

 **Empirical studies in China’s bank industry in post-reform period**

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A thesis submitted in partial fulfilment of the requirements for the degree of

Doctor of Philosophy

The University of Sheffield

Management School

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Submission Date: 21-10-2022

# Declaration

*I, Hua Huang, confirm that the Thesis is my own work. I am aware of the University’s Guidance on the Use of Unfair Means (*[*www.sheffield.ac.uk/ssid/unfair-means*](http://www.sheffield.ac.uk/ssid/unfair-means)*). This work has not been previously been presented for an award at this, or any other, university.*

# Acknowledgments

My PhD studies journey has been lengthy, but it was a good opportunity for me to learn some lessons in my life.

I would like to express my deepest gratitude to my supervisor, Dr Jiao Ji, for her insightful guidance, consistent encouragement and precious support from the very beginning to the end.

I also extend my very special thanks to my other supervisors, Professor Jim Haslam, Dr Junhong Yang and Dr Neng Jiang, for their invaluable suggestions and guidance. I also appreciate all the support given to me by the staff at the Management School of the University of Sheffield.

I could never express my gratitude enough to my family. I would not be at this stage without your unwavering love and help throughout the whole journey.

# Abstract

The Chinese banking sector has experienced significant reform since 2003. The main purpose of the reform was to improve corporate governance structures, improve risk management and enhance performance. The lack of comprehensive research on performance determinants in the Chinese banking sector is the main motive, therefore the thesis investigates the determinants of bank profitability and efficiency in the second chapter. This thesis focuses on significant changes in the Chinese banking sector in two areas: the new regulation Governing Capital Adequacy of Commercial banks and the Guidelines on Corporate Social Responsibility (CSR). Both regulatory reforms implemented by the Chinese government in the early 2000s aim to improve corporate governance, enhance banking risk management and achieve long-term sustainable development. However, while most previous research studies have focused on the impact of capital on banking risk and efficiency, as well as the relationship between CSR and bank financial performance in developed markets, the lack of research into the Chinese banking sector is a gap that this thesis aims to fill.

This study contains three parts. Firstly, using the panel data of Chinese banks from 2004 to 2018, this study contributes to the investigation of bank performance in China and explores the determinants that influenced Chinese banks’ profitability and efficiency. Second, the thesis aims to examine the relationship between capital, risk and efficiency in the Chinese banking industry. Thirdly, the study investigates the relationship between adopting CSR and bank financial performance. A content analysis is adopted to measure the level of CSR for commercial banks. Different estimation methods are applied to examine the relationship.

The findings show that credit risk is significantly and positively contributed to the NIM and Cost-efficiency, while liquidity risk makes a convincingly positive contribution to both the NIM and Cost-efficiency. Moreover, banks with a higher capital adequacy tended to exhibit higher levels of profitability. Non-interest income has a negative impact on all three performance measures. There is a bidirectional negative relationship between capitalisation and banking risk. The higher level of bank cost-efficiency appears to hold less capital. In addition, large banks tend to take less risks than smaller banks. Furthermore, the results show that banks engaging in CSR activities could increase their financial profits.

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# Chapter 1: Introduction

## 1.1 Background of the study

### 1.1.1 Background

A banking system is essential to the foundation of a healthy and sound economy. After an extensive growth model over the past few decades, the Chinese banking sector accumulated many problems in the early 2000s. Low capitalisation and a large amount of non-performing loans have become significant problems due to the banking sector supporting inefficient state-owned enterprises over a long period. Additionally, rapid economic growth in China has been accompanied with serious environmental problems. In order to develop a healthy and sustainable banking system to support national economic development, the government issued a series of new regulations for the banking sector, including regulations on capital adequacy requirements and guidelines on corporate social responsibility.

### 1.1.2 China’s bank reforms

The Chinese financial system developed much later than those of developed countries. Nonetheless, it has made notable progress, transforming the country’s planned economy into a socialist market economy. The banking sector is a vital component of the system, and its effective functioning is crucial to the country’s economic health and growth.

The People’s Bank of China (PBOC), established in 1948, represented the beginning of China’s contemporary banking system. The country’s banking sector was monopolised by the PBOC until 1979. The two main tasks for PBOC are policy lending and commercial operations. In 1978, the Chinese government began to implement comprehensive economic reform. A series of transformations was implemented in the banking system in order to create a healthy and competitive environment and improve banks’ performance. Yao et al. (2008) indicated that the main purpose of these banking reforms was to transform the system from being centralised, state-owned, monopolistic, and policy-driven to a decentralised, multi-owned, competitive, and profit-oriented sector.

The initial period of banking reform lasted from 1979 to 1985, with the government establishing a two-tier banking system. The purpose of this period was to develop a more specialised banking system to better serve state-owned enterprises and enhance banking productivity. Under the new system, the first tier was PBOC, the Central Bank of China, which was responsible for the operation of financial institutions. Four state-owned commercial banks (SOCBs) were established by the government as the second tier of the banking system: Bank of China (BOC), China Construction Bank (CCB), Agriculture Bank of China (ABC), and the Industrial and Commercial Bank of China (ICBC). During this period, these four banks served as the lending mechanism of the government, and only provided funds to SOEs that fulfilled state requirements under the guidance and direction of government. Each of the four SOCBs had a particular business focus. The BOC mainly provided foreign exchange and foreign business transactions; the CCB focused on providing funds and loans to support housing development and infrastructure projects; the ABC was responsible for agricultural development; and the ICBC primarily provided financial support for commercial and industrial activities.

The PBOC and the four SOCBs were widely criticised after the preliminary reforms, because the state-owned enterprises were highly inefficient and incurred massive losses in their operations. Consequently, the four SOCBs accumulated a number of non-performing loans (NPLs), which increased bank risk. Moreover, there was no competition among the four banks as the government gave them strong market power over their designated areas. Such situations breached the original objectives of the government to develop a market-oriented economy. In order to increase competition for the whole banking sector and achieve the nation’s goal, the restriction that the four specialised banks should serve a designated area was removed in 1985; they were subsequently allowed to provide funds to any economic sector. However, the competition was very limited during the period as there was no foreign participation in the banking sector and banks’ operations were still influenced by central and local government (Yao et al., 2007).

The second period of banking reform occurred between 1985 and 1996. To reduce the enormous volume of NPLs in the banking sector, the Chinese government established three policy-lending banks: China Development Bank (CDB), China Export-Import Bank (CEIB), and the Agricultural Development Bank of China (ADBC). They were fully owned by the government and offered funding by accepting deposits and issuing bonds; their purpose was to take over policy-related lending (related to central government plans) from SOCBs and they were not expected to make profits. In particular, the CDB was mainly responsible for government projects in infrastructure and pillar industries; CEIB focused on providing funding to support the export and import of capital goods; ADBC mainly provided loans to agricultural projects of states in rural areas. Dan (2010) suggested that after the three policy banks were established, the four state-owned banks were expected to be profit-oriented rather than policy-driven and they were renamed as ‘commercial banks’.

Two important banking laws were enacted in 1995: the Commercial Bank Law and the Law of the PBOC. Under the PBOC Law, three of the PBOC’s main responsibilities became implementing monitory policy, maintaining financial stability, and developing the macroeconomic management system of the central bank. The Commercial Bank Law ensured the development of a diversified, market-oriented, and independent modern banking system. With these laws established, the Chinese commercial banks formalised their operations and enjoyed more autonomy in credit allocation. However, with limited capital sources and branch networks, the policy banks hardly took over the policy lending activities from SOCBs. Consequently, the state-owned commercial banks continued to provide policy lending to support national projects and the government was still heavily involved in the operations of SOCBs.

To develop a more competitive environment in the banking industry, the Chinese government has permitted the establishment of several new small and medium-sized commercial banks since the mid-1980s. The structure of Joint stock commercial banks (JSCBs) is mixed ownership, which is comprised of the government, state-owned enterprises, private enterprises or individuals. These include the Bank of Communications (1986), China Merchants Bank (1987), the China International Trust and Investment Corporation Bank (CITIC) (1987), Shenzhen Development Bank (1987), Fujian Industrial Bank (1988 – later renamed Industrial Bank), and the Guangdong Development Bank (1988 – later renamed China Guangfa Bank), Bohai Bank and Minsheng Bank, established in 1996. Evergrowing Bank and Shanghai Pudong Development Bank were the most recent JSCBs established in 2003 and 2004. Tan (2014) indicated that JSCBs, unlike SOCBs, enjoy relative independence and less government intervention, thus, they were believed to have healthier asset quality, higher profitability and lower levels of non-performing loans. The banking sector has witnessed more intensified competition since then.

The third period of banking reform began in 1996. During this period, major events included the reorganisation of the PBOC, the restructuring of some urban cooperatives into city commercial banks, the establishment of four Asset Management Companies (AMCs) and the first round of NPL disposal.

Starting from the mid-1990s, a number of large cities consolidated their urban credit cooperatives and rural credit cooperatives into city commercial banks (CCBs). The biggest CCBs included Beijing Commercial Bank, Shanghai Commercial Bank and Shenzhen City Commercial Bank. The government established four asset management companies (AMCs) in 1999 to help the four SOCBs clean up their volume of NPLs. The four AMCs were Cinda Asset Management Company, China Great Wall Asset Management Company, Oriental Asset Management Company and China Huarong Asset Management Corporation. They were paired with CCB, ABC, BOC and ICBC respectively. RMB 1.4 trillion of NPLs from SOCBs were written off by AMCs in 1999, which reduced the SOCBs’ NPL ratio from 35% to 25%.

In 2001, China successfully entered the World Trade Organization (WTO). This was the first time the Chinese banking industry had faced international competition. The Chinese banking system expected to be fully exposed to foreign competition by the end of 2006, according to the agreement agenda between the Chinese government and the WTO (Yao et al., 2007). Despite the previous reforms of the banking sector, the Chinese banks were far from ready to compete with international institutions. To improve the efficiency of regulation and supervision in the banking sector, in 2003 the government established the China Banking Regulatory Commission (CBRC), under the control of the state council. The main task of the CBRC was to independently and effectively supervise China’s banking industry. In order to improve the performance and stability in the Chinese banking system, two laws were realised in 2005: The Law of the People’s Republic of China on the People’s Bank of China and The Law of the People’s Republic of China on Commercial Banks.

In 2003, the reform of the SOCBs was set at the top of the agenda of financial reform. The first step was to recapitalise the SOCBs and resolve the NPL’s burden through bailout and financial restructuring. The State Council injected USD 45 billion to restructure the BOC and the CCB. Bank of Communication (BOCOM) and ICBC were the second group of banks to get capital injections from the government. RMB 3 billion was injected to BOCOM in 2004 and USD 15 billion was injected to the ICBC in 2005. Regarding the NPLs divestment from SOCBs, the government offloaded $57.4 billion NPLs for BOC and CCB in 2004, $87.4 billion for ICBC in 2005 and $133 billion for ABC in 2008. Consequently, the total amount of NPLs reduced significantly. In February 2004, the CBRC promulgated the regulation Governing Capital Adequacy of Commercial Banks in order to improve risk management and stability in the Chinese banking industry. The new regulation was based on combining Basel Accord I and II. As a consequence, there was a great increase in the Chinese bank capital adequacy ratio; 99.9% of banking assets were compliant at the end of 2008 (CBRC, 2010).

After recapitalising the SOCBs and resolving the NPL problem, the SOCBs were encouraged to go public and be listed on stock exchanges. The main purpose of this strategy was to improve corporate governance structures, improve risk management, better solve the agent-principal problem and enhance performance. The capital markets reacted positively to the SOCB’s initial public offerings (IPOs). ICBC raised about $21.9 billion in Hong Kong (H-shares) and Shanghai (A-shares) and became the largest bank in the world. All SOCBs had been transformed into public banks by 2010. The Chinese government believed that SOCBs transformed into public banks and the raising of fresh capital was not the end of reform, as the long-term goal is to transform SOCBs into modern banks with good corporate governance and create a sound and internationally competitive banking system (Yao, 2015). In order to monitor bank reform and achieve these long-term goals, the CBRC published prudential regulation and supervision for the banking system.

Furthermore, the corporate social responsibility and the behaviour of the banking system became more crucial after the financial crisis in 2008. In order to change the extensive growth model with high energy consumption and high pollution as well as upgrade the industrial structure, the National Development and Reform Commission (NDRC), jointly with the PBC and the CBRC, issued the “Announcement on further strengthening industrial policy and credit policy to control credit risks” in 2004. Then, in 2005 and 2006, the State Council released another two policies, the “Regulation on accelerating adjustment of industrial structure” and the “Announcement on accelerating adjustment of industrial structure with excess capacity”, which required financial institutions to adjust national industrial structures by optimising their loan structures. In 2009, CBRC issued the “Guidelines on Corporate Social Responsibility for the Chinese Banking Sector”. These guidelines indicate that the banking sector should take responsibility in economic, social and environmental aspects; they also require banks to issue an annual report on their corporate social responsibility (CSR). As a result, the banking sector started considering and promoting CSR activities.

##  Research Motivation

As noted in the previous section, the Chinese banking sector has experienced several rounds of reform over the past few decades. Some new banking regulations have also been released in the early 2000s and, as a consequence, some new features have emerged in the banking industry, namely the dramatic change of capital standards and the implementation of corporate social responsibility.

Besides, taking the global financial crisis as an opportunity, the Chinese authorities have advanced banking reform towards a sound, comprehensive, and competitive banking sector to serve the real economy (Jiang & Yao, 2015). Therefore, the banking sector in China has witnessed a period of great changes in many aspects. Such significant changes made the Chinese banking sector as an interesting and unique context to investigate the bank performance. Several studies have investigated bank performance, and most of them used return on assets (ROA), return on equity (ROE) and net interest margin (NIM) to measure bank performance. However, none of these studies appear to have considered the commercial banks’ efficiency. Thus, to comprehensively investigate the determinants of Chinese banking profitability and efficiency could be invaluable to bank managers and policy makers.

In order to comply with the new regulatory requirements, commercial banks have significantly adjusted their capital, which provides a unique opportunity to investigate the impact of bank capital in China. Studies on the relationship between bank capital, risk and efficiency have a long history in developed markets, however, the previous literature presented inconclusive results. From a theoretical perspective, two main hypotheses have arisen regarding the link between capital and risk. On one hand, according to the ‘regulatory hypothesis’, there is a positive relationship between capital and risk, suggesting that regulators encourage banks to increase their capital commensurably with the amount of risk taken (Berger, 1995; [Demirgüç-Kunt & Huizinga, 2000](https://www.sciencedirect.com/science/article/pii/S0261560612000903#bib28)). On the other hand, various researchers have suggested that banking capital requirements have a positive impact on safety and soundness (Aggarwal & Jacques, 1998; Ediz et al., 1998). In addition, the ‘moral hazard hypothesis’ implies that bank managers might have incentives to increase their risk when a bank is thinly capitalised. From the empirical evidence, Shrieves and Dahl (1992) indicated a positive correlation between capital and risk by using the data of US commercial banks. Iannotaa et al. (2007) suggested that capital has a positive impact on loan loss provisions by examining the data of the largest European banks between 1999 and 2004. However, Ediz et al. (1998) found that in the UK minimum banking capital requirements have a positive impact on the safety and soundness of banks. Salas and Saurina (2003) reported a negative relationship between the level of capital and the credit risk in Spanish banks.

These mixed results could be a consequence of the non-exclusive hypotheses, the different time periods investigated and various methodologies applied. There are few researchers who have examined the relationship between capital, risk, and bank efficiency of Chinese commercial banks. Tan and Floros (2013) followed the four hypotheses proposed by Berger and De Young (1997) and their results revealed a positive relationship between loan-loss provision and bank efficiency, and a negative relationship between capital and risk (as measured by the Z-score). Pessarossi and Weill (2015) investigated the relationship between capital and cost efficiency and suggested that capital requirements improve cost efficiency in the Chinese banking sector. However, these studies focused on the period before 2009, and the lack of consistent results and the unique Chinese context provide a strong motivation to examine the relationship between capital, risk, and bank efficiency.

Furthermore, the Chinese banking system started making efforts to promote corporate social responsibility in 2009 in order to comply with the “Guidelines on Corporate Social Responsibility for the Chinese Banking Sector”. The investigation of the relationship between adopting corporate social responsibility (CSR) and financial performance of a corporation has a long history but is still a continually debated issue. According to the shareholder view, which stems from neoclassical economic theory, corporate managers are only responsible for maximising the corporation’s profit within the boundaries of what is legally permitted (Friedman, 1970). In contrast, the stakeholder theory (Freeman, 1984) argues that CSR and profit maximisation are not mutually exclusive and can be compatible, and that engaging in CSR activities that act in all stakeholders’ interests ultimately increases performance. One important research study by Simpson and Kohers (2002) extended earlier studies and provided empirical support for a positive relationship between CSR and FP in the US banking industry. Their study was the first to investigate a unique banking industry and implied the previous contradictory results might be the consequence of multiple industries and various measurement issues. Platonova et al., (2018) found a positive relationship between CSR disclosure and the financial performance of Islamic banks in the Gulf Cooperation Council (GCC) region. Their analysis confirmed that the current CSR activities of Islamic banks in the GCC might improve their long-term financial performance. In contrast, some studies have argued for a negative correlation between social reasonability and financial performance. For instance, Esteban-Sanchez et al. (2017) investigated the effect of corporate social performance on corporate financial performance. Using data of 154 financial institutions in 22 countries between 2005 and 2010, they argued that banks did not obtain economic benefits from their CSR performance. Therefore, the relationship between corporate social responsibility and banking financial performance is still controversial. In addition, to the author’s best knowledge, only one study has investigated the link between CSR and Chinese banking performance. Zhu et al. (2017) applied a nonparametric method to investigate the impact of CSR on Chinese banking efficiency and their results indicated that an increase in CSR may have a positive impact on banking conditional efficiency. However, the data sample for their study only included 13 Chinese commercial banks between 2008 and 2013. Thus, the sample may have a selection bias issue. A comprehensive understanding of the relationship between CSR and financial performance could be invaluable to bank managers and policy makers.

##  Research Aim and Research Questions

The main aim of this thesis is to investigate changes that happened to the Chinese banking sector in terms of new regulations, including capital adequacy requirements and guidelines on corporate social responsibility, new features that have emerged in the banking industry.

Using the panel data of Chinese banks from 2004 to 2018, this study contributes to the investigation of bank performance in China and explores the determinants that influenced Chinese banks’ profitability and efficiency. The second research question asks, ‘what was the effect of bank capital on Chinese bank risk and efficiency’? Moreover, the study considers the difference during the sample period to test the effect of two new regulations on bank capital adequacy. The third research question asks whether there was an impact of conducting CSR on bank performance. This thesis also takes into consideration of the impact of CSR on different types of banks.

##  Research paradigm

The American philosopher Tomas Kuhn (1962) was the first to use the term ‘paradigm’ to refer to a philosophical way of thinking. He defined a research paradigm as ‘the set of common beliefs and agreements shared between scientists about how problems should be understood and addressed’ (Kuhn, 1962). Guba and Lincoln (1994) later defined a paradigm as a basic set of beliefs or a worldview that guides research action.

For Punch (2005), ‘research in the social sciences’ refers to the scientific study of human behaviour. The term ‘social’ refers to people and behaviour, acknowledging the social context; whereas ‘science’ refers to the way in which people and their behaviour are studied (Punch, 2005, p.8). The aim of social science is ‘to build an explanatory theory about people and their behaviour’ (Punch, 2005, p.8).

It is essential for the researcher to know the research field and direction of study. Thus, paradigms are essential as they shed light on the views of scholars in a particular discipline. They guide the researcher in identifying what should be studied, how it should be studied, and how the results of the research should be explained (Charles & Ahmed, 2017). According to Guba (1990), a paradigm involves ontology, epistemology and methodology. Ontology refers to questions about what reality is, and epistemology refers to how humans can know that reality. Methodology refers to the process of obtaining scientific knowledge. Figure 1.1 explains the relationship between the terms ontology, epistemology, methodology, method, and source in the research process.

Figure 1‑1 The relationship between ontology, epistemology, methodology, method, and source

### 1.4.1 Ontology

Ontology is a branch of philosophy concerned with how we know that something is real or existent. It involves beliefs about reality and the very nature or essence of being (Scotland, 2012). Ontology implies a philosophy used to answer questions about what reality is and what is true. It helps researchers to conceptualise the form and nature of reality and guides them towards knowledge of it.

Scott and Usher (2004) indicated that ontology is essential to a paradigm because it provides an understanding of the things that constitute the world. Different beliefs regarding the nature or structure of reality require different building blocks of research, leading to a specific research approach (Killam, 2013). These different beliefs can be related to various ontological positions. In general, realism refers to positivist paradigms, relativism concerns interpretive paradigms, and historical realism depends on critical paradigms. These three main taxonomies of paradigms – positivist, interpretivist, and critical (Candy, 1989) – are dominant across all academic research. They provide theoretical foundations for different methodologies (Sarantakos, 2012).

The ontological position of realism is that a single reality or truth exists, which is independent of researchers (Cohen, Manion & Morrison, 2013). Killam (2013) indicated that the truth exists and that what is being studied cannot change within the truth.

By contrast, as Guba and Lincoln (1994) explained, relativism holds that reality is subjective as it is viewed differently by different people. Crotty (1989) stated that reality derives from individual consciousness; as such, reality is meaningless without consciousness. In other words, relativists argue that consciousness determines reality (Killam, 2013) and that multiple versions of reality exist, subject to different people’s notions.

Historical realism differs strongly from both realism and relativism. This school proposes that history defines reality, which is then crystallised over time. Reality is constantly being formed by many values – from social, political, cultural, economic, ethnic, and gender perspectives (Guba & Lincon, 1994; Howell, 2012; Scotland, 2012).

