of GDP per capita and the previous period's logarithm of GDP per capita. When the Error Correction Model is stable, φ_i is negative and less than 1 in absolute value. If $\varphi_i = 0$, then it confirms that there is no evidence of a long-term relationship. $\sum_j a_{ji} x_{it}^j$ represents the impact of x_{it} on the current period's logarithmic growth rate of GDP per capita, while $\sum_j b_{ji} \Delta x_{it}^j$ represents the impact of the lagged difference terms of the exogenous variables on the current period's logarithmic growth rate of GDP per capita. ε_{it} is the error term.

In the empirical regression in this study, x includes fiscal stimulus ($fiscal\_GDP$)/credit expansion ($credit\_GDP$), time dummy ($post$) and their interactive terms, and other control variables (discussed in the next subsection). To control the initial shock of the 4-trillion Yuan stimulus package, I add a variable, $initial\_shock$, which represents the maximum value of fiscal stimulus/credit expansion in 2009 in each province, to the growth regression.[7] The maximum value is preferred to the value of a certain quarter in 2009 in all provinces because local governments started their stimulus plan at different times.

Econometric Estimation

The empirical estimations of the growth model, Equation 3.6, can be performed in different estimators depending on the parameter heterogeneity they allow for across units.

The traditional panel data approach controls group-specific effects using a dynamic fixed effect (DFE) specification, estimated using Fixed Effects or Generalized Method of Moments (GMM) estimators. However, this approach assumes identical slope coefficients across groups, which may produce inconsistent results. If the slope coefficients are not identical, then the DFE approach produces inconsistent and misleading results. In the context of the neoclassical model, the validity of DFE depends on assumptions of common production function and common convergence parameter, which in turn require both common technological progress and population growth across groups. However, there is no reason to assume that the speed of convergence to the steady state is the same across groups (provinces, in this paper) because economies display different degrees of flexibility. Under slope heterogeneity, both LSDV and GMM DFE estimators of the speed of convergence are affected by a potentially serious downward heterogeneity bias (Lee et al. 1997, Pesaran & Smith 1995).

An alternative strategy is the Mean Group (MG) approach, proposed by Pesaran & Smith (1995). This fully heterogeneous-coefficient model imposes no cross-section parameter restrictions. It estimates the model separately for each group and takes a simple average of the group-specific coefficients (Lee et al. 1997). In other words, this estimator produces the intercepts, slope coefficients, and error variances which all differ across groups. In small group samples, this estimator is likely to be inefficient since any group outlier could severely influ-

7. I thank Prof. Campbell Leith for suggesting this.

ence the averages of the group coefficients (Arnold et al. 2011). In addition, in the context of the neoclassical model, it does not consider the fact that certain parameters may be the same across groups. Relying on the assumption that all slope coefficients are entirely unrelated across groups may bring an unwanted loss of efficiency.

Between the two extremes that impose homogeneity on all slope coefficients (DFE) and impose no restrictions (MG) respectively, Pesaran et al. (1999) introduce an intermediate approach, the Pooled Mean Group (PMG) approach. This estimator involves both pooling and averaging the coefficients, allowing the intercepts, short-run coefficients, convergence speeds, and error variances to differ freely across groups, while constraining cross-section homogeneity restrictions to all long-run coefficients. This approach generates consistent estimates of the mean of the short-run slope coefficients across groups by taking the simple average of individual group coefficients.

Briefly, the PMG estimator proceeds as follows. First, the estimation of the long-run slope coefficients is done jointly across groups through a (concentrated) maximum likelihood procedure. Second, the estimation of short-run coefficients, including the speed of adjustment and province-specific error variances, is done on a province-by-province basis, also through maximum likelihood and using the estimates of the long-run slope coefficients which were previously obtained.

The choice among these estimators faces a general trade-off between consistency and efficiency. Under long-run slope homogeneity, the PMG approach increases the efficiency and consistency of the estimates with respect to the MG approach. Its allowance for short-run parameter heterogeneity yields more reliable estimates of the long-run responses and can affect the estimated speeds of convergence towards long-run equilibrium (Pesaran et al. 1999). However, imposing invalid parameter homogeneity in dynamic models typically leads to inconsistency, normally in the form of a downward bias of the speed of adjustment (Pesaran & Smith 1995).

For the case in this paper, the PMG approach offers the best available compromise in the search for consistency and efficiency, given that long-run conditions are expected to be homogeneous across groups while the short-run adjustment depends on individual characteristics (fiscal adjustment mechanism, geographical locations, or institutions). For instance, certain local government policies such as fiscal adjustment and stimulus packages affect the composition of government spending. The change in the composition varies across countries/provinces depending on the country/province's political and financial situations, which affect its short-run growth path. In contrast, long-run relationships tend to be more homogeneous across provinces as the long-run growth impact of certain fiscal policies will be similar across provinces in China, given that in the same country, provinces have access to common technologies and have intensive intra-trade and foreign direct investments.

To ensure the reliability of the results, this paper will discuss the estimated results using the PMG approach and compare them with those derived from using the MG approach. In addition, the Hausman test is applied to examine the difference between the MG and PMG approaches.

Control Variables

In the regression analysis, the dependent variable is the growth rate in real GDP per capita, defined as the change in the natural logarithm of real per capita GDP. The set of control variables considered to comprise cross-section variation in growth includes: [8]

(1) The initial level of real GDP per capita (lny_{it-1}), which is interpreted as the tendency of the short-run growth rate to converge toward an average long-run trend. According to the conditional convergence hypothesis, if countries/regions are similar in terms of preferences and technology, then their steady-state income levels will be the same, and in time, they will tend to reach the same level of income (Barro 1991). Thus, the initial real GDP per capita is expected to have a negative effect on growth.

8. Due to the absence of quarterly data, human capital, population growth, and innovation are not included in the regression.

(2) Fixed capital formation (fcf_GDP), which is measured by the ratio of fixed asset investment to GDP. Following the theoretical model presented above, and in line with the related literature, fixed capital formation constitutes an important driver for economic growth, and the expected sign of the coefficient is positive (Ding & Knight 2011, Yu 1998).

(3) Openness or international-trade dependence (*export_GDP*), which is measured by the ratio of net exports to GDP. International trade has been considered an important instrument for growth (Afonso & Alegre 2011, Bose et al. 2007, Gupta et al. 2005, Wei et al. 2001). The increase in the degree of openness will enable local economies to absorb advanced technologies more quickly, reduce price distortions, and use regional resources more efficiently in various sectors, thereby promoting economic growth.

(4) Institutional changes (*SOE_Total*), which are measured by the ratio of the state-owned enterprise (SOE) workers to total staff and workers. Several studies have found that the presence of SOEs leads to a loss of aggregate output in China and the coefficient is expected to be negative (Biggeri 2003, Chen & Feng 2000).

Definitions of each of these variables are provided in Table 3.1.

Table 3.1: Definition of Variables

Variable	Definition	Unit
g_{it}	Growth rate of real provincial GDP per capita	%
InitialShock	Maximum value of fiscal stimulus/credit expansion in 2009 in each province	%
credit_GDP	Ratio of changes in the loan balance to GDP	%
$fiscal\_GDP$	Ratio of the primary government expenditure to GDP	%
lny_{it-1}	Logarithm of the beginning-period real GDP per capita	RMB
fcf_GDP	Ratio of fixed capital formation to GDP	%
export_GDP	Ratio of net exports to GDP	%
SOE_Total	State-owned enterprise workers/Total staff and workers	%

3.4 Empirical Results

3.4.1 Summary Statistics

Summary statistics and univariate tests of variables are provided in Table 3.2 and 3.3. It reveals that the pre-stimulus periods enjoyed a relatively larger average output growth rate (g_{it}) of 2.9%, whereas the post-stimulus periods recorded an average quarterly growth rate of 1.5%. This is consistent with the stylised fact that after the 4-trillion Yuan stimulus package, China experienced a slowdown in economic growth. The empirical analysis will examine whether this was related to the credit expansion and fiscal stimulus caused by the 4-trillion Yuan stimulus package.

Table 3.2: Summary Statistics

Variable	Mean	SD	Min	Max
g_{it}	0.020	0.116	-1.522	1.166
lny_{it-1}	8.747	0.563	7.011	10.107
$fiscal\_GDP$	0.220	0.101	0.051	0.701
$credit\_GDP$	0.129	0.120	-0.420	0.946
fcf_GDP	0.68	0.242	0.119	2.054
$export\_GDP$	0.142	0.197	-1.141	0.99
SOE_Total	0.562	0.148	0.164	0.829

Table 3.3: Univariate Test

Variable	Full Sample	Before	After	Difference (t-value) Before versus After
g_{it}	0.020	0.029	0.015	0.014** (2.351)
lny_{it-1}	8.749	8.365	9.017	-0.652*** (-28.026)
$fiscal\_GDP$	0.220	0.186	0.242	-0.057*** (-11.287)
$credit\_GDP$	0.131	0.125	0.134	-0.009 (-1.506)
fcf_GDP	0.680	0.540	0.779	-0.239*** (-22.541)
$export\_GDP$	0.142	0.133	0.149	-0.016 (-1.583)
SOE_Total	0.562	0.605	0.512	0.093*** (11.943)

Notes: ***, **, * correspond to p-values of 1%, 5%, and 10%, respectively.

In addition, the ratio of primary government expenditure ($fiscal\_GDP$) has notably increased following the implementation of the stimulus package, signalling a distinct fiscal stimulus post-2009. Similarly, the ratio of fixed capital formation (fcf_GDP) has exhibited a pronounced uptick in response to the stimulus measures, indicating the fact that a significant boost to investment activities during the same period.

3.4.2 Panel Unit Root Tests and Cointegration Analysis

Because of the time period covered by this study, the estimation process begins with the preliminary tests of panel unit root and cointegration. These tests aim to assess the order of integration of the variables and the existence of a long-term relationship among them, respectively.

I initially test the time-series properties of variables using panel unit root tests under two assumptions: homogeneous slopes and heterogeneous slopes. The test under the former assumption is proposed by Levine & Zervos (1998) (Levin, Lin, and Chu Test; in short, the LLC test), which assumes homogeneous coefficients across provinces. When allowing for heterogeneous coefficients across provinces, I employ the panel unit root test developed by Im et al. (2003) - the Im, Pesaran, and Shin Test, or in short, the IPS test.

Table 3.4 displays the result of the panel unit root tests, with the testing equations including either intercepts only or individual trends. This approach is crucial for a comprehensive evaluation of data stationarity, considering overall shifts and long-term trends in the series. Specifically, columns (1) and (2) present the result of the IPS test, while columns (3) and (4) present the result of the LLC test. Furthermore, in columns (5) and (6), the IPS test is applied to demeaned data to address the concerns on cross-section dependence (CSD).[9]

According to Table 3.4, in most cases, the null hypothesis of a unit root for all provinces can be confidently rejected at a significance level of 1%, indicating that these series follow $I(0)$ processes i.e., they are stationary time series. In the case of *SOE_Total* series which is not stationary in its level form, I additionally apply panel unit root tests to its first-differenced values, as shown at the bottom of Table 3.4. The results indicate that the *SOE_Total* series in levels exhibits significant unit roots in all tests, while it appears stationary when differenced once, suggesting that the series of *SOE_Total* follows the $I(1)$ process, i.e., that the series is not stationary in its level form but becomes stationary after differencing it once, as indicated by both the LLC and IPS tests.

9. As the data is not balanced, it is not possible to perform the Cross-Sectionally Augmented IPS test (CIPS); therefore, I use demeaned data to eliminate CSD issues instead.

Table 3.4: Preliminary Test: Panel Unit Root Test

Variables	IPS Test		LLC Test		IPS Test (Demeaned)	
	(1)	(2)	(3)	(4)	(5)	(6)
g_{it}	-5.080***	-0.787	-12.974***	-3.680***	-2.905***	-10.700***
lny_{it-1}	-0.207**	-0.537	-11.352***	-4.939***	-4.126***	-12.227***
$credit\_GDP$	-18.183***	-16.640***	-14.564***	-12.745***	-17.170***	-23.241***
$fiscal\_GDP$	-4.459***	-12.874***	-5.607***	-11.248***	-8.770***	-14.568***
fcf_GDP	-0.273	-8.493***	-1.950**	-14.618***	-0.482	-4.005***
$export\_GDP$	-7.807***	-7.112***	-2.027***	-4.592***	-3.841***	-7.689***
SOE_Total	17.020	12.290	10.807	6.811	4.482	2.681
ΔSOE_Total	-6.203***	-11.640***	-26.118***	-24.541***	-16.259***	-12.149***
Individual Trend	NO	YES	NO	YES	NO	YES

Notes: The lags included in the ADF regressions are selected on the basis of the Akaike Information Criterion (AIC), with the maximum lag order as eight. ***, **, and * denote rejection of the null of non-stationarity at 1%, 5%, and 10% levels, respectively. Δ is an operator that calculates the difference between the value of the variable at time t and $t-1$.

According to Pesaran et al. (1999), the Error Correction Model can only be applied when the variables of interest are integrated at order $I(0)$ or $I(1)$. Since it is observed that no variables are stationary at $I(2)$ or beyond, the data series can be analysed using the Pooled Mean Group approach to investigate the long-term relationship between the variables.

The next step involves conducting the cointegration test, as proposed by Pedroni (2000, 2004). The results of this cointegration test are presented in Table 3.5.

Table 3.5: Preliminary Test: Panel Cointegration Test

	Original Data	Demeaned Data
Panel A: Without Panel-Specific Time Trend		
Panel ADF	-3.676***	-3.258***
Group ADF	-5.098***	-4.604***
Panel B: Wth Panel-Specific Time Trend		
Panel ADF	-6.778***	-5.788***
Group ADF	-10.151***	-5.106***

Notes: The optimal lag orders are selected on the basis of the AIC, with the maximum lag order as eight. ***, **, and * denote rejection of the null hypothesis of non-cointegration at 1%, 5%, and 10% levels, respectively. Unit-specific intercepts and trends are included. The panel-specific statistic represents that the AR parameter is panel-specific in the ADF regressions. The test statistics obtained from using this option are also known as group-mean statistics or between-dimension statistics, while the group-specific statistic represents that the AR parameter is the same for all panels in the ADF regressions. The test statistics obtained from using this option are also known as panel cointegration statistics or within-dimension statistics.

Table 3.5 provides the results categorised into two panels: Panel A, without the panel-specific time trend, and Panel B, with the panel-specific time trend. These statistics are derived from Augmented Dickey-Fuller (ADF) regressions, where the lags are selected based on the Akaike Information Criterion (AIC), with a maximum lag order of eight. It is found that the existence of a cointegration relationship among the variables cannot be rejected, as all cointegration test statistics are significant at the 1% level.

3.4.3 Specification Condition

Uncorrelated Residuals

As outlined in the previous section, the consistency and efficiency of the PMG estimator rely on several specification conditions. The first is that the regression residuals should be serially uncorrelated, and that the independent variables can be treated as exogenous. This can be achieved by introducing a sufficient number of lags in the model. When the main interest is in the long-term parameters, the optimal lag order can be selected using some consistent information criteria (such as the Akaike Information Criterion, in short, AIC; or the Schwartz-Bayesian Criterion, in short, SBC) on a unit-by-unit basis.

The result of the baseline growth model applying the optimal lag order is shown in Table 3.6. Both AIC and SBC suggest that the optimal lag order of the initial level of income, fixed capital formation, international trade dependence, and institutional structure is (1,1,0,1). According to Chudik et al. (2013), growth rates are moderately persistent, so setting up to three lags is sufficient to fully account for the short-term dynamics. Therefore, different lag orders, from one to three, are applied to the model respectively and shown in the table.

According to the estimated parameters shown in Table 3.6, in the long run, the growth rate of GDP per capita is negatively related to the initial level of income and the status of SOEs and positively related to fixed capital formation and international trade openness. These results are consistent with findings from the empirical growth literature, providing reassurance that the methodology can reproduce standard results.

Table 3.6: Preliminary Test: Results of Baseline Model Using PMG Estimator

VARIABLES: g_{it}	Model 1	Model 2	Model 3
Convergence			
lny_{it-1}	-0.181***	-0.168***	-0.197***
	(0.023)	(0.025)	(0.028)
Long-run			
fcf_GDP	0.59***	0.758***	0.783***
	(0.057)	(0.052)	(0.045)
$export\_GDP$	0.08***	0.049***	0.038***
	(0.022)	(0.015)	(0.014)
SOE_Total	-1.263***	-0.581***	-0.565***
	(0.107)	(0.093)	(0.084)
Short-run			
$D1.fcf\_GDP$	-0.273***	-0.393***	-0.517***
	(0.039)	(0.054)	(0.077)
$D2.fcf\_GDP$		0.089***	0.275***
		(0.023)	(0.063)
$D3.fcf\_GDP$			-0.072***
			(0.018)
$D1.SOE\_Total$	0.761***	0.028	0.045
	(0.101)	(0.182)	(0.202)
$D2.SOE\_Total$		0.528***	0.481**
		(0.155)	(0.232)
$D3.SOE\_Total$			0.031
			(0.105)
Observations	1,245	1,215	1,185
Provinces	30	30	30
Log-likelihood	1514.942	1565.057	1588.082

Notes: *, **, *** indicate significant at 10%, 5%, and 1%, respectively. Values in parentheses are standard errors.

When analysing and comparing the short-term parameters, imposing a common lag structure across units, considering the characteristics of the analytical model and the limitations of the data, is recommended (Loayza & Ranciere 2006). Since incorporating too many lags into the model may reduce the degrees of freedom and the power of the test statistics, these conditions are fulfilled by using a richer lag order for the explanatory and control variables, focusing on characterising their long- and short-term effects.[10]

10. Pesaran et al. (1999) argue that estimates of the long-term coefficients are robust to the order of the ECM when the time dimension is large. However, when the time dimension is small, the choice of the lag order, and whether either two or three lags are used, becomes more important. In addition, they demonstrate that the PMG estimator is more robust to outliers and the choice of lag order. The data set used here has a sufficiently long time dimension, so the estimation results should not be significantly affected by using either one or two lags of the variables.

Existence of Long-term Relationship

The second condition refers to the existence of a long-term relationship, as known as dynamic stability, which requires that the coefficient on the error-correction term (ECT), representing the error-correcting speed of the adjustment or convergence, be negative.

Table 3.6 reveals that in all cases, the coefficients of the ECT (lny_{it-1}) are fairly negative and highly significant at the 1% level, with values ranging from -0.197 to -0.168. This indicates that the system corrects its previous-period disequilibrium (policy deviation, crisis, risk, etc.) at a speed ranging from 16.8% to 19.7% quarterly to reach a steady state. Banerjee et al. (1998) suggest that a highly significant ECT signifies a more stable long-term relationship. Therefore, significant ECT values confirm the existing long-term equilibrium relationship between the variables.

Consistent Long-term Parameters

The third condition is that the long-term parameters are the same across countries/regions. Therefore, I test the null hypothesis of homogeneity through a Hausman-type test, based on the comparison between the PMG and MG approaches. In the Hausman test, the null hypothesis is that the difference in coefficients is not systematic. When the probability value calculated by the Hausman test is more than 5%, the PMG is accepted as the best estimator. In contrast, the MG is chosen as the best model when the probability value is less than 5%.

In Table 3.7, the Hausman test statistic and the corresponding p-value show that the homogeneity restriction is accepted in the model. Given the gains in the consistency and efficiency of the PMG over other panel ECM estimators, I focus on the results using the PMG approach.

Table 3.7: Preliminary Test: Results of Hausman Test

	PMG	MG
Panel A: Lag order =1		
fcf_GDP	0.59***	0.484***
$export\_GDP$	0.08***	0.096*
SOE_Total	-1.263***	-1.151**
Hausman Test	Chi2(8)=0.77	
	$Prob > Chi2 = 0.8567$	
Panel B: Lag order =2		
fcf_GDP	0.758***	0.947***
$export\_GDP$	0.049***	0.097
SOE_Total	-0.581***	-2.222***
Hausman Test	Chi2(8)=3.52	
	$Prob > Chi2 = 0.3184$	
Panel C: Lag order =3		
fcf_GDP	0.783***	1.057***
$export\_GDP$	0.038***	0.059
SOE_Total	-0.565***	-1.510***
Hausman Test	Chi2(8)=2.63	
	$Prob > Chi2 = 0.4521$	

Note: The Hausman test is a test of the probability of the long-run coefficient (i.e. of the restriction that all provinces have the same long-run elasticity). The null of the homogenous long-run coefficient is accepted at 5% when the p-values are larger than 0.05.

3.4.4 Baseline Results

Tables 3.8 and 3.9 present the estimates of long- and short-term parameters relating to per capita GDP growth and fiscal stimulus/credit expansion based on Equation 3.6. Each column provides the result following the optimal lag order calculated in the above section across different lengths from one to three.

Table 3.8 presents the result for fiscal stimulus using the PMG approach, which exhibits some variability depending on the lag orders of the explanatory variables. The estimated coefficients of fiscal stimulus ($fiscal\_GDP$), capturing the effects in the pre-stimulus period, are consistently positive and significant when applying either a one, two or three lag order. This suggests that, up until the 4-trillion Yuan package, a unit increase in fiscal stimulus, the ratio of government expenditure to GDP, led to an increase in the growth rate of GDP per cap-

ita of approximately 0.293-0.539 percentage points. This provides direct empirical evidence of fiscal expenditure's positive impact on economic growth during the pre-stimulus periods, likely by directly boosting aggregate demand through raising expenditure and thereby enhancing growth potential.

Table 3.8: Results of Fiscal Stimulus Using PMG Estimator

VARIABLES	Model 1	Model 2	Model 3
Convergence			
lny_{it-1}	-0.234*** (0.027)	-0.213*** (0.029)	-0.275*** (0.043)
Long-run			
Shock	-0.218 (0.467)	-0.255 (0.389)	-0.272 (0.272)
$fiscal\_GDP$	0.539*** (0.088)	0.885***(0.107)	0.293*** (0.073)
$fiscal\_GDP \times post$	-0.025 (0.057)	-0.095 (0.136)	-0.185*** (0.045)
fcf_GDP	0.142** (0.061)	0.154** (0.077)	0.323*** (0.04)
export_GDP	0.092*** (0.02)	0.093***(0.021)	0.083*** (0.013)
SOE_Total	-1.437*** (0.185)	-0.601*** (0.204)	-0.657*** (0.137)
Short-run			
$fiscal\_GDP$			
$D1.$	-0.222*** (0.022)	-0.453*** (0.038)	-0.260*** (0.063)
$D2.$	-	0.142*** (0.019)	0.075 (0.072)
$D3.$	-	-	0.003 (0.023)
$fiscal\_GDP \times post$			
$D1.$	0.029*** (0.004)	0.01 (0.005)	-0.041*** (0.007)
$D2.$	-	0.020*** (0.005)	0.069*** (0.008)
$D3.$	-	-	-0.019*** (0.004)
fcf_GDP			
$D1.$	-0.237*** (0.031)	-0.206*** (0.047)	-0.392*** (0.057)
$D2.$	-	0.007 (0.026)	0.167*** (0.055)
$D3.$	-	-	-0.048** (0.022)
SOE_Total			
$D1.$	1.258*** (0.144)	0.011 (0.275)	0.330 (0.311)
$D2.$	-	0.883*** (0.025)	0.605* (0.335)
$D3.$	-	-	0.089 (0.144)
Sum of short-run			
$\sum \Delta fiscal\_GDP$	-0.222*** (0.022)	-0.311*** (0.042)	-0.182* (0.100)
$\sum \Delta fiscal\_GDP \times post$	0.029*** (0.004)	0.026*** (0.007)	0.010 (0.013)
$\sum \Delta fcf\_GDP$	-0.237*** (0.031)	-0.205*** (0.054)	-0.273*** (0.085)
$\sum \Delta SOE\_Total$	1.258*** (0.144)	0.893** (0.359)	1.025** (0.517)
Time Dummy	YES	YES	YES
Observations	1,189	1,150	1,120
Provinces	30	30	30
Log-likelihood	1,576.683	1,706.21	1,744.746

Notes: *, **, *** indicate significance at 10%, 5%, and 1%, respectively. Values in parentheses are standard errors.

Regarding fiscal stimulus after the 4-trillion Yuan package period, the coefficients of $fiscal\_GDP \times post$ are negative but only significant when applying a three lag order. This suggests a negative association between economic growth and fiscal stimulus post-2009 in the long run. Specifically, by applying a three lag order, after the stimulus period, a one percentage point rise in fiscal stimulus is associated with a 0.185 percentage points lower growth rate of GDP per capita.

The short-run coefficients on fiscal stimulus ($fiscal\_GDP$) tell a different story. As explained earlier, short-run coefficients are not constrained to be the same across provinces, leading to multiple estimates for each coefficient. However, by analysing the average short-run effect through the mean of corresponding coefficients across provinces, a strongly positive relationship between the growth rate of GDP per capita and fiscal stimulus is observed post-2009. This effect is economically significant, implying that temporary fiscal stimulus aimed at stimulating economic growth successfully promoted growth in the short run.

Table 3.9 reports the result of credit expansion using the PMG approach. The estimated coefficients of credit expansion (*credit_GDP*), capturing the effects in the pre-stimulus period, are positive but only significant when applying a two or three lag order. This indicates that, up to the 4-trillion Yuan package, an increase in credit expansion led to an increase in the growth rate of GDP per capita by approximately 0.047-0.108 percentage points. This finding provides direct empirical evidence of the positive impact of credit expansion on economic growth during the pre-stimulus period, which has been documented as an important driver of China's growth performance in the 2000s (Hasan et al. 2009, **?**). Specifically, credit expansion contributed to economic growth by reducing the financial cost of external financing-dependent enterprises, providing funds for capital accumulation (usually profitable large-scale investments) (Levine & Zervos 1998), and facilitating the diffusion of new technologies.

However, the growth-enhancing role of credit expansion appears to have gone into reverse starting from the implementation of the stimulus package. The coefficients of $credit\_GDP \times post$ are significantly negative in all cases. Specifically, an increase in credit expansion after the stimulus period is associated with a 0.055-0.078 percentage point decrease in economic growth.

Table 3.9: Results of Credit Expansion Using PMG Estimator

VARIABLES	Model 1	Model 2	Model 3
Convergence			
lny_{it-1}	-0.251*** (0.025)	-0.229*** (0.026)	-0.22*** (0.028)
Long-run			
Shock	-0.039 (0.461)	-0.057 (0.576)	-0.078 (0.529)
credit_GDP	0.022 (0.014)	0.047*** (0.018)	0.108*** (0.02)
credit_GDP × *post*	-0.055*** (0.018)	-0.055** (0.024)	-0.078*** (0.028)
fcf_GDP	0.327*** (0.051)	0.346*** (0.058)	0.091 (0.062)
export_GDP	0.038* (0.022)	0.006 (0.023)	0.059*** (0.021)
SOE_Total	-1.985*** (0.167)	-1.296*** (0.019)	-1.786*** (0.201)
Short-run			
credit_GDP			
*D*1.	0.002 (0.004)	-0.006 (0.006)	0.001 (0.012)
*D*2.	-	0.004 (0.004)	-0.009 (0.014)
*D*3.	-	-	0.008 (0.006)
credit_GDP × *post*			
*D*1.	0.03*** (0.005)	0.009** (0.004)	-0.008 (0.005)
*D*2.	-	0.013*** (0.004)	0.042*** (0.007)
*D*3.	-	-	-0.014*** (0.003)
fcf_GDP			
*D*1.	-0.317*** (0.04)	-0.336*** (0.046)	-0.411*** (0.067)
*D*2.	-	0.039 (0.025)	0.175*** (0.061)
*D*3.	-	-	-0.049*** (0.019)
SOE_Total			
*D*1.	1.283*** (0.158)	0.646** (0.287)	0.606 (0.414)
*D*2.	-	0.516** (0.231)	0.288 (0.449)
*D*3.	-	-	0.175 (0.215)
Sum of short-run			
$\sum \Delta credit\_GDP$	-0.222 (0.004)	-0.003 (0.007)	0 (0.022)
$\sum \Delta credit\_GDP \times post$	0.03*** (0.005)	0.023*** (0.006)	0.02* (0.011)
$\sum \Delta fcf\_GDP$	-0.317*** (0.04)	-0.297*** (0.053)	-0.285*** (0.089)
$\sum \Delta SOE\_Total$	1.283*** (0.158)	1.162*** (0.372)	1.069 (0.654)
Time Dummy	YES	YES	YES
Observations	1,189	1,146	1,103
Provinces	30	30	30
Log-likelihood	1,516.842	1,605.96	1,659.29

Notes: *, **, *** indicate significance at 10%, 5%, and 1%, respectively. Values in parentheses are standard errors.

In the short run, the relationship between the growth rate of GDP per capita and credit expansion is strongly positive in the post-stimulus period, while it is insignificantly negative in the pre-stimulus period.

The results in Table 3.8 and 3.9 also demonstrate the negative effects of the initial level of income (lny_{it-1}) on provincial growth rates. The estimated coefficients in both fiscal stimulus and credit expansion regressions imply that a one percentage point lower initial level of GDP per capita raises the subsequent growth rate of GDP per capita by 0.02-0.03 percentage points.

The long-term effect of fixed capital formation (fcf_GDP) on economic growth is consistently positive and significant in most cases. This finding aligns with the theoretical expectations of the augmented Solow model (Mankiw et al. 1992) that increased investment (capital formation) leads to the accumulation of capital, which in turn drives economic growth. The regressions of fiscal stimulus indicate coefficients of 0.142, 0.154, and 0.323 across different lag lengths, suggesting that a one percentage point rise in fixed capital formation is associated with a 0.142 to 0.323 percentage point increase in the growth rate of GDP per capita. Similarly, the regressions of credit expansion imply that a one percentage point rise in fixed capital formation is associated with an approximately 0.3 percentage point increase in the growth rate of GDP per capita. This evidence confirms the widely-held belief that China's growth performance has been investment-driven (Ding & Knight 2011, Yu 1998).

International trade ($export\_GDP$), measured by the ratio of net export to GDP, exhibits a consistently positive and significant long-term effect on economic growth in most cases. In the regression result of fiscal stimulus, the coefficients range from 0.083 to 0.093 across different lag orders, while in the credit expansion one, they range from 0.038 to 0.059. This implies that a one percentage point increase in net export leads to an increase in GDP per capita by 0.083 to 0.092 or 0.038 to 0.059 percentage points in the long term. Similar results have been found in many China-specific growth studies (Chen & Feng 2000, Ding & Knight 2011, Yao 2006), highlighting the important role of international trade/openness in promoting economic growth.

The share of SOEs (SOE_Total) serves as a proxy for the pace of economic reform or institutional change. Its effect on economic growth is negative and significant at the 1% level in the long run. In the fiscal stimulus regression, a one percentage point expansion in the share of SOEs leads to a decrease in economic growth by at least 0.601 percentage points, while in the credit expansion regression, it leads to a decrease in economic growth by at least 1.296 percentage points. Similar results have been reported in many prior studies on China's growth

(Chen & Feng 2000, Ding & Knight 2011). The declining share of SOEs in the economy is conducive to the growth of GDP per capita due to insufficient technological innovation and limited adaptability to market mechanisms, prompting increased efficiency and possibly higher levels of investment.

3.4.5 Robustness Check

With worldwide datasets, many studies conclude that the relationship between fiscal policy and economic growth is affected by various factors, such as demographic characteristics and institutional background (Barro 1991, Devarajan et al. 1996). This section aims to test the robustness of the results by splitting the provinces according to the particular characteristics that are likely to affect the relationship between the fiscal stimulus plan and economic activity. By using alternative definitions of the sample, I address the following questions: Is the relationship significantly stable across provinces? And: Do provinces with different characteristics respond differently to the stimulus program?

Heterogeneity Analysis: Coastal versus Inland Provinces

The rationale for conducting a robustness check by analysing coastal versus inland provinces stems from the economic structure heterogeneity within China. Coastal provinces, with their advanced infrastructure, higher degree of industrialization, and greater access to international markets, have historically experienced different growth dynamics compared to the inland provinces. Inland provinces, on the other hand, often rely more on agriculture and less developed industrial sectors, with limited access to international trade. By separating the analysis into 11 coastal and 19 inland provinces, I aim to prove that the baseline findings are not biased by the unique characteristics of any particular region.

Table 3.10 provides the summary statistics in the subsamples. It shows, firstly, that coastal provinces enjoyed a higher initial level of income than inland provinces (9.097 in coastal provinces while 8.530 in inland provinces). Second, inland provinces suffered larger fiscal stimulus and credit expansion compared to coastal provinces (fiscal stimulus: 0.047 on average in coastal provinces while 0.153 in inland provinces; credit expansion: 0.133 and 0.139, respectively). This implies that inland provinces relied more heavily on the 4-trillion Yuan package than coastal provinces did.

Table 3.10: Summary Statistics: Inland Province versus Coastal Provinces

Variable	Mean	SD	Min	Max
Panel A: Coastal Provinces				
g_{it}	0.019	0.117	-1.277	1.166
lny_{it-1}	9.097	0.524	7.431	10.162
$credit\_GDP$	0.133	0.123	-0.362	0.946
$fiscal\_GDP$	0.047	0.052	-0.051	0.294
fcf_GDP	0.538	0.193	0.182	1.114
$export\_GDP$	0.276	0.267	-1.141	0.99
SOE_Total	0.44	0.146	0.164	0.795
Panel B: Inland Provinces				
g_{it}	0.021	0.116	-1.522	0.812
lny_{it-1}	8.530	0.473	7.011	9.666
$credit\_GDP$	0.139	0.421	-0.420	13.073
$fiscal\_GDP$	0.153	0.096	-0.112	0.599
fcf_GDP	0.764	0.228	0.119	2.054
$export\_GDP$	0.064	0.052	-0.091	0.409
SOE_Total	0.633	0.093	0.285	0.829

Table 3.11 presents the results of fiscal stimulus using the PMG approach. For inland provinces, the long-term coefficients on $fiscal\_GDP \times post$ in all cases are negative and significant when applying either a one or two lag order, ranging from -0.295 to -0.199. Meanwhile, for coastal provinces, the long-term coefficients on $fiscal\_GDP \times post$ are only significant when the lag orders of explanatory variables are three, with a value of -0.043. These results reconfirm that fiscal stimulus plays a growth-reducing role after the stimulus period, especially in less developed inland provinces.

Table 3.11: Heterogeneity Analysis of Fiscal Stimulus: Inland versus Coastal Provinces

	Model 1	Model 2	Model 3
Panel A: Inland Provinces			
Long-run			
fiscal_GDP	0.491*** (0.104)	0.576*** (0.099)	0.447*** (0.089)
fiscal_GDP × *post*	-0.295* (0.152)	-0.199*** (0.059)	-0.823 (0.166)
Short-run			
fiscal_GDP (sum)	-0.217*** (0.018)	-0.265*** (0.048)	-0.211 (0.142)
D1	-0.217*** (0.018)	-0.375*** (0.042)	-0.375*** (0.085)
D2	-	0.106*** (0.023)	0.182* (0.094)
D3	-	-	-0.018 (0.029)
fiscal_GDP × *post* (sum)	0.335*** (0.075)	0.017** (0.008)	0.008 (0.018)
D1	0.335*** (0.075)	-0.009 (0.006)	-0.043*** (0.010)
D2	-	0.027*** (0.006)	0.068*** (0.011)
D3	-	-	-0.016*** (0.006)
Observations	749	730	711
Provinces	19	19	19
Log-likelihood	959.459	1046.47	1065.687
Panel B: Coastal Provinces			
Long-run			
fiscal_GDP	0.591*** (0.134)	1.513*** (0.187)	0.601*** (0.150)
fiscal_GDP × *post*	0.003 (0.310)	0.141 (0.531)	-0.043* (0.250)
Short-run			
fiscal_GDP (sum)	-0.285*** (0.052)	-0.414*** (0.104)	-0.307** (0.142)
D1	-0.285*** (0.052)	-0.580*** (0.100)	-0.448*** (0.086)
D2	-	0.166*** (0.036)	0.172* (0.103)
D3	-	-	-0.032 (0.041)
fiscal_GDP × *post* (sum)	0.540*** (0.118)	0.034** (0.014)	0.013 (0.015)
D1	0.540*** (0.118)	0.022* (0.205)	-0.027*** (0.009)
D2	-	0.012 (0.009)	0.061*** (0,009)
D3	-	-	-0.021*** (0.005)
Observations	431	420	409
Provinces	11	11	11
Log-likelihood	624.550	673.683	688.362
Control Variables	YES	YES	YES
Time Dummy	YES	YES	YES

Notes: *, **, *** indicate significant at 10%, 5%, and 1%, respectively. Values in parentheses are standard errors.

According to the results for credit expansion using the PMG approach in Table 3.12, it is observed that during the post-stimulus period, for inland provinces, the long-term coefficients on credit expansion in all cases are negative and only significant when applying one lag order to explanatory variables, with the value of -0.057. Meanwhile, for coastal provinces, the coefficients are significantly negative when applying a two lag order, with a value of -0.77.

Table 3.12: Heterogeneity Analysis of Credit Expansion: Inland versus Coastal Provinces

	Model 1	Model 2	Model 3
Panel A: Inland Provinces			
Long-run			
credit_GDP	0.027 (0.020)	0.005 (0.020)	0.008 (0.024)
credit_GDP × *post*	-0.057** (0.024)	-0.013 (0.024)	-0.036 (0.03)
Short-run			
credit_GDP (sum)	0.010** (0.005)	0.009 (0.011)	0.026 (0.028)
D1	0.010** (0.005)	0.004 (0.009)	0.041*** (0.015)
D2	-	0.005 (0.006)	-0.031 (0.019)
D3	-	-	0.017** (0.008)
credit_GDP × *post* (sum)	0.024*** (0.006)	0.014* (0.007)	0.012 (0.011)
D1	0.024*** (0.006)	0.003 (0.006)	-0.016*** (0.006)
D2	-	0.011** (0.005)	0.043*** (0.008)
D3	-	-	-0.015*** (0.004)
Observations	1189	1146	1103
Provinces	19	19	19
Log-likelihood	906.529	970.669	1005.822
Panel B: Coastal Provinces			
Long-run			
credit_GDP	0.018 (0.014)	0.093*** (0.024)	0.095*** (0.023)
credit_GDP × *post*	-0.031 (0.021)	-0.077** (0.038)	-0.044 (0.034)
Short-run			
credit_GDP (sum)	-0.014* (0.008)	-0.023** (0.010)	-0.024 (0.018)
D1	-0.014* (0.008)	-0.030*** (0.009)	-0.032*** (0.009)
D2	-	0.006 (0.005)	0.010 (0.011)
D3	-	-	-0.002 (0.005)
credit_GDP × *post* (sum)	0.038*** (0.010)	0.037*** (0.010)	0.030*** (0.011)
D1	0.038*** (0.010)	0.025*** (0.008)	0.002 (0.008)
D2	-	0.012** (0.005)	0.041*** (0.007)
D3	-	-	-0.014*** (0.003)
Observations	456	445	434
Provinces	11	11	11
Log-likelihood	623.871	648.497	667.361
Control Variables	YES	YES	YES
Time Dummy	YES	YES	YES

Notes: *, **, *** indicate significant at 10%, 5%, and 1%, respectively. Values in parentheses are standard errors.

Subsamples with 29 Provinces

According to China's National Development and Reform Commission (NDRC), during the stimulus period, about 0.44 RMB trillion in funds went to Sichuan province for the post-disaster reconstruction after the Wenchuan earthquake in May 2008, accounting for 10% of the total funds.

Since estimated results from the ECM estimation via the PMG approach might also be affected by the relatively small number of outliers in the sample, as a further robustness check, I re-estimated the model excluding Sichuan province from the sample. This permits the understanding of whether the results are strongly driven by the behaviour of a single province.

Table 3.13 provides the estimated results of fiscal stimulus and credit expansion in 29 provinces. When Sichuan province is excluded from the sample, the estimated coefficient of fiscal stimulus (shown in Panel A) ranges from -0.021 to -0.091 when applying different lag orders. However, it is only significant in regression applying three lag orders, with the value of -0.091. In relation to the full sample results (-0.185 in regression applying three lag orders), this indicates that Sichuan province's presence contributes to the high long-term coefficient value estimation.

In Panel B, the coefficients of credit expansion after the stimulus period are significantly negative when applying one or two lag orders, with a value of approximately -0.5. Compared with the results of the full sample (ranging from -0.55 to -0.78), Sichuan appears to slightly reduce (in absolute value) the value estimated across the whole panel. This impact, though significant, appears not to be strong enough to alter the qualitative result: the long-term coefficients of fiscal stimulus and credit expansion are still negative after Sichuan province is excluded.

Table 3.13: Robustness Check: Samples for 29 Provinces

	Model 1	Model 2	Model 3
Panel A: Fiscal expansion			
Long-run			
fiscal_GDP	0.569***	0.98***	0.425***
	(0.091)	(0.116)	(0.081)
fiscal_GDP × *post*	-0.026	0.021	-0.091***
	(0.031)	(0.035)	(0.03)
Short-run			
fiscal_GDP (sum)	-0.226	-0.321	-0.244
D1	-0.226*** (0.023)	-0.465*** (0.04)	-0.38*** (0.064)
D2		0.144*** (0.019)	0.155*** (0.071)
D3			-0.019 (0.023)
fiscal_GDP × *post* (sum)	0.03	0.027	0.040
D1	0.03*** (0.004)	0.008* (0.005)	-0.03*** (0.007)
D2		0.019*** (0.005)	0.059*** (0.008)
D3			-0.016*** (0.004)
Observations	1141	1112	1083
Provinces	29	29	29
Log-likelihood	1528.559	1654.296	1688.261
Panel B: Credit expansion			
credit_GDP	0.028**	0.044**	0.028
	(0.013)	(0.018)	(0.018)
credit_GDP × *post*	-0.055***	-0.05**	-0.013
	(0.017)	(0.023)	(0.025)
Short-run			
credit_GDP (sum)	-0.226	0.023	0.008
D1	0 (0.005)	-0.007 (0.006)	0.015 (0.01)
D2		0.03 (0.04)	-0.016 (0.013)
D3			0.009 (0.006)
credit_GDP × *post* (sum)	0.032	0.024	0.016
D1	0.032*** (0.006)	0.012*** (0.004)	-0.016*** (0.005)
D2		0.012*** (0.004)	0.047*** (0.006)
D3			-0.015*** (0.003)
Observations	1150	1108	1066
Provinces	29	29	29
Log-likelihood	1469.034	1551.331	1606.532
Control Variables	YES	YES	YES
Time Dummy	YES	YES	YES

Notes: *, **, *** indicate significant at 10%, 5%, and 1%, respectively. Values in parentheses are standard errors.

3.4.6 Discussion: Growth-reducing Effects of the Stimulus Package in the Long Run

Why did a temporary economic stimulus program aiming at promoting economic growth unexpectedly damage long-run growth potential? This section provides some discussion with reference to several pieces of literature and statistical evidence.

Credit Expansion: Misallocation Trend after 2009

Several strands of literature and stylised facts might explain this reversal from growth-enhancing to -reducing effects of the credit expansion caused by the 4-trillion Yuan stimulus package.

First, the existing literature highlights how the misallocation of factors of production across firms can explain a large proportion of observed differences in aggregate total factor productivity (TFP) and income across countries (Hsieh & Klenow 2009). As a consequence, an efficient reallocation of resources across heterogeneously productive firms can contribute to economic growth (Restuccia & Rogerson 2008). China experienced a gradual reallocation of capital from low- to high-productivity firms during the boom years of the 2000s, which is considered one of the forces behind its fast economic growth in the early 2000s (Cong et al. 2019, **?**). This stylised fact supports empirical findings on the positive effects of credit expansion prior to 2009.

However, after the introduction of the stimulus package, this process of credit allocation reversed. More credit flowed toward SOEs, which are, on average, less productive than private firms, at the outset of the stimulus plan. According to Cong et al. (2019), Deng et al. (2015) and others, the effect of the credit supply increase on firm borrowing was significantly larger for SOEs relative to private firms in the period 2009-10. This change in capital allocation towards less productive firms, including local-government-favoured private firms, had potentially negative effects on the efficiency of capital allocation (Bai et al. 2016, Cong et al. 2019), thereby reducing China's economic growth.

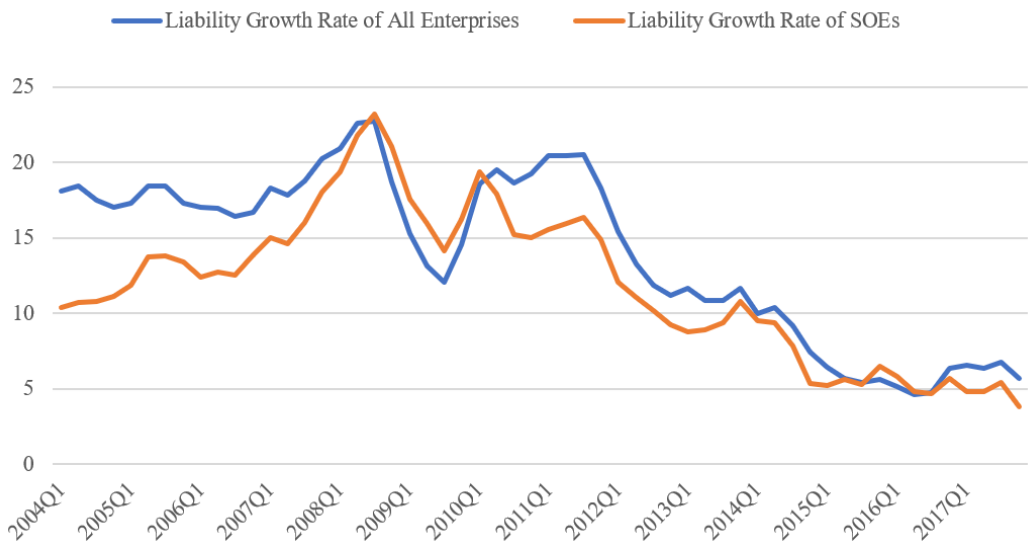

Figure 3.2: Liability Growth Rate of Industrial Enterprises in China (2004Q1-2017Q4)(%)

Source: China Macroeconomic Database (Monthly).

Due to the absence of data on credit reallocation across firms with different ownership, I use the liability growth rate as a proxy to roughly estimate the allocation trend of credit. As shown in Figure 3.2, the growth rate of China's industrial enterprise liability has predominantly been driven by SOEs. Notably, during the stimulus period (2009-10), the growth rate of liability in SOEs surpassed that for all types of enterprises combined. Considering that bank credit is the primary external funding source in China (Allen et al. 2005), this observation further confirms that SOEs receive a significantly larger share of funds when compared to private enterprises.

Additionally, Figure 3.3 illustrates that starting from the first quarter of 2009, the liability-asset ratio of SOEs exhibited a distinct trend compared to that of enterprises of all types. While the liability-asset ratio of the latter was declining, the ratio of SOEs showed a persistent upward trajectory. By 2015, the liability-asset ratio of SOEs is 5 percentage points higher than the overall level, indicating a substantial disparity in credit allocation favouring SOEs. Furthermore, the divergence in the trend of credit allocation between SOEs and private firms persisted beyond the stimulus years, suggesting some enduring effects of the stimulus policies (Cong et al. 2019).

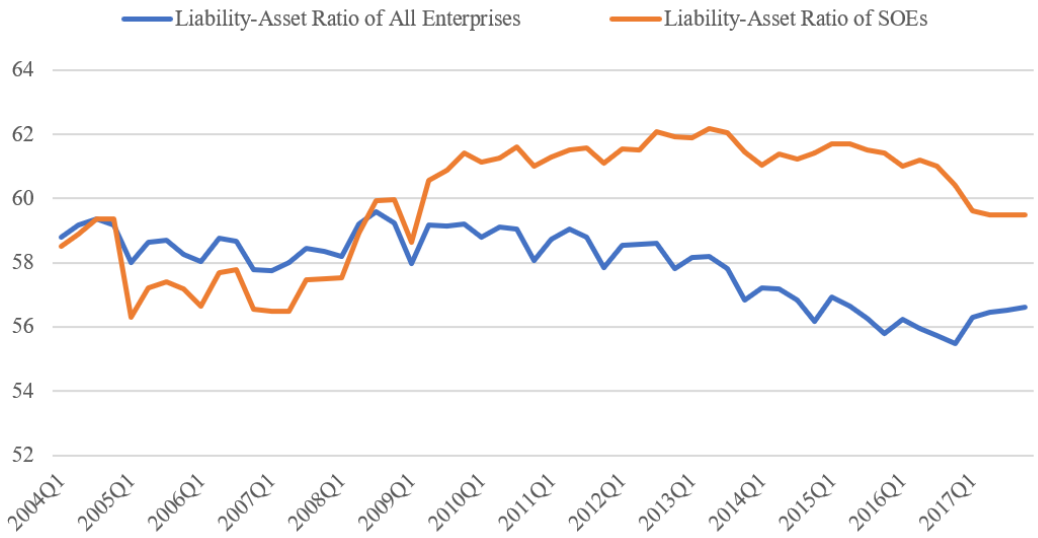

Figure 3.3: Liability-Asset Ratio of Industrial Enterprises in China (2004Q1-2017Q4)(%)

Source: China Macroeconomic Database (Monthly).

Second, the negative effects of credit expansion after the stimulus package may indicate that the level of credit expansion during the stimulus period was excessively high. Excessive financial deepening or rapid credit growth can lead both to inflation and a weakened banking system, which, in turn, hinder economic growth (Rousseau & Wachtel 2011). Figure 2.3 depicts the significant surge in new bank loans in 2009, to nearly double that of the previous year. In the absence of adequate legal or regulatory policies, such rapid short-term expansion may fail to effectively allocate and utilise credit resources, thereby ceasing to play a positive role in promoting economic growth.

3.5 Conclusion

This study presents empirical estimates of the short- and long-term relationship between the 4-trillion Yuan stimulus package and economic growth in a sample of 30 provinces in China from the first quarter of 2004 to the fourth quarter of 2017. Based on a recently developed model: the Error Correction Model (ECM), and the econometric technique of the Pooled Mean Group (PMG) approach, this paper introduces short-term heterogeneous dynamics in the relationship between the 4-trillion Yuan stimulus package and growth, which makes the results more consistent with reality.

Employing two variables, fiscal stimulus and credit expansion, to control the implementation of the stimulus package, the empirical result outlined in the chapter finds that first, the massive one-off stimulus package temporarily boosted GDP growth; and second, there was a significant long-term negative link between fiscal stimulus/credit expansion and growth in China. Although due to data limitations, this study does not provide further tests, the main finding is supported by the existing literature such as Bai et al. (2016) and Ouyang & Peng (2015).

The major implication of these findings is that the large-scale infrastructure construction and investment-dependent policy may not have been as much of a boost to the economy as expected. Additionally, many problems, such as the misallocation of credit resources, are hidden behind the policy-driven credit expansion, and this negative effect extends outside the stimulus period.

Overall, this chapter has examined the long-run effect of China's one-off 4-trillion Yuan stimulus package based on the analysis of quarterly data at the province level. But what can be seen regarding the impact of the 4-trillion Yuan package at the micro level? It will be interesting to look at this issue from the industry and firm perspective. In the next two chapters, I will provide the related empirical evidence from a more granular standpoint as well.

Chapter 4

The Impact of China's Stimulus-driven Credit Expansion on Industrial Investment

4.1 Introduction

The global financial crisis of 2008 has cast a long shadow on the economic fortunes of many countries, resulting in what is often referred to as "the Great Recession". To encourage investment and restore economic growth, major countries worldwide introduced various stimulus packages. At the end of 2008, the Chinese government announced its stimulus package, which not only involved the pursuit of fiscal stimulus in the form of huge government spending but also of credit expansion in the form of relaxing the funding and lending constraints on traditional banks. Several studies have confirmed that this program and the associated credit boom encouraged aggregate investment and thereby stimulated real GDP in the short run (Deng et al. 2015, Ouyang & Peng 2015), but in the long run, it worsened the aggregate allocation trend and growth potential (Bai et al. 2016).

What drove this reversal in the effects of the stimulus package? Using 2-digit industrial data from 2002 to 2016, this chapter seeks to provide a novel perspective at the industry level by examining how the Chinese credit stimulus, interacting with government intervention, influenced industry investment activity and its outcomes, measured by investment efficiency and allocative efficiency. A difference-in-differences (DID) strategy is employed to compare the differential effects of government support across industries.

The main identification challenge faced in this analysis is how to determine the intensity of government support in each industry. It is widely recognised that due to imperfections in the Chinese capital market, credit resources are not allocated fairly to all sectors or firms, with government intervention playing a significant role in this process (Allen et al. 2005, Bai et al. 2016, Firth et al. 2006). However, identifying preferential access to increased bank loans or the extent of government support poses difficulties. To address this challenge, by mutually collecting keywords from official government documents, the samples are categorised into three groups: extensively-supported, narrow-supported, and non-supported industries. This is a key innovation of the present study.

The empirical results reveal a change in the investment ratio across Chinese industries following the introduction of the stimulus package in 2009. In contrast to the responses observed in the US and many European countries, where firms facing uncertainty typically reduce their investments (Duchin et al. 2010), industries in China experiencing government support through the stimulus package exhibited increased investment levels post-2009. This suggests that government backing facilitated easier access to financing for certain industries.

Subsequently, using the residual from the optimal investment level as a measure of investment efficiency, industries receiving government support are found to have demonstrated lower investment efficiency compared to others post-2009.

Finally, expanding the picture to the outcome at the province level, the 2009 credit expansion reveals a negative association with province allocative efficiency, measured by the elasticity of investment growth to output growth.

Overall, China's massive one-off credit expansion significantly influenced industry investment decisions and outcomes. Industries with government support tended to invest more but with lower efficiency. This contributed to a deteriorating allocation trend and a slowdown in allocative efficiency at the aggregate level.

This chapter contributes to several strands of literature in macroeconomics and finance, in the following ways. First, it offers additional evidence on the benefits and costs of government interventions. Previous studies have highlighted how government intervention benefits individual firms or sectors (Chen et al. 2016, Faccio et al. 2006, Khwaja & Mian 2005, Li et al. 2008). However, the present study introduces new evidence suggesting that the helping hand of the government may not always be desirable: with the implementation of the 4-trillion stimulus package, industries with government support tended to increase their investments, which reduced their investment efficiency, resulting in a decline in aggregate allocative efficiency. This finding implies that government intervention can have adverse effects not only on social welfare but also on the individual industries.

Second, this analysis enriches the extant literature on corporate finance. Government ownership or political connections, as a form of market friction, has been well documented in developing countries (Chen 2006). However, most of these studies are based on a normal period. It is much less clear how government intervention fares in periods of financial crisis period. This work adds to this strand of literature by placing the research question against the background of the economic stimulus package, when the government has more power over resource allocation, thereby helping to better observe the role of government and the consequences of such intervention.

Third, this study is related to a new wave of research examining the drivers and consequences of China's unprecedented stimulus package, particularly the aggressive credit boom. Traditional literature emphasises the role of state connections in resource allocation, highlighting a trend where capital and bank lending flows from high-productivity but privately-owned firms towards low-productivity but state-owned firms after financial crises and stimulus programs (Bai et al. 2016, Cong et al. 2019, Deng et al. 2015, Liu et al. 2018). However, this view is challenged by Lardy (2014) and Jiang et al. (2018), who argue that claims of discriminatory lending practices by Chinese banks may be overstated. Consequently, the reallocation towards SOEs does not fully explain the slowdown in China's economy. This paper introduces an alternative perspective: Credit resource preferences not only exist between SOEs and non-SOEs within sectors but also among industries. To the best of my knowledge, this is one of the first studies to examine industry-level trends following China's 4-trillion stimulus package.

The remainder of the study is organised as follows. Section 4.2 summarises the literature on how government intervention affects investment, the introduction to investment efficiency, and allocative efficiency. Section 4.3 lays out the empirical methodology. Section 4.4 provides the main results and associated mechanism analysis, heterogeneous analysis, and robustness check. Section 4.5 concludes the chapter.

4.2 Literature Review

4.2.1 Government Intervention and Investment

Theoretical Background: Tobin's Q and Its Extension

Tobin (1969) proposes that the principal way in which financial policies and events affect the economy is by changing the valuation of physical assets relative to their replacement cost - a variable denoted "Q". Specifically, an unexpected decrease in the nominal policy rate can lead to an increase in stock prices relative to the replacement cost of capital, thereby raising Tobin's Q. This increase in Q reduces the cost of external financing in capital markets, particularly equity financing, and stimulates investment activity. Since then, Tobin's Q has played a crucial role in investment theories.

The Neoclassic Q theory states that what is relevant to a firm's investment decision is marginal Q – the ratio of the market value of a marginal unit of capital to its replacement cost (Tobin 1969). The value indicates how an additional dollar of capital affects the present value of profit. Under certain conditions, it is a sufficient statistic for investment (Hayashi 1982), and all other determinants, including cash flow, are irrelevant. In other words, it is the "fundamental" factor that determines the investment policy of profit-maximising firms in efficient markets.

However, marginal Q is unobservable, which is why many studies use average Q, the ratio of the total value of the firm to the replacement cost of its total capital, as a proxy for marginal Q (Blanchard et al. 1993, Brainard & Tobin 1968).

Hayashi (1982) demonstrates that average Q will deviate from marginal Q whenever average profit differs from marginal profit. Therefore, using average Q as a proxy for marginal Q assumes that average profit and marginal profit are highly correlated.

Furthermore, Fazzari et al. (1988) find that investment is positively sensitive to cash flow, even after controlling for Q, and interprets this finding as evidence of financing frictions. Given that the current cash flow is likely to be positively correlated with future profitability, a link between cash flow and investment could reflect the link between expected profitability and investment rather than the sensitivity of firm investment to cash flow.[1] For this reason, Q is commonly used as a proxy for investment opportunities.

Let I and CF be the physical investment and cash flow, respectively, scaled by physical assets K, and Q be the market-to-book ratio. The investment–Q (β_1) and investment–cash flow (β_2) sensitivities are as follows (Fazzari et al. 1988):

$$\frac{I_{i,t}}{K_{i,t}} = \beta_0 + \beta_1 Q_{i,t-1} + \beta_2 \frac{CF_{i,t}}{K_{i,t-1}} + \varepsilon_{i,t} \tag{4.1}$$

In summary, financial policies and events can shape investment behaviour through various channels, including Tobin's Q and cash flow. The former is influenced by policy changes affecting market dynamics and asset valuations, while the latter is influenced by policies such as interest rate adjustments. Changes in Tobin's q and cash flows caused by these policies directly affect investment decisions made by firms.

Cross-country Evidence

The existing literature has extensively examined various institutional characteristics, economic policies, and unforeseen shocks, analysing their influence on investment decisions.

McLean et al. (2012) explore how investor protection affects firm-level resource allocations. Using average Q as a proxy for marginal Q and drawing on data from firms in 44 countries during the period 1990 to 2007, they find that Q predicts investment and that this relation is significantly stronger in countries with more investor protection. This is partly because high-

1. For example, the current realisation of cash flow would be a proxy for future investment opportunities if productivity shocks were positively serially correlated.

Q firms in these countries can more easily access external finance to fund their investments. Additionally, the study shows that investment sensitivity to cash flow is lower in countries with strong investor protection, as firms with good investment opportunities and limited internal financing can raise capital and invest the proceeds.

Afonso & Jalles (2015) assess the relevance of fiscal components in private and public investment using data from a large panel of 95 countries for the period 1970–2008. Employing cross-section time series analysis, the study aims to determine which budgetary components drive private and public investment. The findings indicate a negative effect of government expenditure and government consumption spending on private investment. Interest payments and subsidies also harm both types of investment, particularly in emerging economies. Social security spending negatively affects private investment for both the full and OECD samples, while government health spending positively impacts private investment. Moreover, stronger fiscal rules decrease public investment.

With regard to the literature on economic policy uncertainty, Kang et al. (2014) analyse the impact of economic policy uncertainty and its components on investment using firm-level data of more than 2,700 US manufacturing firms for 1985–2010. Their study reveals that economic policy uncertainty hampers firms' investment decisions, especially when interacting with firm-level uncertainty. Firms tend to exercise caution in their investment plans when facing uncertain business costs arising from potential changes in regulations, healthcare costs, and taxes. This effect is more pronounced for firms experiencing higher levels of internal uncertainty and during economic downturns. Additionally, the study finds that news-based policy shocks have a significantly negative long-term impact on firms' investment. Interestingly, economic policy uncertainty appears to have limited influence on the investment decisions of the very largest firms, constituting around 20% of listed firms.

Gulen & Ion (2016) employ a news-based index of policy uncertainty to investigate the effect of policy-related uncertainty on US corporate investments. Their study documents a robust negative relationship between firm-level capital investment and the aggregate level of uncertainty associated with future policy and regulatory outcomes. To identify the possible mechanisms through which policy uncertainty propagates in the economy, they further examine whether the negative effect of policy uncertainty on capital investment varies across

firms. The evidence suggests that the relationship between policy uncertainty and capital investment is not uniform in the cross-section, being notably stronger for firms with a higher degree of investment irreversibility and for firms more dependent on government spending. These findings provide empirical support for the notion that policy uncertainty can depress corporate investment by inducing precautionary delays due to investment irreversibility.

Some prior literature also examines the impact of a certain event, such as the financial crisis and a stimulus program, on investment.

Lemmon & Roberts (2010) examine how shocks to the supply of credit impact corporate financing using the shock to the supply of below-investment-grade credit post-1989, based on a firm-level dataset between 1986 and 1993. Their DID strategy reveals that the contraction in the supply of credit to below-investment-grade firms significantly altered their financing and investment behaviour. Net debt issuances nearly halved relative to post-supply shock, with little substitution for alternative sources of finance. Consequently, net investment declined almost one-for-one with the decline in net debt issuances. These results underscore the significant consequences which shifts in the supply of capital can have on the financial and investment policies of firms.

Campello et al. (2010) surveyed 1,050 Chief Financial Officers (COFs) in the US, Europe, and Asia to assess whether their firms were credit-constrained during the global financial crisis of 2008. The study finds that financially constrained firms planned to cut more investment, technology, marketing, and employment relative to financially unconstrained firms during the crisis. Additionally, constrained firms were forced to use up a sizeable portion of their cash savings during the crisis and cut more deeply into planned dividend distributions. Constrained firms also exhibited a higher propensity to sell off assets as a means of generating funds during the crisis. These findings highlight how financial constraints can hamper investment in valuable projects, and suggest that relaxing these constraints could foster additional long-term growth opportunities in the economy.

Duchin et al. (2010) examine the effect of the 2008 financial crisis on corporate investment using a DID approach. Based on a sample consisting of quarterly data on publicly traded firms during 2006-2009, corporate investment is found to have significantly declined following the onset of the crisis, especially for firms with low cash reserves, high net short-term debt, and those which were financially constrained or dependent on external finance. The findings suggest a precautionary savings motive for seemingly excess cash, which is often overlooked.

China-specific Evidence

The corporate finance literature on China primarily investigates the effect of government policies or political conditions on firms' investment behaviour, often after controlling for various proxies representing investment opportunities.

Chow & Fung (1998) explore the relationship between investment and cash flow using a panel of 5,825 manufacturing firms in Shanghai from 1989 to 1992. Their study aims to test the financing constraints hypothesis, using the current and lagged changes in sales as proxies for investment opportunities. They find evidence supporting the notion that firms' investment is constrained by cash flow, with the highest sensitivity of investment to cash flow among private firms, and the lowest in foreign-owned firms. State-owned and collective firms also exhibit positive sensitivities, with the former showing higher levels.

Building on the same dataset, Chow & Fung (2000) focus once again on investment equations, demonstrating that small firms exhibit lower sensitivities of investment to cash flow compared to large firms. They attribute this finding to small firms, which are mainly non-state, rapidly growing enterprises, possibly using their working capital to smooth fixed investment.

Ding et al. (2013) analyse a panel of over 116,000 Chinese firms of varying ownership types from 2000 to 2007. They investigate how different agents' firms used their working capital to mitigate the financial constraints on fixed capital investment. They used the time dummy to interact with the industry dummy to capture investment opportunities, as these dummies are believed to account for all time-varying demand shocks at the industry level. Their results

suggest that in the presence of cash flow fluctuations, older, larger, and slower-growing firms adjust fixed capital investment, while smaller, younger, and faster-growing firms tend to adjust working capital instead. They conclude that an active management of working capital may help firms to alleviate the effects of financing constraints on fixed investment.

Using the World Bank's Enterprise Survey of manufacturing firms in 120 Chinese cities conducted in 2005, Cull et al. (2015) examine whether and how firms with differential government connections are financially constrained in China and how this affects their investment patterns. In the empirical section, both firm-level sales growth and industry-level Tobin's Q are used to proxy growth opportunities. Their findings indicate that investment in firms with strong government connections is less sensitive to internal cash flows and indicators of growth opportunities compared to other firms, thus highlighting the influence of political connections on investment behaviour.

Ding et al. (2018) analyse the sensitivity of investment opportunities in Chinese manufacturing firms from 1998 to 2007. They construct proxies for investment opportunities from the supply side, the demand side, and a forward-looking perspective, and find that private firms place greater value on all types of investment opportunities than SOEs do, though SOEs respond more to supply-side opportunities and less to demand shocks.

Huang et al. (2020) examine variations in local public debt issuance across Chinese cities between 2006 and 2013, and find that public debt issuance crowded out investment by private manufacturing firms by tightening their funding constraints, while leaving SOE investment unaffected. They establish this result in three ways. First, local public debt was inversely correlated with the city-level investment ratio of domestic private manufacturing firms and this relationship is causal. Second, local public debt had a larger negative effect on investment by private firms in industries which are more dependent on external funding. Third, in cities with high government debt, firm-level investment was more sensitive to internal funding. All these results suggest a crowding-out effect on private investment that weakens China's long-term growth potential.

In summary, the existing literature employs various proxies for investment opportunities, and examines the relationship between investment, firms' political conditions (ownership, and political connections), and institutional systems (such as investor protection systems, and financial development). While the role of policies in influencing investment behaviour is well-documented in developed economies, less attention has been paid to certain types of government intervention in emerging economies like China.

4.2.2 Review of the Outcome of Investment: Investment Efficiency

Theoretical Background

Definition of Investment Inefficiency

Within neoclassical theory, firms invest until the marginal benefit equals the marginal cost of this investment, aiming to maximise their values (Abel 1983, Hayashi 1982, Yoshikawa 1980). Conversely, the Keynesian framework argues that expected investment is influenced by growth preference (Crotty 1992, Gordon 1992), potentially causing firms to deviate from their optimal investment levels. This deviation, whether resulting in underinvestment (lower investment than expected investment) or overinvestment (greater investment than expected investment), is defined as "investment inefficiency", whereas investment at the optimal level is deemed "efficient investment".

Measure of Investment Efficiency

In a perfect capital market without friction (Modigliani & Miller 1958), a firm's investment should be solely determined by its profitability, typically measured by Tobin's Q (Tobin 1969). Therefore, the majority of the investment literature employs the sensitivity of investment expenditure to investment opportunities as the measure of investment efficiency, as represented by the following equation:

$$\frac{I_{i,t}}{K_{i,t}} = \beta_0 + \beta_1 q_{i,t-1} + \varepsilon_{i,t} \tag{4.2}$$

Two main measures of investment efficiency stem from this equation. First, the coefficient β_1 signifies the sensitivity of investment expenditure to investment opportunities (Lang et al. 1996, Stein 2003). Second, some literature defines investment efficiency based on residuals from the investment model, where zero residuals imply no deviation from the expected level of investment (Biddle et al. 2009).

Determinants of Investment Efficiency

In perfect financial markets, all positive net present value (NPV) projects should be financed and carried out. However, market imperfections, information asymmetries (Fazzari et al. 1988, Myers & Majluf 1984), and agency costs (Jensen & Meckling 1976, Lang et al. 1996) can all lead to deviations from this ideal scenario. Specifically, overinvestment refers to an excessive allocation of resources to projects with negative NPV, leading to a decrease in the company's value. Conversely, underinvestment denotes a failure to invest enough in projects with positive NPV, resulting in missed opportunities for high returns and a failure to maximize the company's value.

According to agency theory, both overinvestment and underinvestment can be attributed to asymmetric information among stakeholders (Jensen & Meckling 1976). Myers (1977) and Myers & Majluf (1984) developed a framework for understanding the role of asymmetric information in investment efficiency which highlights issues such as moral hazard and adverse selection.

In the context of the moral hazard model, overinvestment arises from agency conflicts between managers and shareholders, stemming from conflicting interests and inadequate monitoring of managers. Managers, motivated by self-interest rather than shareholder value, may prioritise running large, instead of profitable, businesses to consume the perquisites associated with size (Jensen & Meckling 1976), leading to the establishment of a managerial empire and overinvestment.

Conversely, under adverse selection, better-informed managers may overinvest through the sales of overpriced securities. To mitigate this risk, capital suppliers may ration or raise the cost of capital, leading to fund constraints and the rejection of some profitable projects, and resulting in underinvestment (Biddle et al. 2009, Stiglitz & Weiss 1981).

Cross-country Evidence

Biddle et al. (2009) address whether higher-quality financial reporting is linked to a reduction of over-investment or under-investment. They directly model the expected level of investment based on a firm's investment opportunities, with investment efficiency existing when there is no deviation from the expected level of investment. Their study provides evidence of both scenarios, documenting a conditional negative (or positive) association between financial reporting quality and investment for firms operating in settings more prone to overinvestment (or under-investment).