### 1.4.2 Epistemology

Epistemology refers to the study of people’s claims to belief and knowledge. It is concerned with describing *how* we know something: how we understand reality or truth, and how we acquire the very basis of knowledge and new discoveries. Researchers’ beliefs regarding the nature of reality or truth shape their relationship with their studies. Put simply, ontological beliefs determine epistemological beliefs (De Kock, 2015).

From the realist perspective, reality has a true external and objective existence beyond human consciousness. Researchers should therefore remain separate from their study, obtaining knowledge only from the observation and investigation of external reality (Blaikie, 2007). This approach is known as ‘objectivism’ in the ontological position (Heron & Reason, 1997; Killam, 2013).

By contrast, relativists and historical realists argue that reality is subjective and can be influenced by human behaviour. This epistemological approach to acquiring knowledge is called ‘subjectivism’. The difference between the subjectivist and objectivist approaches to human nature can be characterised by their respective answers to the question of whether humans are determined by their environment, or whether, conversely, humans create their environment (Burrell & Morgan, 1979, p.23).

In the relativist ontological view, social reality forms the basis for human behaviour and motivates an individual’s thinking or will. Thus, it is important to consider other humans’ feelings and thoughts (Denzin & Lincoln, 2011). In contrast to relativism, historical realism is more influenced by historical values than by human behaviour, though it also adopts a subjective approach.

### 1.4.3 Methodology

According to Keeves (1997), ‘methodology’ describes the research design, methods, and procedures employed in a well-planned investigation intended to discover and analyse something. Guba and Lincoln (1994) suggested that methodology is based on a set of ontological and epistemological positions, which indicate a way of obtaining knowledge.

Methodology consists of many aspects, such as data gathering, instruments used, and data analysis. It articulates the logic and flow of the systematic processes used in the research, guiding researchers in gathering knowledge for the project. Methodology is essential, as it translates the paradigm into research ‘language’ and indicates the best way to gain the knowledge needed to solve a specific research problem.

Positivists advocate that scientific experiments based on hypotheses are the best means of obtaining knowledge, because they believe reality exists externally and does not change according to human consciousness or behaviour (Howell, 2012). Quantitative research is the main method in this methodological approach. Blaikie (2007) recommended using theoretical models in an investigation; that is, existing theories that have been tested through the study of social phenomena.

Relativist and historical-realist scholars tend to employ qualitative methods. In this approach, methodologies rely on interactions between and among the researcher and participants. They propose that neither reality nor the social world exist objectively; rather, these are subjective from person to person, depending on human creation and thinking (Sarantakos, 2012).

Table 1-1 displays a summary of the paradigms. Each approach is determined by a standpoint on the nature of reality or truth and by the relationship between researchers and their studies. This set of beliefs guides the research strategy and action, leading to different methods and particular sources for investigation.

Table 1-1 Overview of different paradigms (Kuhn, 1962, 1996; Crotty, 1989; Howell, 2012; Killam, 2013)

|  |  |  |  |
| --- | --- | --- | --- |
| Paradigm  | Positivism | Interpretive paradigms | Critical paradigms |
| Ontology | Realism: a single reality exists objectively; this reality is not changed by human behaviour and will | Relativism: multiple realities exist subjectively, each created by human consciousness  | Historical realism: reality is socially constructed and influenced by social values  |
| Epistemology | Reality can be measured using reliable tools | Subjectivism of individual reality must be explored to discover the underlying meaning  | Subjectivism of historical values dictates that knowledge and reality are both socially constructed and influenced by historical values |
| Methodology | Experimental research, quantitative methodology | Qualitative methodology | Qualitative methodology |

To date, there exists no empirical means of proving which paradigm is the best. The debate about the philosophical concepts has been ongoing for centuries. Although the three discussed paradigms are dominant, each one is simply a system for guiding investigators to understand knowledge; none is a perfect approach. To ensure a strong research design, researchers should choose the paradigm that is congruent with their beliefs regarding the nature of reality or truth (Mills, Bonner & Francis, 2006). Killam (2003) suggested that the aim or objective of the research may indicate the most appropriate paradigm.

Based on the research aim and questions, the author believes there is one reality that exists objectively and is not altered by human consciousness, behaviour, or will. Knowledge should be obtained through analysis and observation of this external reality, specifically by conducting scientific experiments based on a hypothesis. Therefore, positivism provides the most suitable foundation for this study. A quantitative methodology was thus applied because the phenomena being studied were measurable. The study was required to be objective. To achieve the research aim, statistical analyses were essential and were compatible with the study objectives.

## Research Methodology

Firstly, to empirically examine the relationship between capital, risk and efficiency in the Chinese banking industry, this study applied both parametric (SFA) and non-parametric (DEA) frontier techniques to measure Chinese banks’ cost- and profit-efficiency; comparatively, most previous studies only used one method for this evaluation. Both the ratio of loan-loss provision to total loans and the Z-score were employed to measure bank risk. Seemingly Unrelated Regression (SUR) was specified to estimate the relationship between capital, risk, and efficiency, because it allows simultaneous regression equations for banks’ capital, risk and efficiency; each equation has its own dependent variable. Moreover, the two-step system GMM technique was adopted to provide robust results and to address potential endogeneity problems in the data.

Secondly, to examine the impact of CSR on bank performance, content analysis was adopted to measure the level of CSR. The checklist was constructed based on three dimensions: economic responsibility, social responsibility and environmental responsibility, as mentioned in the Guidelines on Corporate Social Responsibility for the Chinese Banking Sector (2009). Different estimation methods were used, including pooled OLS, fixed effects and random effects to evaluate the relationship. In order to test the potential endogeneity problem of the model, a two-step system Generalized Method of Moments (GMM) method was applied to provide robust results.

## Structure of the thesis

The remainder of this thesis is structured as follows:

**Chapter 2: Determinants of bank profitability and efficiency: Empirical evidence from the Chinese banking sector**

This chapter explores the determinants that influenced Chinese banks’ profitability and efficiency. The empirical results demonstrate that all the determinants’ variables have a statistically significant impact on Chinese banks’ performance. Credit risk is significantly and positively contributed to the NIM and Cost-efficiency. Banks with a higher capital adequacy tended to exhibit higher levels of profitability. Non-interest income has a negative impact on all three performance measures. Moreover, the positive impact of bank size on performance may occur through economies of scale such as cost advantage and more advanced technologies.

**Chapter 3: Investigating the relationships between Capital, Risk and Efficiency in Chinese commercial banks**

This chapter presents an empirical study to examine the impact of capital on bank risk and efficiency after the great changes in capital standards. The empirical results indicate there is a bidirectional negative relationship between capitalisation and banking risk; cost-efficient banks appear to hold less capital; large banks tend to take on lower levels of risk than smaller banks. In addition, the study found different relationships between capital and risk in two subsample periods.

**Chapter 4: The impact of Corporate Social Responsibility on bank performance: evidence from Chinese commercial banks**

Given the lack of previous studies on the relationship between adopting corporate social responsibility and financial performance in the Chinese banking sector, this chapter adopts content analysis to measure the level of CSR for commercial banks. Different estimation methods, including pooled OLS, fixed effects, random effects and system GMM method, were also applied to examine the relationship. The results show that banks engaging in CSR activities could increase their financial profits.

**Chapter 5: Conclusions**

This chapter summarises the study and highlights the findings and contributions. The limitations of the research are addressed.

# Chapter 2: Determinants of bank profitability and efficiency: Empirical evidence from the Chinese banking sector

## 2.1. Introduction

Banks are amongst the most important financial institutions in any country. The principle role of a bank in the economy is as a financial intermediary. According to Aguilar (2003), bank management is always keen to find an efficient way to measure and manage their performance. In the competitive business environments, good performance management could support organisations to achieve their strategies and operational goals. Better bank performance might also improve the economic conditions of a country. Therefore, the performance of banks is of interest to bank managers, financial markets, and scholars.

The economy of China has international significance; its banking system is the backbone of the Chinese financial system and plays a vital role in maintaining a sustainable and healthy economy for the country. The status and functions of the banking industry in China's economy determine that its performance results in not only financial outputs but also in underpinning the capability of the social functions, such as maintaining the stability of the financial system, as banks play a decisive role in transmitting economic and financial policies to safeguard financial stability and promote economic growth. Following a series of reforms over the past three decades, dramatic changes have occurred in the Chinese banking sector. It is evolving from a mono-bank system into a more commercialised industry, with much attention now being paid to banking performance. The Chinese banking sector has rapidly developed, and the assets of Chinese commercial banks have increased every year since 2003 (China Banking Regulatory Commission report), which indicated the rising demand for banking services. The 2008 global financial crisis had less impact on the banking sector in developing countries. However, banks in transition economies have experienced significant reforms in order to improve stability and performance. The Chinese banking industry developed in a relatively stable manner during the crisis, due to government injection of emergency liquidity to combat the crisis and the implementation of an ambitious stimulus programme to restart economic growth.

Previous papers have sought to investigate the determinants of banking performance, and most of them used return on assets (ROA), return on equity (ROE) and net interest margin (NIM) to measure bank performance. Several empirical studies dominate the field, notably those exploring the determinants of bank performance. Examples include the work by Molyneux and Thornton (1992), Demirguç-Kunt and Huizinga (1999), Goddard et al. (2004), Athanasoglou et al. (2008), Heffernan and Fu (2010), Messai, Gallali, and Jonin (2015) and Menicucci and Paolucci (2016). The ever-changing landscape of the banking industry over the last 30 years may be the reason for the empirical preference. Such changes have affected financial institutions, industrial organisations, and technology. However, none of these studies appear to have considered the commercial banks’ efficiency to measure bank performance.

In the light of the previous background, the Chinese banking sector has experienced significant reform since 2003. For instance, authorities to recapitalise the SOCBs and resolve the NPL’s burden through bailout and financial restructuring. In addition, the SOCBs were encouraged to go public and be listed on stock exchanges. The main purpose of this strategy was to improve corporate governance structures, improve risk management and to better solve the agent-principal problem and enhance performance. After the major overhaul of SOCBs, the banking reform was deepened in 2010 as some programmes were initiated by the government to guide commercial banks to extend their operations to meet the increasingly diversified financial demands and promote financial inclusion. Taking the global financial crisis as an opportunity, the Chinese authorities have advanced banking reform towards a sound, comprehensive, and competitive banking sector to serve the real economy (Jiang & Yao, 2015). Therefore, the banking sector in China has witnessed a period of great changes in many aspects. Such significant changes made the Chinese banking sector as an interesting and unique context to investigate the bank performance.

The main purpose of this study is to examine the determinants of banking profitability and efficiency in China. There are two reasons to focus on Chinese commercial banks. First, previous studies have mainly considered developed countries or used data before the financial crisis. There is no study on the determinants of bank performance in China during the Post-Global Financial Crisis Era. Since 2003, the Chinese government have recognised the important role of commercial banks and accelerated bank reforms, while the legislation was amended to support commercial banks to develop in a sustainable and healthy way. Thus, to comprehensively investigate the determinants of Chinese banking profitability and efficiency could be invaluable to bank managers and policy makers. Second, several studies have investigated bank performance, and most of them used ROA, ROE or NIM to measure bank performance. However, none of these studies appear to have considered the commercial banks’ efficiency, whereas our analysis will examine the determinants of bank efficiency.

Using the panel data of Chinese banks from 2004 to 2018, this study contributes to the investigation of bank performance in China and explores the determinants that influenced Chinese banks’ profitability and efficiency. The empirical results demonstrate that all the determinants’ variables have a statistically significant impact on Chinese banks’ performance. In particular, credit risk is significantly and positively contributed to the NIM and Cost-efficiency, due to managers becoming temporarily engaged in skimping and postponing their costs for loans in exchange for more attractive financial results in the short term while liquidity risk makes a convincingly positive contribution to both the NIM and Cost-efficiency. Moreover, banks with a higher capital adequacy tended to exhibit higher levels of profitability, which supports the Signalling and Expected bankruptcy cost hypotheses. Non-interest income has a negative impact on all three performance measures, indicating that costs from bank diversification might exceed the incomes in the Chinese commercial banks. The positive impact of bank size on performance may occur through economies of scale such as cost advantage and more advanced technologies.

The main contribution of this study is to empirically analysis the determinants of bank performance. First, to the best of our knowledge this study is the first one which considers the post-crisis era in China and the first one to focus on bank efficiency as a complement to comprehensively measure bank performance. Secondly, we split our entire sample into two sub periods and highlight the impact of banking reform. This study has two policy implications. First, large-sized banks might increase competition awareness to avoid overexpansion. Secondly, Chinese banks should be encouraged to conduct non-traditional activities, improve diversity and reduce dependency on interest-earning activities.

The rest of this study is organised as follows. Section 2 reviews the related literature and hypotheses on the determinants on bank performance. Section 3 provides the main model and data samples. Section 4 presents the empirical results and discussion, and the final section provides a conclusion.

## 2.2. Literature review

In recent years, a substantial amount of literature has focused on banking performance. Better understanding on bank performance and its important determinants helps improve bank’s profitability and provides regulators with more flexibility in setting required regulatory frameworks (Trujillo-Ponce, 2013). This is vital to a country’s economy because the soundness of banking sector is considered as an important element in a country’s financial system. Thus, the bank performance has received great attention by bankers, investors, academics, and government.

### 2.2.1. Relevant theories

#### 2.2.1.1. The relationship between liquidity, credit risk and performance.

According to Imbierowicz and Rauch (2014), the Classical financial intermediation theory and the Industrial organization approach could be used to explain the relationship between liquidity, credit risk and performance. The Classical financial intermediation theory sees bank as a pool of liquidity supplying cash for depositors and borrowers, which might help to enhance economic welfare and internalise economic liquidity risk. In contrast, the industrial organisation approach considers bank as a dynamic dealer and pursue profit-maximising that establishes the interest rates on loans and deposits to balance the asymmetrical balance between loan demands and deposit supplies (Sufian and Noor, 2012). Banks could generate returns through interest from loans on the asset side, also, banks might obtain interests on deposits from the liabilities side. Therefore, both credit and liquidity risks could have impact on bank performance, however there is some ambiguity direction of the effect.

#### 2.2.1.2. The relationship between capitalization and performance.

In addition, two hypotheses could be used to explain the correlation between capitalisation and bank financial performance, namely: the Signalling hypothesis and Expected bankruptcy cost hypothesis. According to Saona (2016), the signalling hypothesis is a forward-looking hypothesis that suggests the capitalisation could have a positive impact on bank performance, due to bank managers willing to signal good future prospects and able to generate better cash flows. Thus, banks with good future prospects are expected to report lower debt or higher capitalisation in the financial statements. The expected bankruptcy cost hypothesis supports the positive relationship between capitalisation and financial performance. Berger (1995) explained that the expected bankruptcy costs is the probability of bank failure times the liquidation costs incurred when bank failure occurs. The expected bankruptcy might increase when the probability of bank failure arises. Therefore, banks are willing to increase their capital ratios as a protection against default and decrease the probability of failure and the costs. The banks with higher level of capital adequacy tend to better perform through a decreased interest rate on unsecured debts.

However, the efficiency-risk hypothesis suggests a negative relationship between capitalisation and bank performance, because of the ability of efficient banks to withstand financial distress in case of resorting to higher debt and lower capitalisation. Therefore, the negative impact of increased capitalisation will be evident in cases of inefficient banks due to the choice they make to resort to more capital and lower debt to avoid a higher level of risk that they cannot handle. This may consequence the risk and return will be lower, and supporting a negative relationship between capitalisation and bank performance.

### 2.2.2. Related literature on the determinants of bank financial performance.

#### 2.2.2.1. Determinants of bank financial performance in developed countries

Previous studies have investigated the different factors that might have influence on bank performance in developed and developing economies. Short (1979) stated that bank size influences the capital adequacy, as sizeable banks tend to raise less expensive capital and thus appear more profitable. However, Berger, Hanweck, and Humphrey (1987) argued that bank size, as a determinant, would affect banks’ revenues, as large state banks in the US have failed to simulate the viability problem due to overextended office size, which can potentially increase the cost incurred by the bank and reduce bank revenue. Molyneux and Thornton (1992) examined the determinants of bank performance using data from 18 European countries over the period spanning 1986–1989. Their results indicated that there is a weak and inverse correlation between bank liquidity and profitability; banks need to commonly hold the liquidity asset to hedge against liquidity impasses. Therefore, higher liquidity is associated with lower profitability, since liquid assets usually have low rates of return. They also found a positive relationship between capital ratio, government ownership, and bank profitability. In one important research by Kosmidou (2008), which used a sample of 23 Greece commercial banks over the period of 1992 and 2000, the results show a positive relationship between capitalisation, bank size and performance; while liquidity has a negative impact on bank performance.

#### 2.2.2.2. Determinants of bank financial performance in developing countries

Chantapong (2005) examined the performance of domestic and foreign banks in Thailand after the East Asian financial crisis over the period spanning 1995–2000. The results revealed that foreign banks’ profitability is higher than that of domestic banks. However, the gap between domestic banks and foreign banks narrowed in the post-crisis period due to an improvement and financial restructuring programme, which was implemented in domestic banks in Thailand. Sufian and Noor (2012) investigated the factors, both internal and external, which affect banks’ performance in India’s domestic and foreign banks during the period 2000–2008. Their empirical findings were not uniform across the different types of banks. However, they found a positive relationship between bank size, credit risk, and bank profitability in domestic Indian banks. Girardone, Molyneux and Gardener (2007) investigated the main determinants of Italian banks’ efficiency between 1993- 1996. The results found the banks that are more able to control costs, especially labour costs, will be more efficient. Pasiouras (2008) used DEA to investigate the efficiency of Greek commercial banking in 2000–2004. The results supported the notion that banks in Greece that had expanded their operations abroad were technically efficient, whereas banks with higher capitalisation, loan activity, and market power were highly efficient overall. Svitalkova (2014) compared bank efficiency across the Czech Republic, Slovakia, Austria, Poland, Hungary, and Slovenia. The DEA model was used, and the impact of undesirable outputs was considered. The results revealed that insufficient loans and a substantial number of loan loss provisions were the main reasons for inefficiency. Tecles and Tabak (2010) studied the determinants of the Brazilian banking sector over the period of 2000-2007 and indicated that large banks are most efficient, and capitalisation has a positive impact on efficiency. Overall, the determinants of bank financial performance in developing countries are different to the evidence in developed countries. The possible explanations could be the different development stages and nature of commercial banks. Besides, banks in developing countries usually have been subjected to government interference and protection.

#### 2.2.2.3. Determinants of bank financial performance in China

Previous studies on bank performance in China mainly focused on the influence of bank structure on the performance of financial institutions. Indeed, most of the research was conducted before 2011. For example, Lin and Zhang (2009) investigated the relationship between bank ownership reform and bank performance in China during the period spanning 1997–2004. Their empirical results indicated that the ‘Big Four’ state-owned commercial banks have worse asset quality than other types of banks in China and are relatively less profitable and less efficient, and the researchers suggested that ownership reform should continue to be pushed forward. Heffernan and Fu (2010) concluded that in China, the real GDP growth rate significantly affects bank profitability; however, they failed to identify a correlation between foreign ownership, bank listing, and bank performance. In addition, they concluded that the average performance of the city commercial banks was higher than that of the Big Four but lower than JSCBs (Joint-Stock Commercial Banks) during the period spanning 1999–2006. The Chinese economy and the Chinese banking market have changed considerably over the past 10 years, and the slowdown of GDP growth and the high volume of NPLs are the main factors in rejecting the notion that China’s banks generate more profit. In the field of Chinese banking efficiency, Wei and Wang (2000) applied a non-parametric method to analyse technical efficiency, scale efficiency, and returns to scale. Using the DEA framework, Zhang (2003) examined the efficiency of three types of commercial banks in China during 1997–2001. The empirical results demonstrated that the state-owned commercial banks (SOCBs) were more efficient and stable than other types of bank, and that most city commercial banks (CCBs) did not perform well. To identify Chinese banks’ efficiency before and after the programme of deregulation conducted by the government in 1995, Chen, Skully, and Brown (2005) used DEA methodology to estimate the efficiency of 43 banks during 1993–2000. They found that deregulation improved performance, with overall efficiency increasing between 1993 and 1996. However, efficiency fell after 1997 due to the Asian financial crisis and the proliferation of NPLs among SOEBs. Ariff and Can (2008) utilised a DEA-based tool to investigate the cost and profit efficiency of 28 Chinese commercial banks in 1995–2004. This period was characterised by strong economic growth due to the deregulation and globalisation in the Chinese financial market. They found inefficiency on the revenue side and banking profit efficiency levels well below cost efficiency. The results also confirmed that joint-stock commercial banks (JSCBs) were, on average, more efficient than SOCBs. However, these findings are inconsistent with those of Zhang (2003), whose work focused on the expansion of the JSCBs after 2001. Matthews, Guo, and Zhang (2007) concluded that average productivity modestly increased between 1997 and 2006. They applied the DEA method and MI and accounted for NPL as an undesirable output to adjust for the quality of the loans. The results indicated that JSCBs performed better than SOCBs, given that the latter faced restructuring and the divestiture of their large NPL holdings. In recent research, Zhao and Kang (2015) employed a non-radial super-efficiency DEA model with the SBM to gauge the efficiency of 18 Chinese commercial banks in the period 2006–2012. They found that SOCBs’ efficiency improved significantly after 2007 due to government help and protection. Overall, there are several studies that have investigated the determinants of bank performance in China, which have either used financial ratios to measure bank performance or evaluate their efficiency. However, each method has their advantages and limitations, and none of these studies appear to combine both financial ratio and bank efficiency to comprehensively measure commercial banks’ performance.

### 2.2.3. Determinants of bank performance.

#### 2.2.3.1. Credit Risk

Credit risk can be seen as the inability or delay in serving bank’s loans that leads to the assets’ present value decreasing and consequently deteriorates bank solvency (Herffernan, 1996). Bessis (2015) discussed that credit risk may lead to bank insolvency due to the default of bank’s major clients. Moreover, credit risk might be the most important financial risk that affects bank performance (Badea et al., 2010). Lending is a primary income source for banks and an important element in their business models. Therefore, the quality of the loans has a bearing on both risk and income. Fischer and Jordan (1996) indicated the aim of credit risk management is to improve bank profitability and maximise banks’ return by maintaining credit risk exposure within predetermined limits, which is vital to bank long-term success.