Following the investment equation presented by Biddle et al. (2009), Gomariz & Ballesta (2014) conduct a study with a sample of Spanish-listed firms during the period 1998–2008. They examine the role of financial reporting quality and debt maturity in investment efficiency. Their results indicate that financial reporting quality mitigates the problem of overinvestment. Additionally, lower debt maturity can improve investment efficiency, addressing both overinvestment and underinvestment issues. Furthermore, they find that financial reporting quality and debt maturity serve as mechanisms with some degree of substitution in enhancing investment efficiency: firms with lower (higher) use of short-term debt exhibit higher (lower) effects of financial reporting quality on investment efficiency.

Using a dataset comprising newly privatised firms from 64 countries, Chen et al. (2017) explore the relationship between ownership type and firm-level investment efficiency, as captured by the sensitivity of investment expenditure to investment opportunities. Their findings are consistent with theoretical predictions, indicating that government and foreign institutional owners are associated with different levels of information asymmetry and agency

problems. They find robust evidence suggesting that government (foreign) ownership weakens (strengthens) investment-Q sensitivity, thereby increasing (decreasing)investment inefficiency (efficiency). This highlights the important role of ownership type in shaping firms' investment behaviour and efficiency.

China-specific Evidence

Chen et al. (2011) examine the relationship between government intervention and investment performance based on data from Chinese listed firms spanning the period 2001 - 2006. They define investment efficiency as the sensitivity of investment expenditure to investment opportunities, and compare the coefficients among different groups. Their main findings can be summarised as follows. Firstly, investment efficiency is found to be lower in SOEs than in non-SOEs; secondly, political connections have a significant negative impact on investment sensitivity; and thirdly, this negative effect of political connections is primarily observed in SOEs controlled by local governments. In summary, their results suggest that government intervention in SOEs, whether through majority state ownership or the appointment of connected managers, distorts investment behaviour and undermines investment efficiency.

Deng et al. (2020) examine how government intervention affects firms' investment and investment efficiency, focusing on China's 2009-10 stimulus package. They use investment-Tobin's Q sensitivity to measure the efficiency of investment and capital allocation and identify two instruments of government intervention with state ownership and political connections. Using the listed firm data from 2006 to 2010, They find that the investment efficiency of government-intervened firms decreased and government-intervened firms overinvested after the stimulus period.

In summary, many studies have utilised investment opportunity sensitivity as a proxy for investment efficiency. However, it is important to note that the estimated coefficient merely indicates whether or not investment efficiency increased, without identifying the mechanism behind it. In contrast, the residual from the investment model is often considered a superior measure. Motivated by that, this study applies the residual from the optimal investment level to calculate investment efficiency in the empirical analysis.

4.2.3 Review of the Outcome of Investment: Allocative Efficiency

A substantial body of literature has investigated the connection between economic policies and the allocation of resources across countries.

The reallocation of capital to more productive uses has significant implications for aggregate productivity and welfare, both within industries and countries, and over time (Bartelsman et al. 2013, Guner et al. 2008, Hopenhayn 2011, Hsieh & Klenow 2009, Olley & Pakes 1996). This section provides a summary of both the theoretical and the empirical literature on allocative efficiency and its relationship with policy intervention.

Theoretical Background

Alternative tests of the role of policy interventions in improving allocative efficiency are grounded in the neoclassical argument, which posits that capital should be allocated in such a way that its marginal product is equalised across projects. According to the theory, more productive firms should be able to attract more resources, including capital and labour, compared to less productive firms (Olley & Pakes 1996, Restuccia & Rogerson 2008). However, distortions in the economy prevent the free flow of resources to productive firms. Consequently, more productive firms may operate below their optimal size while less productive firms grow beyond their optimal size, resulting in an inefficient allocation of resources across firms and ultimately reducing aggregate output and Total Factor Productivity (TFP).

The seminal work by Restuccia & Rogerson (2008) incorporates policy distortions into a neoclassical growth model with heterogeneous firms. The authors demonstrate how policy distortions generate resource misallocation, leading to significant output and productivity falls, which explain the cross-country differences in output per capita well. The model highlights that differences in resource allocation across establishments with varying productivity may be a crucial factor in explaining aggregate TFP losses. In their model, all producers face the same prices in the competitive equilibrium without distortions. However, policy distor-

tions create heterogeneity in the prices faced by individual producers, resulting in productivity losses due to misallocation, especially if those distortions are positively correlated with firm productivity. This leads to an aggregate shift of resources away from efficient firms and towards less efficient ones, further reducing aggregate TFP.

Hsieh & Klenow (2009) demonstrate that the greater the variation in the distortions, the larger the aggregate TFP losses. They develop a method to identify the extent of resource misallocation and associated TFP losses based on variations in marginal revenue products of inputs. In their monopolistic competition model, firms with different productivities face different product and factor prices due to firm-level distortions. In perfectly competitive markets without distortions, the marginal revenue product (MRP) for capital and labour would be equalised across all firms, even if their productivity levels differ. However, in the presence of distortions, there are differences in the MRP of capital and labour across firms. This misallocation of resources lowers aggregate TFP.

In summary, the concept behind misallocation proposed by Hsieh & Klenow (2009), suggests that in competitive markets, firms within the same industry should have equivalent total factor productivity revenue (TFPR), but distortions lead to differences in factor prices and MRPs across firms, resulting in resource misallocation and lower aggregate TFP.

Cross-country Evidence at the Industry Level

In simple terms, the criterion for allocative efficiency at the industry level follows the basic principle in microeconomics: if the marginal rate of return on capital invested in different sectors becomes more equal over time, this indicates a better allocation of capital. However, implementing this criterion in practice is challenging due to data limitations and measurement problems.

For instance, a study in the context of South Korea by Cho (1988) uses the marginal cost of the optimising condition because the data required to estimate the marginal rates of return are often unavailable. The author approximates marginal cost with average cost due to these data limitations and compares variations in borrowing costs across 68 manufacturing industries before and after financial deregulation, finding that liberalisation encourages capital flows to equate to marginal returns across sectors.

However, this inference is challenged by Gupta & Lensink (1996), who argue that a reduction in variance may not necessarily indicate improved allocation efficiency. State intervention, for instance, could reduce such a reduction by requiring lending institutions to allocate credit to favoured sectors at uniform rates.

Wurgler (2000) directly examines the relationship between a country's level of financial development and the efficiency of its capital allocation to investment projects. Using the elasticity of industry investment to value-added as a proxy for allocation efficiency across 28 industries, the author finds that countries with developed financial sectors tend to increase investment in "growing" industries, and decrease investment in "declining" industries more than those with underdeveloped financial sectors.

Beck & Levine (2002) analyse the impact of financial structure on industry growth and efficient capital allocation across 42 countries and 36 industries. They find that industries which are heavily dependent on external finance grow faster in economies with higher overall financial development, and that overall financial development boosts efficient capital allocation.

Fisman & Love (2004) introduce a novel methodology centred on industry co-movement to investigate the impact of financial market development on inter-sectoral allocation. Operating under the assumption of common global shocks affecting growth opportunities, they hypothesise that pairs of countries should exhibit correlated patterns of sectoral growth if they can effectively respond to these shocks. Their findings support the notion that well-developed financial markets facilitate responsiveness to such shocks, as evidenced by paired

countries experiencing more highly correlated growth rates across sectors when both possess well-established financial markets. This effect is particularly pronounced among pairs of countries at similar levels of economic development, as they are more likely to encounter similar growth shocks.

Bena & Ondko (2012) examine whether the development of financial markets contributes to the efficient allocation of resources. Using micro-level data from European firms from 1996 to 2005, they demonstrate that firms in industries with growth prospects tend to utilise more external finance in countries with more advanced financial systems. This finding is based on two alternative proxies used to measure the global component of industry growth opportunities: (i) industry value-added growth in the United States, and (ii) change in the global industry price-to-earnings (PE) ratio. Both proxies operate under the assumption that a global component exists in the industry-specific growth opportunities stemming from shifts in demand and productivity.

In essence, the idea is to allocate resources to industries or sectors with high (marginal) returns. At the aggregate level, one can examine either the marginal rate of return or the marginal cost across industries/sectors and use an index to compare allocative efficiency, as defined in the following section.

China-specific Evidence

At an aggregate level, Bai et al. (2006) estimate the return to capital in China by utilising data on the share of capital in total income, the capital-output ratio, the depreciation rate, and the growth rate of output prices relative to capital prices. They find that the aggregate annual return to capital averaged 25% during 1978-1993, declined during 1993-1998, and remained stable at around 20% since 1998. These rates of return surpassed those of most advanced economies, suggesting no evidence of excessive investment at the aggregate level. Additionally, they note a decrease in the dispersion of the return to capital across Chinese provinces since 1978.

Sector-wise, Brandt et al. (2013) investigate the impact of factor market distortions, in the forms of ownership and barriers to factor mobility, on TFP losses associated with capital and labour misallocation in China's non-agricultural sectors across provinces between 1985-2007. They find that the misallocation of factors across provinces and sectors led to aggregate TFP losses in the manufacturing and services of 20%, with within-province accounting for more than half of the total losses. Specifically, within-province distortions declined sharply between 1985 and 1997, contributing to 0.52% of non-agricultural TFP growth per year, but increased significantly in the last decade, reducing the non-agricultural TFP growth rate by 0.5% annually. They argue that within-province distortions are primarily due to the misallocation of capital between the state and non-state sectors induced by government policy.

Recent studies on China focus on identifying the specific factors driving misallocation and reducing aggregate productivity efficiency. Policy distortions are commonly discussed as potential explanations for the dispersion of TFP or marginal revenue products of inputs.

Dollar & Wei (2007) examine the presence of systematic distortions in capital allocation across firm ownership, regions, and sectors in China using firm-level accounting information for 2002-2004. They find that, even after a quarter-century of reforms, SOEs still have significantly lower returns to capital than domestic private or foreign-owned enterprises. Similarly, certain regions and sectors consistently exhibit lower returns to capital than others. Their calculation suggests that China could reduce its capital stock by 8% without sacrificing economic growth if allocated its capital more efficiently.

Wu (2018) finds that the vast majority of capital misallocation in China is due to policy distortions rather than financial frictions. By employing firm ownership as the proxy for policy distortions, and firm size and age as financial friction, the author finds that financial frictions account for 30% of observed capital misallocation in China.

A common theme in the emerging literature outlined above is the heterogeneity highlighted in ownership and regions in productivity performance. This heterogeneity suggests resource misallocation across firms, with potential adverse impacts at the aggregate level. While much attention has been paid to allocation between or within state-owned and non-state-owned enterprises in the same sector, there has been less focus on allocation between industries. In this chapter, I discuss the allocation trend from an industrial perspective, aiming to identify more fruitful connections to the mechanism of resource allocation.

4.3 Data and Methodology

4.3.1 Data and Variables

The province-level 2-digit industry statistics used in this analysis come from the *China Industrial Economic Statistical Yearbook*, which provides data on capital formation, sales, and other relevant information for up to 27 2-digit industrial classification system (ICS) industries across 31 provinces in mainland China from 2002 to 2016. The data is reported in current RMB and converted into a constant value using the Producer Price Index (PPI). The sample size is 12,555 (with $T = 15$, from 2002 to 2016, $N = 27$ in 31 provinces), and is unbalanced. [2]

Most of the province-level control variables are sourced from *China Macroeconomic Database (Annual)*. All nominal variables are deflated to the base year (2000) using the province-level PPI. Additionally, the Financial Marketisation Index is obtained from *China Market Index Database*, which offers indices of marketisation for mainland China's 31 provinces.

2. This chapter applies industry-level rather than firm-level data because the focus is on discussing the aggregate effects of the 4-trillion Yuan stimulus package. Two commonly used firm-level datasets in Chinese studies are the China Industry Business Performance Database and the listed firm database. However, the quality of data in the former has been questioned post-2010 due to missing key variables, while the latter only includes the data of listed firms, which could bias the results.

Measure of Key Variables

Measure of Investment Efficiency Investment Efficiency (*IE*) refers to the effectiveness with which an industry invests resources to maximise returns. To measure *IE*, I begin by constructing a model that predicts the level of investment based on fundamental factors (investment opportunities) (Biddle et al. 2009, Gomariz & Ballesta 2014) and financial factors (cash flow) (Firth et al. 2008, Ding et al. 2018). The deviation from this model's predicted investment level represents investment efficiency. The model is specified as follows:

$$\frac{I_{i,t}}{GDP_{i,t}} = \alpha_0 + \alpha_1 Q_{i,t-1} + \alpha_2 \frac{CF_{i,t-1}}{K_{i,t-1}} + \varepsilon_{i,t} \tag{4.3}$$

where I/GDP represents the investment rate of industry i at time t, defined as the ratio of fixed investment to GDP in the province. CF/K is the ratio of cash flow to total assets, with cash flow calculated as the sum of the net profit and the accumulative depreciation of fixed assets. According to Firth et al. (2008), investment cash flow sensitivity is a reasonable indicator of financial constraints in the Chinese institutional context. The variable Q denotes investment opportunities, represented by various proxies including (1) sales growth, (2) excess sales growth, and (3) inventory growth.

Firstly, sales growth is widely used in corporate finance literature as a proxy for investment opportunities (Biddle et al. 2009, Cull et al. 2015, Ding et al. 2018, Firth et al. 2008, Guiso & Parigi 1999). Love & Zicchino (2006) argue that sales is a suitable exogenous measure of investment opportunities since they are driven by demand-side factors.

Secondly, sales growth is empirically nosier in measuring investment opportunities (Chen et al. 2011) because it reflects past sales growth, which includes some transitory components such as relative market share. To control for these effects, following Ding et al. (2018), a variable of excess sales growth is constructed, defined as sales growth minus the mean value of industry-level sales growth in each province. This measure aims to account for relative market share effects, allowing a better identity of the demand-side shocks that I want to capture.

Thirdly, for the same reason as that set out above, the growth rate of inventory is employed as an inverse proxy for the demand shock (Ding et al. 2018), defined as the first difference between inventory stock to fixed assets. When demand falls, finished goods inventories tend to rise temporarily. Firms often adjust their working capital, including inventories, to smooth fixed asset investment during negative demand shocks (Ding et al. 2013). Therefore, the relationship between inventory growth and investment is expected to be negative.

By using these three measures, I aim to better capture investment opportunities while addressing the potential limitations of using sales growth alone.

Ideally, investment efficiency exists when there is no deviation from the expected level of investment. The residuals from the regression Model 4.3 reflect the deviation from the expected investment level, and I use these residuals as an industry-specific proxy for investment inefficiency. Specifically, a positive residual/deviation means that the industry is investing at a higher rate than expected, resulting in overinvestment. Conversely, a negative residual/deviation suggests that real investment is lower than expected, representing underinvestment. The dependent variable - Investment Efficiency (*IE*) - is the absolute value of the residuals multiplied by -1, where a higher value denotes higher efficiency.

It is important to notice that the measure of investment efficiency is based on Hayashi's idea of using average Q to approximate marginal Q (Hayashi 1982). This approach suggests that a straightforward regression of investment on Tobin's Q should yield a robust relationship. When applying this to provinces with different economics structures, it arises two main challenges:

First, different provinces may have different economic conditions which can significantly impact the application of the Hayashi conditions. For example, regions with developed financial markets may have easier access to credit and investment opportunities than those with underdeveloped financial markets. This results in a stronger relationship between Tobin's Q and investment in developed regions.

Second, in the absence of direct measures of Tobin's Q, using sales as a proxy for average Q is a common practice (see Biddle et al. (2009), Cull et al. (2015), and Firth et al. (2006)). The idea is that sales reflect the demand for a firm's products and thus its investment opportunities. However, the limitation still exists since sales do not capture differences in cost structures and capital intensities across provinces.

To partially address this concern, I (1) calculated the investment efficiency of each industry within each province to eliminate province/industry-specific effects; (2) employed province- and industry-fixed effects in the baseline regression to capture unobserved heterogeneity in economic structures; and (3) conducted robustness checks using alternative proxies for investment opportunities, such as excess sales growth and inventory growth.

Measure of Allocative Efficiency Allocative Efficiency (*AE*) refers to the optimal distribution of resources across various sectors of the economy to maximize overall returns. It ensures that capital is directed towards industries or sectors with the highest potential for growth and profitability, while withdrawing from those with declining prospects (Wurgler 2000). Following this principle, the model used to measure allocative efficiency follows the specification employed by Wurgler (2000), which captures the responsiveness of investment to changes in output across industries. The model can be expressed as:

$$ln\frac{I_{ipt}}{I_{ipt-1}} = \alpha_0 + \alpha_1 ln\frac{Y_{ipt}}{Y_{ipt-1}} + \varepsilon_{ipt} \tag{4.4}$$

where I represents fixed investment, Y denotes output, and i, p, t indexes industry, province, and year, respectively. The slope estimate in Model 4.4 measures the elasticity of investment to output changes indicating the extent to which the economy increases investment in growing industries and decreases investment in its declining industries at time t.

The elasticity of investment with respect to output is a direct measure of AE, showing the degree to which investment is adjusted according to changes in industry performance.

A major concern with this specification is reverse causality, where investment may cause the contemporaneous change in output growth, rather than output growth causing investment. However, Wurgler (2000) argues, based on prior literature, that fixed capital takes some time to become productive. Due to this lag, a more plausible proposition is that contemporaneous output growth causes changes in investment.

I apply the industry-level data in each province to Model 4.4 and estimate Allocative Efficiency among industries supported (and non-supported) by policies before and after the credit expansion of each province. These regressions are run using ordinary least squares (OLS) due to the low number of observations.

China's Financial Development and Allocative Efficiency China has been characterised by a high investment-to-GDP ratio, often exceeding 40%, over the past few decades. This has been regarded as a key driver of the country's rapid growth (Ding & Knight 2011). However, there have been persistent concerns about the efficiency of these investments and the overall productivity of the economy, primarily due to resource misallocation (Hsieh & Klenow 2009). Much of the capital is directed towards less productive SOEs and sectors with overcapacity, driven by political and institutional biases rather than economic efficiency. Therefore, in addition to industry investment and investment efficiency, it is crucial to focus on aggregate allocative efficiency as well.

Table 4.1 presents the elasticity estimates for each province during the sample period. The average province elasticity is 1.048, with a cross-province standard deviation of 0.616. Notably, Shandong exhibits the highest elasticity estimate at 2.478, followed by Hunan, Sichuan, and Shanxi.

In general, and consistent with the findings of Wurgler (2000), provinces with higher elasticity estimates tend to demonstrate better fits. For instance, Neimenggu shows the best fit with an R-square of 0.141 and an elasticity of 1.504, surpassing the average value of 1.048. However, in some provinces, the elasticity estimate is not significantly positive, and the R-square is close to zero. In such cases, investment in growing industries is not accelerated, nor is it decelerated in declining industries, suggesting that factors unrelated to current growth prospects must be exerting a significant influence.

Table 4.1: Estimates of the Elasticity of Industry Investment to Output (Full Sample)

Province	Elasticity	Standard Error	R-square
Beijing	.675	.432	.017
Tianjin	1.117	.368	.027
Hebei	.714	.418	.008
Shanxi	1.890	.386	.120
Neimenggu	1.504	.268	.141
Liaoning	1.043	.476	.012
Jilin	1.273	.350	.058
Heilongjiang	.027	.565	.002
Shanghai	1.169	.661	.025
Jiangsu	1.444	.466	.033
Zhejiang	.942	.344	.030
Anhui	1.128	.360	.038
Fujian	.936	.469	.008
Jiangxi	.358	.340	.004
Shandong	2.478	.391	.137
Henan	.396	.290	.004
Hubei	.265	.573	.001
Hunan	2.220	.467	.095
Guangdong	1.513	.492	.052
Guangxi	.756	.326	.016
Hainan	1.664	.4	.078
Chongqing	.163	.282	.006
Sichuan	1.901	.441	.108
Guizhou	.812	.372	.011
Yunnan	.647	.326	.014
Tibet	1.21	1.078	.012
Shaanxi	.221	.46	.001
Gansu	.678	.282	.048
Qinghai	.428	.388	.003
Ningxia	1.519	.528	.049
Xinjiang	1.408	.318	.067
Mean	1.048		.039
Std. Dev	.616		.042

Figure 4.1, below, plots the relationship between the level of financial development and the elasticity in each province estimates obtained from Table 4.1. While some provinces deviate from the observed pattern, the figure generally reveals a positive association between province elasticity and the average level of financial development. Specifically, the correlation coefficient between province elasticity and the average level of financial development is 0.19. This correlation suggests that the financial market variable accounts for some of the cross-province variations in the elasticity of investment allocation.

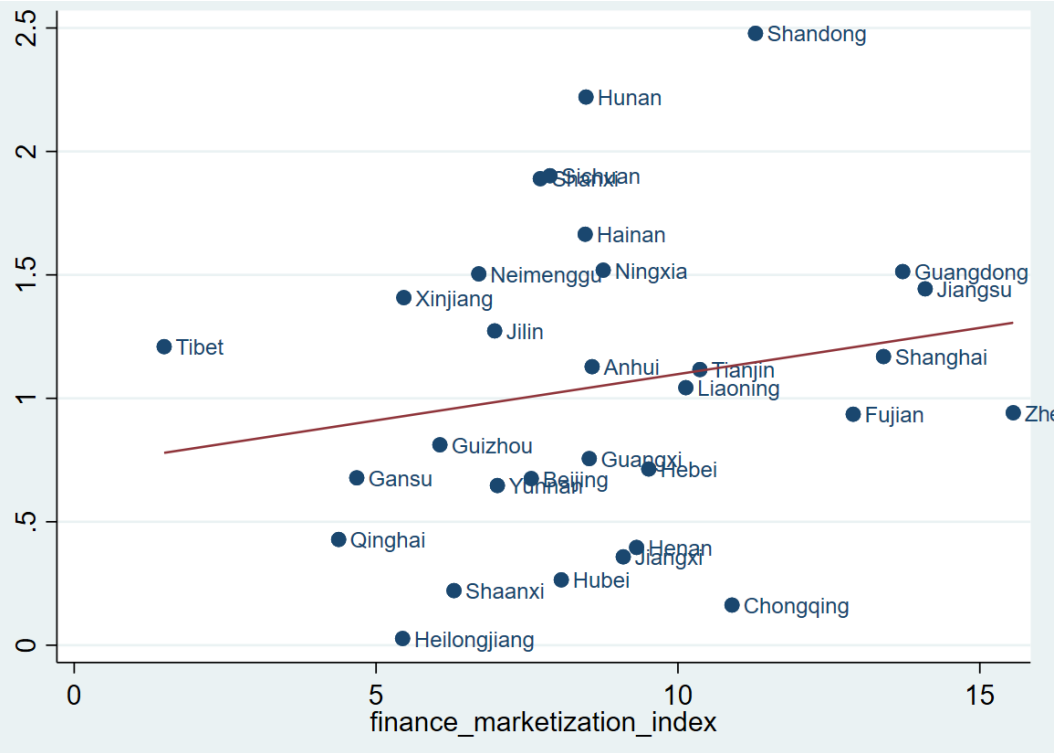

Figure 4.1: Allocative Efficiency of Industry Investment versus Financial Development (2000-16)

Subsequent figures provide a more detailed analysis by separating coastal and inland provinces. Figure 4.2 presents the coastal provinces, where a more noticeable positive correlation exists between the financial marketization index and investment elasticity. Provinces like Guangdong, Jiangsu, and Shanghai show higher levels of financial development corresponding to greater allocative efficiency. This suggests that financial development plays a significant role in improving investment allocation efficiency. Coastal provinces, benefiting from better financial infrastructure and greater access to financial services, demonstrate how enhanced financial marketization can lead to more efficient investment decisions.

In contrast, the relationship between financial development and investment allocation elasticity is less pronounced and more scattered (see Figure 4.3). Provinces such as Hunan, Sichuan, and Shaanxi show higher elasticity despite varying levels of financial marketization, indicating that other factors may be influencing investment allocation efficiency in these regions.

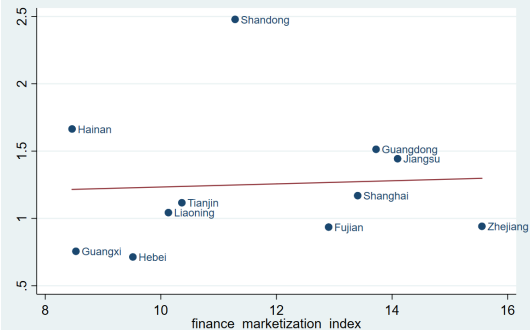

Figure 4.2: Allocative Efficiency of Industry Investment versus Financial Development (2000-16) (Coastal)

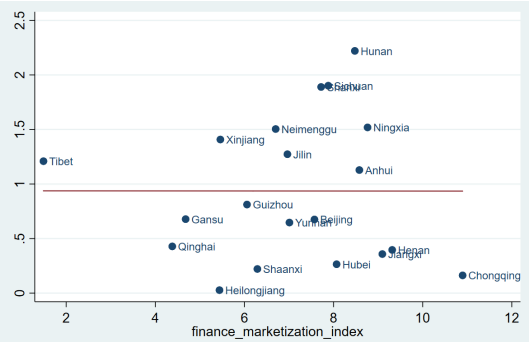

Figure 4.3: Allocative Efficiency of Industry Investment versus Financial Development (2000-16) (Inland)

The sample is further divided into two periods: before and after the 2009 credit expansion. According to Table 4.2, the average elasticity before 2009 is 1.264 with a standard deviation of 0.696. After 2009, the average value decreases to 0.640 with a standard deviation of 0.909. This indicates that post-stimulus, allocative efficiency worsened and exhibited greater variability. For instance, consider a 10% output growth shock. The average estimates suggest that investment would increase by over 12.6% before 2009, but by only 6.4% after 2009.

The decline in the average R-square value further supports this view: Before 2009, the average R-square is 0.073, while after 2009, it decreases to 0.025. This reduction suggests that growth prospects are less effective in explaining allocative efficiency post-stimulus, indicating a stronger influence of unobserved factors, likely to strongly feature government intervention, on the economy.

Moreover, all province elasticities except Heilongjiang (with an R-square of 0) were positive before the stimulus period. However, six province elasticities become negative (insignificant) after the stimulus program, with more elasticities becoming insignificant. This shift indicates that investment allocation was more influenced by unobserved factors rather than growth opportunities post-stimulus, reflecting a worsening investment environment after 2009.

Table 4.2: Estimates of the Elasticity of Industry Investment to Output (before and after Stimulus)

Province	Before Stimulus			After Stimulus		
	Elasticity	Std. Error	R-square	Elasticity	Std. Error	R-square
Beijing	1.418	.684	.033	-.017	.598	0
Tianjin	1.562	.433	.109	-.086	.688	.006
Hebei	1.022	.667	.007	.537	.57	.007
Shanxi	2.36	.571	.167	1.713	.558	.082
Neimenggu	2.189	.31	.325	.683	.478	.032
Liaoning	1.736	.539	.028	-.37	.956	.014
Jilin	1.565	.49	.112	.998	.533	.023
Heilongjiang	-.038	.815	0	-.012	.804	.004
Shanghai	.572	.891	.016	.774	1.204	.008
Jiangsu	.979	.637	.034	1.47	.787	.021
Zhejiang	1.555	.407	.093	.256	.62	.026
Anhui	2.398	.804	.091	.694	.368	.022
Fujian	1.888	.534	.107	-.371	.857	.004
Jiangxi	.017	.567	.003	.099	.411	.001
Shandong	1.705	.584	.01	3.342	.614	.184
Henan	1.245	.549	.024	.042	.385	0
Hubei	.352	.772	0	.205	.82	0
Hunan	1.741	.584	.088	2.426	.754	.043
Guangdong	1.518	.58	.08	.965	1.079	.028
Guangxi	1.144	.589	.033	.594	.405	.003
Hainan	2.193	.606	.059	.706	.495	.016
Chongqing	.29	.427	.013	-.154	.384	0
Sichuan	1.88	.535	.139	1.24	.866	.023
Guizhou	1.269	.473	.015	-.13	.62	.002
Yunnan	.998	.38	.042	.311	.577	.002
Tibet	.989	1.315	.019	-1.065	2.239	.071
Shaanxi	.407	.673	.034	.852	.882	.008
Gansu	.306	.318	.167	2.325	.642	.118
Qinghai	.467	.574	0	.754	.515	.002
Ningxia	1.732	.695	.097	.886	.767	.005
Xinjiang	1.737	.287	.242	.158	.817	.007
Mean	1.264		.073	.64		.025
Std. Dev	.696			.909		

To explore further, I then regress province elasticity on a time dummy (which equals 1 in and after 2009, and 0, otherwise) and the financial marketisation index. The result indicates a stronger negative association between province elasticity and the 2009 stimulus program (t-statistic = 2.99), with an R-square of 0.288. This finding confirms that at the aggregate level, China's allocation trend worsened after the stimulus package program.

4.3.2 Methodology

Identification Strategy

The main challenge faced in this paper is determining which industries received more support from the credit expansion in 2009, as this cannot be confirmed at the data level. This paper therefore uses keywords from a series of government documents issued by the State Council[3] and the National Development and Reform Commission (NDRC)[4] from the end of 2008 through 2009 to identify the industry preference for the credit stimulus program.

The classification approach is conceptually simple: If certain policy-relevant terms appear in the official document of the State Council, such as providing credit or financial support to an industry, then this industry is regarded as having been supported by the 2009 credit expansion and is defined as in the treatment group; otherwise, it is in the control group. The following policy-relevant terms are selected from the official document to identify the preference for government support:

Financial support: {Financial support, Expand corporate financing channels}

Credit support: {Credit support, Credit policy support}

The list of treatment groups and associated policy plans/rules are presented in Table 4.3.

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3. The State Council, China's primary policymaking body, oversees national policies including major construction projects, productivity distribution, and economic policies. It sets development and structural adjustment goals for industries. Under its guidance, local governments and functional departments promulgate various measures including direct intervention and indirect guidance.
4. The NDRC is a ministerial-level department of the State Council. The main functions undertaken by the NDRC include: formulating and implementing strategies on national economic and social development, medium and long-term development plans and annual plans; and coordinating state-level special plans, regional plans, geospatial development plans as well as national development plans.

Table 4.3: Industries Directly Benefiting from the 2009 Credit Expansion

Sector and 2-digit classification code	Policy Measures and Terms in Government Documents
Panel A: Treatment group 1 (Extensive)	
13 Agricultural and sideline food processing 14 Food Manufacturing 15 Beverage Manufacturing 16 Tobacco Products 22 Paper and Paper Products 27 Pharmaceutical Manufacturing	VI. Increase **financial support**. "**Expand corporate financing channels**" (Light Industry Revitalisation Plan, February 2009)
17 Textiles 18 Textile Clothing Shoes and Hats	VI. Increase **financial support** for textile enterprises (Textile Industry Revitalisation Plan, February 2009)
37 Transportation equipment	I. Increase **credit financing support** for production and operation. (Shipbuilding Manufacturing Industry Revitalisation Plan, February 2009)
Panel B: Treatment group 2 (Narrow)	
39 Communication equipment and computer	IV. Improve the investment and financing environment. Implement relevant policies and measures for promoting economic development through finance, and increase **credit support** for the electronic information industry. (Electronic Information Industry Revitalisation Plan, February 2009)
7 Oil and gas extraction 25 Petroleum and coking processing 26 Chemical Raw Materials and Products	III. Strengthening **credit support**. "Encourage financial institutions to provide **credit support** to petrochemical enterprises with good fundamentals, good credit records, law-abiding operations, competitiveness, and market, but temporarily experiencing operational or financial difficulties" (Petrochemical Industry Revitalisation Plan, February 2009)

Source: The official website of the Central People's Government of the People's Republic of China.

In the government official documents, financial support measures encompass both credit support and other forms of financial support, including (1) simplifying the procedures for tax authority audits of bad debt write-offs by financial institutions; (2) supporting eligible enterprises to expand corporate financing channels such as issuing corporate bonds; and (3) encouraging credit guarantee institutions to provide credit guarantees and financing services for small and medium-sized enterprises. Comparatively, credit support is to support financial institutions in providing more credit services to enterprises.

Therefore, the treatment group can be further divided into Treatment Group A (extensively supported by the government), and Treatment Group B (narrowly supported by the government). Specifically,

Treatment group (Extensively): {Financial support (include credit support)}

Treatment group (Narrowly): {Credit support only}

The list of treatment and control groups in this study is shown in Table 4.4.

Table 4.4: List of Treatment and Control Industry Groups

Treatment Group ($N = 13$)	**Control Group ($N = 14$)**
A. Treatment (Extensive) ($N = 9$)	
13 Agricultural and sideline food processing	6 Coal mining
14 Food Manufacturing	8 Ferrous metal mining
15 Beverage manufacturing	9 Non-ferrous metal mining
16 Tobacco products	10 Non-metallic mining
17 Textiles	28 Chemical fibers
18 Textile clothing shoes and hats	30 Non-metallic mineral products
22 Paper and paper products	31 Ferrous metal smelting
27 Pharmaceutical manufacturing	32 Non-ferrous metal smelting
37 Transportation equipment	33 Metal Products
B. Treatment (Narrow) ($N = 4$)	34 General equipment
7 Oil and gas extraction	35 Special equipment
25 Petroleum and coking processing	38 Electrical machineries
26 Chemical raw materials and chemical products	40 Instrumentation
39 Communication equipment and computer	44 Electricity and heat

Model Specification

To estimate the industry-level effect of the economic stimulus package on investment outcomes, a difference-in-differences model is employed as follows:

$$y_{i,p,t} = \alpha + \beta Treat_i \times After_t + \gamma X_{i,p,t} + \delta Z_{p,t} + Year_t + Industry_i + Province_p + \varepsilon_{i,p,t} \quad (4.5)$$

Here and throughout the chapter, y indicates a set of variables of the industry performance, including investment rate, investment efficiency, and allocative efficiency. i, p, and t index industry, province, and time, respectively. $Treat_i$ indicates whether industry i is supported by the credit expansion policy, i.e., $Treat_i = 1$ if the industry i belongs to the treatment group, and $Treat_i = 0$ otherwise. $After_t$ indicates the post-treatment period, taking the value of 0 before 2009, and 1 after. $X_{i,p,t}$ is a set of control variables at the industry level. $Z_{p,t}$ is a set of control variables at the province level. $Year_t$ represents year-specific fixed effects, accounting for possible business cycles and macroeconomic shocks, $Industry_i$ represents industry fixed effects, reflecting time-invariant industrial features affecting industrial performance, and $\varepsilon_{i,p,t}$ is the error term, controlling for other unobserved factors.