Several previous studies used the ratio of loan loss provisions to total loans to measure credit risk (Kosmidou, 2008; Athanasoglou et al., 2008; Saona, 2016; Garcia and Guerreiro, 2016). The higher level of the ratio represents the lower assets quality and higher credit risk. According to the skimping hypothesis, a trade-off exists between short-term operating costs and future loan quality. If banks decide to engage in skimping, they reduce their near-term costs in favour of long-term profit. Their costs can be reduced in the short term by decreasing the underwriting and monitoring of borrowers or by performing less due diligence in evaluating collaterals. In other words, these banks choose to postpone their costs for loans in exchange for more attractive financial results in the short term. Hence, when measured in the short term, even with deteriorating loan quality, banks can maintain or improve their financial performance (Williams, 2004). Empirically, Kosmidou (2008) and Ommeren (2011) found a significant negative relationship between credit risk and bank profitability. However, Saona (2016) suggested the positive impact of credit risk on bank performance, because banks passed the increasing costs of risks to customers as they pay higher margins for the services. Thus, the relationship between credit risk and bank performance is varying across different countries.

#### 2.2.3.2. Liquidity Risk

Liquidity risk might happen from the maturity mismatch between liabilities and assets, the life of liabilities is shorter than assets; in these cases, an unexpected increase in demand for liquidity by borrowers may result in shortage of liquidity (Oldfield and Santamero, 1997). Liquidity risk is usually measured by the ratio of net loans to total assets. A higher level of this ratio implies higher liquidity risk. Ariffin (2012) indicated that liquidity is crucial to a bank and managing liquidity efficiently will enhance bank’s solvency. Liquidity is a key factor in banks’ business models, as observed in many empirical studies of bank performance. Researchers have varying opinions about the association between liquidity and profitability, and there is no agreement regarding the impact of liquidity (Pasiouras & Kousmidou, 2007). Some scholars have proposed a positive relationship between liquidity and performance (Angbazo, 1997; Petria, Capraru & Ihnotove, 2015). The reasoning is that if banks are unable to meet an intense demand for depositor withdrawals or loans without enough liquid assets or borrowing capacity, they are forced to borrow emergency funds at higher interest rates, thereby reducing their NIM. The opposing view suggests that a high level of liquid assets results in high carrying and opportunity costs, both of which negatively contribute to interest income (Molyneux & Thornton, 1992).

#### 2.2.3.3. Capital Strength/ Adequacy

Capital strength or adequacy has always played an essential role in the international banking industry and been an important factor that affect bank performance. Capitalisation is often measured by the ratio of bank’s equity to bank’s total assets, which represents the sufficiency of the bank’s equity to absorb unexpected shocks. Capital adequacy becomes more important after a global financial crisis, especially after failure of large financial institutions. Capital strength features in regulations such as the Basel Accord, established the minimum capital requirements for financial institutions with the goal of minimising credit risk. Lee (2015) indicated that the relationship between capital adequacy and bank profitability is of great importance for regulatory authorities responsible for controlling bank capital adequacy. Additionally, this relationship is important to maintain profitability of the banking sector of a country. Much of the previous literature has proposed that capital strength has a positive significant influence on banks’ financial performance (e.g., Molyneux & Thornton, 1992; Angbazo, 1997; Naceur, 2003).

Two explanations usually underpin the idea that higher capital strength or adequacy results in improved bank performance. The first explanation is risk management; the second relates to the ‘pecking order’ theory. The risk-based view suggests that banks with adequate capital have additional buffering, which helps them to endure adverse macroeconomic shocks, thus increasing safety for depositors and helps to generate a higher interest margin and profitability by reducing insolvency and default risk (Angbazo, 1997; Molyneux & Thornton, 1992). From the pecking-order perspective, highly capitalised banks enjoy greater access to cheaper sources of funds because they have a low risk of bankruptcy, whereas low-capitalised banks suffer high borrowing costs due to their high financial leverage and risk of bankruptcy (Sufian & Habibullah, 2009). Pasiouras and Kosmidou (2007) reported a positive relationship between capitalisation and bank profitability, the results support that well-capitalised banks tend to reduce bankruptcy costs and have a lower requirement for external funding. Djalilov and Pierrse (2016) found that the capitalisation has a positive impact on bank performance due to higher capital ratio reducing the cost of unsecured debt and banks also might send good signals about its future through better capitalisation.

#### 2.2.3.4. Diversification

As in many other businesses, bank diversification has become increasingly important; it allows the generation of substantial income, reduces risk, and combats rising competitive pressure. Nonetheless, the arguments on the relationship between diversification and bank performance have not been achieved a general consensus.

There are three important opinions about positive effect of diversification on bank performance. First, the diversified banks tend to benefits from economies of scope. Unlike companies from other industries, banks have a tendency to maintain long-term contractual relationships with their clients (Elsas et al., 2010). Thus, banks might reuse the information acquired about the clients from traditional banking services to provide additional services. For instance, banks can gather client’s information during the loan-making process that can help them to provide other financial services, such as securities and insurance underwriting. Similarly, the information from other activities can assist and improve loan making decisions (Diamond, 1991; Rajan, 1992; Laeven and Levine 2007). Secondly, diversified banks might reduce their risk of bankruptcy by spreading their operations across various products or markets (Boot and Schmeit, 2000). Thirdly, business diversification is one of the strategies that banks use to deal with uncertainty and it might help to improve their future performance (Boot, 2003; Elsas et al., 2010). Elsas et al. (2010) suggest that technological progress and deregulation trigger dramatic changes in banking sector. Therefore, banks might acquire the necessary skills through extending their operation to new business area and ultimately enjoy additional benefits when a particular business area flourishes. In contrast, increasing agency problems between corporate insiders and small shareholders is one of the most crucial disadvantages of bank diversification for performance. Laven and Levine (2007) indicate that more diversified firm will be more difficult to design efficient managerial incentive contracts for and more difficult to align the incentives of outsiders with insiders. In addition, according to Klein and Saidenberg (1998), banks might suffer from diluting their managers’ comparative advantage by making them operate outside their existing expertise.

Empirically, the relationship between diversification and bank performance has been well documented with conflicting results. According to Vallascas, Crespi and Hagendorff (2012), Italian banks can benefit from diversification. Saunders, Schmid and Walter (2018), in their study of US banks, also report that banks with more non-interest income activities tend to have higher profitability and lower insolvency risk. On the other hand, Laeven and Levine (2007) suggest that financial intermediaries that engage in diversified activities face more severe agency problems. Gamra and Plion (2011) reported that, because of the aggravated agency problems, the costs incurred in bank diversification exceeded the gains. However, as most previous studies do not focus on emerging markets, which have less mature financial sector and banking system compare with developed economies, this may lead to a different relationship between bank diversification and bank performance within this market sector.

During the Post-Crisis Era, to enhance financial stability and improve market competitiveness, Chinese commercial banks have promoted financial inclusion through innovations and diversified market-oriented operations into other financial segments including insurance and trusts. Consequently, new business models and products have emerged such as internet finance and shadow banking, which offer e-commerce services and financial support to customers. Most of the earlier studies have mainly focused on the profitability and/or efficiency of the different types and ownership of Chinese banks (Berger, Hasan and Zhou, 2009; Heffernan and Fu, 2010). However, only a few studies have investigated the impact of diversification on bank performance in China, most of which have studied the period before the Global Financial Crisis. Berger, Hasan and Zhou (2010), using a sample of Chinese banks during 1996-2006, reported that the four dimensions of diversification are associated with reduced profits and higher costs. However, Zhou (2014) found no significant relationship between income-diversification and bank risk. Thus, the previous literation on the impact of diversification on Chinese bank’s performance remains mixed.

#### 2.2.3.5. Asset Size

Researchers have not agreed upon the relationship between asset size and bank performance; this lack of consensus is congruent with the parallel existence of multiple theories. According to SCP theory, a positive relationship exists between size and performance (Bain, 1956), which means that banks with substantial assets have a competitive advantage in terms of reduced operating costs, higher market share, or market power in a concentrated market (Barajas et al., 1999; Afanasieff & Marcio, 2002). However, asset size may negatively impact bank performance. Overexpansion, failure in synergy, and inefficient management may cause large banks to suffer a competitive disadvantage (Naceur, 2003; Goddard et al., 2004; Pasiouras & Kosmidou, 2007). The bank size is generally measured by the logarithm of total assets. Empirically, several studies reported the positive relationship between bank size and bank performance, which indicated the existence of economies of scale and large size banks may have cost advantage over small competitors due to the economies of scale in terms of apply advanced technologies and recruiting more qualified staff (Kosmidou, 2007; Noman et al., 2015; Saona, 2016; Hasanov et al., 2018). However, Ahamed (2017) indicated that bigger sized banks might also suffer from diseconomies of scale due to complicated administrative procedures and increased agency cost. Thus, the relationship between size and bank performance is still inconclusive.

### 2.2.4. Development of research hypotheses

The main aim of this study is to explore different factors that affect bank performance. Different literatures have been reviewed to determine the most relevant factors to bank performance and their expected effects. A summary of the research hypotheses is showed in Table 2-1, which is developed based on the previously discussed.

Table 2-1 Summary of research hypotheses

|  |
| --- |
| H1a: Credit risk has a significant positive impact on performance of Chinese commercial banks |
| H1b: Credit risk has a significant negative impact on performance of Chinese commercial banks |
| H2a: Liquidity risk has a significant positive impact on performance of Chinese commercial banks |
| H2b: Liquidity risk has a significant negative impact on performance of Chinese commercial banks |
| H3: Capital adequacy has a significant positive impact on performance of Chinese commercial banks |
| H4a: Diversification has a significant positive impact on performance of Chinese commercial banks |
| H4b: Diversification has a significant negative impact on performance of Chinese commercial banks |
| H5a: Bank size has a significant positive impact on performance of Chinese commercial banks |
| H5b: Bank size has a significant negative impact on performance of Chinese commercial banks |

## 2.3. Methodology

### 2.3.1. Measuring bank financial performance

Various financial measurements are applied to describe bank performance. Financial ratios such as return on assets (ROA), return on equity (ROE) and net interest margin (NIM) are most commonly used to measure the level of bank profitability and considered as accounting-based measures in previous literature. Sinkey (1983, p.201) argued that ROA and ROE are the best measures of a firm’s overall performance, as “profitability is a bank’s first line of defence against unexpected losses, it strengthens its capital position and improves its future profitability through the investment of retained earnings”.

Pasiouras and Kosmidou (2007) indicated that ROA is the most used measure of bank profitability in the financial literature. In addition, The ROA is defined as the profit earned per unit of asset. This measure represents a bank’s ability to generate returns from its portfolio of assets (Athey & Imbens, 2006). However, one of the major disadvantages of ROA is the exclusion of off-balance sheet (OBS) assets. Because the returns from OBS activities are included in the numerator of the ratio and the OBS assets are not included in the denominator, this might result in an upward bias (Goddard et al., 2004). Another measure of bank profitability used in the banking literature is NIM. The NIM is defined as the ratio of net interest revenue to total earning assets (Angbazo, 1997) and represents the bank’s ability to charge an interest margin as one of its main income sources. Goddard et al., (2004) suggested that NIM calculates the ratio of net interest income to total assets, which could overcome the bias that might result from OBS activities.

However, using ratios to measure the performance of banks might be problematic because banks are complex multidimensional organisations, which could produce multiple outputs using various inputs. Berger and Humphrey (1997) suggested to avoid the limitations of ratio analysis, most studies applied efficiency frontier techniques to examine the bank performance. Using efficiency measure could be considered as complementary to the existing financial ratios.

### 2.3.2. Efficiency measures

Unlike the previous studies, we also apply additional indicators to measure bank performance. Cost efficiency was selected to measure individual bank efficiency. Much literature exists regarding the measurement of banks’ efficiency (Sherman & Gold, 1985; Fukuyama & Weber, 2009; Qin, Wang & Huang, 2016). However, to date, researchers have failed to reach a consensus on banks’ production function. A substantial proportion of previous works used either parametric (stochastic frontier approach (SFA)) or non-parametric methodologies (data envelopment analysis (DEA)) to examine bank efficiency. The difference between these two approaches identifies whether underlying assumptions were necessary for estimating the efficient frontiers. DEA did not require a priori assumptions about the function. However, it suffered from the problems caused by statistical noise as all the random errors, such as measurement errors, accounted for inefficiency. The SFA approach allowed for the effect of statistical noise to be separated from the effect of inefficiency, thereby resulting in a stochastic frontier. However, the approach needed the assumptions for a specific functional form for the shape of the efficient frontier. It might contain errors if the assumptions were mis-specified. Most of the previous studies have used either a non-parametric approach or a parametric methodology, but both methods have their merits and limitations; this study selected DEA to measure banking cost-efficiency.

Data envelopment analysis (DEA) is a non-parametric method that was first proposed by Charnes, Cooper, and Rhodes (1978). They introduced the term ‘decision making unit’ (DMU) and extended Farrell’s (1957) single input–output model to a multiple input–output model. This model has been widely used for assessing efficiency in both non-profit industries (e.g. hospitals, schools, and local government) and profit-seeking areas (e.g. financial institutions, utility companies, and agriculture). The efficiency of the DMU is measured by the ratio of the sum of weighted outputs to the sum of weighted inputs. In the DEA estimation, the ‘efficiency frontier’ is made up of the DMUs that are more efficient than other DMUs within the sample, and the efficiency scores of all the other DMUs are assigned on the basis of their radial distance from the frontier. The efficient units are rated as 100% or 1, while the other inefficient DMUs receive lower ratings. An efficiency score of less than 1 indicates that a linear combination of the other DMUs from the sample could produce the same vector of outputs but use a smaller vector of inputs (Cooper et al., 2006). Non-parametric methods can avoid function-setting errors because there is no requirement to set functions (Berger, 1997).

In this study, we posited that the total loans and the other earning assets were the outputs, and identified three inputs: labour, total physical capital, and total borrowed funds. The selection was based on the intermediation approach proposed by Sealey and Lindely (1977). This approach treats a bank as an intermediary that transforms the collected funds from the savers into profitable projects. Cost efficiency (CE) is the ratio of the best-practice minimum cost to the cost actually incurred.

### 2.3.3. Model specification

To investigate the determinants of bank performance in China, this study applies the two-step Generalised Method of Moments (GMM) approach proposed by Arellano and Bover (1995) and Blundell and Bond (2000). The system GMM estimator combines the regression difference with the regression in levels to reduce the potential biases and imprecision associated with the difference estimator (Arellano and Bover, 1995). In addition, the GMM estimator is used to address potential endogeneity, heteroscedasticity and autocorrelation problems. Ordinary least squares (OLS) and fixed effects estimator were used in previous studies, however, those common panel estimation methods might suffer from endogeneity problems. The example of these problems might be the existence of profit persistence. Reverse causality might be another problem, such as the relationship between diversification and performance, which could go in the opposite direction. Moreover, the unobservable bank heterogeneity exists in the performance models, such as different banks’ corporate governance that might affect bank performance. Thus, the GMM approach is applied to address the problems in the model. Following previous theoretical and empirical studies, we specify the model expressed below:

$$ROA\_{it}=β\_{0}+β\_{1}ROA\_{i,t-1}+β\_{2}Risk\_{it}+β\_{3}Liq\_{it}+β\_{4}Cap\_{it}+β\_{5}Nii\_{it}+β\_{6}Size\_{it}+ε\_{it}+Year Dummies (1)$$

$$NIM\_{it}=β\_{0}+β\_{1}NIM\_{i,t-1}+β\_{2}Risk\_{it}+β\_{3}Liq\_{it}+β\_{4}Cap\_{it}+β\_{5}Nii\_{it}+β\_{6}Size\_{it}+ε\_{it}+Year Dummies \left(2\right)$$

$$ Eff\_{it}=β\_{0}+β\_{1}Eff\_{i,t-1}+β\_{2}Risk\_{it}+β\_{3}Liq\_{it}+β\_{4}Cap\_{it}+β\_{5}Nii\_{it}+β\_{6}Size\_{it}+ε\_{it}+Year Dummies (3)$$

Subscripts i and t denote the cross-sectional dimension across banks and the time period respectively. ROA, NIM and Eff represents bank performance. $β$ is the series of parameters to be estimated. The equation includes one period lag of the dependent variable to help to control for persistence in bank performance. Table 2-2 presents all the variables used in this study.

Table 2-2 Summary of variables and descriptions

|  |  |  |  |
| --- | --- | --- | --- |
| Variables  | Acronym | Definition | Expected effect |
| Performance | ROA | Return on Assets |  |
| NIM | Ratio between net interest income and earning assets |  |
| CE | Cost-efficiency |  |
| Risk | LLR | Loan-loss provision as a fraction to total loans | +/- |
| Bank liquidity | Liq | Net loans/ Total assets | +/- |
| Capital  | Cap | Book value of capital to total assets | + |
| Bank diversification  | Nii | Ratio of non-interest income to total revenues | +/- |
| Bank size | Size | Logarithm of total assets | +/- |

### 2.3.4. Data and basic statistics

To investigate the determinants of bank performance in China, we created a panel data sample including 69 Chinese commercial banks from 2004 to 2018. The sample was obtained from various sources. The financial ratios were obtained from BankScope and the individual banks’ annual reports. The sample period started in 2004, because of the significant reform in the banking sector since 2003.

Table 2-3 presents the summary statistics of all variables in this study. It is worth noting that the average ROA of banks in China has been less than 1%, which is low and reflects poor asset turnover and profit margins in Chinese banks. Moreover, a similar performance can be identified for NIM, while the standard deviation of ROA is 0.44, which suggests that different banks have a wide range of profit level. Compared with the previous study by Liang, Kuo and Chen (2020), focused on the period between 2003 and 2012, the mean ROA 0.97 is higher than 0.88 in their sample, which indicates commercial banks might generate more profit during the Post-Crisis Era. According to the values of risk variables, the difference in the risk level among the banks in different years is relatively large, as the lowest values for LLR is 0.04 and the highest values are 22.02, which is consistent with previous research (Tan, 2016). The highest risk value is for the Agricultural Bank of China in 2007, which was the last state-owned commercial bank to receive a government injection to reduce NPLs. The mean of capital is 6.51, with a minimum value of −13.71 and max value of 31.35, which suggests that the difference in capital positions among banks is huge in different years; this might be explained by the reform and new capital regulations released during the examined period. The mean value of income diversity is 17.13% and its standard deviation is 14.74, which suggests that the difference in bank diversification among banks is huge in different years.

Table 2-3 Summary Statistics

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Variables  | Observations | Mean | Median | SD | Min | Max |
| ROA | 820 | 0.97 | 0.97 | 0.44 | -1.39 | 2.70 |
| NIM | 824 | 2.92 | 2.82 | 1.01 | 0.19 | 6.93 |
| CE (DEA) | 598 | 0.72 | 0.70 | 0.15 | 0.28 | 1.00 |
| Risk | 801 | 2.83 | 2.69 | 1.29 | 0.04 | 22.02 |
| Liquidity | 826 | 46.57 | 47.47 | 9.51 | 16.55 | 76.27 |
| Capital | 827 | 6.51 | 6.40 | 2.35 | -13.71 | 31.35 |
| Diversification | 819 | 17.13 | 13.64 | 14.74 | -14.63 | 91.20 |
| Bank size | 823 | 5.40 | 5.24 | 0.82 | 3.56 | 7.44 |

Pearson correlation is used to measure the level of association between two or more variables. Table 2-4 presents the matrix of correlation coefficients among all variables. All coefficients are less than 0.70, which indicates the model has no serious multicollinearity problems, as previous studies have shown that multicollinearity problems occur only if Pearson correlations are above 0.80 (Farrar & Glauber, 1967; Gujarati, 2003).

Table 2-4 Correlation Matrix for full sample

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Variables | ROA | NIM | CE (DEA) | Risk | Liquidity | Capital | Diversification | Bank size |
| ROA | 1 |  |  |  |  |  |  |  |
| NIM | 0.629\* | 1 |  |  |  |  |  |  |
| CE (DEA) | -0.282\* | -0.384\* | 1 |  |  |  |  |  |
| Risk | -0.062 | 0.011 | -0.118\* | 1 |  |  |  |  |
| Liquidity | 0.055 | 0.282\* | 0.075 | -0.109\* | 1 |  |  |  |
| Capital | 0.176\* | 0.192\* | -0.237\* | -0.152\* | -0.029 | 1 |  |  |
| Diversification | -0.186\* | -0.607\* | 0.086 | 0.051 | -0.098\* | -0.027 | 1 |  |
| Bank size | 0.046 | -0.289\* | 0.315\* | 0.069 | -0.080 | -0.069 | 0.222\* | 1 |

\* Correlation is significant at the 0.01 level

## 2.4. Empirical results

### 2.4.1. Baseline results

To investigate the determinants of bank profitability and efficiency, this study applies the two-step GMM approach proposed by Arellano and Bover (1995) and Blundell and Bond (2000), which address the potential endogeneity problem that may form persistence of bank performance, reverse causality and omitted bias. One-year lagged bank performance is included in the regression. Sargan and Hansen over-identification AR (1) and AR (2) are applied to test the validity of instrumental variables. Table 2-5 provides the regression results from the two-step GMM approach with ROA, NIM and cost-efficiency as dependent variables. The lagged dependent variables are strongly significant which support the profit persistence in the model.