The coefficient of interest is β, which measures the average treatment effect of the economic stimulus package on industries. If β is significantly positive (negative), then this indicates that after the stimulus period, industries supported by credit expansion policies performed better (worse).

Following the literature (Deng et al. 2020, Ding et al. 2018, Lang et al. 1996), a vector of controls X is applied to control for some key characteristics of industries. These are: financial leverage (*leverage*), industry size (*size*), tangibility (*tangibility*), and investment opportunities (q^D).

Specifically, leverage (*leverage*) is calculated as the ratio of total liabilities to total assets (Chen et al. 2011, Firth et al. 2008, Liu et al. 2018). A positive coefficient implies that highly indebted firms are active in investment.

Industry size (*size*) is defined as the natural logarithm of the industry's real total assets. While larger industries are more likely to enjoy a larger market size, and have more resources available for investment, resulting in a positive coefficient for *size* (Myers 1977), a negative relationship is also possible if smaller industries tend to be in their expansion stage (Levchenko et al. 2009, Rajan & Zingales 1998).

Tangibility (*tangibility*) is defined as the ratio of fixed assets to total assets in the industry. A positive coefficient implies that there is a positive sensitivity of investment to asset tangibility, as has been extensively documented (Boasiako et al. 2022, Chaney et al. 2012, Liu et al. 2018). The negative coefficient also makes sense, as it explains that industries with higher asset tangibility are more likely to operate in less dynamic environments with lower growth potential (Ding et al. 2018, Hovakimian 2009)

To isolate changes in investment that are driven solely by credit supply forces instead of credit demand or investment opportunities (q^D), sales growth, inventory growth and excess sales growth are considered to measure investment opportunities from the demand side (Biddle et al. 2009, Cleary et al. 2007, Cull et al. 2015, Ding et al. 2018, Firth et al. 2008). As firms with better investment opportunities are likely to make more investments, a positive coefficient for q^D is expected.

At the province level, the level of financial development, represented by the Financial Marketisation Index (*FinDev*), is controlled as well. This index is developed by *China's National Economic Research Institute* (NERI).[5] This index has previously been used by Firth et al. (2009), Wang et al. (2008), and many others to measure regional institutional development. Higher scores on the index indicate higher degrees of financial market development.

Additionally, China-specific factors that may affect industry-level investment and performance are also considered in the model: the role of state-owned enterprises (*SOE*), which is defined as the share of state-owned assets in total assets in the province.[6]

Detailed definitions of the variables described above are presented in Table 4.5.

5. For detailed information, please see Fan et al. (2003).
6. This paper uses the share of state-owned assets in total assets in the province rather than in each industry due to data limitations.

Table 4.5: Definition of Variables

Variable	Definition
Dependent variable	
Investment rate (%)	Ratio of fixed investment to GDP
Investment efficiency	Absolute value of residuals of the investment model multiplied by -1
Allocative efficiency	Elasticity of the industry's investment to output
Control variable	
Leverage (%)	Ratio of total liabilities to total assets
Cash flow	The sum of the industry's net profit and the accumulative depreciation of fixed assets
Sales growth (%)	Log difference of sales from time $t-1$ to time t
Industry size	Natural logarithm of the real total assets
Tangibility (%)	Ratio of fixed assets to total assets
Inventory growth (%)	Ratio of the first difference of inventory stock to fixed assets
External finance (%)	Ratio of interest expense to sales
Labour productivity	Ratio of real output to the number of employees
SOE (%)	Share of state-owned assets in total assets in the province
Financial marketisation	Financial Marketisation Index calculated by Fan et al. (2003)

4.4 Empirical Results

4.4.1 Parallel Trend Test

The parallel trend, indicating the same tendency in investment activity in the absence of stimulus-driven credit expansion, is a crucial premise for assessing policy effects using the DID approach. This premise necessitates that, in the absence of the 2009 credit expansion, the development trend between the treatment and control groups should be a parallel one. Any systematic differences in the trend of investment activity would undermine the robustness of the results.

Figures 4.4 and 4.5 provide the results of the parallel trend tests between the full treatment and control groups, and between the extensive treatment and control groups. The impact of the revitalisation plan on the investment rate is illustrated by connected circles, while the dashed lines represent 95% confidence intervals. These figures demonstrate that changes in investment activity did not precede the credit expansion, and that the influence became apparent immediately afterwards. Thus, the key identifying assumption for the DID method holds.

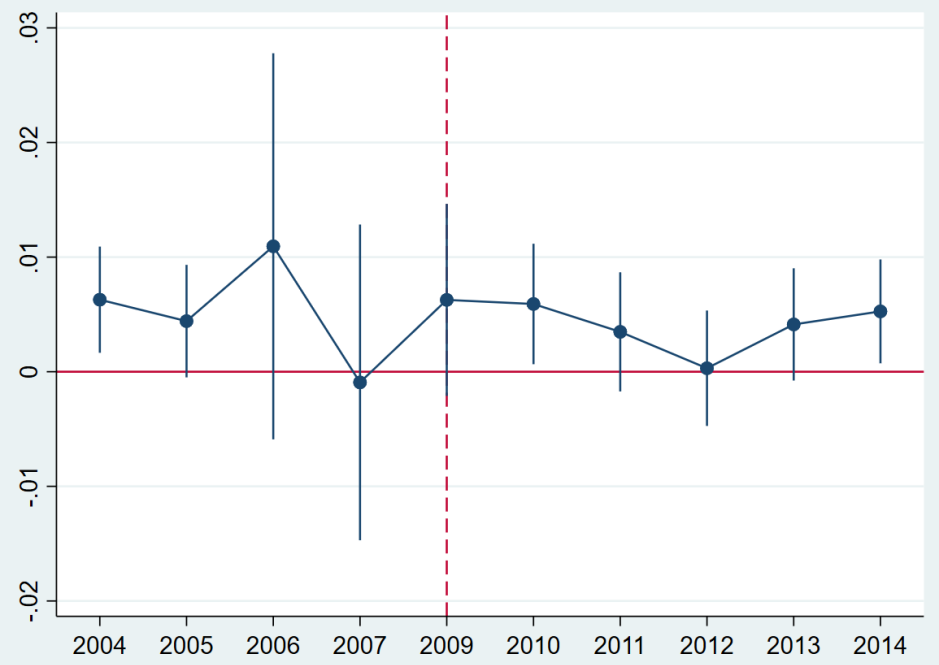

Figure 4.4: Parallel Trend Test of Investment Rate (Treatment v.s Control)

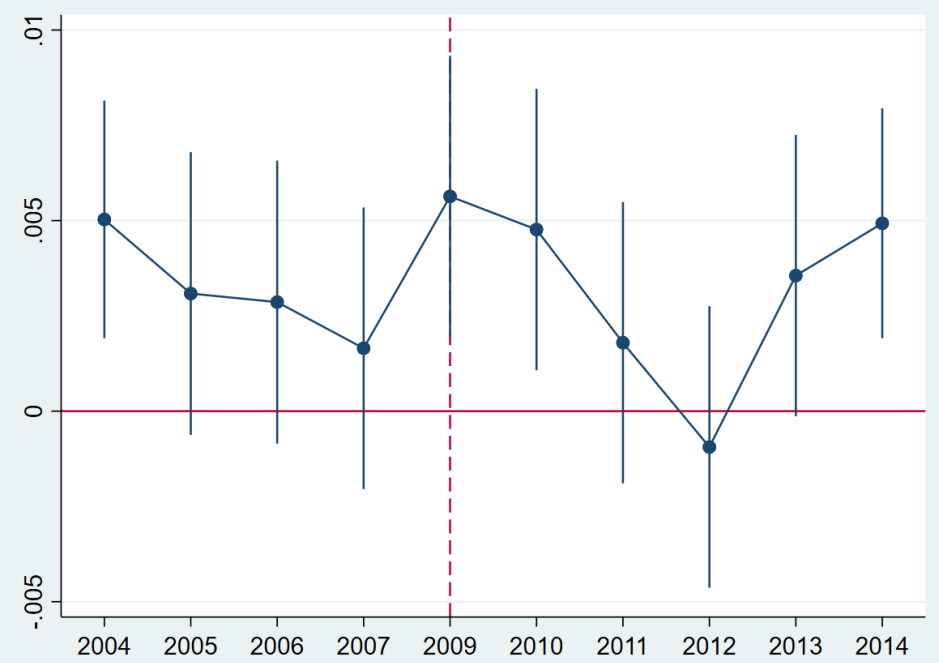

Figure 4.5: Parallel Trend Test of Investment Rate (Extensively-treatment v.s. Control)

4.4.2 Summary Statistics and Univariate Test

Table 4.6 presents the summary statistics and univariate tests of key variables.

Table 4.6: Summary Statistics and Univariate Test

VARIABLES	Full sample	$Treat = 0$	$Treat = 1$	Difference (t-value) $Treat = 0$ versus $Treat = 1$
I_GDP	0.006	0.007	0.004	0.002*** (2.950)
	(0.042)	(0.023)	(0.056)	
IE				
Sales Growth	-0.012	-0.013	-0.012	-0.001 (-1.600)
	(0.03)	(0.034)	(0.025)	
Inventory Growth	-0.012	-0.013	-0.013	-0.002*** (-2.711)
	(0.027)	(0.028)	(0.025)	
Excess Sales Growth	-0.012	-0.013	-0.012	-0.001 (-1.609)
	(0.029)	(0.034)	(0.024)	
Elasticity	0.923	0.984	0.861	0.123 (0.465)
	(1.467)	(1.394)	(1.545)	
Leverage	0.595	0.593	0.597	-.004 (-0.141)
	(1.518)	(0.185)	(2.185)	
Size	4.796	4.761	4.834	-0.073** (-2.135)
	(0.044)	(0.052)	(0.033)	
Sales_Growth	0.149	0.153	0.145	-0.009 (1.422)
	(0.325)	(0.335)	(0.314)	
Tangibility	0.423	0.387	0.461	0.074 (-1.608)
	(2.568)	(0.194)	(3.189)	

Notes: This table reports sample means and standard deviations (in brackets). The "Difference" column reports the difference in the means of corresponding variables between the treatment group and control group associated with the results of the t-test on the equality of means. *** indicates significance at the 1% level.

The average investment rate (*I_GDP*) is 0.006 for the full group, with a standard deviation of 0.042. For the treatment group, the average investment rate is 0.004 with a standard deviation of 0.056, while for the control group, it is 0.007 with a standard deviation of 0.023. The wide variation range of investment rates within each group suggests significant differences in investment decisions among industries within the same group.

Investment efficiency (*IE*) exhibits similar average values across different measures, with averages of -0.012 for the treatment group and -0.013 for the control group. The average allocative efficiency (*Elasticity*) is 0.861 for the treatment group and 0.984 for the control group, and there are no significant differences between the two groups.

Regarding controls, the mean leverage ranges from 0.593 for the control group to 0.597 for the treatment group, indicating that, on average, industry debt accounts for more than half of total assets. The treatment group also exhibits a larger average industry asset (*Size*) of 4.834 compared to 4.761 for the control group. The mean sales growth (*Sales_Growth*) ranges from 0.145 in the treatment group to 0.153 in the control group. Tangibility (*Tangibility*) represents, on average, 42.3% of total assets across all groups, with the treatment group having a larger share of fixed assets at 0.461.

When comparing the industry characteristics which are potentially related to investment performance. T-tests of means for corresponding variables indicate no statistical differences between the treatment and control groups along the dimensions of leverage, sales growth, and tangibility. The only dimension that significantly differs between supported and non-supported industries is industry size, with values of 4.834 and 4.761, respectively. These results can be interpreted as evidence that the 2009 credit expansion was randomly assigned across industry characteristics.

4.4.3 Baseline Results

The empirical analysis is structured in the following three ways. First, I estimate the impact of the 2009 credit expansion on the investment rate at the industry level. Second, I directly model the expected/optimal level of investment based on each industry's financial factor (cash flow) and the fundamental factor (investment opportunities) within provinces, and then test the association between the 2009 credit expansion and deviations from this expected/optimal level (the proxy for investment efficiency). Third, I calculate the elasticity of investment to output (the proxy for allocative efficiency) among supported and non-supported industry groups in each province and examine whether the 2009 credit expansion significantly influenced allocative efficiency among industries.

Investment Rate

The first research question of this paper asks how the 2009 credit expansion influenced industry investments during and after the stimulus period.

Table 4.7 presents the baseline fixed effect regression of Equation 4.5, with the investment rate as the dependent variable. Column (1) uses the full treatment and control groups, while column (2) only employs the extensive treatment and control groups, excluding the narrow treatment one. In addition to the industry- and province-level controls, year-, industry-, and province-fixed effects are included to account for the time-invariant and time-variant unobservable factors that may impact the results.

Table 4.7: The Impact of 2009 Credit Boom on Industry Investment

VARIABLES: *I_GDP*	Model 1	Model 2
$Treat \times After$	0.002**	0.002**
	(0.001)	(0.001)
Leverage	0.005***	0.018***
	(0.001)	(0.001)
Size	0.003***	0.003***
	(0.001)	(0.000)
SalesGrowth	0.006***	0.006***
	(0.001)	(0.001)
Tangibility	0.008***	0.010***
	(0.001)	(0.001)
SOE	-0.006	-0.008**
	0.006	0.003
FinDev	-0.0002*	-0.0002*
	(0.0001)	(0.0001)
Observations	11,577	9,919
Number of industries	818	703
R-squared	0.454	0.138
Treatment Group	Full	Extensive
Industry/Year/Province FE	YES	YES

Notes: The constant term, region dummies, industry dummies, and year dummies are included but not reported. *, **, *** indicate significance at 10%, 5%, and 1%, respectively. The values in parentheses are standard errors.

The coefficient of $Treat \times After$ in Column (1) is significantly positive, suggesting a robust impact of the credit expansion on industries supported by the policy compared to those excluded from the policy. It implies that the 2009 credit expansion is associated with a rise in the industrial investment rate of 0.2 percentage points. When excluding the narrow treatment group, column (2) also provides a positive result, with a magnitude of 0.2 percentage points as well. This confirms that industries with more government support invested more after the stimulus period.

Furthermore, industry characteristics also influence investment. Larger industries with better investment prospects, more tangible assets, and higher debt invested more during the sample period, as is well documented in the literature (Deng et al. 2020, Ding et al. 2018, Firth et al. 2008, Lang et al. 1996, Liu et al. 2018).

Regarding the provincial characteristics, a larger share of state-owned assets in the province inhibited investment. Additionally, the coefficients of proxies for financial development, the financial marketisation index (*FinDev*), are negatively associated with the investment rate at a 10% significance level. This suggests that industries invest more in regions characterised by underdeveloped financial systems. Highly developed financial systems often come with stricter regulations and oversight. This is because regions with underdeveloped financial systems may have less stringent regulations, making it easier and potentially more attractive for industries to invest. In contrast, highly developed financial systems often come with stricter regulations and oversight. This can sometimes discourage investment due to compliance costs or regulatory uncertainty.

Investment Efficiency

Table 4.8 presents the results of estimating Equation 4.5, with different proxies of investment efficiency as the dependent variable. Unless otherwise indicated, the same specifications, controls, and fixed effects are employed identically to the estimates of the investment rate effect in Table 4.7, in order to ensure maximum comparability.

Table 4.8: The Impact of 2009 Credit Boom on Investment Efficiency

VARIABLES	Sales Growth Estimation		Inventory Growth Estimation		Excess Sales Growth Estimation	
IE	(1)	(2)	(3)	(4)	(5)	(6)
$Treat \times After$	0.001	-0.002***	-0.000	-0.004***	0.001	-0.003***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Leverage	-0.013***	-0.016***	-0.012***	-0.016***	-0.013***	-0.016***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Size	-0.004***	-0.003***	-0.004***	-0.003***	-0.004***	-0.003***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Tangibility	0.006***	0.009***	0.006***	0.009***	0.006***	0.009***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
SOE	-0.009	-0.001	-0.006	-0.002	-0.010	-0.002
	(0.007)	(0.005)	(0.007)	(0.006)	(0.007)	(0.005)
FinDep	0.0002	.0002**	.0001	.0002**	.0002	.0002**
	(.0001)	(.0001)	(.0001)	(.0001)	(.0001)	(.0001)
Observations	8,277	7,124	7,599	6,556	8,277	7,124
No. of industries	799	686	796	685	799	686
R-squared	0.041	0.105	0.054	0.109	0.042	0.103
Treatment	Full	Extensive	Full	Extensive	Full	Extensive
Industry FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Province FE	YES	YES	YES	YES	YES	YES

Notes: The constant term, region dummies, industry dummies, and year dummies are included but not reported. *, **, *** indicate significance at 10%, 5%, and 1%, respectively. The values in parentheses are standard errors.

In columns (1), (3), and (5) of Table 4.8, the coefficients of $Treat \times After$ are negative but insignificant, suggesting that the 2009 credit boom did not influence the investment efficiency of supported industries. However, when the narrowly supported industries are excluded, in Columns (2), (4), and (6), a significant differential effect for extensively supported industries is observed compared to non-supported industries: the coefficients of $Treat \times After$ are negative and significant at the 1% level. Thus, the 2009 credit boom reduced the investment efficiency of extensively supported industries. Specifically, compared to non-supported industries, the investment efficiency of extensively supported industries declined by 0.002-0.004 in the post-stimulus period.

Most controls are significantly correlated with investment efficiency. At the industry level, tangibility (*Tangibility*) is positively and significantly associated with investment efficiency in all configurations. In contrast to the estimates in Table 4.7, the coefficients of industry size (*Size*) and leverage (*Leverage*) are negative, indicating that smaller industries with lower leverage made more efficient investments. This finding is consistent with the existing literature, which suggests that smaller industries may have better investment performance due to their ability to adapt more quickly to market changes and potential for more efficient resource allocation (Chen et al. 2011).

Allocative Efficiency

Table 4.9 provides the results regarding the impact of the 2009 credit boom on allocative efficiency (elasticity), accounting for province-fixed effects and time-fixed effects. The elasticity is computed based on Equation 4.4.

Table 4.9: The Impact of 2009 Credit Boom on Allocative Efficiency

VARIABLES: $Elasticity$	Model 1	Model 2
$Treat \times After$	-1.547***	-0.970*
	(0.516)	(0.565)
$FinDep$	-0.013	-0.099
	(0.081)	(0.088)
SOE	-1.116	-0.723
	(3.365)	(3.69)
Observations	124	124
Number of provinces	31	31
R-Squared	0.191	0.084
Treatment	Full	Extensive
Year/Province FE	YES	YES

Notes: The constant term, region dummies, industry dummies, and year dummies are included but not reported. *, **, *** indicate significance at 10%, 5%, and 1%, respectively. The values in parentheses are standard errors.

The findings indicate a strong negative association between the 2009 credit boom and province elasticity. This suggests that following the stimulus package, industries with government support either "underinvested" in growing sectors or "overinvested" in declining sectors, or both, compared to industries without government support.

Moreover, neither the measure of financial sector development (*FinDep*) nor the share of state-owned enterprises (*SOE*) exhibit a significant effect on elasticity in the sample.

Taken together, the main empirical findings confirm that during the implementation of the stimulus package, the credit boom significantly influenced capital allocation at the industry level through government support. Specifically, industries with government intervention invested more than control industries. However, these investments did not lead to higher investment efficiency and instead contributed to a worsening trend in resource allocation at the aggregate level.

4.4.4 Mechanism Analysis

Mechanism Analysis: Over- or Under-investment?

I conducted regressions using the residuals (in absolute value) in subsamples of overinvestment (residual > 0) and underinvestment (residual < 0) to further examine whether the inefficiency of investment was driven by over- or under-investment.

Specifically, a positive residual in Equation 4.3 is defined as a proxy for over-investment (*OverInvestment*), while a negative residual is considered as underinvestment ($UnderInvestment$). I then estimated the regressions for the over- and under-investment groups separately. The results are presented in Table 4.10.

The first two columns of Table 4.10 present the results of the regressions for the overinvestment group. The coefficient of $Treat \times After$ is positive and significant at the 1% level in Column (2), indicating that the credit expansion did indeed stimulate overinvestment. However, in the last two columns of Table 4.10 showing the results of the regressions for the underinvestment group, although the coefficients of $Treat \times After$ are negative, there is no significant correlation between the credit boom and underinvestment.

In summary, the analysis shows that the 2009 credit boom reduced industry investment efficiency by promoting overinvestment while having little influence on underinvestment.

Table 4.10: Mechanism Analysis: Over- and Under-investment Groups

VARIABLES	*OverInvestment*		*UnderInvestment*	
	(1)	(2)	(3)	(4)
$Treat \times After$	0.001	0.003***	0.003	-0.000
	(0.001)	(0.001)	(0.007)	(0.003)
Observations	7,237	6,216	1,040	908
Industries	792	680	402	342
R-squared	0.078	0.163	0.019	0.041
Treatment	Full	Extensive	Full	Extensive
Industry FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Province FE	YES	YES	YES	YES

Notes: This table reports the results of Equation 4.5 for over- and under-investment groups. Columns (1) and (2) present regressions for the over-investment group. Columns (3) and (4) present regressions for the under-investment group, defined by the residual of Equation 4.3 with sales growth as the measure of investment opportunities. The control variables are defined in the same way as in previous tables. *, **, *** indicate significant at 10%, 5%, and 1%, respectively. The values in parentheses are standard errors.

4.4.5 Heterogeneity Analysis

The analysis conducted thus far has demonstrated the impact of the stimulus package on the investment outcomes of industries with government support. In this section, I delve deeper into the examination of cross-sectional variations in the effects of the 2009 credit expansion.

Heterogeneity Analysis: Ownership

It has been well documented that the financial system in China is largely controlled by the government, and SOEs are typically more reliant on bank loans compared to non-SOEs (Allen et al. 2005, Firth et al. 2006). Consequently, changes in bank loan supply, such as those resulting from an expansion triggered by the stimulus package, have a more pronounced impact on SOEs, regardless of their profitability or creditworthiness (Bai et al. 2016, Cong et al. 2019, Liu et al. 2018). When SOEs receive increased bank loans tied to the stimulus package, they tend to invest more, driven by political objectives rather than purely profitable investment opportunities (Deng et al. 2015),[7] potentially harming investment efficiencies.

7. In China, the criteria for evaluating SOE executives often prioritise political loyalty. According to the 2009 Annual Report on State-owned Assets Supervision and Administration Commission (SASAC) of the State Council, the central government emphasises "contributions to the stimulus plan" as a corporate performance objective, highlighting the significance of serving political interests in evaluating SOE executives. Speeches by senior Chinese government officials also underscore the directive that SOEs should prioritise national interests.

Table 4.11: Heterogeneity Analysis: Ownership

VARIABLES	Investment Rate		Investment Efficiency		Allocative Efficiency	
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: State-Owned Dominated Industries						
Treat	0.005**	0.002	0.001	-0.003*	-2.064**	-1.541
	(0.002)	(0.002)	(0.002)	(0.002)	(0.836)	(1.682)
Observations.	5,731	4,643	3,943	3,198	124	121
Industries	409	332	392	317	62	62
R-Squared	0.488	0.082	0.032	0.08	0.215	0.151
Panel B:Private-Owned Dominated Industries						
Treat	-0.000	0.000	0.001	-0.001	-0.114	-0.456
	(0.001)	(0.002)	(0.001)	(0.002)	(0.643)	(0.690)
Observations	5,846	5,276	4,334	3,926	124	124
Industrires	409	371	407	369	62	62
R-Squared	0.169	0.373	0.15	0.343	0.052	0.062
Treatment	Full	Extensive	Full	Extensive	Full	Extensive
Industry FE	YES	YES	YES	YES	/	/
Year FE	YES	YES	YES	YES	/	/
Province FE	YES	YES	YES	YES	YES	YES

Notes: This table reports the results of Equation 4.5 for state-dominated and private-dominated industries. Columns (1) and (2) present the regressions for investment rate. Columns (3) and (4) present the regressions for investment efficiency, calculated by Equation 4.3 with sales growth as the measure of investment opportunities. Columns (5) and (6) present the regressions for allocative efficiency, calculated by Equation 4.4. The control variables are defined in the same way as in previous tables. *, **, *** indicate significance at 10%, 5%, and 1% levels, respectively. The values in parentheses are standard errors.

By investigating the variations in industry ownership, this analysis aims to explore whether and to what extent different ownership types affected investment activity and associated efficiencies with the implementation of the 4-trillion stimulus package.

To conduct the regressions, I categorise industries into two groups based on their state-owned capital share in the economy: more state-dominated industries and less state-dominated (private-dominated) industries, and then re-estimate the main regressions for both industry groups. The results are presented in Table 4.11.

Panels A and B in Table 4.11 display the outcomes of the regressions for the more and less state-dominated industry groups, respectively. Overall, the previous findings hold primarily for more state-dominated industries, while they do not significantly differ for less state-dominated industry groups. This suggests that the impact of the stimulus-driven credit expansion in 2009 was more pronounced in state-dominated industries, which is in line with the expectation.

Heterogeneity Analysis: Corruption Level

In regions characterised by high levels of corruption, local government officials are more likely to extend guarantees to specific sectors and firms (Firth et al. 2008). Consequently, industries located in regions with higher corruption may have experienced a more pronounced influence of the stimulus package on their investment activity and outcomes. By exploiting variations in the level of regional corruption across China, this analysis seeks to understand whether and to what extent regional corruption levels affected the effectiveness of the stimulus package in driving industry investment outcomes.

To conduct the regression analysis, I first define the corruption index as the average ratio of the number of duty crime cases to the total number of government officials for each province during the sample years. All data comes from the *China Procuratorial Yearbook*. Then, I assign provinces in the sample to the high-corruption group if their corruption index is above the average level of the corruption index in all provinces, and otherwise to the low-corruption group.

Table 4.12 reports the results of the regressions for industries located in regions with high and low corruption levels. Consistent with predictions, the coefficients of these interaction terms, $Treat \times After$, are more significant and have a greater magnitude for regressions located in regions of high corruption. This finding is consistent with the argument of Chen et al. (2016). However, at the province level, the credit boom only had a significant effect on allocative efficiency in regions with a low corruption level.

Table 4.12: Heterogeneity Analysis: Provinces with Different Corruption Levels

VARIABLES	Investment Rate		Investment Efficiency		Allocative Efficiency	
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Provinces with Higher Corruption Level						
$Treat * After$	0.004*	0.003***	0.000	-0.004***	0.78	-0.608
	(0.002)	(0.001)	(0.002)	(0.001)	(0.563)	(0.571)
Observations	5,718	4,918	4,133	3,571	60	60
Industries	400	344	395	341	30	30
R-squared	0.513	0.16	0.018	0.192	0.312	0.291
Panel B: Provinces with Reduced Corruption Level						
$Treat * After$	0.000	0.001	0.001	-0.002	-2.247**	-1.308
	(0.001)	(0.001)	(0.001)	(0.001)	(0.851)	(0.934)
Observations	5,859	5,001	4,144	3,553	64	64
Industries	418	359	404	345	32	32
R-squared	0.135	0.245	0.104	0.196	0.212	0.127
Treatment	Full	Extensive	Full	Extensive	Full	Extensive
Industry FE	YES	YES	YES	YES	/	/
Year FE	YES	YES	YES	YES	/	/
Province FE	YES	YES	YES	YES	YES	YES

Notes: This table reports the results of Equation 4.5 for industries located in provinces with high and low corruption levels. Columns (1) and (2) present the regressions for investment rate. Columns (3) and (4) present the regressions for investment efficiency, calculated by Equation 4.3 with sales growth as the measure of investment opportunities. Columns (5) and (6) present the regressions for allocative efficiency, calculated by Equation 4.4. The control variables are defined the same as in previous tables. *, **, *** indicate significance at 10%, 5%, and 1% levels, respectively. The values in parentheses are standard errors.

Heterogeneity Analysis: Marketisation Level

One well-understood characteristic of reform in China is the very uneven economic and legal development across the country. These differences in regional development could have profound effects on the effectiveness of the stimulus package.

To explicitly account for market development, this paper uses the Marketisation Index, drawn from the NERI, to capture differences in institutional factors with respect to different regions within China. Higher scores on the index indicate greater institutional development.

I divide the sample into two groups by the Marketisation Index. Specifically, provinces with an index above the median value are classified as “high level” and others as “low level”. The estimation results for both groups are shown in Table 4.13.

Table 4.13: Heterogeneity Analysis: Provinces with Different Marketisation Levels

VARIABLES	Investment Rate		Investment Efficiency		Allocative Efficiency	
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Provinces with Developed Markets						
$Treat * After$	0.003	0.001	-0.001	-0.002*	-0.817	-0.547
	(0.002)	(0.001)	(0.001)	(0.001)	(0.660)	(0.694)
Observations	6,058	5,204	4,388	3,785	64	64
Industries	424	365	419	361	32	32
R-Squared	0.573	0.114	0.022	0.103	0.111	0.073
Panel B: Provinces with Underdeveloped Markets						
$Treat * After$	0.002	0.003**	0.002	-0.004***	-2.326***	-1.42
	(0.002)	(0.001)	(0.002)	(0.001)	(0.808)	(0.896)
Observations	5,519	4,715	3,889	3,339	60	60
Industries	394	338	380	325	30	30
R-Squared	.081	.191	.059	.15	.316	.208
Treatment	Full	Extensive	Full	Extensive	Full	Extensive
Industry FE	YES	YES	YES	YES	/	/
Year FE	YES	YES	YES	YES	/	/
Province FE	YES	YES	YES	YES	YES	YES

Notes: This table reports the results of Equation 4.5 for provinces with developed and less developed marketisation levels. Columns (1) and (2) present the regressions for investment rate. Columns (3) and (4) present the regressions for investment efficiency, calculated by Equation 4.3 with sales growth as the measure of investment opportunities. Columns (5) and (6) present the regressions for allocative efficiency, calculated by Equation 4.4. The control variables are defined the same as in previous tables. *, **, *** indicate significance at 10%, 5%, and 1% levels, respectively. The values in parentheses are standard errors.

The results suggest that industries located in regions with less developed markets have a higher tendency to invest more and deviate from their optimal investment, thereby reducing overall allocative efficiency.

4.4.6 Robustness Check

Following the extant literature, I also apply the PSM-DID test and alternative measurements of some key variables to check the robustness of the findings.

Alternative PSM-DID Test

I conduct a PSM-DID test to ensure the robustness of the results. First, I employ the Propensity Score Matching (PSM) method to match industries in the two groups and subsequently drop observations that are not successfully matched, and then conduct the Difference-in-Differences (DID) regression using the remaining matched samples. The variables used for matching include all the control variables from the basic regression.

The results, as shown in Table 4.14, confirm that the findings from the PSM-DID analysis align with the main results, thus providing additional robustness to the findings.

Table 4.14: Robustness Check: PSM-DID Test

VARIABLES	Investment Rate		Investment Efficiency		Allocative Efficiency	
	(1)	(2)	(3)	(4)	(5)	(6)
$Treat * After$	0.002**	0.001*	-0.000	-0.002***	-1.547***	-0.970*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.516)	(0.566)
Observations	11,558	9,910	8,262	7,117	124	124
Industries	818	703	799	686	62	62
R-Squared	0.023	0.082	0.030	0.122	0.191	0.082
Treatment	Full	Extensive	Full	Extensive	Full	Extensive
Industry FE	YES	YES	YES	YES	/	/
Year FE	YES	YES	YES	YES	/	/
Province FE	YES	YES	YES	YES	YES	YES

Notes: This table reports the results of Equation 4.5 based on the PSM-DID strategy. Columns (1) and (2) present the regressions for investment rate. Columns (3) and (4) present the regressions for investment efficiency, calculated by Equation 4.3 with sales growth as the measure of investment opportunities. Columns (5) and (6) present the regressions for allocative efficiency, calculated by Equation 4.4. The control variables are defined the same as in previous tables. *, **, *** indicate significance at 10%, 5%, and 1% levels, respectively. The values in parentheses are standard errors.

Alternative Measure of Financial Development

In the baseline regressions, I use the Financial Marketisation Index as a proxy for the development of the financial system. To further assess the robustness of the results, I explore another dimension of financial development at the province level: the size of a province's RMB loan balance relative to its GDP (*CM*). It should be noted that while the ideal measure of the credit market would be the value of private domestic credit as highlighted by Rajan & Zingales (1998) and Wurgler (2000), I use the RMB loan balance due to data limitations at the province level in China,

Table 4.15: Robustness Check: Alternative Measure of Financial Development

VARIABLES	Investment Rate		Investment Efficiency		Allocative Efficiency	
	(1)	(2)	(3)	(4)	(5)	(6)
$Treat * After$	0.003**	0.002**	0.001	-0.002***	-1.560***	-0.970
	(0.001)	(0.001)	(0.001)	(0.001)	(0.51)	(0.569)
Observations	10,870	9,320	8,277	7,124	124	124
No. of Industries	816	701	799	686	62	62
R-Squared	0.456	0.14	0.041	0.104	0.197	0.071
Treatment	Full	Extensive	Full	Extensive	Full	Extensive
Industry FE	YES	YES	YES	YES	/	/
Year FE	YES	YES	YES	YES	/	/
Province FE	YES	YES	YES	YES	YES	YES

Notes: Columns (1) and (2) present the regressions for investment rate. Columns (3) and (4) present the regressions for investment efficiency, calculated by Equation 4.3 with sales growth as the measure of investment opportunities. Columns (5) and (6) present the regressions for allocative efficiency, calculated by Equation 4.4. The control variables are defined the same as in previous tables. *, **, *** indicate significance at 10%, 5%, and 1% levels, respectively. The values in parentheses are standard errors.

Table 4.15 presents results that are consistent with the main findings reported in previous tables, indicating robustness when alternative measurements of financial development are used. This supports the reliability of the conclusions of this study.

Alternative Measure of Investment Opportunities

In the baseline results, I employ a set of proxies of investment opportunities from the demand side: sales growth, excess sales growth, and inventory growth. However, as suggested by Ding et al. (2018) and Foster et al. (2008), the fundamental factor can be decomposed into supply- and demand-side components. Therefore, I re-estimate the investment efficiency equation (Equation 4.3) using an alternative measure of investment opportunity from the supply side: labour productivity growth, defined as the logarithmic difference of labour productivity.

Table 4.16 presents results that remain quantitatively similar to findings reported in previous tables, thereby confirming that the main findings are robust when alternative measurements of investment efficiency are used.

Table 4.16: Robustness Check: Alternative Measure of Investment Opportunities

VARIABLES: *IE*	Model 1	Model 2
$Treat * After$	0.001	-0.003***
	(0.001)	(0.001)
Observations	6,731	5,806
R-squared	0.056	0.11
No. of Industries	798	686
Treatment	Full	Extensive
Industry/Year/Province FE	YES	YES

Notes: Investment efficiency is calculated by Equation 4.3 with labour productivity growth as the measure of investment opportunities. The control variables are defined the same as in previous tables. *, **, *** indicate significance at 10%, 5%, and 1% levels, respectively. The values in parentheses are standard errors. *, **, *** indicate significance at 10%, 5%, and 1% levels, respectively. The values in parentheses are standard errors.