Loan Quality/Credit Risk (LLR): The credit risk is significantly and positively contributed to the NIM and Cost-efficiency but not to the ROA. The results support H1a and indicate that poor loan quality does not harm interest income but rather has the opposite effect. A positive relationship exists between the LLR and NIM and Cost-efficiency, presumably due to managers becoming temporarily engaged in skimping or supplying many ‘government-directed’ or preferential loans, usually to SOEs. Their costs might be reduced in the short term by decreasing the underwriting and monitoring of borrowers. In other words, these banks choose to postpone their costs for loans in exchange for more attractive financial results in the short term. However, this practice could lead to increasing NPLs and deterioration in the long term, eventually adding to banks’ costs and becoming a burden for them if they wish to pursue improved performance in the future. Another explanation could be that banks passed the increasing costs of risks to customers as they pay higher margins for the services.

Liquidity risk (LIQ): The LIQ makes a convincingly positive contribution to both the NIM and Cost-efficiency, which means the higher level of liquidity risk, the higher NIM and cost-efficiency. The findings support H2a and consistent with the result was reported by Bourke (1989) and Rahman et al (2015). The reasoning is that higher levels of this variable imply lower levels of liquidity, while a higher level of LIQ might imply better bank performance due to more interest income being generated.

Capital strength and adequacy (Cap): The relationship between capital strength or adequacy and bank profitability proved to be significant and consistent. As displayed in Table 2-5, banks with a higher capital adequacy tended to exhibit higher levels of both the ROA and NIM. The results are consistent with the Signalling and Expected bankruptcy cost hypotheses. Well-capitalised banks experience higher returns by decreasing their operation costs and reducing their risk of bankruptcy. While the relationship between capital adequacy and cost-efficiency turned out to be negative, the possible reason could be the increased agency costs from the conflicts of interest between shareholders and managers. According to Pessarossi and Weill (2015), a lower capital ratio puts the pressure on bank managers to perform as it reduces “free cash flow” at the disposal of managers (Jensen, 1986) as debt implies interest payment obligations, and as bank managers have incentives to avoid the personal costs of bankruptcy; therefore, the relationship between capital and efficiency might be negative.

Diversification (NII): According to the results in Table 2-5, the NII has a negative impact on all three performance measures, which is consistent with Laven and Levine (2007) and supports hypothesis H4b. This finding suggests that the NII has yet to become a lucrative strategy for Chinese commercial banks and provides support for Barajas’s (1999) study. Thus, although OBS business generates income for commercial banks, it is not necessarily profitable. The additional investments and costs incurred in bank diversification might exceed the incomes and the Chinese commercial banks might suffer from diluting their comparative advantage. Berger et al. (2010) and Tan & Floros (2012) concluded that the NII results in increasing costs and reduced profits among banks in China. There are three possible explanations for profits from NII activities failing to offset the corresponding costs in the Chinese financial system. First, the primary and largest source of business finance in China remains bank loans, which leaves a relatively small market for other OBS activities (China’s Financial Publishing House, 2003–15). Second, the rapid development of non-banking institutions and online operators for non-interest-bearing business reduces the banking market’s profit margin. Thirdly, diversified bank might increase agency costs. The higher level of bank diversified managers may not always be aligned with shareholders and may pursue their own private interests. Besides, the rigorous competition among Chinese commercial banks could result in exaggerating the costs for banks to enter a new sector.

Bank size: The logarithm of banks’ total assets as a proxy in the model indicates that bank performance is generally sensitive to asset size. According to the results, size significantly and positively contributed to the ROA or cost-efficiency but not to NIM. The positive relationship between size and ROA and cost-efficiency is consistent with Kosmidou (2008), Pervan et al. (2015) and Saona (2016). Bigger banks having more resources across the country, in terms of branches, employees and assets. The positive impact may occur through economies of scale such as cost advantage and more advanced technologies. The state-owned commercial banks in China are large banks, which are more capable to conduct marketing campaigns and to attract more customers.

Table 2-5 Two-step GMM regression results

|  |  |  |  |
| --- | --- | --- | --- |
| Variables | ROA (1) | NIM (2) | CEDEA (3) |
| Dep. (-1) | 0.506\*\*\*(16.26) | 0.588\*\*\*(23.70) | 0.716\*\*\*(28.56) |
| Risk | 0.011(1.12) | 0.048\*\*\*(4.81) | 0.008\*\*\*(4.29) |
| Liquidity | 0.001(0.56) | 0.012\*\*\*(8.96) | 0.001\*\*\*(3.72) |
| Capital | 0.025\*\*\*(7.40) | 0.042\*\*\*(6.62) | -0.005\*\*\*(-3.88) |
| Diversification | -0.001\*\*(-2.50) | -0.020\*\*\*(-25.47) | -0.001\*(-1.96) |
| Bank size | 0.045\*\*\*(5.71) | -0.056\*\*\*(-3.33) | 0.021\*\*\*(5.64) |
| Constant | 0.133\*\*(2.50) | 0.886\*\*\*(6.06) | -0.027(-0.94) |
| Year fixed effects | Yes | Yes | Yes |
| Firm fixed effect | Yes | Yes | Yes |
| AR(1) p-value | 0.011 | 0.000 | 0.000 |
| AR(2) p-value | 0.568 | 0.153 | 0.353 |
| Sargan test of over-identification | 0.111 | 0.599 | 0.207 |
| Hansen test of over-identification | 0.982 | 0.995 | 0.950 |
| Observations  | 727 | 732 | 513 |

### 2.4.2. Robustness checks

This study employs a basic OLS and a fixed-effects estimation to allow for a comparison of results and check its robustness with different estimation methods. The results from OLS and fixed-effects estimation show in table 2-6 and 2-7; that most of variables are consistent with the findings in table 2-5.

Table 2-6 OLS regression results

|  |  |  |  |
| --- | --- | --- | --- |
| Variables | ROA | NIM | CEDEA |
| Risk | 0.009(0.44) | 0.113\*\*\*(4.67) | -0.025\*\*\*(-3.01) |
| Liquidity | 0.006(1.29) | 0.033\*\*\*(4.14) | -0.001(-0.41) |
| Capital | 0.039\*\*\*(3.05) | 0.086\*\*\*(3.70) | -0.016\*\*\*(-2.95) |
| Diversification | -0.004\*\*\*(-3.00) | -0.034\*\*\*(-14.47) | -0.001(-0.01) |
| Bank size | 0.064\*\*(2.18) | -0.168\*\*\*(-3.14) | 0.043\*\*(2.05) |
| Constant | -0.386\*(-1.71) | 1.146\*\*\*(2.69) | 0.870\*\*\*(5.80) |
| Year effects | Yes | Yes | Yes |
| R2 | 0.330 | 0.647 | 0.303 |
| Observations | 786 | 792 | 591 |

Table 2-7 Fixed effect regression results

|  |  |  |  |
| --- | --- | --- | --- |
| Variables | ROA | NIM | CEDEA |
| Risk | 0.003(0.27) | 0.096\*\*\*(5.65) | -0.001(-0.02) |
| Liquidity | 0.005\*\*(2.36) | 0.021\*\*\*(5.81) | 0.001(0.94) |
| Capital | 0.021\*\*\*(3.02) | 0.065\*\*\*(5.66) | -0.004\*(-1.79) |
| Diversification | -0.002\*\*(-2.05) | -0.032\*\*\*(-20.00) | 0.001(1.03) |
| Bank size | 0.299\*\*\*(2.64) | 0.076(0.41) | 0.073\*(1.85) |
| Constant | -1.284\*\*(-2.08) | 0.924(0.92) | 0.511\*\*(2.34) |
| Year effects | Yes | Yes | Yes |
| R2 | 0.396 | 0.688 | 0.391 |
| Observations | 786 | 792 | 591 |

### 2.4.3. Additional checks

The Chinese banking sector has experienced significant reform since 2003. For instance, authorities worked to recapitalise the SOCBs and resolve the NPL’s burden through bailout and financial restructuring. After the major overhaul of SOCBs, the banking reform was deepened in 2010 as some programmes were initiated by the government to guide commercial banks to extend their operations to meet the increasingly diversified financial demands and promote financial inclusion. Taking the global financial crisis as an opportunity, the Chinese authorities have advanced banking reform towards a sound, comprehensive, and competitive banking sector to serve the real economy (Jiang & Yao, 2015). In order to control for the reform aspect, we split our entire sample into two sub periods ranging from 2004-2011 and from 2012-2018.

Table 2-8 and table 2-9 report the regression results for two sub periods. The results generally confirm the findings from the entire sample period. The results report significant impact of capital and bank diversification on ROA in the first period, however there is no significant correlation in the second period. Credit risk shows opposite impact in the two periods. The determinants of NIM in the two periods are similar with findings from the entire sample period. The findings suggest liquidity risk has a negative influence on cost-efficiency, which is different from the result from the first period and entire period. The varies of determinants of bank performance in two sub periods support the fact that the Chinese banking sector conducted major reform.

Table 2-8 Two-step GMM regression results over 2004-2011

|  |  |  |  |
| --- | --- | --- | --- |
| Variables | ROA (1) | NIM (2) | CEDEA (3) |
| Dep. (-1) | 0.403\*\*\*(6.09) | 0.648\*\*\*(8.28) | 0.440\*\*\*(2.99) |
| Risk | 0.032\*\*\*(4.24) | 0.067\*\*\*(4.85) | -0.037\*\*(-2.36) |
| Liquidity | 0.001(0.69) | 0.008\*\*(2.27) | -0.001(-0.11) |
| Capital | 0.030\*\*\*(4.20) | 0.037\*\*\*(2.78) | -0.002(-0.44) |
| Diversification | -0.005\*\*\*(-3.46) | -0.019\*\*\*(-4.77) | 0.002\*\*\*(3.27) |
| Bank size | 0.001(0.06) | -0.130\*\*\*(-4.42) | 0.025\*\*(2.28) |
| Constant | 0.582\*\*\*(3.42) | 1.836\*\*\*(4.49) | 0.717\*\*(2.19) |
| Year fixed effects | Yes  | Yes  | Yes  |
| Firm fixed effect | Yes | Yes | Yes |
| AR(1) p-value | 0.004 | 0.001 | 0.075 |
| AR(2) p-value | 0.510 | 0.277 | 0.713 |
| Sargan test of over-identification | 0.161 | 0.270 | 0.499 |
| Hansen test of over-identification | 0.329 | 0.348 | 0.793 |
| Observations  | 257 | 260 | 100 |

Table 2-9 Two-step GMM regression results over 2012-2018

|  |  |  |  |
| --- | --- | --- | --- |
| Variables | ROA (1) | NIM (2) | CEDEA (3) |
| Dep. (-1) | 0.908\*\*\*(7.47) | 0.281\*\*\*(3.23) | 0.783\*\*\*(12.30) |
| Risk | -0.037\*\*\*(-3.81) | 0.100\*\*\*(4.05) | 0.007\*\*(2.49) |
| Liquidity | -0.003\*\*\*(-2.83) | 0.020\*\*\*(3.61) | -0.001\*(-1.70) |
| Capital | 0.010(0.91) | 0.053\*\*(2.53) | -0.006\*\*(-2.11) |
| Diversification | -0.001(-0.54) | -0.025\*\*\*(-11.82) | -0.001(-0.91) |
| Bank size | 0.041\*\*\*(2.66) | 0.006(0.12) | 0.019\*\*\*(2.61) |
| Constant | -0.007(-0.09) | 1.118\*\*\*(3.15) | -0.001(-0.01) |
| Year fixed effects | Yes  | Yes  | Yes  |
| Firm fixed effect | Yes | Yes | Yes |
| AR(1) p-value | 0.043 | 0.000 | 0.000 |
| AR(2) p-value | 0.186 | 0.260 | 0.651 |
| Sargan test of over-identification | 0.599 | 0.268 | 0.454 |
| Hansen test of over-identification | 0.654 | 0.276 | 0.336 |
| Observations  | 405 | 406 | 355 |

## 2.5. Conclusion

The banking industry plays an important role in economic development. Banks’ performance attracts sustained interest from bank managers and scholars alike (Durusu-Ciftcia et al., 2017; Naceur et al., 2017). Banks’ performance not only reflects the robustness and dynamics of the banking industry but also mirrors the stability and vigour of the overall economy in many ways.

The main purpose of this study was to explore the determinants of the performance of the Chinese banking sector. Using an unbalanced panel data of 69 banks covering the period between 2004 and 2018 in the empirical analysis, several interesting observations arose. First, poor loan quality does not harm interest income but rather has the opposite effect. Chinese bank managers might engage in skimping or supplying many ‘government-directed’ or preferential loans, usually to SOEs. This supports the study by Luo (2016), who suggested that instead of providing funding according to risk-and-return assessments, SOBs were expected to support and issue loans to the enterprises that had ‘special relationships’ with the government. Commercial banks choose to postpone their costs for loans in exchange for more attractive financial results in the short term. Second, Well-capitalised banks experience higher returns by decreasing their operation costs and reducing their risk of bankruptcy. Third, bank loans remain the primary and largest source of business finance in China. The other OBS activities have a relatively smaller market; therefore, non-interest income is yet to become a lucrative strategy. Finally, large sized banks have more resources across the country, in terms of branches, employees and assets. The positive impact of bank size on performance may occur through economies of scale such as cost advantage and more advanced technologies.

This study has policy implications. First, it is a priority to optimise the scale of large-sized banks and to increase competition awareness to avoid overexpansion or failure in synergy. Second, Chinese banks should be encouraged to engage in OBS and non-traditional activities. Although the sector has undergone several rounds of reform, bank loans remain the primary source of business finance, leaving a smaller market for other OBS activities. To reduce dependency on interest-earning activities and to improve diversity, Chinese banks should develop more non-traditional activities, which would protect them against the ramifications of the strong influence of macroeconomic conditions on interest. Banks may obtain profits through economies of scope in well-developed, interest-earning, and non-traditional activities.

Finally, further research with appropriate adjustments could include more variables to measures of performance or the relevant variables, such as, for assessing the value of corporate governance and the integration of CSR for banks (Jizi et al., 2014). In terms of methodology, a statistical cost accounting or ‘frontier optimisation technique’, like the stochastic frontier analysis (SFA) approach, is recommended to examine bank’s financial performance.

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# Chapter 3. Investigating the relationships between Capital, Risk and Efficiency in Chinese commercial banks

## 3.1. Introduction

The Chinese banking sector has undergone several rounds of reforms since 1978 to improve bank performance and develop a modern and sustainable banking system. Over recent decades, the China Banking Regulatory Commission (CBRC) has strengthened prudential regulation to enhance risk management, enhance corporate governance, and achieve long-term sustainable performance. In particular, in the major reforms of capital adequacy regulation in 2004, CBRC issued the ‘Regulation governing the capital adequacy of commercial banks’; this was the first time capital in the Chinese banking sector had been defined. It can be seen as a revolution in the banking system. As a consequence, there was a significant adjustment of Chinese bank capital adequacy ratios: almost all the commercial banks (accounting for 99.9% of banking assets) were compliant at the end of 2008, while only less than 10% of banks had met the requirements in 2004 (CBRC, 2010). In addition, CBRC improved the prudential regulatory standards and set stricter capital regulations in 2011. Very little research has investigated the impact of bank capital in the Chinese banking sector, however the dramatic change of capital provides a unique context to examine its effects on bank risk-taking and efficiency.

Bank capital is one of the significant factors that impact the safety and soundness of commercial banks. It not only acts as a cushion against unexpected losses and bank insolvency, but can also affect banks’ competitive position. Bank capital refers to the difference between a bank’s total assets and total liabilities; the bank’s total assets include cash, government securities and investment-earning loans. Bank liabilities are composed of loan-loss reserves and any debt that it owes. Different national authorities have their own definitions of regulatory capital. The global standards for bank capital were established by the Basel Committee on Banking Supervision (BCBS) through the international accords of Basel I, Basel II and Basel III; these aimed to provide greater supervision of the global banking sector, and to promote competition among banks internationally, by requiring them to comply with the same regulatory standards (Jablecki et al., 2009).

Research on the impact of bank capital has a long history in developed markets, particularly after the introduction of the Basel I Accord in 1988. Although many studies have investigated the relationship between bank capital and risk-taking, the results remain ambiguous. A review of the literature suggests two main hypotheses regarding the link between capital and risk. On the one hand, according to the *‘regulatory hypothesis’*, there is a positive relationship between capital and risk, suggesting that regulators encourage banks to increase their capital commensurably with the level of risk taken (Berger, 1995; [Demirgüç-Kunt & Huizinga, 2000](https://www.sciencedirect.com/science/article/pii/S0261560612000903#bib28)). Previous studies have shown that banks might be forced to increase the level of capital with the amount of risk taken in order to prevent the moral hazard issues (Kim and Santomero, 1998). On the other hand, the *‘moral hazard hypothesis’* yields contradictory predictions, implying that bank managers might have incentives to increase their risk when a bank is thinly capitalised (Jeitschko & Jeung, 2005). To address this question, the empirical evidence in the extant literature is inconclusive and most of the studies focus on the banks in the US and a few other developed economies. Shrieves and Dahl (1992) indicated a positive correlation between capital and risk by using the data of US commercial banks. Altunbas *et al.* (2007) found evidence for similar results in the European banking sector. However, Berger and Bouwman (2012) suggested that capital decreases bank risk and improves banks’ soundness of medium and large US banks. Hughes and Moon (1995) and Hughes and Mester (1998) argued that it was important to recognise the impact of efficiency on capital and risk. Kwan and Eisenbeis (1997) followed the work by Huges and Moon (1995) and applied a simultaneous equation framework; their results provided evidence to support the theory that efficiency and capital are relevant to bank risk. Altnubas et al. (2007) indicated that inefficient European banks tend to have higher levels of capital and lower risk positions. However, Fiordelisi et al. (2011) reported that more efficient banks are more capitalised, additionally, there is a positive correlation between capital ratio and bank efficiency. The previous results are not conclusive. This may be a consequence of the different time periods investigated and various methodologies applied, as most of the previous studies investigated developed countries.

The Chinese banking sector has unique features, which are quite different from those of developed markets. Firstly, in 2004 and 2011, the China Banking Regulatory Commission (CBRC) issued two regulations governing the capital adequacy of commercial banks. Consequently, there has been a significant adjustment of capital adequacy ratios in the Chinese banking sector. Secondly, to help state-owned banks (SOBs) recapitalise and resolve the non-performing loans (NPL) problem, the Chinese government injected a significant amount of capital into the banking sector. For instance, the State Council provided $45 billion to help the Bank of China (BOC) and China Construction Bank (CCB) restructure in 2003, and in 2005 the state unloaded RMB 705 billion of NPLs from the Industrial and Commercial Bank of China (ICBC) and injected $15 billion of fresh capital into the bank. In addition, RMB 130 billion was injected into the Agricultural Bank of China (ABC) by the State Council, to reduce ABC’s huge number of NPLs. According to the 2009 CBRC annual report, the NPL ratio of Chinese commercial banks dropped dramatically from nearly 20% in 2003 to 1.58% at the end of 2009. However, such support from the government might reduce bank managers’ efforts and induce moral hazards, because banks could become less efficient and issue more risky loans, due to the implicit guarantees (Jiang et al., 2013). Because one of the most important functions of capital is to absorb unexpected operating losses, and to safeguard against bank insolvency, when banks were forced by the government to hold capital above the minimum requirement, it can be seen as a way to prevent bank failure. The negative relationship between bank capital and level of risk is expected to be revealed in this study.

To empirically examine the relationships between capital, risk and efficiency in the Chinese banking industry, we considered a panel of 69 commercial banks for the period of 2004–2018. We applied both parametric (SFA) and non-parametric (DEA) frontier techniques to measure Chinese banks’ cost- and profit-efficiency; comparatively, most previous studies only used one method for the evaluation. Both the ratio of loan-loss provision to total loans and the Z-score were employed to measure bank risk. Following the work of Altunbas et al. (2007), Zellner’s (1962) Seemingly Unrelated Regression (SUR) was specified to estimate the relationships between capital, risk, and efficiency, because it allows simultaneous regression equations for banks’ capital, risk and efficiency; each equation has its own dependent variable. Moreover, the two-step system GMM technique was adopted to provide robust results and to address potential endogeneity problems in the data, as the two-step estimator is generally more efficient than the one-step method. Compared with those of previous studies that only used a single estimator (Altunbas et al., 2007; Tan & Floros, 2013), the results of the present study are more robust, because of the use of different methods to measure efficiency, and different techniques to estimate parameters. Furthermore, we considered the impact of various subsample periods, to take account of two different capital requirements from the new regulations.

The empirical results show that there is a bidirectional negative relationship between capitalisation and banking risk, which is consistent with previous studies (Ediz et al., 1998; Tan & Floros, 2013) and the expectation. On the on hand, capital provides a cushion against the risk of the bank’s losses, which suggests that banks with higher capital are more capable of absorbing losses and reducing risk. The fact that the State Council injected a large amount of capital into commercial banks in order to reduce NPLs could explain this finding. On the other hand, the negative relationship also confirms the moral hazard hypothesis, as banks manager might issue more risky loans to compensate the profit losses when leverage is already high. Secondly, we found negative effects of cost-efficiency on the banking capital level: cost-efficient Chinese banks appear to hold less capital. Thirdly, large banks were not willing to take on higher levels of risk than small banks; this could be because they play the role as agents of the government, and are responsible for piloting China’s financial reforms and leading the industry. Thus, the state’s economic stability and financial health became the priority for them. Fourthly, the results suggest a negative association between liquidity and bank capitalisation because there might be a trade-off between higher capital ratios and liquidity: holding more capital may harm banks’ liquidity (Horvath et al., 2014). Finally, in this study, we compared two subsample periods, and found a significantly positive relationship between capital and risk over the period of 2012–2018. The significant adjustment of Chinese bank capital adequacy ratios could be the reason for the negative relationship in the first period, because of capital absorbing the risk losses. In the later period, regulators may have encouraged banks to increase their capital commensurately with the amount of risk taken.

Our study contributes to the literature on the relationship between capital, risk and efficiency in several aspects. First, the extant studies have drawn considerable attention to developed markets (Berger, 1995; Editz et al., 1998; Altunbas et al., 2007; Fiordelisi et al., 2011); however, banks in emerging markets have their own characteristics, which are different from developed countries. Our study extends the empirical literature by investigating the Chinese context with the latest panel data, unlike the previous research on China, which covered only part of the period. For instance, Tan and Floros (2013) investigated the relationship during the period of 2003–2008; Pessarossi and Weill (2015) studied the relations between capital and cost efficiency in 2004–2009. The present study extends the panel sample to include the two important regulations of 2004 and 2011 on bank capital adequacy requirements, which caused significant changes in bank capital; thus, the number of observations (589) is larger than in previous studies (178 and 294 respectively). Examining the interaction relations between capital, risk and efficiency could provide useful information for banking managers and policymakers.

Second, previous studies either use SFA or DEA to calculate a bank’s efficiency, we adopted both methods, as each one has their own advantages and limitations: SFA allows statistical noise to be separated from the effect of inefficiency, and DEA avoids any mis-specified assumptions to measure efficiency, as it does not require a priori assumptions. Moreover, we adopted two risk indicators: loan loss provision to the total loans and the Z-score.

Third, different estimation methods have been used in this study. We followed the research by Altunbas et al. (2007) in utilising Seemingly Unrelated Regression (SUR) to examine the relationship between capital, risk and efficiency. In addition, a system Generalized Method of Moments (GMM) approach was applied to address the potential endogeneity problem, which fixed effects methods could not solve. Finally, we considered the difference impact of various periods.

The rest of this chapter is organised as follows. Section 2 reviews the related literature and hypotheses on relations between capital, risk and efficiency. Section 3 provides the main model and variables. Section 4 discusses the measurement of efficiency. Section 5 summarize data and statistics. Section 6 presents the empirical results and discussion. The final section is the conclusion.

## 3.2. Literature review and hypothesis development

### 3.2.1. The importance of banks

According to Matthews and Thompson (2005), financial intermediaries are not required in a perfect capital market with symmetric information. In such a perfect market, funds can be transferred between lender and borrowers without any barriers or extra cost; thus, financial intermediaries will not exist. However, the real world that we live in is imperfect and incomplete, which brings an increasing need for financial intermediaries.

Previous research modified the assumptions underlying the perfect and complete world framework to explain why financial intermediaries exist. Santos (2001) separated the theories into earlier and contemporary theories. Transaction costs were viewed as the major cause of market frictions in the early theories, while asymmetric information was considered as the main reason for market frictions in contemporary theories.

In earlier theories of financial intermediation, the main role of financial intermediaries was to act as asset transformers, to transform the securities issued by firms into securities demanded by investors (Gurley & Shaw, 1960). The high transaction cost for savers and investors when they make asset transformation activities emphasised the importance of financial intermediaries (Benston & Smith, 1976; Mishkin, 2004). Financial intermediaries might take advantage of economies of scale by bundling the funds of many savers and investors; for instance, the transaction costs per dollar of investment are reduced as the scale of transactions increases.

In contemporary theories of financial intermediation, the provision of liquidity and the provision of monitoring services are two prominent explanations for the existence of intermediaries such as depository institutions (Ramakrishnan & Thakor, 1984; Millon & Thakor, 1985). The important role of banks in these theories arises from the existence of asymmetric information. The asymmetric information issues occur when firms are assumed to understand more about the value of their assets and opportunities than outside investors. Banks are important as providers of liquidity because they provide depositors with liquidity insurance by issuing demand deposits (Bryant, 1980; Diamond & Dybvig, 1983). The deposits allow better risk-sharing among households that face idiosyncratic shocks to their consumption needs over time; thus, the shock is not publicly observable. Banks are important as providers of monitoring services because they act as delegated monitors for investors and avoid the duplication of monitoring costs (Diamond, 1984). Because of asymmetric information, banks can not only save the monitoring costs for investors, but can also provide funds at a lower cost to borrowers by providing the monitoring services. Diamond and Rajan (1998) established a model and suggested that both investors and borrowers are concerned about liquidity. The uncertainty about the time needed to reduce financial asset-holding is the reason why investors care about liquidity; while borrowers care about liquidity because they are not sure about their ability to raise funding in the future.

Therefore, studies on the existence of financial intermediation confirm the importance of banks. In an imperfect world, with market frictions and asymmetric information, banks play a vital and irreplaceable role in financial markets, to facilitate investment for the economy.

### 3**.2.2. The importance of bank capital**

Bank capital is one major factor that affects the safety and soundness of commercial banks. Because of banks’ importance, it is crucial for them to hold enough capital; not only for conducting financial business to earn profit, but also for absorbing losses. Bank capital functions as a source of funds, as a cushion to absorb unexpected operating losses, and the final safeguard against bank insolvency (Jiang & Yao, 2015). Diamond and Rajan (2000) defined the role of bank capital as ensuring bank safety by providing a buffer to absorb losses. Holding adequate capital helps banks to refinance at low cost, and to minimise distress costs.

In addition, Greuning and Bratanovic (2009) suggested that bank capital might affect the competitive position of banks. As shareholders expect a return on their equity, banks normally need to attract deposits from the public, and to grant loans. Depositors’ confidence in the bank is important for doing so, and this in turn can best be established and maintained by a capital buffer. If the bank faces inadequate capital or high cost of capital, it may lose business to its competitors. Diamond and Rajan (2000) indicated that an appropriate capital structure allows banks to attract more deposits from the public, and to improve their lending capacity.

### 3.2.3. Capital regulations across the world

The Basel Accords were formed with the aim of enhancing financial stability and creating a regulatory framework for risk management. Basel I, the first Basel capital adequacy standard, was signed in 1988 by the Group of Ten (or G-10, including eleven industrial countries: Belgium, Canada, France, Germany, Italy, Japan, the Netherlands, Sweden, Switzerland, the United Kingdom, and the United States). Basel I aimed to set up rules and regulations to enhance the banking system’s stability and the soundness of banking operations. After the Accord’s implementation, international banks started to gain some equality in competition, which had not previously existed due to the different national capital requirements (BCBS, 2015). There are two main reasons for adopting international standards for capital requirements: first, the regulations might put pressure on banks to increase their capital positions and enhance the stability of the international banking system; second, internationally active banks would have a fair competition environment (Jackson et al., 1999). A minimum of 8% for the ratio of capital to risk-weighted assets was required under the Basel I Accord; banks had to comply with it by the end of 1992. Basel I defined that bank capital should comprise two tiers. Tier 1, or the core capital, was the most liquid funding source of the bank; it included the book value of common stock, non-cumulative perpetual preferred stock, share premiums, retained profit, general and legal reserves. Tier 2 capital consisted of less liquid capital and hybrid instruments, such as revaluation of assets, undisclosed reserves, and cumulative preferred stock. Basel I required a minimum of 4% for the Tier 1 ratio and 8% for the total capital ratio. Pattison (2006) stated that more than 100 countries had voluntarily agreed to accept the standards. According to Jableck (2009), the bank capital adequacy ratio improved from 8.5% to 12% for 29 OECD countries from 1990 to 2001.

Basel I was updated in 2006 (known as Basel II); this constituted more sophisticated rules and principles to measure risk exposure, and focused on internationally active banks. The minimum capital requirements, institutional supervision of capital adequacy, and market discipline were considered the three pillars that were addressed in the new Basel II Accord. The new framework aimed to provide strong risk management practices for the international banking system. The minimum capital ratio of 8% for risk-weighted assets was unchanged from the Basel I Accord; however, a new structure for market risk calculation was included in the Basel II Accord.

Basel III enhanced the capital, liquidity and leverage requirements after the financial crisis in 2010; its structure and the minimum capital requirements were approved in 2010. Thus, Basel III improved the three pillars of the Basel II Accord.

The Bank for International Settlements (BIS) conducted a survey in 2015, revealing that all 27 member countries of the Basel Committee on Banking Supervision (BCBS) had implemented enhanced risk-based capital regulations by the end of 2013. Another survey, carried out by the Financial Stability Institute (FSI), showed that 95 out of 117 non-Basel Committee members that were monitored had adopted or were in the process of adopting Basel III in 2015. Thus, the Basel Accord became a model for capital regulations for national banking systems. However, different countries might have different implementations of the Basel principles: depending on how the regulators define the items that may reflect on equity capital or risk-weighted assets, some freedom can be expected in the implementation of the Accord, particularly for the non-BCBS countries. The evolution of the Basel Accords is illustrated in Figure 3-1, and the capital adequacy requirements for Basel II and Basel III are listed in Table 3-1.



Figure 3‑1 The evolution of the Basel Accords

Table 3‑1 Capital adequacy requirements for Basel Ⅱ and Basel Ⅲ

|  |  |  |
| --- | --- | --- |
|  | Basel Ⅲ | Basel Ⅱ |
| Capital adequacy ratios | 10.5% | 8% |
| Core Tier 1 (ratio of total capital to RWAs) | 4.5% | 2% |
| Tier 1 capital to RWAs | 6% | 4% |
| Capital buffers | 2.5% | 0% |
| Countercyclical capital buffers | 0-2.5% | None |
| Leverage ratio | 3% | None |

### 3.2.4. Capital adequacy requirements in China

To improve the banking system’s stability and health, the Chinese banking sector has undergone significant reform since 1978. However, after three decades, state-owned banks (SOBs) had accumulated a large number of NPLs because of the long periods of supporting inefficient state-owned enterprises (SOEs). After China successfully entered the World Trade Organization (WTO), the Chinese banking system expected to be fully exposed to foreign competition. Table 3-2 shows the performance of SOBs and world-class banks in 2002: SOBs were greatly outperformed by world-leading banks. In order to improve the Chinese banking sector’s stability, the government ultimately decided to address risk management and to monitor the capital adequacy requirements.

Table 3‑2 Performance of Chinese SOBs and world-class banks in 2002 (%)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | ROE | Net interest revenue/assets | Operating profit/ assets | NPLs/ Total loans |
| Citibank | 15.29 | 4.36 | 7.16 | 2.15 |
| HSBC | 12.20 | 2.07 | 3.58 | 2.90 |
| BOC | 0.32 | 1.60 | 0.59 | 23.40 |
| ICBC | 0.15 | 1.86 | 0.39 | 25.30 |
| CCB | 0.20 | 2.20 | 0.70 | 15.20 |
| ABC | 0.11 | 1.90 | 0.42 | 30.70 |

Source: BankScope (Luo, 2016)

In 2004, the China Banking Regulatory Commission (CBRC) issued the ‘Regulation governing the capital adequacy of commercial banks’. The regulation took effect on 1st March, and Chinese commercial banks had a transition period until 1st January 2007, with a feasible phase-in plan to meet the minimum capital requirements. Desombre and Chen (2004) reported that this was the first time that capital requirements were defined with a precise method of calculation and measurement: capital adequacy ratios referred to the ratios of bank-held capital and the risk-weighted assets of commercial banks. The commercial banks’ capital adequacy ratio is calculated as follows:

$$Capital adequacy ratio =(core capital+subsidiary capital-deductions)/(risk weighted assets+12.5\*market risk and operational risk capital required)$$

The total amount of capital includes the core capital and supplementary capital. The core capital consists of common stocks, reserves, capital surplus, retained earnings and minority interests. The supplementary capital comprises revaluation reserves, general loan-loss reserves, preference shares, and long-term subordinated debt. The minimum capital adequacy ratio was required to be no less than 8%, and 4% for core capital adequacy. Some of the rules in the Basel II Accord were also included in the 2004 prudential regulation. Before this regulation, ‘the concepts of capital and capital adequacy were not on the mind of either bank managers or bank regulators, and capital constraints were unheard of’ (Cousin, 2011), and there were no requirements for commercial banks to disclose the capital adequacy ratio before 2004. As a consequence, there was a significant adjustment of Chinese bank capital adequacy ratios: almost all the commercial banks (accounting for 99.9% of banking assets) were compliant at the end of 2008, while less than 10% of banks had met the requirements in 2004 (CBRC, 2010).

Low capitalisation had been one of major problems in the Chinese banking sector, and a large part of the Chinese banking system had become virtually bankrupt (Lardy, 1998). Therefore, since 1998, the Chinese government has made significant efforts to increase banks’ capital adequacy, including capitalisation and NPLs off-loading. The State Council provided $45 billion to help the Bank of China (BOC) and China Construction Bank (CCB) restructure in 2003; and in 2005 the state unloaded RMB 705 billion of NPLs from the Industrial and Commercial Bank of China (ICBC), and injected $15 billion of fresh capital into the bank. In addition, RMB 130 billion was injected into the Agricultural Bank of China (ABC) by the State Council to reduce ABC’s huge number of NPLs. According to the 2009 CBRC annual report, the NPL ratio of Chinese commercial banks dropped dramatically, from nearly 20% in 2003 to 1.58% at the end of 2009.

The 2008 global financial crisis, triggered by the US subprime mortgage crisis, highlighted the importance of bank supervision and asset quality. The Basel Committee on banking supervision proposed a strong regulatory standard, known as Basel III. In 2011, the CBRC released ‘Guidelines for Implementing New Regulatory Standards in the PRC Banking Industry’, which is widely referred to as ‘China’s Basel III’ (Sekine, 2011). The new standards aimed to improve the prudential regulatory standards for the Chinese banking sector, and set stricter regulations for each type of commercial bank. According to the new guidelines, the Chinese banking system could be divided into two types of banks: the systemically important banks (SIBs; including the ICBC, CCB, BOC, ABC, and Bank of Communications), and the other banks. Under the ‘New Standards’, the methods of calculating capital adequacy ratios were improved, as the regulatory capital of the banks was divided into three tiers (core Tier 1, Tier 1, and Tier 2) instead of the previous two. The capital adequacy requirements for the three tiers were 5% for core Tier 1, 6% for Tier 1, and 8% for Tier 2 (including Tier 1). In addition, a reserve excess capital conservation buffer of 2.5% and a countercyclical capital buffer of 0–2.5% were also imposed. For the SIBs, a capital surcharge of 1% was also applied for the time being. In this case, the effective capital adequacy requirements for the SIBs and the other banks were 11.5% and 10.5%, respectively. This standard was considerably higher and more stringent than that of the Basel Accord.

The implementation of the New Standards can be viewed as strategically important to the Chinese banking sector. Basel III had put pressure on commercial banks to improve lending restrictions after the financial crisis of 2008. In addition, the use of stricter regulations may set a good example to other G20 members, which could give China a greater influence in the international financial system. By keeping in line with the new global banking requirements, Chinese commercial banks might find it easier to establish foreign banking branches and engage in international expansion. Because Chinese commercial banks have been pressured by regulators to comply with new capital requirements from 2004, the Chinese context is different from banks in developed markets, whose capital is well above the regulatory minimums (Berger & Bonaccorsi di Patti, 2006). As a result, the capital adequacy ratio of China’s commercial banks has been significantly adjusted. Table 3-3 shows the capital adequacy requirements for Basel II and Basel III and Chinese banks. Figure 3-2 illustrates the total capital ratio of SOCBs over the period of 2004–2018. The adequacy ratios for all SOCBs in 2003 are below the minimum requirement of 8%. After the Chinese government’s significant efforts to inject capital and off-load the banking NPLs, all SOCBs have increased their capital; except for ABC, whose reform started late, in 2008. The average capital adequacy ratio slightly declined in 2009 due to the impact of the global financial crisis, and then continually increased to 2012. The explanation might be the government’s stimulus package and rapid expansion of the economy, at a GDP growth rate of 10% in 2010 and 9.5% in 2011. Figure 3-3 plots the E/A (Equity to asset) ratio for SOCBs between 2004 and 2018. The E/A ratio’s movement is consistent with the total capital adequacy ratio. Due to government support, the E/A ratio increased since 2004, and all SOCBs managed a steady increase after 2011.

Table 3‑3 Capital adequacy requirements for Basel Ⅱ and Basel Ⅲ and Chinese banks

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | SIBs | All other banks | Basel Ⅲ | Basel Ⅱ |
| Core Tier 1 | 5% | 5% | 4.5% | 2% |
| Tier 1  | 6% | 6% | 6% | 4% |
| Tier 2 | 8% | 8% | 8% | 8% |
| Capital buffers | 2.5% | 2.5% | 2.5% | 0% |
| Countercyclical capital buffers | 0-2.5% | 0-2.5% | 0-2.5% | None |
| Capital surcharge | 1% | None  | None  | None  |
| Capital adequacy ratios | 11.5% | 10.5% | 10.5% | 8% |
| Deadline  | End-2013 | End-2016 | End-2018 | End- 2006 |
| Leverage ratio | 4% | 4% | 3% | None |

Source: Sekine (2011).

Figure 3‑2 Total capital ratio of SOCBs

Figure 3‑3 Equity to asset ratio of SOCBs

### 3.2.5. Related literature on the relationship between capital, risk, and efficiency

As mentioned above, based on the banking sector’s reform and newly capital adequacy regulations in China, commercial banks were forced to increase capital to comply with the new requirements. The overall aims of the new regulations were to improve risk management and stability of the Chinese banking system. So, the effects of bank capital on the risk and efficiency of banks remains the key research question.

An examination of the influence of bank capital on bank risk-taking has a long history, mainly since the mid-1970s; for instance, Peltzman (1970) and Mayne (1972) investigated the relationship between bank capital and risk-taking behaviour. The authorities’ major concern was prudential regulation; various early studies examined the effectiveness of capital regulation and tested whether the existence of a flat-rate deposit insurance scheme induced incentives for excessive risk-taking by bankers and shifted the risk to the Federal Deposit Insurance Corporation (FDIC) (Altunbas et al., 2007). Marcus (1983) suggested that banks holding higher levels of capital with large capital buffers tend to keep their capital buffers and increase risk when they increase capital, while banks with less capital and low capital buffers tend to increase capital in order to reduce the risk. Thus, there is a positive relationship between capital and risk adjustment when banks have high capital buffers, while for banks with low capital buffers, the bank capital and risk adjustment could be negatively related.

After the introduction of Basel I on bank capital in 1988, a new wave of studies concentrated on the effects of bank capital regulations; most of these studies focused on developed countries. Ediz et al. (1998) indicated that in the UK, minimum banking capital requirements have a positive impact on the safety and soundness of banks. Aggarwal and Jacques (1998) suggested that banks with capital ratios above the minimum capital requirements tend to survive in stress situations by using data from 2,552 FDIC-insured commercial banks over the period between 1990 and 1993. Salas and Saurina (2003) reported a negative relationship between the level of capital and the credit risk in Spanish banks, which was consistent with the moral hazard hypothesis. However, according to the ‘regulatory hypothesis’, banks should hold an amount of capital commensurate with the amount of risk taken, which suggests a positive relationship between capital and risk. Iannotaa et al. (2007) found that capital has a positive impact on loan loss provisions by applying the data of the largest European banks between 1999 and 2004. In conclusion, the relationship between bank capital and risk-taking remains controversial.

Kwan and Eisenbeis (1997) made a major contribution concerning the effects of bank efficiency on capital regulation and bank risk-taking behaviour. They followed the study by Huges and Moon (1995) and applied a simultaneous equation framework and tested the regulation hypothesis and moral hazard hypothesis; their results revealed that it is necessary to recognise the concept of efficiency when examining the influence of capital on risk; furthermore, they provided evidence to support the theory that efficiency and capital are relevant to bank risk. Lee and Hsieh (2013) suggested that the correlation between bank capital and risk-taking should be extended to investigate bank efficiency.

Berger and De Young (1997) indicated that bank capital and risk might be impacted by bank efficiency. From a regulatory point of view, efficient banks are more flexible for leverage and risk-taking. On the contrary, from the moral hazard perspective, a less efficient bank may take on extra risk to compensate for the lost returns. They used the Granger causality method to examine the relationship between efficiency, non-performing loans, and capital, by using a sample of US banks from 1985 to 1994. They proposed four different hypotheses, namely the ‘bad luck’ hypothesis, the ‘bad management’ hypothesis, the ‘skimping’ hypothesis and the ‘moral hazard’ hypothesis. These four hypotheses are not mutually exclusive. Their findings demonstrated that declines in cost efficiency precede increases in non-performing loans; moreover, particularly for thinly capitalised banks, higher NPL levels result in decreased cost efficiency.

More recently, Williams (2004) followed Berger and De Young (1997) by using the Granger causality approach to investigate the inter-temporal relationships between problem loans, cost efficiency, and capital for European deposit banks between 1990 and 1998. The study also tested the four hypotheses which were identified by Berger and De Young (1997). The results were inconsistent with the previous findings from the US. Altunbas et al. (2007) applied seemingly unrelated regression (SUR) to examine the relationship between banking capital, loan-loss provision, and cost efficiency, for a sample of banks in 15 European countries from 1992 to 2000. In contrast to Williams (2004), they reported that inefficient banks tend to hold more capital levels and take less risk. Fiordelisi et al. (2011) argued that banks with less efficiency tend to take more risks and found that being well-capitalised increased the efficiency of the commercial banks in 26 European Union countries during the period from 1995 to 2007. Overall, the extant studies provide evidence to support the argument that efficiency is correlated with capital and risk. In addition, the previous studies on developed markets yielded contradictory findings on the relationships between banking capital, risk, and efficiency.

An increasing number of empirical studies aimed to investigate the relationship between capital, risk, and efficiency in emerging market banks. Miah and Sharmeen (2015) used a stochastic frontier analysis to determine bank efficiency and the seemingly unrelated regression system to assess the relationship between capital, risk, and efficiency, for the Islamic and conventional banks in Bangladesh from 2001 to 2011. Their findings confirmed the moral hazard hypothesis and indicated inefficient conventional banks with higher risk. Bitar et al. (2018) examined the impact of capital on risk and efficiency by using a bank sample from 39 OECD countries over the period 1999–2013. They revealed that banks with higher-quality forms of capital improve their efficiency and profitability.