4.5 Conclusion

The objective of this study was to examine whether and how government intervention played a role in determining industry investment behaviour and province allocative efficiency during the economic stimulus package led by the Chinese government.

Using data from 27 2-digit industries across 31 provinces in mainland China for the period 2000-2016 and employing a DID approach, the empirical results indicate that the stimulus-driven credit expansion encouraged industries with government backup to make more investments. However, this led to less efficient investment by industries with strong government intervention, resulting in a poor post-stimulus allocation trend within provinces. This finding is robust to alternative measures of key variables and PSM-DID tests.

Mechanism analysis confirms that the decline in investment efficiency was driven more by over-investment than under-investment, primarily due to easier access to external financing. Furthermore, these effects were more pronounced in state-dominated industries located in regions with high corruption levels and less developed markets.

Overall, this analysis reveals the economic consequence of stimulus packages in emerging markets by highlighting the negative role that government support can play in resource allocation.

Chapter 5

Biased Bank Loans and Firm Political Connections: Evidence from China's 2009 Stimulus Program

5.1 Introduction

To counter the shock of the 2008 global financial crisis, the Chinese authorities announced a two-year 4-trillion Yuan stimulus package, aiming to stimulate economic growth by encouraging lending and investment. China's banking sector enthusiastically responded to the government's call for economic stimulus with prompt and substantial hikes in bank lending: in the first quarter of 2009, the real growth rate of total loan balance in all commercial banks reached a historic high of 32.7%.[1] In 2009, an "extra" 4.7 trillion Yuan was estimated to have been injected into the real economy (**?**). As a result, China became the first major economy to recover from the recession.

How were Chinese banks able to quickly find borrowers to lend a massive amount of credit to? Why were Chinese firms so willing to borrow when the future appeared so gloomy and uncertain? Closer inspections conducted by several studies have revealed that the transmission mechanism behind the stimulus package is based on the government's effective control of the economy (Deng et al. 2015, Wen & Wu 2019).

1. Source: People's Bank of China.

China's economy is characterised by relatively weak investor protection and strong government intervention in business activities (Allen et al. 2005), often described as a situation where "politics trumps economics" (Wei et al. 2005). Unlike Western countries where banks independently make lending decisions, in China, the banks are controlled by the government (or it has some involvement) and make loans as a substitute for fiscal actions that would otherwise need to be taken (Deng et al. 2015, Elliott & Yan 2013), as was clearly shown in the use of the banking system to provide the bulk of the 4-trillion Yuan economic stimulus after the 2008 financial crisis.

Moreover, the Chinese government also actively intervenes in the decision-making of credit lending, and often pushes loans to particular firms, sectors, and regions for political purposes (Elliott & Yan 2013). This has raised a major concern regarding the banks' lending bias (Allen et al. 2005, Cull et al. 2015, Firth et al. 2009). Historically, a large share of bank funding has gone to state-controlled firms, leaving firms in the private sector more heavily reliant on alternative financing channels. The banks would prefer to lend to State-Owned Enterprises (SOEs) either out of government policy priority or due to implicit government guarantees.

This encourages non-government participants to seek ways to establish government relationships in order to access preferential resources and potential assistance. A common method of doing so is through executives' networks or backgrounds (Fan et al. 2007, Li et al. 2019, Pan & Tian 2020).

Notably, although the existing laws and regulations in China state that current government officials are prohibited from serving as managers, directors, or supervisors in an enterprise, the employment of retired government officials as directors is popular among China's listed firms. According to statistics, in 2013, 31.84% of listed firms were visited by government officials (firms have vigorously publicised this), and 12.08% of CEOs used to work in the government. The proportion of chairpersons with political ties is even higher. Additionally, some firms will appoint more than one executive with political connections.[2]

2. Source: Reform of China's State-owned Monopoly Enterprises and Executive Compensation. C.Du, 2015.

In the context of China's economic stimulus measures, it has been observed that capital was inappropriately allocated towards state-owned firms and government-favoured privately-owned firms to support the national economy (Bai et al. 2016, Cong et al. 2019, Deng et al. 2020, Liu et al. 2018). However, there is scarce evidence to identify the mechanisms through which these advantages were granted by governmental entities besides firm ownership. This study aims to fill the research gap by providing fresh evidence on how informal government involvement, in the form of executives' political background, influences firm bank loan financing when interacting with a stimulus-driven credit boom. Political connection is defined here as having the CEO/chairperson holding a political or regulatory position in a government department, with the information collected from their curricula vitae.

Matching this political connection data with Chinese-listed firm observations spanning from 2003 to 2018, this study finds that following the economic stimulus package, firms with political connections obtained larger bank loans, demonstrating an inappropriate allocation trend toward government-favoured firms. This result is robust after employing several instrumental variables (IVs) to address endogeneity issues and alternative definitions of key variables. Mechanism analysis reveals that the influence of political connections is more pronounced for firms characterised by lower transparency, poorer audit quality, and which are located in regions with higher corruption levels.

A natural question occurred is whether the increased granted loans are driven by supply- or demand-side. This study therefore considers two possible channels (with very different implications) to explain why politically connected firms benefit more from bank lending. The *Self Selection Process* suggests that political connections boost firms' confidence in applying for bank loans, while the *Bank Selection Process* highlights how these connections serve as an implicit guarantee, enabling politically connected firms to obtain and maintain favourable treatment from banks. This process is primarily driven by the supply-side dynamics, where banks perceive politically connected firms as less risky due to their connections.

Based on the individual bank loan contract announcements, [3] I use the number of loan applications to proxy demand-side dynamics (*Self Selection Process*), and the number of successful loan applications and approval rates to proxy supply-side dynamics (*Bank Selection Process*). The empirical finding enriches the framework of credit allocation by supporting the *Bank Selection Process*. During the 2009 stimulus-driven credit boom, both politically connected and non-connected firms increased their loan applications. However, politically connected firms were significantly more successful in securing loans. This suggests that banks were more willing to grant loans to firms with political connections, indicating a clear supply-side preference. Additionally, even when non-connected firms managed to secure loans, they faced higher borrowing costs, further emphasizing the supply-side dynamics.

Overall, this chapter offers a comprehensive discussion of the credit allocation trend after the stimulus package. Inappropriate allocation existed more in the process of bank selection than in firms' self-selection, as regardless of whether they had implicit government protection, firms made more borrowing applications with the encouragement of the stimulus package. However, banks preferred to provide financial support to those with political connections, in the form of larger bank loan sizes, and preferential contract terms.

This analysis is related to several strands of the literature on macroeconomics and finance. Foremost among them is the literature on the role of executive networks in corporate financial decisions. Most prior studies have examined the effects of executives' political connections on firms' access to preferential treatment such as bank lending (Chaney et al. 2011, Faccio et al. 2006, Houston et al. 2014), especially in many developing countries in which bank lending is subject to direct government intervention (Beck & Demirguc-Kunt 2006, Dinç 2005, Khwaja & Mian 2005). This study looks more specifically at the effects related to business and credit cycles, and confirms the existing findings that the role of executive networks in leading to more bank loans remains prominent in the wave of the stimulus-driven credit boom.

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3. Compared to Jiménez et al. (2012, 2014) using detailed credit registry data to separate the changes in the composition of the supply of credit from the concurrent changes in the volume of supply and quality, and the volume of demand, this study relies on individual bank loan contract announcements that may not capture the full complexity of loan dynamics.

This study is also related to the macro literature on resource misallocation over the business cycle. The *Bank Selection Process* that causes misallocation has been well documented: banks are more inclined to grant favourable terms to firms with implicit government assistance but low productivity due to political pressure to do so (Bai et al. 2016, Cong et al. 2019, Liu et al. 2018). This paper highlights another potential mechanism through which political connections influence access to bank lending, namely, the *Self Selection Process* of firms: whether firms with political connections are more confident in applying for bank loans. The results confirm that firms lacking political connections also made more bank loan applications after the credit boom; however, their applications were less likely to be approved compared to their politically connected peers. This finding indicates that the inappropriate credit allocation caused by political connections was primarily driven by banking decisions.

Moreover, by demonstrating that political connections influence the costs and prices of obtaining bank financing, this paper further enriches the mechanism of the *Bank Selection Process*, and the broader literature on relationship lending (Sapienza 2004, Yeh et al. 2013) and financial contracting (Graham et al. 2008, Houston et al. 2014). Several studies show that banks often charge higher interest rates or require greater collateral requirements to hold during distress. Others, however, suggest that banks provide financial support to their clients to overcome distress (Berger & Udell 2002). This paper fills the gap by providing evidence on the selective aid of banks to explain the conflicting findings in the literature. When facing a recession, banks provide loans with preferential terms to politically connected firms at the expense of charging higher prices to the remaining clients.

The remainder of this chapter is organised as follows. Section 5.2 reviews the related literature. Section 5.3 describes the sample, variables, and model specification. Section 5.4 provides empirical results including baseline regressions, strategies to address the endogeneity issues, mechanism analysis, and robustness checks. Section 5.5 applies individual contract data and presents some further analysis. Section 5.6 concludes the chapter.

5.2 Literature Review

5.2.1 Determinants of Firm Loan Access

Definition of Capital Structure

Based on the definitions given by many economists, a firm's capital structure refers to the way in which it raises the capital required to initiate and expand its business activities. This involves a combination of various types of equity and debt capital shaped by the firm's financing decisions. The amount of debt that a firm utilises to finance its assets is known as leverage, with highly leveraged firms having a substantial amount of debt in their capital structure.

Various leverage measures are used in capital structure studies, as discussed in Rajan & Zingales (1995). Broad leverage refers to the ratio of total liabilities to total book assets, whereas narrow leverage is defined as the amount of debt (both long-term and short-term debt).

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Theoretical Background: Capital Structure Theory

The capital structure of a firm has significant implications for its value and cost of capital, making the determination of the optimal capital structure a crucial issue in academic research. Firms typically use more debt capital in their capital structure as the interest paid on debt is tax-deductible, reducing its effective cost, and equity holders do not have to share their profits with debt holders, who receive a fixed return.

However, the higher the debt capital, the riskier the firm, hence the higher its cost of capital. Therefore, it is important to identify the key elements of capital structure and to determine the best capital structure for a particular firm at a particular time.

To this end, various capital structure theories have been developed, which seek to explain the factors that influence a firm's capital structure decisions. These are now discussed in turn.

Capital Structure Irrelevance Theory The starting point of the modern theory of capital structure begins with the premise that financing decisions do not have any impact on the cash flow stream.

Specifically, Modigliani & Miller (1958) demonstrate that the firm value remains constant to the changes in capital structure when certain idealised conditions are met. These conditions include perfect capital markets with no transaction costs, bankruptcy costs, or corporate or personal taxes; all relevant information is available for insiders and outsiders to make decisions (with no information asymmetry); and the firm's financing and investment decisions are independent. In this case, managers should not be concerned about the capital structure, and they can freely select the composition of debt to equity.

However, when one or more of these unrealistic assumptions are relaxed, three major theories emerge showing how firm value may vary with changes in the debt-equity mix.

Static Trade-off Theory The static trade-off theory proposes that a firm is able to trade off the benefits and costs of debt and equity financing, set a target debt-to-equity ratio, and gradually move towards it. This implies that some form of optimal capital structure exists that can maximise the firm value while simultaneously minimising the cost of prevailing market imperfections, such as taxes, bankruptcy costs, and agency costs.

The extension of the static trade-off theory is contingent upon the definition of costs and benefits. For instance, Myers (1977) argues that the application of debt up to a certain level offsets the cost of financial distress and interest tax shields. The agency cost approach proposed by Jensen & Meckling (1976) predicts that the value of the firm is maximised when the total agency costs of debt and external equity are minimised, by issuing both debt and equity. In a similar vein, Fama & French (2002) propose that the optimal capital structure can be identified through a consideration of the benefits of debt, such as the tax deductibility of interest, and the costs of bankruptcy and agency costs.

Pecking Order Theory Assuming the perfect capital market theorised by Modigliani & Miller (1958), Myers & Majluf (1984) suggest that firms do not have a well-defined target capital structure. Instead, they prefer internal financing, such as retained earnings or excess liquid assets, to external financing; and debt to equity if they issue securities.

There are two explanations for this preference for debt over equity. The traditional view argues that the pecking order applies in situations with high transaction costs, taxes, and agency costs. Internal funds are regarded as "cheap" and are not subject to any outside interference, followed by external debt that is perceived as cheaper and less restrictive than issuing new equity. Issuing external equity is deemed the most expensive way of financing a firm (Myers & Majluf 1984).

The other explanation proposed by Myers (1984) assumes the problem of information asymmetry between managers/insiders and shareholders/outsiders and the separation of ownership, which explains why firms may avoid the capital market. To avoid paying too much for new financing (or underpricing new issues), managers choose to rely on the pecking order and prioritise internal financing over external financing.

When considering more complex securities, firms may still prefer internal funds over external financing, and within external financing, they may prioritise simpler and more traditional securities before turning to more complex ones (Caselli & Negri 2021). For instance, if internal funds are insufficient, they may issue straightforward debt instruments, such as bonds or bank loans, which have well-defined terms and conditions and are familiar to investors. Only when traditional debt financing is not available or cost-effective may firms consider more complex securities, such as asset-backed securities.

The extension of pecking order principles to more complex securities underscores the idea that firms prefer financing options that are simple and transparent. Complex securities often involve higher transaction costs, greater information asymmetry, and more uncertainty, making them less attractive financing options unless necessary.

Market Timing Theory The market timing theory states that a firm's current capital structure is the cumulative outcome of past attempts to time the equity market. Specifically, firms tend to issue new shares when they perceive they are overvalued, and to repurchase their own shares when they consider them to be undervalued. This share price fluctuation affects corporate financing decisions, and, ultimately, the capital structure of the firm (Baker & Wurgler 2002).

Moreover, consistent with the pecking order theory, market timing theory suggests that firms do not necessarily aim to achieve a target leverage ratio as equity transactions are completely timed to stock market conditions. As a result, changes in capital structure prompted by market timing are likely to have long-lasting effects.

Summary: Capital Structure Puzzle The capital structure puzzle refers to the question within corporate finance research about the optimal mix of debt and equity that firms should use to finance their operations and growth. Despite extensive theoretical and empirical investigation, there is no definitive answer or model that fully explains the capital structure choices of firms across different industries and contexts.

Specifically, based on Modigliani & Miller (1958)'s theorem of capital structure irrelevance, the trade-off theory suggests that a firm should strive for an optimal debt-to-equity mix that maximises value and minimises costs, while the pecking order theory explains how a firm raises funds following a hierarchy.

The differences in capital structure theories stem from the explanations of the significance of taxes and changes in information and agency costs. For instance, the trade-off theory assumes perfect information and eliminates the impact of information asymmetry. The pecking order theory assumes that all financing is either internal or external, but in practice, firms may use hybrid securities or other complex instruments that do not fit neatly into the pecking order framework. The market timing theory does not offer a single theory of capital structure, instead suggesting that capital structure is the outcome of various decisions taken by the firm over time.

Consequently, no single theory of capital structure incorporates all the important factors. Despite significant research, the capital structure puzzle still remains due to differences and limitations of these theories in fully explaining real-world corporate behaviour.

Proxies for The Determinants of Capital Structure

In empirical studies, there has been significant exploration of the explanatory power of capital structure models on corporate behaviour, particularly within the context of developed countries and predominantly in the United States. Much of this work aims to discern the determinants of capital structure based on a theoretical framework. The primary determinants tested encompass risks, age, the collateral value of assets (tangibility), growth opportunities, profitability, and firm size. These variables typically reflect the value and risks faced by bondholders, equity holders, and managers, and each can be traced back to various capital structure theories.

This section reviews the findings of previous theoretical and empirical studies concerning these factors and summarises the proxies used to measure them.

Profitability One theoretical controversy in the capital structure literature revolves around the relationship between leverage (capital structure) and profitability (a measure of firms' earning power, which is also of fundamental concern to their shareholders).

The trade-off theory suggests that firms usually prefer to incorporate more debt into their capital structure due to the tax deductibility of interest payments, leading to a positive correlation between leverage and profitability. Conversely, the pecking order theory proposes that firms prefer financing ordered as retained earnings as their primary source of funds for investment, followed by debt, and finally by equity (Myers & Majluf 1984). A highly profitable firm has the capacity to utilise retained earnings to fulfill its financing requirements (Myers 1984), resulting in a lower debt-to-asset ratio.

Empirical evidence typically utilises operating income over total assets or sales (Li et al. 2009, Rajan & Zingales 1995, Titman & Wessels 1988) or EBITDA divided by book value of assets (Rajan & Zingales 1995) as proxies for profitability. Most findings support the pecking order theory, indicating that highly profitable firms exhibit lower leverage ratios (Frank & Goyal 2009, Wald 1999, Rajan & Zingales 1995).

Tangibility/Liquidity Tangibility, also referred to as the collateral value of assets or asset composition, pertains to assets that creditors can accept as security for issuing debt. In an uncertain world with asymmetric information, a firm's asset structure significantly influences its capital structure since its tangible assets are the most widely accepted basis of bank borrowing and secured debts.

The trade-off theory suggests a positive link between tangibility and leverage, in that tangible assets can be pledged as collateral, reducing the lender's risk (Jensen & Meckling 1976). In contrast, the pecking order theory argues that firms with fewer tangible assets face greater monitoring costs and asymmetric information problems, leading them to accumulate more debt over time, thus becoming more highly leveraged (Frank & Goyal 2003).

Empirical studies generally incorporate ratios such as inventory plus gross plant and equipment to total assets (Titman & Wessels 1988) or the ratio of fixed assets to the book value of total assets (Rajan & Zingales 1995) to measure tangibility. Results have been produced in support of both theories, with some studies finding a positive relationship between tangibility and leverage (Titman & Wessels 1988, Frank & Goyal 2009, Rajan & Zingales 1995), while others suggest a negative correlation (Li et al. 2009).

Growth The relationship between growth opportunities and the debt ratio is conflicting. The trade-off theory implies a negative correlation, as firms with extensive growth prospects may not issue debt due to wealth transfer concerns (Myers 1977). Specifically, if high-growth firms require additional equity financing to pursue identified opportunities, existing debt may discourage such investments because they effectively transfer wealth from stockholders to

debtholders. Consequently, firms with substantial growth opportunities may opt not to issue debt, leading to an expected negative relationship between leverage and growth opportunities. Conversely, the pecking order theory proposes a positive correlation, as rapidly growing firms often require external sources of finance for expansion.

Various indicators of growth have been empirically examined, including capital expenditures over total assets, Tobin's Q (Bhabra et al. 2008, Rajan & Zingales 1995), the growth of total assets measured by the percentage change in total assets (Titman & Wessels 1988), and the five-year average of sales growth (Wald 1999). Findings regarding the relationship between leverage and growth have been mixed, with some studies supporting the trade-off theory (see Frank & Goyal (2009), Bhabra et al. (2008), Booth et al. (2001), Kim (1978), Smith & Watts (1992), and Wald (1999)), while others the pecking order theory.

Size Many studies support the proposition that there is a positive relationship between leverage and firm size.

According to the trade-off theory, leverage is positively correlated with firm size, and negatively correlated with firm bankrupt risk. This is mainly because larger firms tend to have more valuable and diverse assets, which can serve as collateral for securing debt financing and which reduce the possibility of bankruptcy(Rajan & Zingales 1995). As a result, lenders are more willing to provide larger loans to larger firms, which can lead to higher levels of debt (Warner 1977).

Alternatively, the pecking order theory suggests that firm size has a negative effect on leverage, as larger firms tend to have more internal resources and more financing alternatives than smaller firms. Specifically, large firms are expected to have lower information asymmetries making their equity issues in public markets more attractive than those of small firms (Akhtar & Oliver 2009), which could help to reduce their reliance on debt. Conversely, small firms may face more difficulty in obtaining external financing due to their limited access to capital markets and asymmetric information problems, leading them to rely more heavily on debt financing, resulting in higher leverage levels (Smith 1977).

The natural logarithm of sales (Booth et al. 2001, Li et al. 2009, Rajan & Zingales 1995), the natural logarithm of assets (Akhtar & Oliver 2009, Delcoure 2007), and the number of employees have also been employed in empirical studies, and the empirical evidence is mixed. Several studies, such as Rajan & Zingales (1995), Frank & Goyal (2009), and Marsh (1982), support the trade-off theory's predictions that firm size is positively related to leverage. However, other studies provide evidence that supports the pecking order theory's prediction of a negative relationship between firm size and leverage. For instance, Titman & Wessels (1988) find that leverage increases with firm size for US firms.

Age The pecking order theory and trade-off theory provide different explanations for the relationship between leverage and the age of a firm.

According to the trade-off theory, age is usually seen as a proxy for a range of issues relevant to capital structure choice. This includes agency costs, default risks, and information asymmetries. Older firms are expected to face lower debt-related agency costs (Frank & Goyal 2009), resulting in greater access to debt, hence a higher leverage ratio for older firms is expected. Older firms generally face a lower default risk due to more stability in their earnings, and this also implies a higher leverage ratio for older firms (Myers 1977).

On the other hand, age may also proxy for lower internal resources and lower information asymmetries. The pecking order theory suggests that firms prefer to use internal financing before external financing, and they have a hierarchy of financing sources (Myers & Majluf 1984). Accordingly, younger firms have fewer internal resources, and they are more likely to rely on external financing sources such as debt. Additionally, in the presence of information asymmetries, firms should finance themselves with relatively value-insensitive securities like debt, rather than by issuing value-sensitive securities like equity (Akhtar & Oliver 2009). Consequently, according to pecking order theory, managers will prefer debt over equity, and therefore with lower levels of information asymmetry, older firms are expected to have less leverage.

Empirical studies have found mixed evidence on the relationship between leverage and age. Some studies support the pecking order theory, showing that younger firms have higher leverage ratios than older firms. Other studies provide evidence for the trade-off theory, showing that older firms have higher leverage ratios than younger firms.

Overall, the relationship between leverage and age appears to be a complex one, and may be influenced by various factors, such as the industry, the business cycle, and the availability of financing options.

Risk/Volatility Risk is associated with the future operations of the business. Firms with higher risks tend to have volatile cash flows and face higher expected costs of financial distress.

Generally, an inverse relation between leverage and risks is expected due to the associated increase in bankruptcy risks. More volatile cash flows reduce the probability that tax shields will be fully utilised, and increase the risk of bankruptcy (Akhtar & Oliver 2009). Therefore, higher risk should result in less debt under the trade-off theory.

In contrast, the pecking-order theory predicts that risky firms have high leverage if firms with volatile stocks have a severe adverse selection.

Empirically, possible indicators include the variance of stock returns (Frank & Goyal 2009), the standard deviation of return on sales (Booth et al. 2001), and the standard deviation of the percentage change in operating income (Titman & Wessels 1988). Among these studies, Frank & Goyal (2009) and Marsh (1982) report a negative relationship between firm risk and leverage, lending support to the trade-off theory.

Summary Table 5.1 provides a summary of the implications and empirical evidence of two prominent capital structure theories, trade-off and pecking order, in relation to the determinants of capital structure. Notably, the two theories generally offer inconsistent expected relations between leverage and its determinants. This means that the nature of the relation between each determinant and leverage remains open to debate.

Table 5.1: Determinants of Capital Structure: Theoretical Prediction and Empirical Results

Proxy	Theoretical	Major Empirical Results
Profitability	+ (trade-off)	Bowen et al. (1982) on US
	- (pecking-order)	Frank & Goyal (2009) on US;
		Rajan & Zingales (1995) on G-7 countries
Tangibility	+ (trade-off)	Titman & Wessels (1988) on US;
		Bhabra et al. (2008) on China
		Rajan & Zingales (1995) on G-7 countries;
		Frank & Goyal (2009) on U.S
	- (pecking-order)	Li et al. (2009) on China
Growth	- (trade-off)	Frank & Goyal (2009) on US;
		Bhabra et al. (2008) on China;
		Booth et al. (2001) on 10 developing countries
	+ (pecking-order)	Titman & Wessels (1988) on US
Size	+ (trade-off)	Marsh (1982) on UK ;
		Frank & Goyal (2009) on US;
		Rajan & Zingales (1995) on G-7 countries;
		Booth et al. (2001) on 10 developing countries
	- (pecking-order)	Titman & Wessels (1988) on US
Age	+ (trade-off)	Keasey et al. (2015) on Italy
Risk	- (trade-off)	Frank & Goyal (2009) on U.S; Marsh (1982) on UK;
		Booth et al. (2001) on 10 developing countries

Determinants of Firm Loan Access: Cross-country Evidence

The determinants of firm loan access include both macro-level factors and firm-level factors (Rajan & Zingales 1995). From a macro perspective, institutions, financial liberalisation, and the economic environment are all important for the development of credit markets.

Bae & Goyal (2009) investigate the impact of legal protection, creditor rights, and property rights protection on loan characteristics across 48 countries based on individual bank contract data. They aim to determine whether differences in legal frameworks affect loan size, maturity, and interest rate spread. Their findings suggest that the enforceability of contracts has a significant impact on loan characteristics. Specifically, the average loan amount will increase by about $57 million if a borrower moves from a country in the sample with the

weakest protection of property rights to a country with the strongest protection of property rights, all else being equal. Similarly, the average loan maturity will increase by 2.5 years and the average loan spread will decline by 67 basis points in moving from a country with the weakest protection of property rights to the strongest protection of property rights.

Gopalan & Sasidharan (2020) study the impact of financial liberalisation, in the form of greater foreign bank presence, on the credit constraints of firms in emerging markets and developing economies (EMSEs). Using a firm-level dataset spanning 60 EMDEs in 2006-2014, they employ an ordered probit model to empirically examine the relationship between foreign banks' presence and firms' access to credit. The empirical results suggest that a greater foreign bank presence tends to ease firms' credit constraints in the sample of EMDEs. Additionally, firms with audited financial statements tend to experience lower credit constraints. Furthermore, for micro, small, and medium-sized firms, greater information availability through audited financial statements, in combination with greater foreign bank presence, is found to be jointly associated with lower credit constraints.

Determinants of Firm Loan Access: China-specific Evidence

One of the most widely studied determinants of Chinese firm loan access is ownership structure. State-owned enterprises (SOEs) have historically enjoyed preferential access to credit compared to private enterprises.

Cull et al. (2009) posit that formal credit allocation in China is biased towards relatively unprofitable SOEs, and that private firms are denied access to bank loans. To investigate this issue, they employ a large panel dataset of Chinese industrial firms from 1998 to 2003. The findings of their analysis reveal that less profitable firms tend to receive more loans than more profitable ones, indicating a lack of efficiency in the credit allocation process. When controlling for profitability, SOEs are found to be the primary beneficiaries of formal credit, followed by collective and legal-person firms, and then by domestic private and foreign firms. This trend demonstrates an institutional bias in favour of SOEs and against private enterprises.

Firth et al. (2009) investigate the determinants of loan allocation by Chinese state-owned banks to private firms. They utilise survey data from the World Bank in 2002 to confirm that lending decisions are based on commercial judgments. Specifically, banks tend to lend to financially healthier and better-governed firms. Furthermore, state ownership positively impacts firms' access to bank finance. The study highlights the variation in lending determinants across industries, firm size, and level of market development. In particular, commercial judgments play a more significant role in lending to manufacturing firms, larger firms, and firms in regions with a more liberalised banking sector. On the other hand, political connections are more important for firms in the service industry, larger firms, and firms in regions with a less liberal banking sector. The study provides evidence of the market orientation of the Chinese banking system as reforms take effect.

Lin (2011) explores the impact of foreign bank entry on access to bank credit for Chinese non-financial publicly-traded firms between 2002 and 2005. The study finds that, on average, foreign bank entry in its early stages does not have a significant impact on either the incidence or the amount of long-term bank loans. However, the impact of foreign bank entry varies with firm heterogeneity, in that profitable firms tend to rely more on long-term bank loans, which supports the portfolio composition hypothesis that non-state-owned firms are able to substitute more expensive trade credit with long-term bank loans. Interestingly, firms with greater potential collateral do not use more bank loans after foreign bank entry. In conclusion, the findings highlight that the banking sector liberalisation policy on foreign bank lending helps to alleviate the financial constraints faced by firms, especially those that are less connected to the government.

Focusing on the 2009 credit expansion and its associated change in bank lending and firm investment decisions, Liu et al. (2018) analyse a panel of Chinese listed firms from 2003 to 2013, showing that both SOEs and non-SOEs significantly increased their bank borrowings following the economic stimulus package. Moreover, SOEs received more bank loans and made more investments than non-SOEs, with their investments less connected to investment opportunities, indicating a potential misallocation of resources.

Along similar lines, Cong et al. (2019) study the allocation of bank credit across firms in China following the major credit expansion program in 2009. By matching a comprehensive loan-level data set with firm-level data on manufacturing firms, they find that a gradual reallocation of capital from low-productivity state-owned firms to high-productivity private firms occurred up to 2008. This is believed to have contributed to China's rapid growth in the 2000s. However, this trend reversed with the introduction of the stimulus plan, with new credit allocated relatively more towards state-owned or state-controlled firms and less productive private firms favoured by the government. The authors argue that this reversal, driven by implicit government guarantees, worsened resource allocation in China.

Summary

This review of the literature on the determinants of firm loan access started with the various theoretical frameworks of capital structure. These theories suggest that factors such as a firm's financial condition, growth prospects, and the agency costs associated with the relationship between managers and shareholders influence its decision to seek external financing. Based on the theoretical support, empirical studies have used various proxies to examine the determinants of capital structure.

When focusing on bank loan access, which is an important source of external financing, there is cross-country evidence that institutional factors, such as the quality of the legal system and creditor protection, have a significant impact on a firm's ability to access credit. Studies in the Chinese context have highlighted the importance of the government's role in shaping firms' financing decisions. SOEs have easier access to credit than their private counterparts, as the government provides them with implicit guarantees.

5.2.2 Impact of Political Connections on Firm Loans Access

Political connections are important in the worldwide context, particularly in developing and transitional economies (Adhikari et al. 2006). In general, as Berkman et al. (2010) indicate, a firm's political connection may stem from its ownership structure and the background of its executives. The former refers to government ownership, while the latter pertains to executives' prior or current work experience, and relationships with political parties, senior government officials, and politicians (Fisman 2001, Johnson & Mitton 2003).

It is well established that politically connected firms enjoy various benefits, including preferential treatment from governments (Faccio et al. 2006, Fisman 2001). One of the main channels through which political connections work is access to credit loans (Claessens et al. 2008, Giannetti & Ongena 2009, Khwaja & Mian 2005, Sapienza 2004). Existing studies have investigated how political connections may affect the availability of bank loans in terms of size, maturity, and cost.

Theoretical Background

The impact of political connections on firm credit availability can be understood through several different economic theories. This context highlights the potential benefits and drawbacks of political connections for firms seeking credit.

Positive Effect: Resource-based Theory Drawing on resource-based theory, a firm's competitive advantage is established by the possession of tangible and intangible resources that are costly or difficult for competitors to obtain (Barney 1991). The earning potential of some of these resources is relationship-based, as firms rely on relationships with stakeholders to leverage these assets. The intangible relational asset of a firm's political connections is one form of such resources, and its value is primarily driven by the firm's ties with the government, which can enable it to acquire vital resources and subsequently to improve its value (Pfeffer & Salancik 1978).

In the context of political connections and firm bank loans, this theory posits that firms with political connections possess unique resources and capabilities that give them an advantage in obtaining bank loans. Specifically, political connections provide firms with unique information, contacts, and political influence, which enhance their reputation and credibility from the perspective of banks. This, in turn, increases their likelihood of obtaining bank loans on favourable terms.

Additionally, political connections may help firms to access government resources, such as subsidised loans, which can further enhance their ability to obtain bank loans. Overall, resource-based theory suggests that political connections can provide firms with a valuable resource that enhances their ability to obtain bank loans.

Positive Effect: Stewardship Theory Stewardship theory suggests that politically connected managers may have a positive impact on a firm's access to bank loans. According to this theory, managers who enjoy connections with political elites may act in the best interests of their firm and its stakeholders, including its lenders (Donaldson 1990, Donaldson & Davis 1991). Politically connected managers may be able to use their relationships with government officials to secure favourable loan terms, provide valuable information to lenders, and help to mitigate the risks associated with lending to the firm. As a result, firms with politically connected managers may find it easier to obtain loans, and may be viewed as less risky borrowers by lenders.

Negative Effect: Agency Theory Despite the apparent benefits of political connections for firms, their impact on firm performance is not always positive. This is often attributed to the agency problem, which arises from the separation of control and ownership of a firm.

As Jensen & Meckling (1976) posit, the agency problem stems from conflicting interests between owners (shareholders) and agents (managers), where managers may prioritise their own interests at the expense of shareholders (Fama & Jensen 1983*a*,*b*, Jensen & Meckling 1976). Since the monitoring of managers is costly and difficult due to information asymmetry, such opportunistic behaviour can occur. Hence, political connections may not benefit the firm's performance or long-term interests, but may instead serve the interests of the politically connected manager.

In addition to the agency problem, the political aspirations and career concerns of government officials also play a significant role in shaping the relationship between firms and the government. Local governments, for instance, are motivated to intervene in the operations of firms in order to achieve political and social objectives such as reducing unemployment, which in turn, may impact firm value (Jin et al. 2005). Politically connected managers often act as the bridge to fulfill such goals. This can create a policy burden for the firm, leading to negative effects on firm value and performance (Li & Zhou 2005).

Cross-country Evidence

Khwaja & Mian (2005) analyse a loan-level data set of more than 90,000 firms in Pakistan from 1996 to 2002 to investigate the impact of political connections on firm credit. The authors define a politically connected firm as one which has a politician on its board, and find that such firms receive significant preferential treatment in borrowing, with 45% more loans obtained and 50% higher default rates compared to non-politically connected firms. This preferential treatment is observed exclusively in government banks, and increases with the strength of the politician and whether they or their party are in power, while it decreases with the degree of electoral participation in the politician's constituency. However, due to data limitations, the authors use interest rates categorised by loan size in each bank branch as a proxy for individual loan contract interest rates rather than actual interest rates.

Houston et al. (2014) conducts an empirical analysis to examine whether the political connections of listed firms in the US impact on the cost and terms of loan contracts. Using a hand-collected dataset of the political connections of S&P 500 companies over the 2003-2008 period, the study finds that politically connected firms benefit from significantly lower-cost bank loans, and these effects are stronger for firms with stronger connections. The study also shows that political connections reduce the likelihood of capital expenditure restriction or liquidity requirement imposed by banks at loan outset, which results in lower monitoring costs and credit risk faced by banks, ultimately leading to lower borrowing costs for the firm. In addition, the authors use multiple measures to differentiate the strength of political connections, such as the number of connected board members, years of political positions held, and the relevance of the political position held in the banking sector.

Claessens et al. (2008) present an innovative approach that utilises campaign contribution data to construct indicators of political connections in Brazil. They explore the potential channels which politicians use to repay these contributions, and choose bank leverage growth as a proxy for access to finance due to data limitations. While they do not provide direct evidence of preferential lending and associated benefits for contributing firms, their findings reveal that firms that made contributions to elected federal deputies experienced a significant increase in bank leverage over the four-year period following the election. These results suggest that finance serves as a critical channel through which contributing firms can reap benefits from their political connections.

Infante & Piazza (2014) contribute to the literature by examining the impact of political connections at all levels of government on interest rates on overdrafts in Italy. They identify politically connected firms as those with either a board member or top executive who is a member of a political body. Using bank-firm-quarter observations from 2005 to 2009, they find that politically connected firms enjoy lower interest rates when the political connection is at a local level. This effect is stronger when borrowing from politically influenced banks (i.e., those with politicians on their boards), as well as local banks. Furthermore, the effect is more pronounced in areas with higher levels of corruption.

In addition to the benefits of political connections, Bertrand et al. (2018) document the potential cost of political connections using plant-level data from France. They find that political connections between CEOs and politicians may affect important corporate policies, such as job/plant creation and destruction, to help incumbent politicians in their bid for re-election. Specifically, both employment growth and the rate of plant creation increases at connected firms in election years, while the rate of plant destruction decreases. These employment practices are proved detrimental to firm performance. Moreover, there is little evidence that connected firms benefit from preferential access to government resources, such as subsidies or tax exemptions. They summarize that the difference between their findings for France and some of the earlier papers is driven by the quality of the institutions across countries or the fact that France is a stable democracy.

In recent years, there has been a surge of scholarly interest in exploring political connections in the context of exogenous shocks.

Blau et al. (2013) examine whether the level of political engagement determines the allocation, timing, and magnitude of Troubled Asset Relief Program (TARP) support funds during the 2008 economic crisis. They define political engagement as lobbying expenditures for each firm and political connections if the firm previously/currently employs a federal government official, and analyse the effect of this political engagement on the distribution of TARP for a sample of 237 firms that receive support and 334 financial firms that do not receive support. Their findings indicate that political engagement is an important determinant in the distribution of TARP funds. Political engagement is not only directly related to the likelihood of receiving TARP support, but also related to both the timing and magnitude of support.

Duchin & Sosyura (2012) investigate the relationship between corporate political connections and government investment using data on firm applications for capital under the Troubled Asset Relief Program (TARP) post-2008 financial crisis. The study finds that politically connected firms are more likely to be funded, yet investments in politically connected firms underperform those in unconnected firms. The findings of the study also show that connections between firms and regulators may distort investment efficiency.

In summary, the cross-country literature on the impact of political connections on firm loan access suggests that political connections can affect access to financing in various ways depending on the institutional context. Political connections with government officials or politicians can facilitate access to credit in countries with a weak rule of law, high levels of corruption, and less developed financial markets. However, these connections may hurt firm financing and performance due to the potential for rent-seeking behaviour and lack of transparency.

China-specific Evidence

A number of cross-country studies document the value of political connections in credit access in emerging economies. There is also a large body of literature that focuses on China and shows that political connections and affiliation with the Communist Party are connected with greater access to loans, especially for private firms.

Li et al. (2008) conduct an empirical investigation on the impact of political connections, defined as affiliation with the ruling Communist Party, in the operations of private firms in China. The study employs a nationwide survey conducted in 2002 with a sample of 3,258 private enterprises. The results of the study indicate a positive association between the membership of private entrepreneurs in the ruling Communist Party and their firm performance, after controlling for relevant factors such as human capital. Additionally, the study finds that political connections enable private entrepreneurs to more easily secure loans from banks or other state institutions and gain greater confidence in the legal system. Moreover, the study shows that the significance of political connections in firm performance is more pronounced in regions with weaker market institutions and legal protection.

In light of the presence of both government-owned firms and politically connected executives, several studies aim to distinguish the effect of political connections from that of state ownership, and explore whether the impact of a politically connected manager on firm performance varies across different ownership structures.

Johansson & Feng (2016) undertake an empirical investigation around the launch of the large stimulus program in the fall of 2008. Analysing a dataset of listed firms, the study reveals that SOEs exhibited a superior ability to maintain leverage levels and had better access to both short- and long-term debt relative to private firms following the introduction of the stimulus program. However, the study further demonstrates that preferential access to debt financing did not translate into improved performance for SOEs, as they performed significantly worse than private firms in the post-stimulus period. In contrast, political connections gained through political participation are found to alleviate the discrimination faced by private firms from Chinese banks and to lead to enhanced firm performance.

Pan & Tian (2020) examine the impact of executives' connections with banks or governments on bank lending decisions using a sample of bank loans granted to Chinese-listed non-SOEs from 2003 to 2010. Their study employs the sensitivity of the amount of bank loans to firm profitability as a proxy for bank lending decisions. The results indicate that bank loans are positively associated with profitability for firms with banking connections, whereas political connections have an adverse effect on bank lending decisions. These findings are more pronounced in industries with less support, and in regions with lower development levels.

Moreover, borrowers with bank connections are less likely to face financial distress and to exhibit higher future stock returns once their bank loans are initiated, while borrowers with political connections are more prone to financial distress and to report lower future stock returns. The results suggest that bank connections can serve as a substitute for legal protection, alleviate information asymmetry, and enhance capital allocation efficiency. In contrast, political connections are utilised by exerting political pressure, which may not mitigate credit risk and could lead to the misallocation of capital.

To sum up, the China-specific literature suggests that political connections can facilitate access to financing, especially in the case of private firms facing institutional constraints. However, their impact on firm performance and capital allocation efficiency remains controversial.

Summary

The existing literature suggests that politically connected firms receive preferential treatment such as lower interest rates, longer loan periods, greater numbers of lenders, and a higher probability of obtaining non-secured loans when compared to their non-politically connected counterparts. This phenomenon is more prevalent in less developed countries, where political connections are highly correlated with political power, which is a crucial component in the financial markets of many transitional and developing economies (Faccio et al. 2006).

However, some studies posit that politically connected firms have a lower quality of reported earnings (Chaney et al. 2011), and high information asymmetry (Boubakri et al. 2012), both of which reduce firms' access to bank credit.

Motivated by the mixed empirical findings, this study focuses on the biggest emerging economy, China, and explores whether and how political connections of firm executives play a role in accessing bank loan financing in a credit stimulus context.

Table 5.2: Definition of Political Connections in the Cross-country Literature

Definition	Country	Source
Have a politician on the board of directors	Pakistan	Khwaja & Mian (2005)
Campaign contributions to federal deputy candidates	Brazil	Claessens et al. (2008)
A board member holds or held an important political or regulatory position	U.S.	Houston et al. (2014)
A board member or a top executive is a member of a political body	Italy	Infante & Piazza (2014)
Government affiliation	China	Guariglia & Yang (2016)
Government or military working experience	China	Fan et al. (2007) Fan et al. (2014)
Communist Party member	China	Li et al. (2008)
Government intervention in CEO appointment	China	Cull et al. (2015)

5.3 Data and Methodology

5.3.1 Data and Variables

Data Collection Process

The sample covers all A-share[4] companies listed on the Shanghai and Shenzhen Stock Exchanges (SHSE and SZSE) from 2003 to 2018. The sampling period starts in 2003 because the new accounting and auditing standards were implemented for all listed firms in China in 2002.

The annual firm-level observations are drawn from three databases within the *China Stock Market and Accounting Research* (CSMAR) database: corporate governance data from the *Corporate Governance Research Database* on China's listed firms, executive characteristics data from the *China's Listed Firm Characteristics Database*, and firm characteristic data from the *China Stock Market Financial Statement Database*. In addition, provincial financial environment data is obtained from the *National Economic Research Institute*.

4. Currently, most Chinese companies listed and traded on the Shanghai Stock Exchange (SHSE) or Shenzhen Stock Exchange (SZSE) issue two classes of shares: A- and B-shares. A-shares are domestic shares quoted in Chinese yuan that are restricted to domestic investors and Qualified Foreign Institutional Investors (QFII). B-shares, on the other hand, are foreign shares quoted in foreign currencies (US dollars for Shanghai B-shares and Hong Kong dollars for Shenzhen B-shares). Until February 2001, B-shares were exclusively available to foreign investors.

Following previous studies, several steps are taken to ensure data quality and consistency. First, financial firms (identified by the China Securities Regulatory Commission [CSRC] code J) are removed due to their differing investment activities. Second, firms with Special Treatment (ST, or *ST)[5] status are also discarded according to standard data processing methods. Third, firms with missing or incomplete financial or governance data are excluded.[6] Fourth, firms with less than three years of consecutive observations are deleted. Finally, firms that switch between different ownership types during the sample period are dropped to eliminate the potential conflicting results of political connections in different ownerships.

The final sample comprises 16,108 firm-year observations, representing 1,784 listed firms. It is unbalanced, with the number of firm-year observations of each firm varying from three to sixteen. A detailed overview of the sample selection process is presented in Table 5.3.

Table 5.3: Sample Selection Process

Sample	**Size**	**Firm**
Firm-year observations of A-share listed companies	29,714	3,410
Subtract:		
Financial firms	229	31
Special Treatment firms	1,494	19
Observations due to missing information for the main variables	7,086	853
Missing information for executives	1,643	5
Less than 3 years of consecutive observations	1,013	526
Ownership does not consist	2,141	192
Final sample	16,108	1,784
Of which:		
Non-SOEs	8,972	1,157
SOEs	7,136	627

To minimise the influence of outliers, the data is winsorised following the approach used in the literature such as Guariglia & Yang (2016). Specifically, values in the tails of the distribution, corresponding to the 1st and 99th percentiles, are replaced with the values at the 1st and 99th percentiles, respectively. Furthermore, all variables are deflated using the producer price index (PPI) deflator provided by the *National Bureau of Statistics of China*.

5. ST stands for special treatment and refers to listed firms that have reported negative net profits for two consecutive years. *ST refers to listed firms that have reported negative net profits for three consecutive years and thus face the probability of delisting from the stock exchanges.

6. I deleted observations that exhibit the following issues: missing or zero values for total assets, the number of board of directors, number of employees, equity nature, and Tobin's Q.

Definition of Political Connections

Information on executive characteristics is obtained from various databases. The CSMAR database provides profiles of the executives working for listed firms, including details such as their age, gender, education, professional background, and employment history. These profiles are used to trace the executives' political connections by analysing their work experience. In cases where specific records are unavailable in the CSMAR database, curricula vitae are manually collected from sources such as Sina, Google, or firms' official websites and annual reports.

In the empirical analysis, the political connections of a listed firm are defined based on whether the CEO/chairperson has previously served as a government official,[7] as current government officials in China are legally prohibited from acting directors of executives of listed firms.

This paper focuses on CEOs and chairpersons only, for the following reasons.

First, the chairperson of the board and the general manager (CEO) are widely recognised as the top two executives in Chinese firms. The general manager is elected by and accountable to the board and is essentially equivalent to a CEO in the US (Fan et al. 2007), while in contrast to the chairperson role in the US, the chairperson in China holds the highest authority and serves as the firm's legal representative responsible for overall operations. Hence, the CEO and chairperson are key decision-makers, and their political connections can significantly impact the firm's value and performance (Hung et al. 2012, Wu et al. 2012).

Second, the board composition in China's listed firms typically lacks directors who represent public stock investors (Fan et al. 2007). This suggests that insiders with connections to government officials or other influential individuals may dominate boards. Consequently, many studies employ the CEO's political ties as an indicator of political connections, rather than relying on the largest shareholders (Fan et al. 2007, 2014).

7. It is acknowledged that this measure has certain limitations. One notable limitation is that connections can also be established through relatives, business partners, or figureheads, which may not be captured by this measure. However, using the CEO/chairperson's political ties as a proxy for political connections provides a conservative estimate of the true extent of political influence.

Moreover, Wu et al. (2012) find that neither the chairperson nor the CEO alone drives the effects of political connections on firm value and performance, and suggest that it is better to regard both of them as top management in Chinese listed firms.

Firms with and without political connections are hereafter referred to as PC and non-PC firms, respectively.

Sample Structure

Table 5.4 and 5.5 summarise the distribution of the sample according to the number of observations of each year and industry. Among the 16,108 observations, 2,493 (15.48%) have a politically connected CEO or/and chairperson.

Table 5.4 demonstrates that the sample firms are unevenly distributed across the sample period. The sample coverage improves over time, with the number of observations ranging from a minimum of 145 in 2003 to a maximum of 1,550 in 2018.

Table 5.4: Structure of the Unbalanced Panel (by Year)

Year	Firms			Political connected firms	
	#	%	cum %	#	%
2003	145	0.90	0.90	34	23.45
2004	306	1.90	3.80	74	24.18
2005	500	3.10	6.90	112	22.40
2006	651	4.00	10.90	149	22.89
2007	760	4.70	15.60	169	22.24
2008	834	5.20	20.80	195	23.38
2009	898	5.60	26.40	199	22.16
2010	894	5.50	31.90	170	19.02
2011	1,198	7.40	39.30	195	16.28
2012	1,296	8.00	47.30	205	15.81
2013	1,262	7.80	55.10	182	14.42
2014	1,338	8.30	63.40	163	12.17
2015	1,437	8.90	72.30	165	11.47
2016	1,525	9.50	81.80	171	11.22
2017	1,514	9.40	91.20	156	10.30
2018	1,550	9.60	100.00	154	9.94
Total	16,108	100		2,493	15.48

Notes: *PC* represents politically connected firms. *% of Sample* refers to the percentage of the total sample that each year represents. *% of Year* denotes the proportion of politically connected firms for each year, calculated as a percentage of the total number of observations in that year.

Table 5.5 provides a distribution of firms with political connections by industry. The industry classification is based on specifications of the 2017 China Securities Regulatory Commission (CSRC). In general, firms in residential services, repairs, and other services (83.87%), transportation, warehousing, and postal services (52.71%), environment and public facilities management (48.95%), and electricity, heat, gas, and water (41.56%) are more likely to have political connections than other industries. These industries are all heavily controlled by the government because they are regarded as strategic sectors in China.

Table 5.5: Structure of the Unbalanced Panel (by Industry)

Industry	All firms		Political connected firms	
	#	%	#	%
Residential services, repairs and other services	31	0.19	26	83.87
Transportation, warehousing and postal	590	3.66	311	52.71
Environment and public facilities management	143	0.89	70	48.95
Electricity, heat, gas, and water	493	3.06	205	41.56
Public Administration and Social Organization	324	2.01	117	36.11
Leasing and business services	197	1.22	67	34.01
Agriculture	243	1.51	82	33.74
Culture, sports and entertainment	90	0.56	27	30.00
Wholesale and retail trade	915	5.68	216	23.61
Real estate	849	5.27	177	20.85
Construction	456	2.83	86	18.86
Mining	367	2.28	69	18.79
Accommodation and Catering	65	0.40	7	10.77
Manufacturing	10,464	64.98	961	9.18
Information transmission, computer services	757	4.70	66	8.72
Scientific research, technical services	87	0.54	6	6.90
Education	6	0.04	0	0.00
Health, social security and social welfare	31	0.19	0	0.00
Total	16,108	100	2,493	15.48

Notes: *PC* represents politically connected firms. *% of Sample* refers to the percentage of the total sample that each industry represents. *% of Industry* denotes the proportion of politically connected firms within each industry, calculated as a percentage of the total number of observations within that industry.

5.3.2 Methodology

Since the economic stimulus package constitutes a nationwide exogenous shock, a dummy variable, denoted *Stimulus*, is introduced in the baseline model. The dummy *PC_Dummy* is also added to gain understanding of the potential difference in bank lending incentives between firms with and without political connections. The fundamental specification for this

analysis is captured by the following regression equation, Equation 5.1:

$$LoanSize_{it} = \alpha_0 + \alpha_1 Stimulus_t \times PC_{it} + \alpha_2 PC_{it} + \alpha_3 Stimulus_t + \alpha_4^{'} X_{it} + \alpha_5^{'} Z_{pt} + \mu_i + \mu_j + \mu_p + \mu_t + \varepsilon_{i,j,p,t} \quad (5.1)$$

where the subscripts i, j, p, and t indicate firm, industry, province, and year, respectively. μ_i, μ_j, μ_p and μ_t denote firm-, industry-, province-, and year-fixed effects, respectively. $\varepsilon_{i,j,p,t}$ is the error term. Industry-fixed effect controls 21 industries, with non-manufacturing industries given a one-digit code and manufacturing industries a two-digit code.

The dependent variables are the size of bank loans, defined as the natural logarithm of bank loan size plus one since the value of bank loan size in some observations is zero. *Stimulus* is a dummy variable equal to 1 for firm-year observations falling in the post-stimulus period and 0 otherwise. In the empirical regression, this variable is omitted to avoid collinearity issues, given that the presence of year fixed effect has already controlled for changes across years. *PC* is a dummy variable equal to 1 for politically connected firms and 0 otherwise. The variable of interest in this study is the interactive term $Stimulus \times PC$, which examines whether political connections play a role in allocating bank loan resources under the credit expansion prompted by the 2009 stimulus package.

In line with previous studies (Firth et al. 2009, Liu et al. 2018, Zheng & Zhu 2013), two sets of firm-specific control variables (X_{it}), including firm characteristics, and corporate governance characteristics, are applied in this model.

Firm Characteristic Variables

Following the literature summarised in the above section, five key variables: profitability, growth opportunities, size, tangible assets, and risk, are used in this study. Specifically:

(1) *ROE* is the return on equity, which is the proxy for firm profitability. This variable is typically found to be a significant determinant of a firm's capital structure and is often interpreted as capturing its operating cash inflows (Leuz & Oberholzer-Gee 2006, Liu et al. 2018, Titman & Wessels 1988). Better-performing firms are likely to obtain more bank loans, so the coefficient is expected to be positive.

(2) *Tobin_Q* is the value of Tobin's Q, calculated as the ratio of firm market value to replacement value, which is used as a proxy for firm investment opportunities (Chen et al. 2011, Firth et al. 2008, Pan & Tian 2015). As firms with better investment opportunities are likely to receive larger bank loans, the coefficient is expected to be positive.

(3) *Asset* is the natural logarithm of firm total assets. It captures a firm's access to capital markets and its associated transaction costs (Frank & Goyal 2009, Marsh 1982). Banks may find lending for small firms expensive because they typically borrow in small amounts, thus raising the cost of monitoring, enforcement, and other transaction costs. Another reason for controlling for size is to avoid omitted variable bias since larger firms are more likely to have stronger political connections (Faccio et al. 2006).

Since firms with more collateral assets face less difficulty in getting bank loans, (4) *Tangibility*, defined as the ratio of tangible assets to firm total assets, is also included to control for collateral information; the sign of the coefficient is expected to be positive.

Finally, (5) *Risk*, is defined as a dummy variable equal to 1 if the Altman's Z score of the firm is below average, indicating higher risk; while it is 0 if the Altman's Z score of the firm is above average.[8]

Corporate Governance Variables

Good corporate governance can help reduce credit risks by mitigating the agency problems between shareholders and managers and by improving corporate transparency and the quality of financial information (Shleifer & Vishny 1997). The following proxies for corporate governance are included in the regression:

(1) *Indep*, the ratio of independent directors to the total number of directors on a firm's board. Independent directors are more likely to deter top executives from pursuing personal objectives, and instead, to force management to focus on firm value. Other stakeholders, including lenders, should benefit from this monitoring (Chen 2006, Francis et al. 2012).

8. I use a dummy variable rather than the original Altamn's Z score to eliminate the potential multicollinearity concerns.

(2) *Duality*, a dummy variable with a value of 1 if the board chair and CEO are the same person and 0 otherwise. Concentrating power in one person's hands runs the risk that any abuse of power will be harder to prevent (Barth et al. 2009, Jensen & Meckling 1976).

Provincial Control Variables

In addition to firm characteristics, the Financial Marketisation index (*Fin_dev*) employed in Chapter 4 is also considered in the empirical regression.

Definitions of the control variables are shown in Table 5.6.

Table 5.6: Definition of Control Variables

Variable	Definition
Panel A. Firm characteristics	
ROE	Net profit over shareholders' equity
Tobin_Q	Market value over total assets
Tangibility	Property, plant, and equipment plus inventories over total assets
Asset	Natural logarithm of real total assets (RMB Million)
Risk	A dummy variable equals one if the Altman Z score is lower than the average Z score in the sample, and zero otherwise
Panel B. Corporate governance	
Indep	Number of independent directors over number of total directors
Duality	A dummy variable equals one if the CEO is the board chair
Panel C. Institutional feature	
Fin_dev	Financial Marketisation Index

5.4 Empirical Results

5.4.1 Summary Statistics

Table 5.7 provides the summary statistics for all the variables in this study. The data from the table reveals that the average bank loan size in natural logarithm stands at 6.125, comprising 3.589 for long-term bank loans (defined as loans with a duration of one year or more) and 5.551 for short-term bank loans (defined as loans with a duration of less than one year). This suggests a notable dependency on bank loans as a financing source among Chinese listed firms.

Table 5.7: Summary Statistics of Firm Loans and Characteristics

Variable	Observation	Mean	Std. Dev.	Mix	Max
Panel A: firm loans					
$\log(Loan_{it}+1)$					
Long-term	16,108	3.589	3.080	0	10.454
Short-term	16,108	5.551	2.063	0	9.877
Total	16,108	6.125	1.926	0.638	10.881
Panel B: firm Characteristic					
State-owned	16,108	0.443	0.497	0	1
Tobin's Q	16,108	1.83	1.012	0.899	6.773
Total asset (logged)	16,108	8.254	1.337	5.752	12.374
ROE	16,108	0.043	0.388	-8.917	0.938
Tangibility	16,108	0.230	0.164	0.000	0.960
Duality	16,108	0.223	0.422	0	1
Indep (%)	16,108	0.37	0.056	0	0.8
Z_Score	16,108	3.345	2.972	0.030	17.864
Risk	16,108	0.345	0.475	0	1

5.4.2 Univariate Test

Table 5.8 presents the preliminary univariate statistics on bank loan size, comparing the values before and after the introduction of the stimulus package for the full sample, firms with political connections, and firms without political connections.

Panel A compares the total bank loan size in the natural logarithm, while Panel B compares the long-term bank loan size. In the first column for the full sample, the average bank loan size is observed to be higher after the introduction of the stimulus package, and the difference is statistically significant (with t-values of -6.052, and -8.165, respectively). This is different from the situation in the US where bank loans sharply decreased during the crisis (Duchin et al. 2010). This significant difference still holds when splitting the sample into firms with and without political connections, in columns 2 and 3, with larger increases for firms with political connections. Specifically, bank loans in total and in the long term of politically connected firms increased by 0.597 and 1.017 respectively, while their peers without such connections increased by 0.216 and 0.413 respectively.

The last column reports the results of the univariate test comparing firms with and without political connections. The statistically significant difference results confirm that firms with political connections received significantly higher bank loans compared to their peers without such connections.

Table 5.8: Univariate Tests: Firm Bank Loans

Variable $log(Loan_{it}+1)$	Full sample	$PC=0$	$PC=1$	Difference (t-value) $PC=0$ versus $PC=1$
Panel A: Total Loan				
Full sample	6.125	6.024	6.677	-0.653*** (-15.685)
Before	5.941	5.847	6.256	-0.409*** (-6.188)
After	6.171	6.063	6.853	-0.790*** (-15.534)
Difference (t-value)	-0.23***	-0.216***	-0.597***	
Before versus After	(-6.052)	(-5.093)	(-7.096)	
Panel B: Long-term				
Full sample	3.580	3.422	4.423	-1.001***(-16.25)
Before	3.224	3.091	3.693	-0.602*** (-0.391)
After	3.675	3.504	4.710	-1.205*** (-16.362)
Difference (t-value)	-0.451***	-0.413***	-1.017***	
Before versus After	(-8.165)	(-6.754)	(-8.093)	

Notes: The "Difference" column reports the difference in the means of corresponding variables between different groups associated with the results of the t-test on the equality of means. ***, **, * correspond to p-values of 1%, 5%, and 10%, respectively.

Table 5.9 presents the univariate test results for the control variables in the full sample as well. On average, politically connected firms are larger and riskier than their peers without these connections, while also exhibiting higher tangibility, poorer growth opportunities, and lower profitability.

Table 5.9: Univariate Tests: Firm Characteristics

Variable	$PC=0$	$PC=1$	Difference	Std. Err	t-value
Tobin's Q	1.863	1.675	0.189***	0.021	9.1
State Own	0.388	0.741	-0.352***	0.001	-36.21
Total asset (logged)	8.153	8.539	-0.386***	0.027	-14.45
ROE	0.039	0.044	-0.005	0.008	-0.65
Tangibility	0.227	0.259	-0.032***	0.004	-9.45
Duality	0.251	0.104	0.148***	0.009	17.45
Independent	0.370	0.367	0.003**	0.001	2.41
Risk	0.352	0.258	0.095***	0.010	9.922

Notes: ***, **, * correspond to p-values of 1%, 5%, and 10%, respectively.

5.4.3 Baseline Results

This subsection conducts a multivariate analysis to examine whether and how executives' political connections influenced their firms' access to bank loans after the 2009 credit expansion using the regression model specified in Equation 5.1. The estimation results of fixed effect OLS are presented in Table 5.10. The constant term, firm-, industry-, province-, and year-fixed effects are included in the regressions but are not reported in the table for brevity. The effects of time dummy *Stimulus* are eliminated due to the year-fixed effects. The p-values in the panel regressions are based on standard errors corrected for firm clustering.[9]

The estimated coefficient *PC_Dummy* is insignificant, suggesting that political connections did not play a significant role in securing bank loans. However, when interacting with the stimulus package, the coefficient of the interaction term $Stimulus \times PC\_Dummy$ is positive and significant at the 10% level in Column (2). This implies that the relationship between politically connected firms and long-term bank loans became more significant during the government stimulus measures.

In terms of firm-specific controls, expected signs consistent with previous studies are observed in both columns. Firm size, tangibility, and growth opportunities are statistically positively related to firms' access to bank credit, indicating that larger and more tangible firms with better growth opportunities were able to secure more bank loans.

Moreover, corporate governance variables and the Financial Marketisation Index [10] are all insignificant in both columns.

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9. The observations are not independent and the errors are potentially serially correlated, which leads to inflated t-statistics. To overcome this problem, I cluster observations by firm and commute cluster-robust standard errors.

10. The insignificance of the Financial Marketisation Index is due to using a provincial dummy and little change in the variable over time. I thank the examiners for pointing out this issue.

Table 5.10: Effects of Political Connections on Firm Loan Access after the Credit Expansion

VARIABLE: $log(Loan_{it}+1)$	Total Loans	Long-term Loans
$Stimulus \times PC\_Dummy$	0.075	0.283*
	(0.057)	(0.147)
PC_Dummy	-0.011	-0.225
	(0.058)	(0.143)
ROE	-0.011	-0.046
	(0.020)	(0.037)
$Tobin\_Q$	0.454***	0.075**
	(0.025)	(0.029)
$Tangibility$	0.897***	1.393***
	(0.147)	(0.330)
$Asset$	1.232***	1.646***
	(0.030)	(0.057)
$Risk$	-0.242***	-0.694***
	(0.010)	(0.059)
$Duality$	-0.010	-0.106
	(0.032)	(0.070)
$Indep$	0.189	-0.202
	(0.246)	(0.495)
Fin_dev	-0.005	-0.013
	(0.005)	(0.011)
Observations	16,108	16,108
Number of firms	1,784	1,784
R-squared	0.544	0.274
Firm/Industry/Province/Year FE	YES	YES

Notes: The constant term, region dummies, industry dummies, and year dummies are included but not reported. Standing errors, which are based on robust standard error corrected for clustering at the firm level, are presented in the parentheses below the estimates. Significance levels 0.1, 0.05, and 0.01 are noted by *, **, and *** respectively.

5.4.4 Endogeneity Issues

To investigate the causal effect of political connections on firms' bank loan access, it is necessary to address potential endogeneity issues. First, reverse causality must be considered - a firm may strategically appoint politically connected executives when it is already considering entering external capital markets. If this is a common occurrence, the observed positive association between the presence of political connections and the firm's bank loan access may partially stem from reverse causality.

Second, the omitted variable problem - in this context means that firms with political connections may possess other unobserved firm-specific characteristics that are not accounted for in the model, but which simultaneously affect both the connection status and access to bank loan financing. This correlation between firms' political connections and unobserved variables can potentially add bias to the results. For instance, firms with political connections may have higher growth or better performance, enabling them to obtain more bank credit.

To mitigate concerns about these endogeneity issues affecting the relationship, two approaches are employed in the rest of the study. First, I include instrumental variables (IVs) estimation based on the fixed effect two-stage least squares (FE-2SLS) method. Second, I consider the long-term tenure of politically connected executives.

IV Construction

In the spirit of Laeven & Levine (2009) and Lin et al. (2012), I calculate the proportion of connected firms within the industry sample and use it as an IV. As Agrawal & Knoeber (2001) point out, political connections might be particularly valuable in certain industries or sectors, meaning that as a consequence, firms in these sectors are more likely to bring in politically connected directors. Moreover, the industry trend variable is unlikely to directly influence the loan size of any particular firm except through the borrower's political connections (Lin et al. 2012).

State-Peer Political Connection Specifically, state-peer political connections within industries are calculated using the following equation:

$$Peer\_PC_{i,j,t} = \frac{\sum_{k \neq i}^{n_{j,t}} PC\_Dummy_{k,j,t}}{N_{j,t} - 1} \tag{5.2}$$

Here, the numerator $\sum_{k \neq i}^{n_{j,t}} PC\_Dummy_{k,j,t}$ captures the total number of other firms ($k \neq i$) building political connections in the same industry (j). The denominator $(N_{j,t} - 1)$ represents the total number of firms in the same industry (j), excluding firm i. This equation signifies the ratio of political connections built up by firm i's peers in the same industry j during the same year t.

Region-Peer Political Connection Additionally, firms may be influenced by geo-neighbouring peers within specific economic regions. This is particularly important in the Chinese context due to large differences in initial economic structure and resource bases among regions.

Region-peer political connections within industries are calculated as follows:

$$Peer\_PC_{i,IR,t} = \frac{\sum_{k \neq i}^{n_{IR,t}} PC\_Dummy_{k,IR,t}}{N_{IR,t} - 1} \tag{5.3}$$

where the numerator $\sum_{k \neq i}^{N_{IR,t}} PC\_Dummy_{k,IR,t}$ captures the total number of other firms ($k \neq i$) building up political connections in the same industry-region (IR). The denominator $(N_{IR,t} - 1)$ accounts for the total number of firms in the same industry-region (IR), excluding firm i.

The industry-region classifications are based on economic region divisions, namely: (1) Northeast economic zone; (2) Northern coastal economic zone; (3) Eastern coastal economic zone; (4) Southeast coastal economic zone; (5) Yellow River upper and middle economic zone; (6) Yangtze River upper and middle economic zone; (7) Pearl River upper and middle economic zone; and (8) Far Western economic zone. These economic regions share similar industrial structures and economic conditions, as shown in Table 5.11.

Table 5.11: Economic Regions of China

Zone	Province	Key Industries
Northesast	Liaoning	Heavy equipment and machinery manufacturing;
	Jilin	Energy and raw materials manufacturing;
	Heilongjiang	Corn, soybean, and sugar beet agriculture.
Northern Coastal	Beijing	High-tech research and manufacturing.
	Tianjin	
	Hebei	
	Shandong	
Eastern Coastal	Shanghai	Light industrial equipment
	Jiangsu	High-tech R&D and manufacturing
	Zhejiang	
Southeast Coastal	Guangdong	High-end durable and non-durable consumer goods
	Fujian	high-tech product manufacturing
	Hainan	
Yellow River	Shaanxi	Coal mining and processing
Upper and Middle	Gansu	Natural gas and hydropower development
	Ningxia	Steel industry, Non-ferrous metal industry,
	Shanxi	Equipment Manufacturing,
	Henan	high-tech industry
Yangtze River	Sichuan	Deep processing industries based on agricultural products
Upper and Middle	Chongqing	Raw material base for steel and non-ferrous metallurgy
	Hubei	transportation equipment industry
	Hunan	
	Anhui	
	Jiangxi	
Pearl River	Yunnan	Tourism along the Pearl River
Upper and Middle	Guizhou	R&D and production for traditional Chinese medicine and bioproducts
	Guangxi	
Far Western	Neimenggu	Agriculture
	Xinjiang	
	Qinghai	
	Tibet	

Source: The official website of China's State Council.

Rank-Neighbouring Political Connection Besides geo-neighbouring peers, firms are also likely to be influenced by peers with similar characteristics within the industry groups. Thus, by sorting firms in the same industry and the same year according to their total market value, I calculate the ratio of rank-neighbouring political connections to emphasise the potential influence of firms with similar characteristics on firm i in building up political connections:

$$Rank\_Neighbour\_PC_{i,j,t} = \frac{\sum_{k=i-m}^{i+m} PC\_Dummy_{k,j,t}}{2m} \quad \text{where} \quad k \neq i \tag{5.4}$$

where m denotes the relative position of firm i in the total market value ranking within its industry (j) and year (t). "Neighbouring" in ranking refers to firms that are close in rank, specifically those ranked 20% higher and 20% lower than firm i, respectively, are considered in the empirical analysis.[11]

Similarly, the ratio of Rank-Non-Neighbouring political connections is calculated as:

$$Rank\_Non\_Neighbour\_PC_{i,j,t} = \frac{\sum_{k\neq i}^{n_{j,t}} PC\_Dummy_{k,j,t} - \sum_{k=i-m}^{i+m} PC\_Dummy_{k,j,t}}{N_{k,j,t} - 2m - 1} \text{where} \quad k \neq i \tag{5.5}$$

IV Empirical Results

To address the possible endogeneity problem, I further estimate the empirical results of FE-2SLS estimation using different IVs. Political connections are instrumented with various measures of peer political connections, including (1) state-level peers in the same industry; (2) region-level peers in the same industry; and (3) the combination of state- and region-peers in the same industry; and (4) rank-(non-) neighbouring peers in the same industry.

Table 5.12 documents the empirical second-stage results of FE-2SLS estimation using total and long-term bank loan size as the dependent variable. Only the coefficients of interest are presented for reasons of brevity, and the untabulated results for other control variables are similar to those in Table 5.10.

The coefficient of both $Stimulus \times PC$ and PC to total bank loan size are insignificant in the baseline regressions in Table 5.10. However, after applying different IVs, as shown in Panel A, Table 5.12, the fitted values of $Stimulus \times PC$ become significantly positive in all cases, indicating that political connections were beneficial to firm bank loan access after the stimulus period. In particular, the fitted value of *PC_Dummy* becomes significantly positive in columns (1) and (4), implying that firms with political connections were able to obtain greater bank loans.