There are only a few research studies that have assessed the relationship between capital, risk, and bank efficiency of Chinese commercial banks. Tan and Floros (2013) followed the four hypotheses proposed by Berger and De Young (1997) and their results revealed a positive relationship between the loan-loss provision and bank efficiency, and a negative relationship between capital and risk (as measured by the Z-score). Pessarossi and Weill (2015) investigated the relationship between capital and cost efficiency and suggested that capital requirements improve cost efficiency in the Chinese banking sector. Table 3-4 summarize the main theoretical studies on the relationship between capital, risk and efficiency.

Table 3‑4 Overview of main theoretical studies on the relationship between capital, risk and efficiency

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Authors (year) | Period under study | Countries  | Methodology  | Main empirical evidence |
| Peltzman (1970) | 1963-1965 | United States | A theoretical model developed by Peltzman (1965) and regression analysis | Uncertainty about the effectiveness of the capital risk relationship |
| Mayne (1972) | 1961-1968 | United States | Ordinary Least Squares (OLS) regressions | A more standardized formula for capital requirements may lead to better bank compliance regarding any capital increase |
| Shrieves and Dahl (1992) | 1983-1987 | United States | Simultaneous equations | A positive relationship between changes in risk and capital |
| Jacques and Nigro (1997) | 1990-1991 | United States | Three stage least squares (3SLS) regressions | A negative correlation between capital ratios and banks risk |
| Rime (2001) | 1989-1995 | Swiss banks | Three stage least squares (3SLS) regressions | A positive correlation between changes in risk and capital |
| Salas and Saurina (2003) | 1968-1998 | Spain | Ordinary Least Squares (OLS) regressions | A negative relationship between capital and risk |
| Altnubas et al. (2007) | 1992-2000 | 15 European countries  | Seemingly unrelated regression (SUR) approach | Inefficient European banks have higher capital positions and lower risk  |
| Iannotta et al. (2007) | 1999-2004 | 15 European countries  | Ordinary Least Squares (OLS) regressions | A positive relationship between capital and risk |
| Fiordelisi et al. (2011) | 1995-2007 | 26 European Union countries | Generalized Method of Moments (GMM) | More efficient banks are more capitalized; higher capital ratios are positively correlated with bank efficiency.  |
| Lee and Hsieh (2013) | 1994-2008 | Asian banks | Dynamic panel data approach | There is a negative relationship between capital and risk but an inconclusive relation between bank capital and profitability |
| Tan and Floros (2013) | 2003-2009 | China | Three stage least squares (3SLS) regressions | Weak positive association between capital and bank technical efficiency  |
| Bitar et al. (2018) | 1999-2013 | 39 OECD countries | Ordinary Least Squares (OLS) regressions | Good quality capital improve bank efficiency |

### 3.2.6. Main hypotheses to explain the relationship between capital, risk, and efficiency

The relationship between capital, risk and efficiency is still an inclusive topic. In this section, several testable hypotheses were proposed to clarify the associations.

#### 3.2.6.1. The relationship between efficiency and risk.

The main purpose of the series of reforms in the Chinese banking sector is to improve performance, enhance risk management and develop sustainably. To improve bank efficiency banks have been forced to operate closer to the “best practice” banks or an efficient production frontier. Therefore, market concentration and competition may increase when all banks are trying to achieve higher level of efficiency, which result in greater risk-taking behaviour in short term (Altunbas et al., 2007; Fiordelisi et al., 2011; Saeed et al., 2022). The explanation could be that increased competition may reduce banks’ market power, which result in their charter values decreasing. The decline in level of bank charter value combined with banks' limited liability and a rather flat-rate deposit insurance encourages banks to take more risks (Salas and Saurina, 2003; Goddard and Wilson, 2009; Fiordelisi et al., 2011; Saeed et al., 2022).

A review of the literature suggests two main hypotheses regarding the relationship between efficiency and risk. According to the “skimping hypothesis”, a higher level of bank efficiency is positive associated with risk-tacking behaviour. This is because a trade-off may exist between short-term efficiency and future risk-taking. In this case, Berger and De Young (1997) suggested that banks appear to be more efficient as they devote fewer resources to credit screening and monitoring. As a result, the stock of non-performing loans remains unaffected in the short run. In the medium term, however, banks reach higher risk levels. Empirically, Altunbas et al. (2007) found evidence to show inefficient European banks take on less risk. This leads to the following hypothesis:

Hypothesis 1a: The level of bank efficiency is positively associated with the banks’ risk-taking.

On the other hand, Berger and De Young (1997) and Williams (2004) proposed the “bad management” hypothesis; banks operating with low levels of efficiency have higher costs due to inadequate credit monitoring and inefficient control of operating expenses, which leads to increased risk-tacking. Fiordelisi et al. (2011) reported that lower efficient banks with higher levels of risk-taking exist in European banking sector. Thus, we hypothesis the following:

Hypothesis 1b: The level of bank efficiency negatively contributed to the banks’ risk-taking

#### 3.2.6.2. The relationship between bank capital and risk.

Theory offers opposing perspective on the relationship between bank capital and risk. On the one hand, the regulatory hypothesis requires banks to hold a minimum capital level to total risk and proposes a positive relationship between capital and risk (Shrieves & Dahl, 1992; Editz et al., 1998). According to the risk-based capital plan by Kim and Santomero (1998), banks are forced to increase their capital commensurately with the amount of risk taken, which might help to prevent the moral hazard problem. Iannotta et al. (2007) found empirical evidence to support positive relationship between capital and loan loss provisions by examining the largest European banks from 1999 to 2004. Altunbas et al. (2007) indicated the similar results by analyses a large sample of European banks between 1992 and 2000. In Chinese context, the CBRC issued two different regulations to improve bank corporate governance and capital adequacy requirements in 2004 and 2011. The Chinese government injected substantial capital into the banking system during 2003–2008. As a consequence, there was a significant adjustment of Chinese bank capital adequacy ratios: 99.9% of the banking assets were compliant at the end of 2008. Thus, Chinese commercial banks were forced to hold capital above the minimum requirements, and it could be seen as a way to prevent bank failure. This leads to the following hypothesis:

Hypothesis 2: The level of bank capital is positively associated with the banks’ risk-taking.

An alternative hypothesis, the ‘moral hazard hypothesis’ may suggest a negative relationship between bank capital and risk. The term “moral hazard” originated in the insurance literature. Economists used it to describe loss-increasing behaviour that arises under insurance in economics (Rowell & Connelly, 2012). The moral hazard behaviour occurs when one party has an incentive to increase its exposure to risk because it does not bear the costs of that risk. The presence of informational frictions and the existence of ‘agency problems’ could be the reason for the moral hazard. Altunbas et al. (2007) argued that the moral hazard hypothesis might become particularly relevant when the levels of bank risk and leverage are already high, which indicate that banks would increase risk positions as capital declines. Jeitschko and Jeung (2005) suggested that when a bank is thinly capitalised or more inefficient, the bank manager tends to take on more risk and has incentives for doing so. In the Chinese context, the 2004 capital adequacy regulation could be seen as a revolution. Chinese government injected capital to support banks’ recapitalisation. However, Jiang et al. (2013) indicated that the government’s support can induce moral hazards, as banks could be less efficient and issue more risky loans because of implicit guarantees. Lu et al. (2005) reported that because the government allows soft budget constraints for both SOEs and SOBs, Chinese banks have a systematic lending bias in favour of SOEs, which are riskier and have higher default risk. In addition, higher capital ratios reduce bank liability and expectations for public bailouts. Jacques and Nigro (1997) found that higher level of capital tend to decrease bank risk. Berger and Bouwman (2013) suggested that higher capital improve the probability of survival for small banks. In China, huge amount of capital were injected into banking sector to write off non-performing loans, because one of the functions of capital is to absorb unexpected operating losses and to safeguard against bank insolvency. Therefore, we hypothesis the following:

Hypothesis 3a: The level of bank capital has a negatively impact on banks’ risk-taking.

On the other hand, Altunbas et al. (2007) proposed that the direction of causality could also flow from risk to capital and could be derived from the consequences of regulatory actions. Bank should hold a minimum capital level. Anginer and Demirguc-Kunt (2014) indicated that banks aim to have high level of capital to resist earnings shocks and to ensure their capacity to honor deposit withdrawals. They also argued that higher capital buffers might make bank investment decisions more prudent and wiser. Higher level of bank risk needs more capital to absorb the profit loss. This leads to the following hypothesis:

Hypothesis 3b: banks’ risk-taking is negatively contributed to bank capital level.

#### 3.2.6.3. The relationship between bank capital, risk and efficiency

Furthermore, the bank capital may have an impact on the trade-off between bank risk and efficiency. Fiordelisi et al. (2011) suggested that banks could hold low level of capital because they operate efficiently and have no incentive to increase their level of capital with respect to their loans and investments, as higher levels of efficiency provides them with a buffer to build up capital in the future. On the other hand, banks could be thinly capitalised because they are inefficient and may try to compensate the higher operating costs with lower funding via expensive capital. In this case, banks may build capital, simultaneously increasing their risk-tacking.

Altunbas et al. (2007) indicated that the level of bank efficiency may influence the capital and risk. From a regulatory point of view, regulators may allow efficient and better managed banks more room for leverage. Alternative, from a moral hazard perspective, a less efficient bank may try to balance the lost returns. Therefore, bank capital, risk and efficiency are all correlated. However, the relationship between bank capital, risk and efficiency is not conclusive. Several existing empirical studies yield contradictory findings: Altunbas et al. (2007) and Fiordelisi et al. (2011) found the positive relationship between capitalisation and efficiency in European banking sector, while Berger and Bonaccorsi di Patti (2006) reported an inverse relationship in US banks.

In the Chinese context, limited studies do exist with mixed results. Tan and Floros (2013) found a negative relationship between capital and risk. However, they could not find evidence to confirm a significant relationship between capital and efficiency. While Pessarossi and Weill (2015) reported that increased capital has a positive influence on bank cost-efficiency. Both studies focus on the period before 2009, which is out-of-date because several regulations have been issued after. Furthermore, previous studies applied a small sample (178 and 294 observations respectively). Therefore, after significant changes in capital requirements in the Chinese banking sector, investigating the interaction relations between capital, risk and efficiency could provide useful information for banking managers and policymakers.

## 3.3. Main modelling framework and variables

As the theories and hypotheses discussed in the previous sections suggest, a simultaneous relationship exists between bank capital, risk, and efficiency. In order to examine this relationship, we specified the simultaneous equations on the basis of the works of Shrieves and Dahl (1992), Jacques and Nigro (1997), Rime (2001a), Altunbas et al. (2007), and Tan and Floros (2013). These equations can be expressed as follows:

$Risk\_{it}=α\_{0}+α\_{1}Cap\_{it}+α\_{2}Eff\_{it}+α\_{3}Size\_{it}+α\_{4}Liq\_{it}+α\_{5}Nii\_{it}+α\_{6}Pro\_{it}+ ε\_{it}+ Year Dummies$ (1)

$Cap\_{it}=β\_{0}+β\_{1}Risk\_{it}+β\_{2}Eff\_{it}+β\_{3}Size\_{it}+β\_{4}Liq\_{it}+β\_{5}Nii\_{it}+β\_{6}Pro\_{it}+ ε\_{it}+Year Dummies$ (2)

$Eff\_{it}=γ\_{0}+γ\_{1}Cap\_{it}+γ\_{2}Risk\_{it}+γ\_{3}Size\_{it}+γ\_{4}Liq\_{it}+γ\_{5}Nii\_{it}+γ\_{6}Pro\_{it}+ ε\_{it}+ Year Dummies$ (3)

where i and t denote the cross-sectional dimension across banks and the time period, respectively. There are three dependent variables in these simultaneous equations. The first equation tests whether bank capital and efficiency impact risk; the second model examines whether the levels of risk and efficiency reflect the changes in the bank capital level; and the final model assesses the determinants of bank efficiency.

Risk is the variable used to measure individual banks’ risk, including the ratio between loan-loss provision and total loans as well as the Z-score (Z-score is the ratio between a bank’s return on assets plus equity capital/total assets and the standard deviation of the return on assets). Banks unable to or who delay to serve loans deteriorates bank solvency which in turn could be viewed as bank risk (Heffernan, 1996). Previous studies used the ratio between loan-loss provision and total loans to measure bank risk (Tan & Floros, 2013). This ratio measures the loan quality of a bank, as a higher proportion of reserves indicates a lower level of quality assets and higher bank risk. The ratio is calculated from the accounting data which has a limitation (Shrieves & Dahl, 1992; Altunbas et al., 2007, Tan & Floros, 2013) that bank managers might minimise cost to hide these measures. In order to provide robust results, we use alternative variable Z-score to measure bank risk level. Z-score compares buffers (capitalisation and returns) with risk (volatility of returns) to measure a bank’s solvency risk, where a higher Z-score suggests a lower probability of bank insolvency and lower bank risk. Cap is the variable used to represent the level of bank capital and is calculated using the ratio of equity to total assets, which reflects the proportion of total assets financed by equity capital. Individual bank efficiency (Eff) is estimated by using the DEA and SFA methods. For the bank-specific variables, Bank size (Size), Liquidity (Liq), Non-interest income (Nii), and Profitability (Pro) are important to explain individual bank performance.

Firstly, the natural logarithm of bank total assets is used to represent bank size, which is a very important factor in the model to investigate the relationship between bank capital, risk and efficiency. Altunbas et al. (2007) found that large European banks appear to be less risky, hold lower levels of capital and are more cost inefficient than smaller banks. Tan and Floros (2013) suggested that there is a positive relationship between technical efficiency and size in the Chinese banking sector due to bigger banks having more resources across the country, and a larger sized bank tends to have lower capital positions. Pessarossi and Weill (2015) indicated that larger banks perform better in the Chinese banking sector. Bitar et al. (2018) reported a positive association between bank size and efficiency. Size may have an impact on the relationship between capital, risk, and efficiency through economies of scale such as cost advantage and more advanced technologies and diversity. However, banks might also suffer from diseconomies of scale due to complicated procedures.

Second, the ratio of net loans to total assets (Liq) measures the level of bank liquidity; it shows the possible inability of banks to cover decreases in liabilities or fund increases on the assets’ side of the balance sheet (Tan & Floros, 2012a). The traditional loan activities can lower bank costs as they are less expensive to monitor than other financial derivatives. However, if the loan growth is rapid, it may increase bank risk and adversely affect capital and bank efficiency. The higher level of this ratio means lower liquidity and higher liquidity risk. Tan and Floros (2013) concluded that lower levels of liquidity reduced the capital position in Chinese banks.

Thirdly, we controlled for bank diversification by applying the ratio of non-interest income to total revenues, as diversification is another crucial factor in previous studies. Non-traditional activities such as investments in derivatives and securities are more exposed to risk than the loan portfolio. Demirgüç-Kunt and Huizinga (2010) reported that non-interest income is linked to more volatile returns, different non-interest activities may enhance bank performance by increasing income as an alternative to interest income. However, diversification might also suffer from the potential effect of economies of scope that may result in increasing costs. Bitar et al. (2018) reported that bank diversification negatively impacts on bank risk, as it decreases bank credit defaults.

Finally, we used the return on assets to control individual bank profitability (Pro). Berger (1995) revealed that there is a positive relationship between profits and capital in US banking. Altunbas et al. (2007) reported that capital levels are inextricably linked to bank performance and confirmed the findings of Berger (1995) in European banking sector. Table 3-5 summarises all the variables used in this study.

Table 3‑5 Summary of variables and descriptions.

|  |  |  |
| --- | --- | --- |
| Variables  | Acronym | Definition |
| Risk | LLR | Loan-loss provision as a fraction to total loans |
| Z-score | Ratio between a bank’s return on assets plus equity capital/total assets and the standard deviation of the return on assets |
| Capital  | Cap | Book value of capital to total assets |
| Efficiency | CO | Cost-efficiency |
| PO | Profit-efficiency |
| Bank size | Size | Logarithm of total assets |
| Bank liquidity | Liq | Net loans/ Total assets |
| Bank diversification | Nii | Ratio of non-interest income to total revenues |
| Profitability | Pro | Return on Assets |

## 3.4. Measures of banking efficiency

Cost efficiency and profit efficiency were selected to measure individual bank efficiency. We calculated the distance to an efficient cost frontier or profit frontier by using a non-parametric method (data envelopment analysis) and a parametric technique (stochastic frontier approach). The difference between these two approaches is whether underlying assumptions were necessary for estimating the efficient frontiers. DEA did not require a priori assumptions about the function. However, it suffered from the problems caused by statistical noise, as all the random errors, such as measurement errors, were accounted to inefficiency. The SFA approach allowed for the effect of statistical noise to be separated from the effect of inefficiency, thereby resulting in a stochastic frontier. However, the approach needed the assumptions for a specific functional form for the shape of the efficient frontier. It might contain errors if the assumptions were mis-specified. Most of the previous studies used either a non-parametric approach or a parametric methodology, but both methods have their merits and limitations; thus, the use of both of these methods provided a more robust and better assessment of bank efficiency.

### 3.4.1. Basic DEA models

Data envelopment analysis (DEA) is a non-parametric method that was first proposed by Charnes, Cooper, and Rhodes (1978). They introduced the term ‘decision making unit’ (DMU) and extended Farrell’s (1957) single input–output model to a multiple input–output model. This model has been widely used for assessing efficiency in both non-profit industries (e.g. hospitals, schools, and local government) and profit-seeking areas (e.g. financial institutions, utility companies, and agriculture). The efficiency of the DMU is measured by the ratio of the sum of weighted outputs to the sum of weighted inputs. In the DEA estimation, the ‘efficiency frontier’ is made up of the DMUs that are more efficient than other DMUs within the sample, and the efficiency scores of all the other DMUs are assigned on the basis of their radial distance from the frontier. The efficient units are rated as 100% or 1, while the other inefficient DMUs receive lower ratings. An efficiency score of less than 1 indicates that a linear combination of the other DMUs from the sample could produce the same vector of outputs but use a smaller vector of inputs (Cooper et al*.*, 2006).

Farrell (1957) made a path-breaking contribution and reported that economic efficiency (EE) could be decomposed into allocative efficiency and technical efficiency, where allocative efficiency (AE) refers to the ability to use the appropriate proportion of inputs given the prices of the resources and technical efficiency (TE) represents the capacity for maximising the outputs for the given inputs.

There are several advantages that make DEA a superior tool for estimating efficiency. Firstly, DEA does not require any restriction on either the form of the underlying production function or the distribution of the data used (Banker et al*.*, 1984; Al-Faraj et al*.*, 1993). The DEA production possibility set is contracted by the linear combination of a set of best practice observations; thus, it avoids the mis-specification of inputs and outputs. Furthermore, it can flexibly process multiple inputs and outputs without standardisation. Secondly, the parametric methods need to assume the functional form, such as Cobb-Douglas or Translog, which makes it difficult to estimate the efficiency of multiple outputs. Finally, DEA can identify factors that contribute to the inefficiency of certain DMUs and suggest reference DMUs for further improvement. With a similar input and output mix, DEA makes it easier to understand the nature of inefficiencies and to set up targets accordingly.

The Charnes, Cooper, and Rhodes (CCR) model for constant return to scale (CRS) and the Banker, Charnes, and Cooper (BCC) model for variable return to scale (VRS) are fundamental to DEA. The difference between the two is that the production frontier of the CCR model spans the existing DMUs with a linear combination, whereas the production frontier of the BCC model is spanned by the convex hull of the existing DMUs.

The DEA model assumes that there are n DMUs and that each DMU consumes varying numbers of inputs, xij = (x1, x2, …, xij), to produce the desired number of outputs, yrj = (y1, y2, …, yrj). Thus, the efficiency is equal to the sum of the weighted outputs divided by the sum of the weighted inputs. The precise form of the CCR model is as follows:

$$Max h\_{0}=\frac{\sum\_{r=1}^{s}u\_{r }y\_{r0}}{\sum\_{i=1}^{m}v\_{i}x\_{i0}}$$

subject to: $ \frac{\sum\_{r=1}^{s}u\_{r }y\_{r0}}{\sum\_{i=1}^{m}v\_{i}x\_{i0}}\leq 1, j=1, 2,…, n$

 $ u\_{r},v\_{i}\geq 0;r=1,…,s, i=1,2,…,m$

In the mathematical formulation, ‘o’ productive units (i.e. each bank) are measured as follows. The yrj, xij term refers to the outputs and inputs of the jth DMU, which are all positive; and ur, vi reflects the variable weights, which are positive. The efficiency score is between 0 and 1, and the DMU is relatively efficient when the score is equal to 1.

The equation is non-linear, which means that there may be infinite solutions of (ur\*, vi\*); this allows DMUs to have optimal weights to maximise efficiency under the constraints. To avoid this problem, Charnes et al*.* (1978) set the denominator to 1 and transformed the former fractional program into a linear programming problem (LP), as shown below:

$$Max Z=\sum\_{r=1}^{s}u\_{r}y\_{r0}$$

subject to: $ \sum\_{r=1}^{s}u\_{r}y\_{rj}-\sum\_{i=1}^{m}v\_{i}x\_{ij}\leq 0$, j=1,2,…,n

 $\sum\_{i=1}^{m}v\_{i}x\_{i0}=1$

 $ u\_{r}, v\_{i} \geq 0, r=1,2,…,s; i=1,2,…,m$

The equation is the ‘multiple’ or ‘primal’ CCR model; it has been proven to be equivalent to the ‘envelopment’ or ‘dual’ version of the CCR model, which is based on a production boundary (Thanassoulis, 2001). Solving the ‘envelopment’ CCR model is considerably easier because it has fewer constraints; the number of DMUs (n) is normally larger than the number of inputs and outputs (m + s); moreover, more time is required to calculate the linear programming problem. An equivalent envelopment is derived from the following:

$$Min z\_{0}=θ\_{0}$$

subject to: $ \sum\_{j=1}^{n}λ\_{j}x\_{ij}\leq θ\_{0}x\_{i0}, i=1,2,…,m$

 $\sum\_{j=1}^{n}λ\_{j}y\_{rj}\geq y\_{r0}, r=1,2,…,s$

$$λ\_{j}\geq 0$$

The CCR model operates under the assumption of constant return to scale (CRS), which means that with every increase in the number of inputs, the level of outputs will increase by the same proportion; thus, the efficiency of firms will not be affected by their return-to-scale characteristics. However, Liu and Song (2004) and Zheng and Cao (2005) suggested that some firms experience VRS, meaning that a change in input consumption will not result in a proportional change in output production.