11. In the empirical analysis, other percentage rankings, ranging from 25% to 50%, are also considered. The results obtained from these alternative rankings were found to be similar to those from the 20% ranking, and are therefore not reported here.

Furthermore, all instruments pass the under-identification test at a 1% significance level, indicating no under-identification bias in the regression. The weak identification test rejects the null hypothesis that the instruments are weak, as the test statistics exceed the critical value based on 5% relative bias. Nevertheless, the combination of both industry-state and industry-region (IR) peer political connection estimation is the most valid IV for this research as the Cragg-Donald Wald F statistic value is the highest.

Columns (3) and (4) show the results of the FE-2SLE regressions I ran using two sets of instrumental variables in the first stage with a check on whether the results are influenced by over identification bias. Only the result in column (4) pass the overidentifying restrictions, as the Hansen J test result is insignificant (with p-value = 0.965). Therefore, they fail to reject the null hypothesis that the instrumental variables are uncorrelated with the residuals in the second-stage regression.

The results of the second stage using long-term bank loan size as the dependent variable are presented in Panel B, Table 5.12. The fitted values of the interactive term $\widehat{Stimulus} \times PC$ are positive and highly significant at the 1% level, with even larger magnitudes than the coefficient estimated from the baseline fixed effect regression in Table 5.10. As the IV regression addresses the downward bias in OLS, it is reasonable that the estimated coefficient in the FE-2SLS regression is larger than the coefficient in the FE regression.

It is interesting to note that the coefficients of *PC_Dummy* are still insignificant in all regressions although this effect is significant in some cases in the total bank loan regression using IVs. This result is consistent with the findings of a previous study by Liu et al. (2018) that firms' political connections play a more important role in financing short-term resources when compared to their long-term resources.

In addition, under-identification bias, weak-instrument bias, and over-identification bias are not concerns in any case in Panel B, Table 5.12.

The first-stage results in Table 5.13 show that $Stimulus \times PC$ is positively correlated with the instruments and their interactions with $Stimulus$ in all cases at the 1% significance level. PC is also significantly related to the instruments in all cases. This suggests the validity of the instruments employed in the regression.

Table 5.12: FE-2SLS Result Using IVs (Second Stage Results)

VARIABLE	(1)	(2)	(3)	(4)
Panel A: Total Bank Loan Size as Dependent Variable				
$\hat{Stimulus} \times PC$	0.890***	0.588**	0.621***	0.882**
	(0.329)	(0.291)	(0.237)	(0.350)
$\hat{PC\_Dummy}$	1.310*	-0.577	0.270	1.430**
	(0.699)	(0.735)	(0.481)	(0.697)
Observations	16,086	15,814	15,814	16,015
Number of firms	1,784	1,778	1,778	1,784
R-squared	0.601	0.714	0.699	0.587
Under identification test	12.414***	9.158***	21.851***	13.241***
Weak identification test	21.192	29.349	30.806	11.632
(Critical value)	(7.03)	(7.03)	(11.04)	(11.04)
Over identification test	-	-	7.459**	0.071
(P-value)	-	-	(0.024)	(0.965)
Panel B: Long-term Bank Loan Size as Dependent Variable				
$\hat{Stimulus} \times PC$	2.098***	2.149***	2.050***	1.805***
	(0.626)	(0.698)	(0.600)	(0.652)
$\hat{PC\_Dummy}$	-1.012	-1.125	-0.919	-1.780
	(1.203)	(1.441)	(0.913)	(1.082)
Observations	16,086	15,814	15,814	16,015
Number of firms	1,784	1,778	1,778	1,784
R-squared	0.531	0.534	0.532	0.535
Under identification test	12.414***	9.158***	21.851***	13.241***
Weak identification test	21.192	29.349	30.806	11.632
(Critical value)	(7.03)	(7.03)	(11.04)	(11.04)
Over identification test	-	-	0.111	0.985
(P-value)	-	-	(0.946)	(0.611)
Fixed Effects	YES	YES	YES	YES
Controls	YES	YES	YES	YES

Notes: In this table, $\hat{Stimulus} \times PC$ and $\hat{PC\_Dummy}$ are the predicted values of $Stimulus \times PC$ and PC estimated from the first stage regression. Instrumental variables for columns (1), (2), (3), and (4) are state-peer political connections, region-peer political connections, the combination of state- and region-peer political connections, and the combination of rank-neighbouring and rank-non-neighbouring political connections. The constant term, region dummies, industry dummies, and year dummies are included but not reported. Standing errors, which are based on robust standard error corrected for clustering at the firm level, are presented in the parentheses next to the estimates. Significance levels of 0.1, 0.05, and 0.01 are denoted by *, **, and ***, respectively. The under-identification test reports the Kleibergen-Paap Wald rk LM statistic, with the null hypothesis that the equation is under-identified. The weak identification test reports the Cragg-Donald Wald F statistic and its critical value to pass the weak identification test, with the null hypothesis that the equation is weakly identified by the instruments. The over-identification test reports the Hansen-J statistic and its p-value, with the null hypothesis that the instruments are uncorrelated with the error term, i.e., are valid instruments.

Table 5.13: FE-2SLS Result Using IVs (First Stage Results)

VARIABLE	(1)		(2)		(3)		(4)	
	PC_Dummy	$Sti \times PC$	*PC_Dummy*	$Sti \times PC$	*PC_Dummy*	$Sti \times PC$	*PC_Dummy*	$Sti \times PC$
$Stimulus \times IV(state)$	-0.072	0.813***			-0.134	0.599***		
	(0.100)	(0.083)			(0.146)	(0.100)		
Peer_Connection	-0.379***	-0.715***			-0.470***	-0.708***		
	(0.136)	(0.085)			(0.175)	(0.100)		
$Stimulus \times IV(region)$			0.031	0.510***	0.077	0.244***		
			(0.072)	(0.054)	(0.094)	(0.062)		
$IV(region)$			0.142**	0.215***	0.163*	0.006		
			(0.071)	(0.035)	(0.084)	(0.022)		
$Stimulus \times IV(neighbor)$							-0.159	0.229***
							(0.080)	(0.061)
$IV(neighbor)$							-0.041	-0.255***
							(0.076)	(0.031)
$Stimulus \times IV(non-nei)$							0.056	0.564***
							(0.096)	(0.079)
$IV(non-neighbor)$							-0.333***	-0.514***
							(0.117)	(0.064)

Notes: This table presents the first-stage results using IVs as dependent variables. columns (1), (2), (3), and (4) are state-peer political connections, region-peer political connections, the combination of state- and region-peer political connections, and the combination of rank-neighbouring and rank-non-neighbouring political connections. The constant term, region dummies, industry dummies, and year dummies are included but not reported.

Long-term Tenure of Politically Connected Executives

To further ensure that the results are not driven by reverse causality, I conduct additional tests using subsamples that are less prone to endogeneity concerns. Following the method applied by Huang et al. (2014) and Pan & Tian (2020), if an executive with political connections is appointed to facilitate bank loan finance, then the deal is likely to be announced shortly after that executive's appointment.

Table 5.14: FE-2SLS Result after Excluding Short-term Tenure Observations

VARIABLE	FE	FE-2SLS estimation			
$log(Loan_{it}+1)$	(1)	(2)	(3)	(4)	(5)
Panel A: Total					
$Stimulus \times PC\_Dummy$	0.096	0.832*	0.679	0.577*	0.798*
	(0.069)	(0.427)	(0.437)	(0.314)	(0.447)
PC_Dummy	-0.001	1.545*	-0.644	0.583	1.681**
	(0.074)	(0.803)	(1.082)	(0.602)	(0.822)
Observations	15,325	15,325	15,069	15,069	15,211
Number of firms	1,784	1,784	1,777	1,777	1,784
R-squared	0.546	0.603	0.713	0.689	0.592
Under identification test		13.365***	5.807**	21.142***	12.737***
Weak identification test		25.136	21.398	28.976	12.710
(Critical Value)		(7.03)	(7.03)	(11.04)	(11.04)
Over identification test		0.000	0.000	5.60*	0.498
Panel B: Long					
$Stimulus \times PC\_Dummy$	0.333**	2.818***	2.868***	2.62***	3.250***
	(0.168)	(0.818)	(1.012)	(0.783)	(0.877)
PC_Dummy	-0.187	-1.526	-1.475	-0.931	-1.940
	(0.171)	(1.360)	(2.124)	(1.143)	(1.312)
Observations	15,325	15,325	15,069	15,069	15,211
Number of firms	1,784	1,784	1,777	1,777	1,784
R-squared	0.280	0.527	0.526	0.522	0.523
Under identification test		13.365***	5.807**	21.142***	12.737***
Weak identification test		25.136	21.398	28.976	12.710
(Critical Value)		(7.03)	(7.03)	(11.04)	(11.04)
Over identification test		-	-	0.152	0.286
Fixed Effects	YES	YES	YES	YES	YES
Controls	YES	YES	YES	YES	YES

Notes: Firm/Industry/Province/Year fixed effects are included in the regressions. Instrumental variables for columns (2), (3), (4), and (5) are state-peer political connections, region-peer political connections, the combination of state- and region-peer political connections, and rank-neighbouring political connections. The Cragg-Donald Wald F statistic values are well above the corresponding critical value to pass the weak-identification test. The over-identification test reports the Hansen J statistic, which is well above the critical value for the overidentification test (0.05). Significance levels 0.1, 0.05, and 0.01 are noted by *, **, and *** respectively.

Therefore, I limit the empirical sample to observations that are less prone to endogeneity bias by excluding observations in which a politically connected chair or CEO's tenure is less than two years.

The subsample consists of 15,325 observations among 1,784 firms. Table 5.14 reports the empirical results of the FE estimation and FE-2SLS estimation using different types of instruments. The coefficients of interest are significantly positive in all the regressions. This supports the robustness of the findings in that the positive causal effect of the stimulus program and political connections on bank loan access persists even after excluding firms with a politically connected executive who has only held a short-term tenure.

5.4.5 Mechanism Analysis

Conditional Effects of Political Connections

In the above analysis, I assume that all types of political connections have the same effect on bank credit. However, in reality, their influence may not be homogeneous. Therefore, in this section, I provide further evidence to support the main argument by investigating different dimensions of political connections, including the length and "freshness" of such ties, as well as their categorisation into central and local affiliations.

Political Connections Conditional on Length and "Freshness" In addition to simply measuring the presence of political connections, it is interesting to discuss whether the intensity of such connections holds significance. Accordingly, I calculate a set of measures to explore the potential influence of connection strength on loan size. These measures include (1) the length of political connection, measured by the total tenure that connected executive served in the government - that is, if both the CEO and chair are politically connected, then the measure will be the average value of their tenure length; and (2) the freshness of political connection, measured by the maximum ratio of one over one plus the number of elapsed years since the most recent departure of either the politically connected CEO or chairperson. Specifically:

$$Freshness_T = \frac{1}{1 + max(T - T_{CEO\_Departure}, T - T_{Chair\_Departure})} \tag{5.6}$$

in which T represents the current year, and $T_{Departure}$ represents the departure year of the politically connected executive. The *max* function is used to select the most recent departure year between the CEO and chairperson. The resulting freshness ratio ranges between 0 and 1, with a higher value for fresher connections.

Information on executives' government experience is manually collected. The final dataset comprises 105 observations for the length and 605 observations for the "freshness" of political connections. The summary statistics are shown in Table 5.15.

Table 5.15: Summary Statistics: Length and "Freshness" of Political Connections

VARIABLE	Obs	Mean	Std. Dev.	Mix	Max
$ln(Length+1)$	105	2.059	0.668	0.693	3.850
$Freshness$	605	0.050	0.000	0.050	0.051

The minimum and maximum values of the length of political connections range from 0.693 to 3.850, revealing variations among the observed executives. Turning attention to the "freshness" of political connections, the mean value is found to be 0.050, with minimum and maximum values tightly grouped at 0.050 and 0.051, respectively. The standard deviation is reported as 0, indicating that the "freshness" values are exceptionally consistent across the 605 observations. This can be attributed to the limited sample range, covering the years 2003 to 2018.

Table 5.16 provides the FE and FE-2SLS estimation results employing the length of political connections as alternative measures. Four sets of instruments are used separately: state-peer political connections, region-peer political connections, the combination of state- and region-peer political connections, and the combination of rank-neighbouring and -non-neighbouring political connections.

Panel A reports the results with total bank loan size as the dependent variable. The interactive term of the stimulus package and the length of political connections is only significant in column (4). However, for long-term bank loan results in Panel B, no matter which instrument is used, the interactive term of the stimulus package and the length of political connections is always a significant and positive coefficient. This indicates that firms characterised by stronger political connections, as gauged by the tenure of executives in political roles, tended to secure heightened volumes of long-term bank loans following the 2009 credit expansion.

Table 5.16: Mechanism Analysis: Length of Political Connections

VARIABLE	FE	FE-2SLS estimation			
$log(Loan_{it}+1)$	(1)	(2)	(3)	(4)	(5)
Panel A: Total Bank Loan					
$Stimulus \times PC\_Dummy$	0.097	1.568	2.100	2.348*	2.887
	(0.109)	(5.137)	(1.366)	(1.331)	(1.818)
PC_Dummy	-0.084	-9.107	-1.151	-1.930	-3.167
	(0.088)	(6.225)	(1.592)	(1.485)	(2.009)
Observations	13,704	13,684	13,487	13,487	13,606
Number of Firms	1,730	1,730	1,719	1,719	1,729
R-squared	0.549	0.238	0.704	0.703	0.692
Under identification test	-	1.553	8.558***	8.837**	7.922**
Weak identification test	-	3.035	30.202	15.664	6.973
(Critical value)	-	(7.03)	(7.03)	(11.04)	(11.04)
Over identification test	-	-	-	8.208**	7.743**
Panel B: Long-term Bank Loan					
$Stimulus \times PC\_Dummy$	0.547**	11.565**	7.659**	8.515**	7.913**
	(0.254)	(4.792)	(3.341)	(3.449)	(4.035)
PC_Dummy	-0.432*	-4.023	-3.611	-4.527	-5.505
Observations	13,704	13,684	13,487	13,487	13,606
Number of Firms	1,730	1,730	1,719	1,719	1,729
R-squared	0.283	0.403	0.493	0.488	0.500
Under identification test	-	1.553	8.558***	8.837**	7.922**
Weak identification test	-	3.035	30.202	15.664	6.973
(Critical value)	-	(7.03)	(7.03)	(11.04)	(11.04)
Over identification test	-	-	-	0.490	2.412
Fixed Effects	YES	YES	YES	YES	YES
Controls	YES	YES	YES	YES	YES

Notes: Firm/Industry/Province/Year fixed effects are included in the regressions. Instrumental variables for columns (2), (3), (4), and (5) are state-peer political connections, region-peer political connections, the combination of state- and region-peer political connections, and rank-neighbouring political connections. The Cragg-Donald Wald F statistic values are well above the corresponding critical value to pass the weak-identification test. The over-identification test reports the Hansen J statistic, which is well above the critical value for the overidentification test (0.05). Significance levels 0.1, 0.05, and 0.01 are noted by *, **, and *** respectively.

Table 5.17: Mechanism Analysis: "Freshness" of Political Connections

VARIABLE	FE	FE-2SLS estimation			
$\log(Loan_{it}+1)$	(1)	(2)	(3)	(4)	(5)
Panel A: Total Bank Loan					
$Sitmulus \times PC\_Dummy$	4.649	51.561**	15.277	28.029**	47.903***
	(2.864)	(19.017)	(15.769)	(11.586)	(18.199)
PC_Dummy	-4.606*	32.486	-28.116	-3.157	34.191
	(2.731)	(23.565)	(25.889)	(18.235)	(25.194)
Observations	14,127	14,107	13,882	13,882	14,022
Number of firms	1,728	1,728	1,720	1,720	1,728
R-squared	0.547	0.592	0.711	0.704	0.597
Under identification test	-	9.962***	5.402**	13.670***	9.828***
Weak identification test	-	17.901	29.810	27.639	8.815
(Critical value)	-	(7.03)	(7.03)	(11.04)	(11.04)
Over identification test	-	-	-	7.429**	1.663
Panel B: Long-term Bank Loan					
$Sitmulus \times PC\_Dummy$	10.868*	66.321*	72.487**	76.974**	52.735
	(6.347)	(34.715)	(32.860)	(30.886)	(35.807)
PC_Dummy	-12.132*	-71.659*	-32.161	-47.033	-84.094**
	(6.282)	(39.005)	(48.386)	(34.097)	(41.275)
Observations	14,127	14,107	13,882	13,882	14,022
Number of firms	1,728	1,728	1,720	1,720	1,728
R-squared	0.280	0.531	0.527	0.530	0.522
Under identification test	-	9.962***	5.402**	13.670***	9.828**
Weak identification test	-	17.901	29.810	27.639	8.815
(Critical value)	-	(7.03)	(7.03)	(11.04)	(11.04)
Over identification test	-	-	-	0.221	0.215
Fixed Effects	YES	YES	YES	YES	YES
Controls	YES	YES	YES	YES	YES

Notes: Firm/Industry/Province/Year fixed effects are included in the regressions. Instrumental variables for columns (2), (3), (4), and (5) are state-peer political connections, region-peer political connections, the combination of state- and region-peer political connections, and rank-neighbouring political connections. The Cragg-Donald Wald F statistic values are well above the corresponding critical value to pass the weak-identification test. The over-identification test reports the Hansen J statistic, which is well above the critical value for the overidentification test (0.05). Significance levels 0.1, 0.05, and 0.01 are noted by *, **, and *** respectively.

Beyond the length, one may posit that the temporal proximity of an executive's tenure in a political role might amplify their value. Table 5.17 shows the estimation results of the "freshness" of political connections. The coefficient of the interactive term is positive and significant in most cases in both panels. Although in columns (2) and (5), the coefficients of political connection proximity are significantly negative, they become insignificant in column (4), which applies the most valid IV for this research as the Cragg-Donald Wald F statistic value is the highest. This result underscores that the "fresher" the political connection, the greater the bank loans received after the stimulus package.

Overall, these results find consistent evidence that "stronger" political connections help firms obtain more external bank loans than their nonconnected peers.

Political Connections Conditional on Central and Local Ties Due to the administrative decentralisation in China, local governments have the authority to allocate resources within a particular region, and to establish more beneficial policies when dealing with enterprise-related affairs (Xu 2011). Central-level connections may be less influential in terms of resource allocation, or they may have a more diluted impact on individual firms compared to local-level connections.

To explore whether the effects of political connections are driven by local governments, I repeat the above analysis by categorising the appointments of ex-government officials as either central (appointments above the provincial level) or local connections (appointments at or below the provincial level). Two dummy variables, *Central_Dummy*, and *Local_Dummy*, are employed to capture these distinctions. These variables are assigned a value of 1 if a firm is politically connected at the central or local level, and 0 otherwise.

Table 5.18 presents the results of the influence of different levels of political connections on firms' access to bank credit. Columns (1) and (2) display the FE estimation results of full samples, while columns (3) and (4) display the FE estimation results excluding observations in which a politically connected chair or CEO's tenure is less than two years to partially address the endogeneity concern. Both *Central_Dummy* and *Local_Dummy* are included in one model.[12] To enhance the reliability of the regression results, cases where an executive possesses both central and local government working experience, are excluded.

The results show that the previous findings are mainly driven by local political connections, reflected by significant and positive coefficients of the interactive term $Stimulus \times Local\_Dummy$ in columns (2) and (4), and insignificant coefficients of $Stimulus \times Central\_Dummy$. This finding highlights the importance of local political connections for firms in securing bank credit.

12. The results of including either *Central_Dummy* or *Local_Dummy* separately in the regression model are similar.

Table 5.18: Mechanism Analysis: Central versus Local Connections

VARIABLE	FE Estimation		PC More than 2 years	
$\log(Loan_{it}+1)$	Total (1)	Long-term (2)	Total (3)	Long-term (4)
$Stimulus \times Central\_Dummy$	-0.169	-0.017	-0.217	-0.036
	(0.169)	(0.279)	(0.153)	(0.278)
$Central\_Dummy$	-0.017	-0.097	-0.028	0.004
	(0.142)	(0.249)	(0.149)	(0.242)
$Stimulus \times Local\_Dummy$	0.095	0.289*	0.113	0.342*
	(0.060)	(0.158)	(0.072)	(0.181)
$Local\_Dummy$	-0.003	-0.21	-0.024	-0.197*
	(0.063)	(0.155)	(0.079)	(0.184)
Observations	16,051	16,051	15,288	15,288
Number of firms	1,784	1,784	1,784	1,784
R-squared	0.546	0.280	0.547	0.280
Firm/Industry/Province/Year FE	YES	YES	YES	YES
Controls	YES	YES	YES	YES

Notes: The constant term, region dummies, industry dummies, and year dummies are included but not reported. Standing errors, which are based on robust standard error corrected for clustering at the firm level, are presented in the parentheses below the estimates. Significance levels 0.1, 0.05, and 0.01 are noted by *, **, and *** respectively.

Probity and the Value of Political Connections

The existing literature suggests that the value of political connections may vary across countries (Faccio et al. 2006). Political connections are prevalent in underdeveloped countries with high levels of corruption, as politicians are more likely to be directly involved in the allocation of bank lending (Beck & Demirguc-Kunt 2006, Dinç 2005, Faccio et al. 2006, Fisman 2001).

In addition, the value of political connections may also vary depending on the probity of firms. Leuz & Oberholzer-Gee (2006) argue there is an interesting substitution relationship between political connections and transparency. Chaney et al. (2011) show that politically connected firms are not penalised in the lending market for their lower-quality disclosures. Similarly, Houston et al. (2014) find that while firms with less transparent accounting statements pay higher loan costs, these effects are significantly reduced if they have political connections.

This subsection tests how political connections influence the links between accounting transparency and firm bank loan financing via subgroups based on the probity of regions and firms. Three proxies are employed to measure the relationship between probity and the value of political connections. The regional-level measure is the average number of prosecuted corruption cases in each province, sourced from the *Procuratorial Yearbook of China* for 2003-2018. The measures of a firm's probity are (1) the degree of accounting transparency from an annual survey conducted by the Shenzhen Stock Exchange, and (2) whether the firm's auditor is one of the Big Four accounting companies.

Table 5.19 displays the second-stage results of subgroup FE-2SLS estimation, focusing on the corruption levels of different provinces. The coefficients of $Stimulus \times PC$ are consistently positive and statistically significant among firms situated in provinces with higher corruption levels in most cases.

Table 5.20 presents the results of the subgroups based on the firms' transparency, specifically focusing on how firms' levels of financial reporting transparency influence the relationship between political connections and bank loan size. Notably, the coefficients of $Stimulus \times PC$ remain significantly positive among firms with lower transparency in most cases, and insignificant among firms with higher transparency in all cases.

Table 5.21 shows the results of the subgroup analysis based on the firm's choice of auditor. Here, the coefficients of $Stimulus \times PC$ are significantly positive only among firms whose auditor is not one of the Big Four accounting companies.

Overall, the positive relationship between political connections and loan size is stronger in provinces with more corruption cases and among firms with lower transparency and poorer auditing quality.

Table 5.19: Mechanism Analysis: Region's Corruption Level and the Value of Political Connections

VARIABLE	FE		FE-2SLS Estimation							
$\log(Loan_{it}+1)$	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Panel A: Total	High	Low	High	Low	High	Low	High	Low	High	Low
$Stimulus \times PC$	0.105	0.044	1.272**	0.625	0.667	1.672	0.997***	0.434	1.138**	0.769*
	(0.073)	(0.091)	(0.549)	(0.461)	(0.421)	(1.723)	(0.384)	(0.398)	(0.506)	(0.436)
PC_Dummy	-0.072	0.075	2.082	0.927	0.486	-4.009	0.930	-0.359	1.656*	0.612
	(0.065)	(0.101)	(1.387)	(0.720)	(0.695)	(3.334)	(0.649)	(0.723)	(0.865)	(0.788)
R-squared	0.554	0.527	0.417	0.705	0.657	0.514	0.602	0.762	0.501	0.720
Under identification test			6.085**	6.592**	6.697***	1.759	11.716***	10.684**	11.964***	9.548**
Weak identification test			7.949	13.127	22.214	4.627	17.887	10.786	6.031	5.854
(Critical value)			(7.03)	(7.03)	(7.03)	(7.03)	(11.04)	(11.04)	(11.04)	(11.04)
Over identification test			-	-	-	-	3.247	7.305**	1.859	0.282
Panel B: Long-term	High	Low	High	Low	High	Low	High	Low	High	Low
$Stimulus \times PC$	0.34*	0.221	2.608**	1.017	2.139**	4.483	2.808***	0.793	3.138***	1.272
	(0.197)	(0.21)	(0.996)	(0.797)	(0.990)	(3.430)	(0.886)	(0.839)	(1.045)	(0.868)
PC_Dummy	-0.191	-0.245	-2.163	0.052	0.485	-8.790	-0.575	-0.697	-1.702	-1.116
	(0.191)	(0.208)	(1.796)	(1.520)	(1.570)	(6.678)	(1.203)	(1.237)	(1.468)	(1.482)
R-squared	0.294	0.253	0.483	0.610	0.438	0.209	0.454	0.621	0.472	0.616
Under identification test			6.085**	6.592**	6.697***	1.759	11.716***	10.684**	11.964***	9.548**
Weak identification test			7.949	13.127	22.214	4.627	17.887	10.786	6.031	5.854
(Critical value)			(7.03)	(7.03)	(7.03)	(7.03)	(11.04)	(11.04)	(11.04)	(11.04)
Over identification test			-	-	-	-	2.428	8.624***	0.458	2.369
Observations	9,583	6,525	9,567	6,519	9,431	6,383	9,431	6,383	9,507	6,471
No. of Firms	1,662	814	1,667	813	1,650	807	1,650	807	1,658	808
Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Fixed Effects	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Notes: "High" indicates firms located in high-corruption level provinces, while "Low" indicates that firms located in low-corruption level provinces. Firm/Industry/Province/Year fixed effects are included in the regressions. Instrumental variables for columns (3)(4), (5)(6), (7)(8), and (9)(10) are state-peer political connections, region-peer political connections, the combination of state- and region-peer political connections, and rank-neighbouring political connections. Under, weak, and over identification tests are the same ones used in previous tables. Significance levels 0.1, 0.05, and 0.01 are noted by *, **, and *** respectively.

Table 5.20: Mechanism Analysis: Firm's Transparency and the Value of Political Connections

VARIABLE	FE		FE-2SLS Estimation							
$\log(Loan_{it}+1)$	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Panel A: Total	High	Low	High	Low	High	Low	High	Low	High	Low
$Stimulus \times PC$	0.007	0.052	0.487	0.833**	-0.072	0.807**	0.270	0.734**	1.915	0.801**
	(0.085)	(0.073)	(0.614)	(0.376)	(0.980)	(0.330)	(0.561)	(0.310)	(0.585)	(0.326)
PC_Dummy	0.009	0.013	1.745*	0.975	-1.251	0.136	1.296	0.580	1.045	0.560
	(0.077)	(0.078)	(0.993)	(0.870)	(3.994)	(0.840)	(1.025)	(0.640)	(0.707)	(0.744)
R-squared	0.568	0.508	0.584	0.638	0.653	0.709	0.639	0.683	0.659	0.680
Under identification test			7.887***	7.804***	0.438	8.335***	7.110*	14.993***	15.278***	12.364**
Weak identification test			13.660	9.771	1.615	17.814	7.494	15.959	9.292	10.264
(Critical value)			(7.03)	(7.03)	(7.03)	(7.03)	(11.04)	(11.04)	(13.97)	(13.97)
Over identification test			-	-	-	-	3.561	0.98	6.249	3.60
Panel B: Long-term	High	Low	High	Low	High	Low	High	Low	High	Low
$Stimulus \times PC$	0.041	0.378*	1.491	2.153***	1.222	2.204***	1.563	2.169***	1.983	2.428
	(0.197)	(0.202)	(1.147)	(0.739)	(1.742)	(0.779)	(1.207)	(0.728)	(1.371)	(0.733)
PC_Dummy	0.041	-0.373*	0.324	-2.108	0.445	-0.929	0.475	-1.142	-0.286	-1.908
	(0.195)	(0.196)	(1.656)	(1.541)	(6.089)	(1.608)	(1.747)	(1.142)	(1.250)	(1.846)
R-squared	0.293	0.261	0.475	0.575	0.478	0.572	0.468	0.576	0.476	0.575
Under identification test			7.887***	7.804***	0.438	8.335***	7.110*	14.993***	16.642***	6.842*
Weak identification test			13.660	9.771	1.615	17.814	7.494	15.959	11.151	2.980
(Critical value)			(7.03)	(7.03)	(7.03)	(7.03)	(7.03)	(11.04)	(11.04)	(11.04)
Over identification test			-	-	-	-	0.156	0.23	0.935	0.06
Observations	9,583	6,525	9,567	6,519	9,431	6,383	9,431	6,383	9,507	6,471
No. of Firms	1,662	814	1,667	813	1,650	807	1,650	807	1,658	808
Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Fixed Effects	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Notes: "High" indicates firms with a higher degree of transparency, while "Low" indicates that firms with a lower degree of transparency. Firm/Industry/Province/Year fixed effects are included in the regressions. Instrumental variables for columns (3)(4), (5)(6), (7)(8), and (9)(10) are state-peer political connections, region-peer political connections, the combination of state- and region-peer political connections, and rank-neighbouring political connections. Under, weak, and over identification tests are the same ones used in previous tables. Significance levels 0.1, 0.05, and 0.01 are noted by *, **, and *** respectively.

Table 5.21: Mechanism Analysis: Firm's Auditor Quality and the Value of Political Connections

VARIABLE	FE Estimation		FE-2SLS Estimation							
$\log(Loan_{it}+1)$	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Panel A: Total	High	Low	High	Low	High	Low	High	Low	High	Low
$Stimulus \times PC$	-0.118	0.075	1.450	1.068*	-0.220	0.622*	0.471	0.812***	0.614	1.030***
	(0.198)	(0.057)	(1.480)	(0.569)	(1.747)	(0.330)	(1.033)	(0.258)	(0.788)	(0.276)
PC_Dummy	0.039	-0.011	-2.487	2.125	1.164	-0.212	-0.123	-0.379	0.692	0.061
	(0.217)	(0.058)	(3.962)	(6.147)	(3.115)	(0.696)	(1.877)	(0.635)	(0.867)	(1.460)
R-squared	0.491	0.542	0.727	0.382	0.748	0.640	0.787	0.639	0.743	0.619
Under identification test			0.609	0.278	0.987	11.556***	3.582	12.480***	6.837*	3.402
Weak identification test			0.639	0.485	1.561	36.338	2.016	20.412	2.423	1.690
(Critical value)			(7.03)	(7.03)	(7.03)	(7.03)	(11.04)	(11.04)	(11.04)	(11.04)
Over identification test			-	-	-	-	1.03	1.759	2.65	1.257
Panel B: Long-term	High	Low	High	Low	High	Low	High	Low	High	Low
$Stimulus \times PC$	0.471	0.199	6.521	1.488	0.827	2.203***	3.304	2.303***	3.005*	2.663***
	(0.465)	(0.150)	(4.695)	(2.925)	(5.034)	(0.715)	(2.333)	(0.641)	(1.669)	(1.020)
PC_Dummy	-0.420	-0.163	-11.260	-15.216	3.804	-0.416	-1.701	-0.961	0.845	-5.486
	(0.420)	(0.153)	(12.034)	(27.324)	(8.913)	(1.333)	(3.346)	(1.192)	(1.990)	(3.403)
R-squared	0.269	0.274	0.103	-1.895	0.421	0.469	0.659	0.478	0.546	0.326
Under identification test			0.609	0.278	0.987	11.556***	3.582	12.480***	6.837*	3.402
Weak identification test			0.639	0.485	1.561	36.338	2.016	20.412	2.423	1.690
(Critical value)			(7.03)	(7.03)	(7.03)	(7.03)	(11.04)	(11.04)	(11.04)	(11.04)
Over identification test			-	-	-	-	1.64	3.172	4.51	1.694
Observations	1,178	14,930	1,178	14,908	1,148	14,666	1,148	14,666	1,166	14,812
No. of Firms	174	1,718	174	1,718	171	1,712	171	1,712	173	1,718
Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Fixed Effects	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Notes: "High" indicates firms with one of the Big Four auditing companies as the auditor, thereby having a higher auditing quality. while "Low" indicates that firms without any Big Four auditing company as the auditor, thereby having a lower auditing quality. Firm/Industry/Province/Year fixed effects are included in the regressions. Instrumental variables for columns (3)(4), (5)(6), (7)(8), and (9)(10) are state-peer political connections, region-peer political connections, the combination of state- and region-peer political connections, and rank-neighbouring political connections. Under, weak, and over identification tests are the same ones used in previous tables. Significance levels 0.1, 0.05, and 0.01 are noted by *, **, and *** respectively.

Additional Test: Firm Ownership and the Value of Political Connections

According to the resource-based theory, the value of political connections is primarily driven by the firm's ties with the government. For privately owned firms that operate in weak institutional environments and which lack ties with the government, having a politically connected executive helps them to overcome market and institutional barriers and to seek favourable treatment from the government (Firth et al. 2009, Li et al. 2008). However, government ownership represents a much more direct tie with the government than having a politically connected executive. The value of a connected executive among SOEs may be diluted by government ownership, and a firm having a connected executive does not ensure that it will obtain favourable treatment from the government. Therefore, the existing literature generally analyses the effects of political connections among private firms only (Li et al. 2008, Pan & Tian 2020).

To verify whether the effect of political connections on bank loans differs across ownership types, I divide the sample into two groups: SOEs and non-SOEs and re-estimate the regression equation. The outcomes for these two subsets are outlined in Table 5.22. Notably, the coefficients of $Stimulus \times PC$ in total bank loan size regressions, shown in Panel A, are only significant for private firms in most cases, lending empirical support to the premises of the resource-based theory.

However, in Panel B, the coefficients in long-term bank loan size regressions present mixed results. This may be due to the fact that long-term loans are usually issued based on other characteristics such as stable bank-firm relationships, which dilutes the role of political connections to a certain extent.

Table 5.22: Mechanism Analysis: Firm's Ownership

VARIABLE	FE Estimation		FE-2SLS Estimation							
$ln(Loan_{it}+1)$	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Panel A: Total	SOE	Non-	SOE	Non-	SOE	Non-	SOE	Non-	SOE	Non-
$Stimulus \times PC$	-0.016	0.259**	0.373	2.817*	0.478	2.761	0.218	2.309*	0.381	3.373*
	(0.067)	(0.119)	(0.385)	(1.493)	(0.512)	(1.994)	(0.293)	(1.186)	(0.364)	(1.769)
PC_Dummy	-0.006	0.025	1.351**	1.007	-0.507	0.472	0.390	0.289	1.063*	1.768
	(0.069)	(0.113)	(0.643)	(2.157)	(1.112)	(1.233)	(0.501)	(0.939)	(0.557)	(2.661)
R-squared	0.505	0.582	0.607	0.484	0.697	0.482	0.710	0.589	0.643	0.313
Under identification test			15.936***	2.062	6.153**	1.994	25.388***	6.311*	17.441***	2.197
Weak identification test			20.555	3.683	12.846	5.918	20.222	4.805	11.070	2.207
(Critical value)			(7.03)	(7.03)	(7.03)	(7.03)	(11.04)	(11.04)	(11.04)	(11.04)
Over identification test			-	-	-	-	5.656*	1.42	0.218	0.89
Panel B: Long-term	SOE	Non-	SOE	Non-	SOE	Non-	SOE	Non-	SOE	Non-
$Sitmulus * PC$	0.13	0.756***	1.669**	8.048*	1.592	10.136	1.631**	10.139**	1.665**	7.288
	(0.169)	(0.274)	(0.746)	(4.690)	(1.035)	(6.501)	(0.732)	(4.353)	(0.747)	(5.210)
PC_Dummy	-0.243	-0.180	0.312	-6.700	-1.218	-3.038	-0.662	-3.028	0.491	-7.250*
	(0.169)	(0.263)	(1.065)	(4.105)	(2.204)	(4.503)	(0.928)	(2.936)	(0.903)	(3.949)
R-squared	0.257	0.308	0.546	0.358	0.590	0.155	0.584	0.154	0.578	0.352
Under identification test			15.936***	2.062	4.613**	0.905	25.388***	7.245*	17.441***	2.197
Weak identification test			20.555	3.683	9.598	2.587	20.222	4.089	11.070	2.207
(Critical value)			(7.03)	(7.03)	(7.03)	(7.03)	(11.04)	(11.04)	(11.04)	(11.04)
Over identification test			-	-	-	-	1.412	0.000	1.230	1.54
Observations	7,136	8,972	7,120	8,966	6,939	8,875	6,939	8,875	7,049	8,929
Number of firms	627	1,157	627	1,157	625	1,153	625	1,153	627	1,157
Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Fixed Effects	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Notes: "SOE" indicates state-owned firms, while "Non-" indicates non-state-owned firms. Firm/Industry/Province/Year fixed effects are included in the regressions. Instrumental variables for columns (3)(4), (5)(6), (7)(8), and (9)(10) are state-peer political connections, region-peer political connections, the combination of state- and region-peer political connections, and rank-neighbouring political connections. Under, weak, and over identification tests are the same ones used in previous tables. Significance levels 0.1, 0.05, and 0.01 are noted by *, **, and *** respectively.

5.4.6 Robustness Check

Alternative Measure of Political Connections

Following Liu et al. (2013), I apply the founder's connections (*PC_Founder*), defined as a firm having a politically connected founder when it was established, as the new measure of political connections of firms. This variable is exogenous because it cannot be influenced by other factors.

In the full sample, 5.7% of firms were established by politically connected founders, with a standard deviation value of 0.233. Table 5.23 provides the results of the univariate test for bank loan size, indicating that firms with politically connected founders have a significantly larger amount of long-term bank loans than firms without.

Table 5.23: Univariate Test: Founder's Political Connections

VARIABLE	Full	$PC\_Founder = 0$	$PC\_Founder = 1$	Difference (t-value)
$Ln(TotalLoan_{it}+1)$	6.125	6.118	6.251	-0.133*** (-2.044)
Before	5.941	5.949	5.836	0.113 (1.032)
After	6.171	6.159	6.383	-0.224 (-2.89)
Difference (t-value)	-0.230***	-0.210***	-0.547***	
Before versus After	(-6.052)	(-5.317)	(-3.961)	
$Ln(LongLoan_{it}+1)$	3.589	3.578	3.768	-0.190* (-1.821)
Before	3.279	3.296	3.060	0.236 (1.195)
After	3.666	3.647	3.993	0.0346*** (-2.848)
Difference	-0.387***	-0.351	-0.933	
Before versus After	(-6.364)	(-5.581)	(-4.040)	

Notes: This table summarizes the univariate tests between firms with and without politically connected founders. These variables are defined as in the previous tables. ***, **, * correspond to p-values of 1%, 5%, and 10%, respectively.

The regression results in Table 5.24 show that the interactive term between *Stimulus* and *PC_Founder* is significantly positively associated with the amount of long-term bank loans, thus confirming the robustness of the baseline results.

Table 5.24: Robustness Check: Founder's Political Connections

VARIABLE $ln(Loan_{it}+1)$	Total (1)	Long-term (2)
$Stimulus \times PC\_Founder$	0.094 (0.107)	0.365* (0.219)
Observations	16,108	16,108
Number of firms	1,784	1,784
R-squared	0.545	0.280
Firm/Industry/Province/Year FE	YES	YES
Controls	YES	YES

Notes: The constant term, region dummies, industry dummies, and year dummies are included but not reported. Standing errors, which are based on robust standard error corrected for clustering at the firm level, are presented in the parentheses below the estimates. Significance levels 0.1, 0.05, and 0.01 are noted by *, **, and *** respectively.

Alternative Measure of Bank Loan Size

Additionally, I also repeat the bank loan equation estimation using the ratio of bank loans to total assets as a robustness check. The results, shown in Table 5.25, remain quantitatively similar to the main results reported in previous tables, thereby confirming that the main findings are robust across alternative measurements.

Industry-Province Cluster Standard Errors

To ensure the robustness of the findings, I conduct estimations using an industry-province cluster, with the results presented in Table 5.26. By employing this clustering method, the analysis accounts for potential heterogeneity across different industries and provinces, thereby strengthening the reliability of the conclusions drawn.

The estimation results reaffirm the consistent and robust nature of the relationship between political connections and firms' access to bank credit. Despite the inclusion of industry and province clustering, the overall conclusion is unchanged.

Table 5.25: Robustness Check: Alternative Measure of Bank Loans

VARIABLE	FE-2SLS estimation			
$Loan_{it}/Asset_{it}$	(1)	(2)	(3)	(4)
Panel A: Total Bank Loans				
$Stimulus \times PC$	0.060*	0.043	0.044	0.063*
	(0.037)	(0.036)	(0.034)	(0.038)
PC_Dummy	0.085	0.020	0.063	0.082
	(0.070)	(0.087)	(0.063)	(0.059)
Observations	16,086	15,814	15,614	15,978
Number of firms	1,784	1,778	1,778	1,784
R-squared	0.274	0.354	0.317	0.276
Under identification test	12.414***	9.158***	21.851***	18.570***
Weak identification test	21.192	29.349	30.806	11.389
(Critical value)	(7.03)	(7.03)	(11.04)	(11.04)
Over identification test	-	-	1.287	5.777*
Panel B: Long-term Bank Loans				
$Stimulus \times PC$	0.059**	0.068**	0.061**	0.068**
	(0.028)	(0.032)	(0.028)	(0.029)
PC_Dummy	-0.032	0.021	0.014	-0.039
	(0.048)	(0.068)	(0.046)	(0.039)
Observations	16,086	15,814	15,614	15,978
Number of firms	1,784	1,778	1,778	1,784
R-squared	0.361	0.276	0.306	0.357
Under identification test	12.414***	9.158***	21.851***	18.570***
Weak identification test	21.192	29.349	30.806	11.389
(Critical value)	(7.03)	(7.03)	(11.04)	(11.04)
Over identification test	-	-	0.752	1.339
Fixed Effects	YES	YES	YES	YES
Controls	YES	YES	YES	YES

Notes: Firm/Industry/Province/Year fixed effects are included in the regressions. Instrumental variables for columns (1), (2), (3), and (4) are state-peer political connections, region-peer political connections, the combination of state- and region-peer political connections, and rank-neighbouring political connections. The Cragg-Donald Wald F statistic values are well above the corresponding critical value to pass the weak-identification test. The over-identification test reports the Hansen J statistic, which is well above the critical value for the overidentification test (0.05). Significance levels 0.1, 0.05, and 0.01 are noted by *, **, and *** respectively.

Table 5.26: Robustness Check: Standard Errors Clustered at the Industry-province Level

VARIABLE	FE-2SLS Estimation			
$ln(Loan_{it}+1)$	(1)	(2)	(3)	(4)
Panel A: Total Bank Loans				
$Stimulus \times PC$	0.890**	0.588*	0.621**	0.888***
	(0.345)	(0.305)	(0.245)	(0.316)
PC_Dummy	1.310	-0.577	0.270	1.095*
	(0.804)	(0.693)	(0.461)	(0.644)
Observations	16,086	15,814	15,814	15,978
Number of firms	1,784	1,778	1,778	1,784
R-squared	0.600	0.714	0.699	0.624
Under identification test	9.925***	6.805***	17.369***	15.369***
Weak identification test	21.192	29.349	30.806	11.389
(Critical Value)	(7.03)	(7.03)	(11.04)	(11.04)
Over identification test	-	-	6.216**	2.41
Panel B: Long-term Bank Loans				
$Stimulus \times PC$	2.098**	2.149***	2.050***	2.412***
	(0.732)	(0.807)	(0.690)	(0.785)
PC_Dummy	-1.012	-1.252	-0.919	-1.488
	(1.229)	(1.572)	(0.970)	(1.038)
Observations	16,086	15,814	15,814	15,978
Number of firms	1,784	1,778	1,778	1,784
R-squared	0.531	0.534	0.532	0.530
Under identification test	9.925***	6.805***	17.369***	15.369***
Weak identification test	21.192	29.349	30.806	11.389
(Critical Value)	(7.03)	(7.03)	(11.04)	(11.04)
Over identification test	-	-	0.097	0.681
Fixed Effects	YES	YES	YES	YES
Controls	YES	YES	YES	YES

Notes: Firm/Industry/Province/Year fixed effects are included in the regressions. Instrumental variables for columns (1), (2), (3), and (4) are state-peer political connections, region-peer political connections, the combination of state- and region-peer political connections, and rank-neighbouring political connections. The Cragg-Donald Wald F statistic values are well above the corresponding critical value to pass the weak-identification test. The over-identification test reports the Hansen J statistic, which is well above the critical value for the overidentification test (0.05). Significance levels 0.1, 0.05, and 0.01 are noted by *, **, and *** respectively.

5.5 Further Analysis: Process of Bank Credit Allocation

A comprehensive investigation into the determinants of bank credit allocation should consider both the demand and supply aspects of the process. Specifically, the *Self Selection Process* reflects the demand side, where firms apply for credit, while the *Bank Selection Process* pertains to the supply side, where banks decide which firms to lend to and set the terms of a bank loan contract. However, the existing literature has largely overlooked the former due to data limitations.

In the previous analysis, I explored whether and how political connections affected bank loan size after the stimulus package. In this section, based on a novel dataset, I aim to examine the *Self Selection Process* of firms and the subsequent *Bank Selection Process*. The results will contribute to a deeper understanding of the bank credit allocation process in the context of China's 4-trillion Yuan stimulus package.

5.5.1 Data and Variable

The data used in this section is sourced from the *Bank Loan data set* of the CSMAR database, which provides detailed information on individual bank loan transactions. This dataset covers various aspects of each loan announcement, including the loan amount, interest rate, loan maturity, lending bank, and indicators such as whether the loan was/is guaranteed by a third party or secured by collateral. It is worth noting that according to the China Securities Regulatory Commission (CSRC), Chinese listed firms are required to disclose bank loans that either exceed 10% of their equity book value, or are valued at more than 10 million RMB. Consequently, the sample of bank loans comprises both large transactions, which are disclosed compulsorily, and smaller loans, which are disclosed voluntarily.

Using the *Bank Loan dataset* from CSMAR, I identify both successful and unsuccessful bank loan announcements (the latter category reflects a firm's intention of seeking a loan without eventually being granted it), and then match this information with the firm-level dataset used in the baseline regression to examine several key variables, including the number of bank loan

announcements made by each firm, the number of successful bank loan announcements, and the approval rate. These variables offer insights into firms' willingness to apply for bank loans and the decisions made by banks regarding these applications. Panel A of Table 5.27 presents the definitions of these variables.

Across the sample, 8,346 firm observations involve bank loan announcements, with an average of eight announcements per firm. However, only 495 firm observations successfully secured bank loan contracts, averaging three contracts per firm. The average approval rate for these loan announcements is 4.7%.

Qian & Strahan (2007) and Graham et al. (2008) emphasise the importance of bank loan terms in loan contracts for firms. Therefore, I merge the successful bank loan announcements with the firm-level dataset used in the baseline regression to investigate changes in the following major bank loan terms: interest rate spread, loan size, maturity, and whether the loan is secured by collateral. Definitions and summary statistics for these variables are presented in Panel B of Tables 5.27 and 5.28.

Table 5.27: Definition of Variables

Variable	Definition
Panel A: Firm	
$Application\_Dummy$	A dummy variable that equals one if a firm intends to apply for a bank loan
$Ln(Application)$	Natural logarithm of the number of loan announcements made by a firm
$Secure\_Dummy$	A dummy variable that equals one if a firm is successful in receiving a loan
$Ln(Secure)$	Natural logarithm of the number of loans successfully obtained by a firm
$Approval$	Ratio of loan contracts to loan announcements
Panel B: Individual	
$LoanSize$	Natural log of the amount of the loan
$Spread$	Ratio of lending bank interest rate to the benchmark rate issued by PBOC
$Maturity$	Natural logarithm of the actual term of bank loans in months
$D_{Collateral}$	A dummy variable that equals one if the loan is secured by collateral

The sample comprises 2,586 contract observations where loans were granted to 358 firms between 2003 and 2018. Among these observations, 337 (approximately 13.03% of total observations) involve firms with political connections, and 2,134 observations were granted after the stimulus program.

Table 5.28: Summary Statistics of Firm Observations/Contract Terms

Variable	Observation	Mean	Std. Dev.	Mix	Max
Panel A: Firm					
Application_Dummy	16,108	0.518	0.500	0	1
Ln(*Application*)	8,346	1.293	1.090	0	5.938
Secure_Dummy	8,346	0.059	0.236	0	1
Ln(*Secure*)	495	0.657	0.848	0	3.784
Approval	8,346	0.047	0.20	0	1
Panel B: Contract					
Spread	472	1.164	0.362	0.245	3.086
LoanSize	2,586	4.304	1.586	-2.126	10.327
Maturity	1,694	2.860	0.824	-2.120	5.481
$D_{Collateral}$	2586	0.203	0.402	0	1

5.5.2 Empirical Results

Did the Stimulus Package Encourage Firms to Borrow More?

Table 5.29 presents several univariate tests for these variables. It reveals that the stimulus program incentivised firms to make more announcements, leading to a decrease in the number of successful contracts and a lower approval rate.

Importantly, these differences are statistically significant, particularly when comparing firms with and without political connections, especially in the post-stimulus period. Panel B further illustrates that the stimulus program raised "false hope" for firms lacking political connections, as they made more announcements which ultimately resulted in fewer successful contracts and a lower approval rate when compared to firms with political connections.

Table 5.30 provides the FE-2SLS results using the combination of state- and region-peer political connections as IVs. The number of bank loan applications, the number of granted bank applications, and the approval rate are included as the dependent variables. The first variable examines whether political connections play a role in the *Firm Selection Process*, while the latter two variables investigate whether political connections affect the *Bank Selection Process*.

Table 5.29: Univariate Test: Firm Level

Variable	Full	$PC = 0$	$PC = 1$	Difference (t-value) $PC = 0$ versus $PC = 1$
Application_Dummy	0.510	0.525	0.431	0.094*** (9.325)
Before	0.201	0.199	0.207	-0.009 (-0.584)
After	0.593	0.605	0.524	0.080*** (6.841)
Difference(t-value)	-0.393***	-0.406***	-0.317***	
Before versus After	(-45.690)	(-42.181)	(-16.373)	
$Ln(Application)$	1.293	1.317	1.141	0.176*** (5.319)
Before	0.740	0.754	0.693	0.061 (0.872)
After	1.343	1.362	1.215	0.147*** (4.098)
Difference(t-value)	-0.603***	-0.608***	-0.522***	
Before versus After	(-14.914)	(-13.269)	(-5.973)	
Secure_Dummy	0.031	0.030	0.036	-0.006 (-1.624)
Before	0.037	0.037	0.036	0.000 (0.039)
After	0.030	0.029	0.036	-0.007* (-1.752)
Difference(t-value)	0.007***	0.008**	0.001	
Before versus After	(2.181)	(2.279)	(0.072)	
$Ln(Secure)$	0.641	0.669	0.514	0.156* (1.731)
Before	0.561	0.591	0.452	0.139 (0.914)
After	0.667	0.694	0.540	0.154 (1.401)
Difference(t-value)	-0.107	-0.102	-0.088	
Before versus After	(-1.322)	(-1.091)	(-0.599)	
Approval	0.049	0.045	0.070	-0.025*** (-4.030)
Before	0.169	0.170	0.165	0.005 (0.155)
After	0.038	0.035	0.054	-0.019*** (-3.297)
Difference(t-value)	0.131***	0.135***	0.111***	
Before versus After	(17.531)	(16.501)	(5.647)	

Notes: This table summarizes the univariate tests between firms with and without political connections. These variables are defined as in the previous tables. ***, **, * correspond to p-values of 1%, 5%, and 10%, respectively.

In column (1), the estimated coefficient of $Stimulus \times PC$ is insignificant, suggesting that there is no difference between firms with and without political ties in their pursuit of bank financing. This indicates that political connections did not influence firms' willingness to make bank loan applications following the implementation of the stimulus package, thus not affecting the *Self Selection Process* of firms.

In columns (2) and (3), the coefficient of $Stimulus \times PC$ is significantly positive in column (2) and insignificant in column (3). This indicates that more bank loan contracts were granted to politically connected firms after the stimulus package, reflecting that political connections may influence the size of firm bank loans through the *Bank Selection Process*.

Overall, it is evidenced that firms responded actively to the stimulus-driven credit boom, no matter whether they have political ties. However, only politically connected firms benefited from the stimulus, as demonstrated by the increased number of granted bank loan announcements. This result further confirms that the inappropriate bank credit allocation caused by the stimulus package stemmed from banking decisions rather than firms' willingness or performance.

Table 5.30: Further Analysis: Political Connections, Stimulus Program, and Loan Application

VARIABLE	$ln(Application)$ (1)	$ln(Secure)$ (2)	$Approval$ (3)
$Stimulus \times PC$	-0.225	1.617*	-0.004
	(0.416)	(0.896)	(0.140)
PC_Dummy	0.575	-0.639	0.040
	(0.465)	(0.888)	(0.134)
R-squared	0.120	0.123	0.099
Under identification test	18.271***	11.204**	18.271***
Weak identification test	16.439	3.580	16.439
(Critical Value)	(11.04)	(11.04)	(11.04)
Over identification test	0.241	1.44	2.767
(P-value)	(0.886)	(0.486)	(0.251)
Observations	8,216	478	8,216
Number of firms	1,679	301	1,679
Fixed Effects	YES	YES	YES
Controls	YES	YES	YES

Notes: Firm/Industry/Province/Year fixed effects are included in the regressions. Instrumental variables are the combination of state- and region-peer political connections. The Cragg-Donald Wald F statistic values are well above the corresponding critical value to pass the weak-identification test. The over-identification test reports the Hansen J statistic, which is well above the critical value for the overidentification test (0.05). Significance levels 0.1, 0.05, and 0.01 are noted by *, **, and *** respectively.

Did Political Connections Transfer into Better Loan Contract Terms?

Table 5.31 presents the results univariate test of individual loan contract terms. There was a significant increase in interest spread post-stimulus, compared with the pre-stimulus period. Additionally, both loan size and maturity exhibited significant decreases, and fewer contracts were secured by collateral.

Upon comparing the contracts granted to firms with and without political connections, politically connected firms enjoy more favourable pricing terms, leading to lower interest spreads.

Table 5.31: Univariate Test: Individual Level

Variable	Ful sample	$PC = 0$	$PC = 1$	Difference (t-value) $PC = 0$ versus $PC = 1$
Spread	1.164	1.185	1.053	0.132*** (2.987)
Before	0.989	0.991	0.976	-0.015 (0.440)
After	1.222	1.249	1.080	0.168*** (2.949)
Difference (t-value)	-0.234***	-0.258***	-0.104	
Before versus After	(-6.303)	(-6.454)	(-1.103)	
Maturity	2.860	2.852	2.906	-0.054 (-0.9379)
Before	2.710	2.668	2.906	-0.238** (-2.128)
After	2.895	2.894	2.906	-0.012 (-0.177)
Difference (t-value)	-0.185***	-0.226***	0.000	
Before versus After	(-3.670)	(-4.085)	(0.003)	
LoanSize	4.304	4.296	4.356	-0.060 (-0.645)
Before	3.650	3.554	4.140	-0.585*** (-2.885)
After	4.441	4.445	4.416	0.029 (0.288)
Difference (t-value)	-0.792***	-0.890***	-0.276	
Before versus After	(-9.792)	(-10.107)	(-1.364)	
$D_{Collateral}$	0.203	0.210	0.154	0.056** (2.368)
Before	0.146	0.136	0.205	0.070 (-1.543)
After	0.214	0.225	0.140	0.084*** (3.143)
Difference (t-value)	-0.067***	-0.089***	0.065	
Before versus After	(-3.232)	(-3.885)	(1.367)	

Notes: This table summarizes the univariate tests between firms with and without political connections. These variables are defined as in the previous tables. ***, **, * correspond to p-values of 1%, 5%, and 10%, respectively.

It is noteworthy that there is no statistically significant difference in loan sizes between politically connected and non-connected firms. However, politically connected firms tended to provide more collateral. Moreover, while political connections have been associated with benefits in terms of loan size and maturity in the past, these advantages seem to have diminished following the implementation of the stimulus package. This suggests a changing landscape in the relationship between political connections and the terms of lending agreements, transitioning from non-price benefits to price benefits following the implementation of the stimulus package.

To further explore the effects of political connections on bank loan contract terms, I replace the dependent variable in Equation 5.1 with collateral requirement (Dummy $D_{Collateral}$), debt maturity (in natural logarithms), and interest rate spread. The OLS and FE regression results are documented in Table 5.32.

Table 5.32: Further Analysis: Political Connections, Stimulus Program, and Loan Contract Terms

VARIABLE	*Spread*		*Maturity*		$D_{Collateral}$	
	(1)	(2)	(3)	(4)	(5)	(6)
Stimulus × *PC*	-0.137*	-0.163*	-0.075	0.001	-0.532**	-0.377
	(0.082)	(0.093)	(0.129)	(0.129)	(0.216)	(0.236)
PC_Dummy	0.024	0.027	0.181	0.111	0.454**	0.368*
	(0.070)	(0.087)	(0.114)	(0.116)	(0.192)	(0.212)
Stimulus	0.284***	0.386***	-0.071	0.001	0.057	-0.286
	(0.052)	(0.098)	(0.067)	(0.162)	(0.109)	(0.281)
Observations	472	472	1,694	1,694	2,586	2,570
R-Squared	0.461	0.556	0.119	0.203	0.108	0.169
Year Dummy	No	Yes	No	Yes	No	Yes
Industry Dummy	No	Yes	No	Yes	No	Yes
Controls	Same as baseline regressions					

Notes: Significance levels of 0.1, 0.05, and 0.01 are noted by *, **, and *** respectively.

In the first two columns with interest spread as the dependent variable, the coefficients of *Stimulus* are significantly positive, while the coefficients of the interactive term, *Stimulus* × *PC*, are significantly negative. This suggests that firms with political connections tend to secure loans at a lower interest rate during the stimulus package, and this is at the expense of charging higher loan rates to all firms in the sample.

One possible explanation is that these lower rates reflect a lower risk of lending to politically connected firms since they are believed to have easier access to government support, especially during economic downturns. Consequently, banks might view these firms as more stable and less likely to default, leading to lower interest rates.

Regarding loan maturity, shown in columns (3) and (4), the regression results do not reveal significant effects of either political connections or the stimulus program. According to columns (5) and (6), the coefficient of *PC_Dummy* is significantly positive, suggesting that politically connected firms are more required to provide collateral than firms lacking this connection. When interacting with the stimulus package, the coefficient of *Stimulus* × *PC* becomes negative in the OLS regression in column (5). This implies that after 2009, firms' political connections reduced the probability of pledging collateral to obtain bank loans. However, this effect becomes insignificant after controlling for year and industry dummies.

Table 5.33: Further Analysis: Political Connections, Stimulus Program, and Loan Size in Contracts

VARIABLE:	Total		Short term		Mid-long term	
LoanSize	(1)	(2)	(3)	(4)	(5)	(6)
Stimulus × *PC_Dummy*	-0.268	-0.170	0.051	1.045*	-0.229	-0.198
	(0.194)	(0.192)	(0.535)	(0.543)	(0.206)	(0.203)
PC_Dummy	0.255	0.116	0.516	0.193	0.193	0.029
	(0.174)	(0.175)	(0.500)	(0.501)	(0.184)	(0.183)
Stimulus	-0.116	-0.327	0.191	0.318	-0.154	-0.372
	(0.095)	(0.252)	(0.257)	(0.718)	(0.103)	(0.268)
Observations	2,586	2,586	247	247	2,339	2,339
R-Squared	0.290	0.349	0.178	0.413	0.289	0.357
Year Dummy	No	Yes	No	Yes	No	Yes
Industry Dummy	No	Yes	No	Yes	No	Yes
Controls	Same as baseline regressions					

Notes: Significance levels of 0.1, 0.05, and 0.01 are noted by *, **, and *** respectively.

Table 5.33 presents the OLS and FE regression results using loan size (in natural logarithms) as the dependent variable. The coefficient of *Stimulus* × *PC* is only significant in column (4), indicating that with the implementation of the 4-trillion Yuan stimulus package, firms with political connections benefited more from short-term bank loan contracts than firms without connections.

Overall, these additional results provide further evidence supporting the main finding that political connections had a greater impact after the stimulus program not only in terms of accessing bank loans but also on interest cost, and possibly also on collateral requirements.

5.6 Conclusion

This chapter has provided direct empirical evidence of the effectiveness of relatively the largest stimulus package in the world in response to the 2008 financial crisis, China's 4-trillion Yuan stimulus package, particularly focusing on its impact on bank loan financing among firms.

Based on the Chinese listed firm data from 2003 to 2018, this study investigated the causal effect of credit expansion, when interacting with political connections, on firm bank loan size. It revealed that political connections played a vital role in determining firm bank financing during the government-led economic stimulus. Bank credit tended to be allocated more to politically connected firms, particularly ones with strong and local authority connections. This effect is prominent in provinces with more corruption cases and among firms with lower transparency and poorer auditing quality.

Through a series of additional tests, this study demonstrated that these effects are not likely to be driven by concerns related to omitted variable problems or reverse causality. Estimates from fixed effects two-stage least squares (FE-2SLS) using a variety of Instrumental Variables (IVs) further support the primary conclusion that political connections had a direct influence on bank loan access post-stimulus.

Moreover, based on firm bank loan announcements and contracts, this study explored the possible explanations of the role of political connections and proposed two channels for the main findings. The *Self Selection Process* reflects the demand aspect of firms applying for credit, suggesting that political connections boost firms' confidence in seeking bank loans. In contrast, the *Bank Selection Process* pertains to the supply aspect of banks selecting which firms to lend to, highlighting how these connections served as an implicit guarantee to help firms obtain and/or maintain favourable treatment from banks. The latter phenomenon has been well documented in the existing literature.

Further analysis yields interesting results supporting the *Bank Selection Process*. Specifically, the 2009 stimulus package incentivised firms to seek more bank loans, with no significant difference in willingness observed between firms with and without political connections. However, firms with no political connections faced significantly fewer successful contracts compared to their politically connected peers. Moreover, even when these non-connected firms successfully secured loan contracts with banks, they incurred higher borrowing costs.

Overall, this study offers new insights into how government-led credit expansion influences firms' bank lending behaviour through political connections, contributing to a deeper understanding of the welfare effects of such connections and the unintended consequences of China's unprecedented stimulus package.

Chapter 6

Conclusion and Discussion

This chapter summarizes the empirical findings of this thesis, provides some political implications, and offers potential research directions in the future.

6.1 Summary of Key Results

China's 4-trillion Yuan stimulus package led to a rapid recovery in its GDP after the global financial crisis. However, there is scarce empirical evidence of its effectiveness. The effects on growth and the allocation of resources among industries and firms have been so far overlooked.

This thesis has painted a broad picture of the long-lasting and unintended consequences of China's aggressive stimulus package from three perspectives: macro-, industry-, and firm-level. Specifically:

After an introduction to the research background in Chapter 2, Chapter 3 investigated the growth effects of China's economic stimulus plan of 2009-10 in a sample of 30 provinces in China over the period from 2004 to 2017. Employing high-frequency quarterly data and the recently developed Error Correction Model (ECM), this chapter introduced short-term heterogeneity in the relationship between the 4-trillion Yuan stimulus package and growth, making the results more consistent with reality. The empirical findings reveal that the massive one-off stimulus package in China temporarily boosted GDP growth. However, this came at the expense of a significant long-term decline in growth over the recent decade.

The subsequent two chapters focused on powerful political forces, in the forms of official government orders and implicit government connections, to explore the mechanisms behind China's growth slowdown caused by the 4-trillion Yuan stimulus package from the industry and firm levels.

Chapter 4 examined whether and how government intervention played a role in determining industry investment behaviour and province allocative efficiency during the economic stimulus package. Using data from 27 2-digit industries across 31 provinces in mainland China for the period 2000-16 and employing a Difference-In-Differences (DID) approach, the empirical results indicate that the stimulus-driven credit expansion encouraged industries with government backup to make more investments. However, it also led to less efficient investment by industries with strong government intervention, resulting in a poor provincial post-stimulus allocation trend. This finding is robust to the alternative PSM-DID test. The mechanism analysis confirms that the decline in investment efficiency was driven more by over-investment than under-investment. Furthermore, these effects were more pronounced in state-dominated industries in regions with high corruption levels and underdeveloped markets.

Chapter 5 provided empirical evidence on the effects of China's stimulus package on firm bank loan financing, with a particular focus on the role of political connections. Based on Chinese listed firm data from 2003 to 2018, I found that politically connected firms, particularly those enjoying close ties with the local authorities and having lower levels of probity, tended to receive larger bank loans during the stimulus period. A series of additional tests based on Instrumental Variables (IVs) addressed endogeneity concerns. Furthermore, it examined two potential processes to explain the findings: the *Self Selection Process* and the *Bank Selection Process*. The *Self Selection Process* suggests that political connections boost firms' confidence in applying for bank loans, while the *Bank Selection Process* highlights how these connections serve as an implicit guarantee, enabling politically connected firms to obtain and maintain favourable treatment from banks. The subsequent analysis supports the *Bank Selection Process*, indicating that politically connected firms face more granted announcements and incur lower borrowing costs compared to their non-connected counterparts.

Overall, this thesis has illustrated how China's stimulus package, which was designed to revive the economy by boosting investment and bank credit, led to potentially unintended consequences when interacting with government interventions. The results presented in this thesis can be applied to the case of stimulus packages in emerging markets in response to the Great Recession.

6.2 Policy Implications

Based on the empirical findings in this thesis, the following implications are proposed as follows:

First, and arguably the most important implication is for policy-makers. During recessions, the government often aim to stimulate the economy through expansionary fiscal and monetary policies. These efforts may fail to achieve the desired effects due to excessive government intervention, as evidenced by the resource allocation trends towards industries and firms with government guarantees after the 4-trillion Yuan stimulus package. This has resulted in aggregate inefficiencies in China post-2009, suggesting that in the long run, it is necessary to improve the institutional building and the business environment to eliminate the influence of government intervention in the allocation of credit resources of the commercial banking system.

Second, in the long run, private investment should be promoted rather than public investment. Fiscal expenditure is mainly invested in areas with long construction periods and poor short-term economic benefits, such as infrastructure construction. After the economy recovers and private investment becomes more active, private investment can be introduced into these areas through relaxing related investment restrictions and then investing fiscal funds into other areas such as welfare projects.

Third, the present results show that credit expansion does not always promote economic growth. Although shrinking credit scale may lead to a further slowdown in economic growth and trigger potential risks, excess expansion can also exacerbate resource misallocation. Based on China's experience, policy-driven credit expansion should be adapted to the needs of real economic growth. The important thing is to carefully consider the current credit scale and the demand and supply of the market.

The last implication is for market participants. The empirical findings confirm that the response to the effects of government-oriented credit expansion varies across industries and firms. In particular, industries and firms with government guarantees are more likely to benefit from the credit expansion than those that lack government guarantees. This encouraged government-favoured industries and firms to expand investments, resulting in the loss of investment efficiency. This implies industries and firms should carefully evaluate investment opportunities and prioritise projects that offer the highest returns and long-term sustainability rather than expanding external financing and investments.

6.3 Proposal for Future Research

The present thesis proposes two channels for government involvement in the allocation of resources across industries and firms. The subsequent outcomes, including investment efficiency and allocative efficiency, have been discussed at the industry level. Given the limited research progress, more research is needed to test the consequences of firm-level allocation through implicit government guarantees to offer a more comprehensive understanding of China's 4-trillion Yuan stimulus package. For instance, to what extent did the stimulus package cause misallocation and TFP loss across firms?

Another area for future research is the relationship between the executives' experience and firm bank loan financing during financial distress. The present research focuses on the political connections of the CEO and chairperson, who are considered key decision-makers in Chinese listed firms. One notable limitation is that using the CEO/chairperson's political ties as a proxy for political connections provides a conservative estimate of the true extent of political influence, as political connections could also be established through other members

of firms, and their relatives, networks and backgrounds. For instance, in the Chinese context, it has been extensively documented that firms linked to the Politburo members, namely, princeling firms (Chen & Kung 2018), and firms affiliated with the Communist Party (Li et al. 2008) are beneficial to cheap access to scarce national resources (i.e., land purchase) and preferential policy treatment. Future research could expand by exploring the impacts of such connections of founders, board members and shareholders of firms, on corporate financing strategies during periods of financial crises.

Extra attention could be paid to the effects of bank connections of executives (through their former banking experience), which have also been widely believed to be valuable for firms' bank loan financing (Custódio & Metzger 2014, Engelberg et al. 2012, Haselmann et al. 2018). Unlike political connections which generally result in capital misallocation and worsen subsequent performance, firms' connections with banks are found to create value by alleviating information asymmetry and lowering bank monitoring costs (Custódio & Metzger 2014, Pan & Tian 2020). It will be interesting to explore how bank connections influence firm financing strategies when facing an uncertain future and credit boom.

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