Banker, Charnes, and Cooper (1984) developed the VRS DEA model. Figure 2.4 shows the difference between the CCR model and the BCC model. The CRS efficient frontier is the line that passes through B from the origin, while the efficient frontier of the BCC model is non-linear and connects the non-dominated units E, B, C, and D. Furthermore, one constraint needs to be added.

In this study, we posited that the total loans and the other earning assets were the outputs, and identified three inputs: labour, total physical capital, and total borrowed funds. The selection was based on the intermediation approach proposed by Sealey and Lindely (1977). This approach treats a bank as an intermediary that transforms the collected funds from the savers into profitable projects. Cost efficiency (CE) is the ratio of the best-practice minimum cost to the cost actually incurred.



Figure 3‑4 Efficient frontiers of the CCR model and BCC model

### 3.4.2. Stochastic frontier analysis (SFA)

SFA, the parametric efficiency measurement, was first proposed by Aigner et al*.* and Meeusen and Van Den Broeck in 1977. This model may improve the accuracy of estimation, as it can take into account the random shocks or statistical noise caused by the addition of a symmetric error term to the frontier. However, it has been criticised for pre-specifying the function form and inefficiency distribution. The stochastic cost function with the produced specific random shocks can be written as follows:

$$InTC\_{it}=f\left(Y\_{it},W\_{it};β\right)+V\_{it}+U\_{it} i=1, …,I; t=1, …T$$

where t denotes the time dimension; InTCi is the logarithm of the total costs for bank, i, is the cost frontier common to all the banks, and represents the minimum cost of producing outputs Yit when banks face input prices Wit. β is a vector of the technology parameters. The random error term Vit is a normally distributedterm with zero mean and variance $δ\_{v}^{2}$ and reflects the effects of statistical noise. Uit is a non-negative random disturbance term that represents the effects of cost inefficiency.

In this study, we followed Altunbas et al*.* (2007), Fiordelisi et al*.*, (2011), Dong et al*.* (2014), and Fang et al*.* (2019) to adopt the translog (transcendental logarithmic) cost function, which is the most commonly used functional form in the banking efficiency literature. The variables used in the SFA method are identical to those used in the DEA approach. The translog cost function specification is expressed as follows:

$$In\left(\frac{TC}{w\_{3}}\right)=α\_{0}+\sum\_{i=1}^{2}α\_{i}In(Y\_{i})+\sum\_{m=1}^{3}β\_{m}In(\frac{w\_{m}}{w\_{3}})+\frac{1}{2}\sum\_{i=1}^{2}\sum\_{j=1}^{2}δ\_{ij}\left(InY\_{i}InY\_{j}\right)+\frac{1}{2}\sum\_{m=1}^{3}\sum\_{n=1}^{3}In∂\_{mn}\left(\frac{w\_{m}}{w\_{3}}\right)In(\frac{w\_{n}}{w\_{3}})+\sum\_{i=1}^{2}\sum\_{m=1}^{3}Inε\_{im}\left(Y\_{i}\right)In(\frac{w\_{m}}{w\_{3}})+u\_{it}+v\_{it}$$

where TC is the total cost of the bank, Yi (i = 1, 2) are outputs (total loans and the other earnings assets), wm (m = 1, 2, 3) are the input prices (personnel expense to total employees, non-interest expense to fixed assets, and interest expenses to total deposits). In order to impose a linear homogeneity restriction on the model, the total cost and input price terms are normalised by the last input price w3, uit is the bank’s efficiency level, and vit represents the errors and the other uncontrolled factors.

## 3.5. Data and summary statistics

In order to investigate the relationship between capital, risk and efficiency in Chinese commercial banks, we used a panel data sample including 69 Chinese commercial banks for the period from 2004 to 2018. The banks considered in this study are five state-owned commercial banks, 11 joint stock commercial banks, and 53 city or rural commercial banks. All of the individual bank information was obtained from BankScope (a comprehensive database maintained by Bureau Van Dijk) and the individual banks’ annual reports. The data sample is an unbalanced panel, given the fact that not all banks have available information for all years. The sample contains all the major commercial banks in China, which held 83% of the total assets of Chinese banking institutions. The period covers 2004 to 2018, as the capital requirement regulations were announced in this period, and Chinese commercial banks experienced significant changes in their capital ratios to achieve compliance.

Table 3‑6 Summary Statistics

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Variables  | Observations | Mean | Median | SD | Min | Max |
| Loan-loss reserves/ Total loans | 801 | 2.83 | 2.69 | 1.29 | 0.04 | 22.02 |
| Z-Score | 825 | 28.59 | 24.28 | 18.56 | -46.04 | 150.33 |
| Capital | 827 | 6.51 | 6.40 | 2.35 | -13.71 | 31.35 |
| CE (DEA) | 598 | 0.72 | 0.70 | 0.15 | 0.28 | 1.00 |
| CE (SFA) | 603 | 0.94 | 0.94 | 0.03 | 0.69 | 0.98 |
| PE (DEA) | 603 | 0.54 | 0.49 | 0.27 | 0.10 | 1.00 |
| PE (SFA) | 603 | 0.63 | 0.62 | 0.06 | 0.47 | 0.88 |
| Bank size | 823 | 5.40 | 5.24 | 0.82 | 3.56 | 7.44 |
| Liquidity | 826 | 46.57 | 47.47 | 9.51 | 16.55 | 76.27 |
| Diversification | 819 | 17.13 | 13.64 | 14.74 | -14.63 | 91.20 |
| Profitability | 820 | 0.97 | 0.97 | 0.44 | -1.39 | 2.70 |

Table 3‑7 Correlation matrix for full sample

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | EA | LLR | Z-score | CEDEA | CESFA | PEDEA | PESFA | LNTA | LIQ | NII | ROA |
| EA | 1 |  |  |  |  |  |  |  |  |  |  |
| LLR | -0.152\* | 1 |  |  |  |  |  |  |  |  |  |
| Z-score | 0.304\* | -0.125\* | 1 |  |  |  |  |  |  |  |  |
| CEDEA | -0.237\* | -0.118\* | 0.047 | 1 |  |  |  |  |  |  |  |
| CESFA | -0.131\* | -0.045 | 0.047 | -0.280\* | 1 |  |  |  |  |  |  |
| PEDEA | -0.108\* | -0.041 | 0.008 | 0.798\* | -0.224\* | 1 |  |  |  |  |  |
| PESFA | -0.162\* | -0.056 | -0.109\* | -0.048 | 0.706\* | 0.012 | 1 |  |  |  |  |
| LNTA | -0.069 | 0.069 | 0.354\* | 0.315\* | 0.035 | 0.107\* | -0.035 | 1 |  |  |  |
| LIQ | -0.029 | -0.109\* | -0.207\* | 0.075 | 0.006 | -0.024 | 0.209\* | -0.079 | 1 |  |  |
| NII | -0.027 | 0.051 | 0.061 | 0.086 | -0.200\* | 0.064 | -0.233\* | 0.222\* | -0.098\* | 1 |  |
| ROA | 0.176\* | -0.062 | 0.195\* | -0.282\* | 0.272\* | -0.262\* | 0.088 | 0.046 | 0.055 | -0.186\* | 1 |

Table 3-6 shows the summary statistics of all the variables in this study. The number of observations varies between bank efficiency and other variables, because some banks had missing values in input and output variables when bank efficiency was calculated. According to the values of risk variables, the difference in the risk level among the banks in different years is relatively large, as the lowest values for LLR and Z-score are 0.04 and −46.04; the highest values are 22.02 and 150.33, respectively, which is consistent with previous research (Tan, 2016). The highest risk value is for the Agricultural Bank of China in 2007, which was the last state-owned commercial bank to receive a government injection to reduce NPLs. The mean of capital is 6.51. with a minimum value of −13.71 and max value of 31.35, which suggests that the difference in capital positions among banks is huge in different years; this might be explained by the reform and new capital regulations released during the examined period. Regarding the efficiency variables, the value calculated by SFA is higher than the DEA mean scores. A possible explanation is that SFA allowed the effect of random shocks or statistical noise to be separated from inefficiency, whereas under the DEA measures any departure from the frontier can be wholly classed as inefficiency.

Table 3-7 presents the correlation matrix between variables. All correlation coefficients are strictly below 0.4, except the correlation between different measures of bank efficiency. We only use one of the four bank efficiency values to run the regression model, so that the analysis is not likely to suffer from multicollinearity problems.

## 3.6. Empirical results

In this study, the seemingly unrelated regression (SUR) approach was applied to estimate the relationship between bank capital, risk, and efficiency. The model was developed by Arnold Zellner in 1962 as a generalisation of a linear regression model that consists of several regression equations, each having its own dependent variable and potentially different sets of exogenous explanatory variables, and accounts for a contemporaneous correlation. The method has greater efficiency because it estimates parameters of all equations simultaneously and the parameters of each single equation also take the information provided by other equations into account (Judge et al. 1988). All the equations can be stacked into a single equation as follows:

$$y\_{it}= x\_{it}^{T}β\_{i}+ ε\_{it}, i=1, …, m.$$

Here, the model supposes that there are m regression equations; t denotes the time period, and i shows the equation number, taking the transpose of the xit column vector. Each equation i has a single response variable yit and a ki-dimensional vector of regressors xit. Thus, the model can be expressed in the vector form as follows:

$$y\_{i}= X\_{i}β\_{i}+ ε\_{i}, i=1, …, m$$

where yi is the t\*1 vector of all the stacked dependent variables, Xi is the t\*ki matrix, βi is the ki\*1 vector of all the stacked coefficient vectors, and εi is the t\*1 vector of the stacked error vectors of all the equations.

$$\left[\begin{array}{c}y\_{1}\\y\_{2}\\\vdots \\y\_{m}\end{array}\right] = \left[\begin{matrix}X\_{1}&0&\begin{matrix}0&0\end{matrix}\\0&X\_{2}&\begin{matrix}0&0\end{matrix}\\\begin{matrix}0\\0\end{matrix}&\begin{matrix}0\\0\end{matrix}&\begin{matrix}\begin{matrix}\ddots &0\end{matrix}\\\begin{matrix}0&X\_{m}\end{matrix}\end{matrix}\end{matrix}\right] \left[\begin{array}{c}β\_{1}\\β\_{2}\\\vdots \\β\_{m}\end{array}\right] + \left[\begin{array}{c}ε\_{1}\\ε\_{2}\\\vdots \\ε\_{m}\end{array}\right]=Xβ+ ε$$

Every single parameter by separate single-equation can be obtained by an OLS estimation of the entire system of equations, i.e. $β^{OLS}= (X^{'}X)^{-1}X^{'}y$. The SUR estimator takes considerations for interrelations between the single submodels can be obtained by $β^{SUR}=\left[X'Ω^{-1}X\right]\left[X'Ω^{-1}Y\right]$, where $Ω^{-1}$ is a weighting matrix based on the covariance matrix of the error terms $Σ$. This covariance matrix $Σ= \left[σ\_{ij}\right]$ has the elements $σ\_{ij}=E \left[ε\_{in}ε\_{jn}\right]$, where $ε\_{in}$ is the error term of the $n^{th}$ observation of the $i^{th}$ equation. Finally, the inverse of the weighting matrix can be calculated by $Ω= Σ ⨂ I\_{N}$, where $I\_{N}$ is an N\*N identity matrix and $⨂$ denotes the Kronecker product. However, as the true error terms ε are unknown, they are often replaced by observed residuals, for example obtained from OLS estimates, $\hat{ε\_{i}}= y\_{i}- X\_{i}β\_{i}^{OLS}$ so that the elements of the covariance matrix can be calculated by $\hat{σ\_{ij}}= \frac{\hat{ε\_{i}'}\hat{ε\_{j}}}{N}$. Therefore, a SUR model is an application of the generalised least squares (GLS) approach and the unknown residual covariance matrix is estimated from the data.

### 3.6.1. Results using Seemingly Unrelated Regression

Tables 3-8 and 3-9 present the results derived from the SUR simultaneous estimations, with bank risk as the dependent variable. The ratio of the loan-loss reserves to the total assets is the dependent variable in the first two estimates, and Z-score is the dependent variable in the last two columns. Cost-efficiency and Profit-efficiency were used to measure levels of bank efficiency, respectively. The results show consistency and report that capitalisation has a negative impact on banking risk (the Z-score indicator is inversely linked to risk insolvency). Banks with higher capitalisation reduce bank risk; this supports the hypothesis 3a and is consistent with previous findings (Jacques & Nigro, 1997; Aggarwal & Jacques, 1998; Ediz et al., 1998; Tan & Floros, 2013; Anginer & Demirguc-Kunt, 2014). The results indicate that a 1% increase in capital tends to increase banks’ loan quality and decrease banks’ insolvency risk. The negative relationship also confirms the moral hazard hypothesis, which consistent with Jiang et al. (2013), as banks manager might issue more risky loans when leverage is already high. In the Chinese context, the CBRC issued two different regulations to improve bank corporate governance and capital adequacy requirements since 2004; the government forced Chinese banks to increase their capital to comply with the new requirements. Capital acts as a cushion against the risk of banks’ losses, which suggests that banks with higher capital were more capable of absorbing losses and reducing risk. We further found that sizeable banks were not willing to take on higher levels of risk, which aligns with the finding by Altunbas et al. (2007). In the context of China, the state-owned commercial banks are large banks in terms of total assets; they have more branches across the country, and are more capable of diversifying than other banks, through various businesses. Moreover, they were responsible for piloting China’s financial reforms and leading the industry. Thus, the state’s economic stability and financial health became priorities for big banks. The government injected substantial capital into state-owned commercial banks to help them recapitalise and solve their NPL problems; as a consequence, the loan quality has been improved significantly. The results could not find a significant and consistent relationship between bank efficiency and risk in Chinese commercial banks.

Tables 3-10 and 3-11 show the results derived from the simultaneous estimates using capital as the dependent variable. The results report a negative relationship between bank risk-taking and capital: a higher level of risk needs more capital to absorb the profit loss which results in risky banks with lower bank capital. Because the major function of capital is to absorb the operating profit losses and safeguard against bank insolvency. The results also imply the negative effects of cost-efficiency on the banking capital level (only significant when cost-efficiency is measured by DEA), as cost-efficient Chinese banks appear to hold less capital. For the other control variables, bank size is found to be strongly negatively correlated with bank capital. Large banks had lower levels of capital than smaller banks due to economies of scale: bigger banks might access and raise capital more easily because of the cost advantage, which is in line with existing studies (Altunbas et al., 2007; Deelchand & Padgett, 2009). The results suggest a negative association between liquidity and bank capitalisation, because a higher liquidity ratio implies lower liquidity, which is consistent with Berger and Bouwman (2012). As there might be a trade-off between higher capital ratios and liquidity, holding higher capital might harm banks’ liquidity, and vice versa (Horvath et al., 2014).

Table 3‑8 Main results of seemingly unrelated regression (Bank risk as dependent variable)

|  |
| --- |
| SURE model |
|  | Dependent variable |
|  | LLR | LLR | Z-SCORE | Z-SCORE |
| EA | -0.441\*\*\*(-18.39) | -0.552\*\*\*(-24.21) | 4.031\*\*\*(72.17) | 3.949\*\*\*(76.75) |
| CEDEA | -0.412(-0.80) |  | 8.600\*\*\*(5.73) |  |
| CESFA |  | -8.188\*\*\*(-3.79) |  | -8.857(-1.50) |
| LNTA | -1.546\*\*\*(-3.25) | -1.733\*\*\*(-3.38) | 6.299\*\*\*(4.67) | 7.568\*\*\*(5.54) |
| LIQ | -0.008(-0.96) | -0.010(-1.12) | 0.055\*\*(2.15) | 0.066\*\*\*(2.61) |
| NII | -0.013\*\*\*(-3.55) | -0.016\*\*\*(-4.23) | 0.029\*\*\*(2.81) | 0.030\*\*\*(2.92) |
| ROAA | -0.133(-0.80) | 0.060(0.34) | 3.122\*\*\*(6.48) | 3.064\*\*\*(6.36) |
| Year effect | Yes | Yes  | Yes | Yes  |
| Firm effect | Yes | Yes  | Yes  | Yes  |
| CONSTANT | 16.351\*\*\*(4.87) | 26.327\*\*\*(6.91) | -37.709\*\*\*(-3.97) | -29.336\*\*\*(-2.87) |
| Obs | 589 | 594 | 595 | 600 |

Table 3‑9 Main results of seemingly unrelated regression (Bank risk as dependent variable)

|  |
| --- |
| SURE model |
|  | Dependent variable |
|  | LLR | LLR | Z-SCORE | Z-SCORE |
| EA | -0.560\*\*\*(-24.52) | -0.561\*\*\*(-24.61) | 3.949\*\*\*(76.90) | 3.947\*\*\*(76.95) |
| PEDEA | 0.142(0.58) |  | 1.189\*(1.79) |  |
| PESFA |  | -2.302\*(-1.66) |  | -6.100(-1.62) |
| LNTA | -2.174\*\*\*(-4.32) | -2.116\*\*\*(-4.20) | 7.166\*\*\*(5.38) | 7.320\*\*\*(5.47) |
| LIQ | -0.008(-0.90) | -0.009(-1.00) | 0.072\*\*\*(2.81) | 0.067\*\*\*(2.65) |
| NII | -0.015\*\*\*(-4.04) | -0.015\*\*\*(-4.04) | 0.030\*\*\*(2.96) | 0.031\*\*\*(3.01) |
| ROAA | 0.014(0.08) | 0.018(0.10) | 2.972\*\*\*(6.17) | 3.004\*\*\*(6.25) |
| Year effect | Yes | Yes  | Yes  | Yes  |
| Firm effect | Yes  | Yes  | Yes  | Yes  |
| CONSTANT | 21.086\*\*\*(5.90) | 22.693\*\*\*(6.20) | -36.299\*\*\*(-3.84) | -31.455\*\*\*(3.24) |
| Obs | 594 | 594 | 600 | 600 |

Table 3‑10 Main results of seemingly unrelated regression (Bank capital as dependent variable)

|  |
| --- |
| SURE model |
|  | Dependent variable |
|  | EA | EA | EA | EA |
| LLR | -0.979\*\*\*(-18.39) | -1.104\*\*\*(-24.21) |  |  |
| Z-SCORE |  |  | 0.245\*\*\*(72.17) | 0.250\*\*\*(76.75) |
| CEDEA | -2.503\*\*\*(-3.27) |  | -2.320\*\*\*(-6.30) |  |
| CESFA |  | 0.287(0.09) |  | 3.402\*\*(2.29) |
| LNTA | -5.797\*\*\*(-8.81) | -5.848\*\*\*(-8.64) | -1.621\*\*\*(-4.98) | -2.048\*\*\*(-6.10) |
| LIQ | -0.034\*\*\*(-2.65) | -0.035\*\*\*(-2.70) | -0.014\*\*(-2.21) | -0.017\*\*\*(-2.67) |
| NII | -0.024\*\*\*(-4.59) | -0.026\*\*\*(-4.78) | -0.007\*\*\*(-2.88) | -0.008\*\*\*(-2.96) |
| ROAA | 0.605\*\*(2.45) | 0.571\*\*(2.28) | -0.752\*\*\*(-6.23) | -0.759\*\*\*(-6.16) |
| Year effect | Yes  | Yes  | Yes | Yes  |
| Firm effect | Yes | Yes  | Yes  | Yes  |
| CONSTANT | 49.792\*\*\*(10.91) | 48.120\*\*\*(9.54) | 10.012\*\*\*(4.36) | 7.251\*\*\*(2.86) |
| Obs | 589 | 594 | 595 | 600 |

Table 3‑11 Main results of seemingly unrelated regression (Bank capital as dependent variable)

|  |
| --- |
| SURE model |
|  | Dependent variable |
|  | EA | EA | EA | EA |
| LLR | -1.110\*\*\*(-24.52) | -1.114\*\*\*(-24.61) |  |  |
| Z-SCORE |  |  | 0.251\*\*\*(76.90) | 0.251\*\*\*(76.95) |
| PEDEA | -0.408(-1.18) |  | -0.377\*\*(-2.25) |  |
| PESFA |  | -1.802(-0.92) |  | 1.524(1.61) |
| LNTA | -5.820\*\*\*(-8.83) | -5.755\*\*\*(-8.69) | -1.889\*\*\*(-5.75) | -1.926\*\*\*(-5.84) |
| LIQ | -0.036\*\*\*(-2.76) | -0.036\*\*\*(-2.71) | -0.019\*\*\*(-2.94) | -0.018\*\*\*(-2.75) |
| NII | -0.025\*\*\*(-4.75) | -0.026\*\*\*(-4.81) | -0.008\*\*\*(-3.03) | -0.008\*\*\*(-3.09) |
| ROAA | 0.579\*\*(2.32) | 0.564\*\*(2.26) | -0.728\*\*\*(-5.91) | -0.739\*\*\*(-6.01) |
| Year effect | Yes  | Yes  | Yes  | Yes  |
| Firm effect | Yes  | Yes  | Yes  | Yes  |
| CONSTANT | 48.530\*\*\*(10.50) | 49.284\*\*\*(10.34) | 9.831\*\*\*(4.20) | 8.547\*\*\*(3.54) |
| Obs | 594 | 594 | 600 | 600 |

Table 3‑12 Main results of seemingly unrelated regression (Cost-efficiency as dependent variable)

|  |
| --- |
| SURE model |
|  | Dependent variable |
|  | CEDEA |  CESFA | CEDEA | CESFA |
| LLR | -0.003(-0.80) | -0.003\*\*\*(-3.79) |  |  |
| Z-SCORE |  |  | 0.006\*\*\*(5.73) | -0.001(-1.50) |
| EA | -0.007\*\*\*(-3.27) | 0.001(0.09) | -0.028\*\*\*(-6.30) | 0.003\*\*(2.29) |
| LNTA | 0.064\*(1.67) | 0.054\*\*\*(5.65) | 0.049(1.30) | 0.056\*\*\*(5.83) |
| LIQ | 0.001(0.97) | -0.001(-1.02) | 0.001(0.74) | -0.001(-1.04) |
| NII | 0.001(0.85) | -0.001\*(-1.67) | 0.001(0.58) | -0.001(-1.12) |
| ROAA | -0.015(-1.13) | 0.004(1.23) | -0.037\*\*\*(-2.69) | 0.006\*(1.83) |
| Year effect | Yes  | Yes | Yes  | Yes  |
| Firm effect | Yes  | Yes  | Yes  | Yes  |
| CONSTANT | 0.456\*(1.68) | 0.639\*\*\*(9.34) | 0.442\*(1.65) | 0.615\*\*\*(9.01) |
| Obs | 589 | 594 | 595 | 600 |

Table 3‑13 Main results of seemingly unrelated regression (Profit-efficiency as dependent variable)

|  |
| --- |
| SURE model |
|  | Dependent variable |
|  | PEDEA |  PESFA | PEDEA | PESFA |
| LLR | 0.004(0.58) | -0.002\*(-1.66) |  |  |
| Z-SCORE |  |  | 0.004\*(1.79) | -0.001(-1.62) |
| EA | -0.006(-1.18) | -0.001(-0.92) | -0.022\*\*(-2.25) | 0.003(1.61) |
| LNTA | -0.065(-0.76) | 0.028\*(1.84) | -0.077(-0.90) | 0.034\*\*(2.25) |
| LIQ | -0.003\*(-1.80) | -0.001(-0.73) | -0.003\*(-1.83) | -0.001(-0.03) |
| NII | 0.001(0.77) | -0.001(-0.41) | 0.001(0.52) | -0.001(-0.03) |
| ROAA | 0.038(1.26) | -0.001(-0.25) | 0.024(0.77) | 0.001(0.17) |
| Year effect | Yes  | Yes  | Yes  | Yes  |
| Firm effect | Yes  | Yes  | Yes  | Yes  |
| CONSTANT | 1.187\*(1.94) | 0.642\*\*\*(5.94) | 1.215\*\*(2.00) | 0.598\*\*\*(5.56) |
| Obs | 594 | 594 | 600 | 600 |

### 3.6.2. Results using the two-step system GMM model

In order to check the robustness of the results of seemingly unrelated regression, the study conducted a two-step system dynamic GMM model to address potential endogeneity issues. For instance, Bandt et al. (2017) suggested that it is important to consider the endogeneity of capital level in the performance model, as the potential endogeneity problem that may form persistence of bank performance and also efficiency might have an impact on optimal bank capital in two ways; efficient banks might be more willing to increase capital in the short-term; however, over the long-term, efficient banks might be less willing to increase capital as they have future income that could be used if necessary. Thus, these authors used the system GMM model to address the endogeneity problems. As mentioned before, capital might have a different impact on bank-risk taking due to different hypothesis. Therefore, the GMM is used to control the endogeneity problems.

Arellano and Bover (1995) and Blundell and Bond (2000) developed the two-step GMM estimator. In addition, Blundell and Bond (2000) indicated that a system panel estimator that simultaneously uses difference panel data and data based on the original levels of specification gives rise to dramatic increases in both consistency and efficiency ([Beck and Levine, 2004](https://www.sciencedirect.com/science/article/pii/S0261560612000903%22%20%5Cl%20%22bib13); [Doytch and Uctum, 2011](https://www.sciencedirect.com/science/article/pii/S0261560612000903%22%20%5Cl%20%22bib32)). The system GMM estimator combines the regression difference with the regression in levels to reduce the potential biases and imprecision associated with the difference estimator (Arellano and Bover, 1995).

Tables 3-14 to 3-19 present the results of the two-step system GMM estimator. According to the results of the serial-correlation tests and Hansen tests, the null hypothesis cannot be rejected, which implies that the instruments are valid and there is no serial correlation. Tables 3-14 and 3-15 report similar findings to the SUR model, which confirms that capitalisation has a negative impact on the banking risk, and large banks appear to take less risk. Tables 3-16 and 3-17 indicate a negative relationship between bank risk-taking and capital and large Chinese banks appear to hold less capital. However, Tables 3-18 and 3-19 show no consistent impact of capital on efficiency. Thus, the relationship between capitalisation and bank risk is bidirectional and negative: inefficient banks appear to hold more capital. However, the study could not find a consistent relationship between bank efficiency and risk.

Table 3‑14 Results of two-step system GMM model (Bank risk as dependent variable)

|  |
| --- |
| Two-step system GMM model |
|  | Dependent variable |
|  | LLR | LLR | Z-SCORE | Z-SCORE |
| L.LLR / L. Z-SCORE | 0.247\*\*\*(12.37) | 0.310\*\*\*(18.62) | 0.933\*\*\*(55.79) | 0.946\*\*\*(66.50) |
| EA | -0.296\*\*\*(-8.32) | -0.264\*\*\*(-9.89) | 1.923\*\*\*(18.85) | 1.687\*\*\*(13.17) |
| CEDEA | -2.880\*\*\*(-6.01) |  | -4.442\*(-1.96) |  |
| CESFA |  | -2.135\*(-1.68) |  | 42.071\*\*\*(6.93) |
| LNTA | -0.298\*\*(-2.44) | -0.425\*\*\*(-6.13) | 2.918\*\*\*(3.71) | 2.911\*\*\*(3.93) |
| LIQ | 0.011\*\*(1.98) | 0.003(0.67) | -0.125\*\*\*(-6.06) | -0.086\*\*\*(-3.47) |
| NII | -0.005\*\*\*(-3.05) | -0.004\*\*(-2.52) | -0.014\*(-1.77) | -0.002(-0.32) |
| ROAA | -0.116(-1.10) | 0.233\*\*\*(2.72) | -1.381\*\*(-2.17) | -1.115\*\*\*(-2.75) |
| CONSTANT | 6.552\*\*\*(8.66) | 8.675\*\*\*(6.74) | -11.174\*\*(-2.05) | -60.248(-7.49) |
| Year effects | Yes | Yes | Yes | Yes |
| Firm effect | Yes  | Yes  | Yes  | Yes  |
| AR(1) p-value | 0.180 | 0.190 | 0.046 | 0.038 |
| AR(2) p-value | 0.784 | 0.725 | 0.642 | 0.982 |
| Hansen test of overidentification | 0.698 | 1.000 | 1.00 | 1.000 |

Table 3‑15 Results of two-step system GMM model (Bank risk as dependent variable)

|  |
| --- |
| Two-step system GMM model |
|  | Dependent variable |
|  | LLR | LLR | Z-SCORE | Z-SCORE |
| L.LLR / L. Z-SCORE | 0.274\*\*\*(10.40) | 0.305\*\*\*(12.18) | 0.931\*\*\*(60.62) | 0.943\*\*\*(51.59) |
| EA | -0.313\*\*\*(-9.02) | -0.254\*\*\*(-9.58) | 1.969\*\*\*(14.15) | 1.708\*\*\*(14.74) |
| PEDEA | -1.016\*\*\*(-8.19) |  | -5.436\*\*\*(-5.82) |  |
| PESFA |  | 2.390\*\*(2.31) |  | 18.287\*\*(2.48) |
| LNTA | -0.340\*\*\*(-3.51) | -0.324\*\*\*(-3.49) | 4.216\*\*\*(5.19) | 2.880\*\*\*(4.83) |
| LIQ | 0.008(1.30) | 0.010\*\*(2.49) | -0.111\*\*\*(-4.61) | -0.092\*\*\*(-3.82) |
| NII | -0.004\*\*\*(-3.48) | -0.003\*(-1.87) | -0.003(-0.32) | -0.005(-0.71) |
| ROAA | 0.165(1.50) | 0.144\*(1.84) | -0.379(-0.56) | -0.976\*\*(-2.11) |
| CONSTANT | 7.180(9.10) | 1.738(1.39) | -18.990\*\*\*(-3.03) | -29.072\*\*\*(-4.29) |
| Year effects | Yes | Yes | Yes | Yes  |
| Firm effect | Yes  | Yes  | Yes  | Yes  |
| AR(1) p-value | 0.150 | 0.185 | 0.050 | 0.042 |
| AR(2) p-value | 0.917 | 0.778 | 0.948 | 0.837 |
| Hansen test of overidentification | 1.000 | 0.483 | 0.250 | 1.000 |

Table 3‑16 Results of two-step system GMM model (Bank capital as dependent variable)

|  |
| --- |
| Two-step system GMM model |
|  | Dependent variable |
|  | EA | EA | EA | EA |
| L.EA | 0.256\*\*\*(11.20) | 0.311\*\*\*(13.86) | 0.220\*\*\*(8.97) | 0.242\*\*\*(13.67) |
| LLR | -0.580\*\*\*(-8.49) | -0.546\*\*\*(-8.18) |  |  |
| Z-Score |  |  | 0.037\*\*\*(8.37) | 0.035\*\*\*(16.92) |
| CEDEA | -2.511\*\*\*(-3.86) |  | -1.393\*\*\*(-3.26) |  |
| CESFA |  | -8.480\*\*\*(-2.17) |  | 2.011(0.93) |
| LNTA | -0.288\*\*\*(-4.36) | -0.328\*\*\*(-5.42) | -0.357(-0.91) | -0.747\*\*\*(-4.86) |
| LIQ | 0.030\*\*\*(6.37) | 0.016\*\*\*(3.16) | 0.050\*\*\*(4.67) | 0.045\*\*\*(5.28) |
| NII | -0.005\*\*(-2.32) | -0.004\*(-1.86) | -0.003(-1.49) | -0.003\*(-1.72) |
| ROAA | 0.955\*\*\*(5.56) | 1.435\*\*\*(8.73) | 0.766\*\*\*(2.79) | 0.755\*\*\*(4.67) |
| CONSTANT | 6.402\*\*\*(9.96) | 12.629\*\*\*(3.36) | 4.840\*(1.68) | 4.007\*(1.88) |
| Year effects | Yes | Yes  | Yes | Yes  |
| Firm effect | Yes  | Yes  | Yes  | Yes  |
| AR(1) p-value | 0.004 | 0.013 | 0.012 | 0.015 |
| AR(2) p-value | 0.386 | 0.630 | 0.303 | 0.600 |
| Hansen test of overidentification | 1.000 | 1.000 | 0.997 | 0.500 |

Table 3‑17 Results of two-step system GMM model (Bank capital as dependent variable)

|  |
| --- |
| Two-step system GMM model |
|  | Dependent variable |
|  | EA | EA | EA | EA |
| L.EA | 0.304\*\*\*(8.08) | 0.288\*\*\*(12.81) | 0.242\*\*\*(9.53) | 0.260\*\*\*(8.72) |
| LLR | -0.569\*\*\*(-8.41) | -0.577\*\*\*(-9.88) |  |  |
| Z-Score |  |  | 0.034\*\*\*(6.97) | 0.032\*\*\*(5.56) |
| PEDEA | -0.326(-0.92) |  | -0.564\*\*(-2.46) |  |
| PESFA |  | -0.912(-0.36) |  | -0.599(-0.50) |
| LNTA | -0.261(-1.36) | -0.383\*\*\*(-6.43) | -0.670\*\*(-2.03) | -0.623\*(-1.87) |
| LIQ | 0.029\*\*\*(3.25) | 0.023\*\*\*(4.88) | 0.038\*\*\*(4.24) | 0.042\*\*\*(4.70) |
| NII | -0.002(-0.96) | -0.004(-1.52) | -0.002(-0.85) | -0.002(-0.85) |
| ROAA | 1.235\*\*\*(7.66) | 1.271\*\*\*(7.71) | 0.950\*\*\*(3.96) | 0.938\*\*\*(3.25) |
| CONSTANT | 6.565\*\*\*(4.30) | 6.578\*\*\*(2.70) | 5.949\*\*(2.41) | 5.801\*\*(2.06) |
| Year effects | Yes | Yes  | Yes | Yes  |
| Firm effect | Yes  | Yes  | Yes  | Yes  |
| AR(1) p-value | 0.017 | 0.011 | 0.025 | 0.018 |
| AR(2) p-value | 0.713 | 0.543 | 0.995 | 0.625 |
| Hansen test of overidentification | 0.739 | 1.000 | 0.996 | 0.769 |

Table 3‑18 Results of two-step system GMM model (Cost-efficiency as dependent variable)

|  |
| --- |
| Two-step system GMM model |
|  | Dependent variable |
|  | CEDEA | CEDEA | CESFA | CESFA |
| L.CEDEA | 0.641\*\*\*(19.33) | 0.524\*\*\*(19.78) |  |  |
| L.CESFA |  |  | 0.646\*\*\*(19.89) | 0.611\*\*\*(21.00) |
| LLR | -0.001(-0.09) |  | -0.001(-1.15) |  |
| Z-Score |  | -0.001(-0.05) |  | -0.001(-0.17) |
| EA | -0.001(-0.28) | -0.001(-0.08) | -0.002\*\*\*(-3.43) | -0.001\*(-1.85) |
| LNTA | 0.028\*\*\*(3.44) | 0.033(1.23) | -0.003(-1.34) | -0.001(-0.74) |
| LIQ | 0.001\*\*(2.06) | 0.001(1.01) | -0.001(-1.43) | -0.001(-1.48) |
| NII | -0.001\*\*\*(-2.84) | -0.001(-1.09) | -0.001\*\*(-2.08) | -0.001(-1.34) |
| ROAA | -0.038\*\*\*(-7.98) | -0.015(-0.89) | 0.008\*(1.80) | 0.016\*\*\*(3.23) |
| CONSTANT | 0.031(0.47) | 0.036(0.21) | 0.352\*\*\*(10.94) | 0.383\*\*\*(16.51) |
| Year effects | Yes  | Yes  | Yes  | Yes |
| Firm effect | Yes  | Yes  | Yes  | Yes  |
| AR(1) p-value | 0.001 | 0.001 | 0.067 | 0.058 |
| AR(2) p-value | 0.361 | 0.258 | 0.243 | 0.223 |
| Hansen test of overidentification | 1.000 | 1.000 | 1.000 | 1.000 |

Table 3‑19 Results of two-step system GMM model (Profit-efficiency as dependent variable)

|  |
| --- |
| Two-step system GMM model |
|  | Dependent variable |
|  | PEDEA | PEDEA | PESFA | PESFA |
| L.PEDEA | 0.642\*\*\*(17.42) | 0.634\*\*\*(17.46) | 0.534\*\*\*(11.18) | 0.458\*\*\*(9.92) |
| L.PESFA |  |  |  |  |
| LLR | 0.001(0.19) |  | -0.003\*\*(-2.34) |  |
| Z-Score |  | 0.002\*(1.85) |  | -0.001\*\*\*(-2.61) |
| EA | -0.009(-1.90) | -0.009\*(-1.69) | 0.001\*(1.68) | 0.001(0.01) |
| LNTA | 0.015(0.72) | 0.004(0.18) | -0.003(-1.09) | -0.003(-0.65) |
| LIQ | -0.001(-0.37) | 0.001(0.25) | -0.001(-0.30) | -0.001(-1.30) |
| NII | 0.001(0.80) | 0.001(0.56) | -0.001(-0.93) | -0.001(-1.27) |
| ROAA | -0.001(-0.05) | -0.041(-1.08) | 0.007\*(1.94) | 0.016\*\*(2.33) |
| CONSTANT | 0.071(0.25) | -0.009(-0.05) | 0.286\*\*\*(7.16) | 0.407\*\*\*(10.43) |
| Year effects | Yes | Yes  | Yes | Yes  |
| Firm effect | Yes  | Yes  | Yes  | Yes  |
| AR(1) p-value | 0.001 | 0.001 | 0.007 | 0.003 |
| AR(2) p-value | 0.982 | 0.996 | 0.117 | 0.078 |
| Hansen test of overidentification | 0.359 | 0.477 | 1.000 | 0.809 |

Table 3‑20 Results of seemingly unrelated regression in various subsample periods

|  |  |
| --- | --- |
|  | SURE MODEL |
|  | 2004-2011 |
|  | EA | LLR | CEDEA | EA | LLR | CESFA |
| EA |  | -0.485\*\*\*(-13.33) | -0.018\*\*\*(-4.10) |  | -0.565\*\*\*(-15.95) | -0.001(-0.17) |
| LLR | -1.333\*\*\*(-13.33) |  | -0.033\*\*\*(-4.71) | -1.330\*\*\*(-15.95) |  | 0.001(0.76) |
| CEDEA | -5.526\*\*\*(-4.10) | -3.791\*\*\*(-4.71) |  |  |  |  |
| CESFA |  |  |  | -1.034(-0.17) | 2.960(0.76) |  |
|  | 2012-2018 |
|  | EA | LLR | CEDEA | EA | LLR | CESFA |
| EA |  | 0.269\*\*\*(8.53) | -0.017\*\*\*(-3.78) |  | 0.282\*\*\*(8.95) | 0.002\*(1.80) |
| LLR | 0.584\*\*\*(8.53) |  | -0.015\*\*(-2.34) | 0.607\*\*\*(8.95) |  | -0.002\*(-1.86) |
| CEDEA | -1.989\*\*\*(-3.78) | -0.839\*\*(-2.34) |  |  |  |  |
| CESFA |  |  |  | 4.921\*(1.80) | -3.472\*(-1.86) |  |

### 3.6.3. Additional checks in various periods

Table 3-20 presents results of the SUR models in the two subsample periods: the early period is from 2004 to 2011, and the second period is 2012–2018, which represent the two capital requirement regulations respectively. To conserve space, we provide the interaction coefficients between capital, risk and efficiency. The results from the early period suggest that there is a bidirectional negative relationship between capitalisation and banking risk, suggesting that banks with higher capital were more capable of absorbing losses and reducing risk, which is consistent with the previous findings (Tan and Floros, 2013; Anginer and Demirguc-Kunt, 2014). The explanation might be huge capital increase to comply with new requirements and absorb the risk losses. In the later period, we found a significantly positive relationship between capital and risk; this supports the regulatory hypothesis, meaning that regulators may encourage banks to increase their capital commensurately with the amount of risk taken. The new standards in 2011 mainly targeted the small- and medium-sized banks and most of the banks had already achieved the capital adequacy ratio after the financial crisis such as the 16 listed banks. Marcus (1983) suggested that banks that hold higher levels of capital with large capital buffers tend to keep their capital buffers and increase risk when they increase capital.

## 3.7. Conclusion

The purpose of this chapter was to investigate the relationship between bank capital, risk and efficiency in Chinese commercial banks. While the previous theoretical and empirical studies focused on developed markets and provided contradictory results, our study considered the context of Chinese commercial banks, and extended the sample size and period compared to existing research. To ensure robustness of the results, we applied two variables to measure banking risk, and used both non-parametric and parametric methods to estimate the level of bank efficiency. Both the Seemingly Unrelated Regression approach and two-step GMM technique were employed to estimate the relationship.

The empirical results reveal a bidirectional negative relationship between capitalisation and banking risk, suggesting that banks with higher capital were more capable of absorbing losses and reducing risk. We further found that cost-efficient banks appeared to hold less capital, and large banks had lower levels of capital than smaller banks, due to the economies of scale: bigger banks might access and raise capital more easily than smaller banks because of the cost advantage. In addition, large banks might be unwilling to take on higher levels of risk. As large banks might be responsible for piloting China’s financial reforms and leading the industry, this shows that the state’s economic stability and financial health became the priorities. Finally, the study suggested that the relationship between capital and risk appears to change over the period, and we found a significantly positive relationship between capital and risk over the subsample period of 2012–2018.

Overall, the empirical results have extended the previous literature on the relationship between capital, risk and efficiency, and obtained different findings from those of studies of developed markets. The results might be helpful for commercial banking managers and capital regulatory authorities to make related decisions.

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# Chapter 4. The impact of corporate social responsibility on bank performance: evidence from Chinese commercial banks

## 4.1. Introduction

The investigation of the relationship between adopting corporate social responsibility (CSR) and financial performance of a corporation has a long history but is still a continually debated issue. From a theoretical perspective, according to the shareholder view, which stems from neoclassical economic theory, corporate managers are only responsible for maximising the corporation’s profit within the boundaries of what is legally permitted (Friedman, 1970). The additional costs of engaging in CSR activities, although supported by shareholders, are wasted, which results in lower profit. Therefore, the relationship between CSR and bank performance should be negative. In contrast, the stakeholder theory (Freeman, 1984) argues that CSR and profit maximisation are not mutually exclusive and can be compatible and that engaging in CSR activities that act in all stakeholders’ interests ultimately increases performance.

The banking system is the key element in economic development (Levine, 2005; Shen & Lee, 2005), as banks serve as financial intermediaries by facilitating cash flow between lenders and borrowers; their health and soundness can bring financial stability and create external benefits for society (Shen & Lee, 2006). CSR and the behaviour of the banking sector has become more critical after the 2008 financial crisis because poor corporate governance might negatively impact economies and the financial industry’s stability. Consequently, professionals and academics worldwide have acknowledged and researched the importance of CSR practices in the banking sector. In the emerging economic environment, it is vital for financial intermediaries to integrate moral, ethical and environmental concerns into their business operations (Evangelinos et al. 2009, p. 167). In other words, banks are driven by public demand to increase their transparency and accountability with respect to social responsibility as a result of changing norms and expectations in society. For the banking sector, it is accepted that being socially responsible is a deep-rooted concept in the financial service industry (Scholtens 2009, p. 159).

A number of studies have reported that CSR improves firm financial performance because CSR activities enhance the company’s reputation (Simpson & Kohers, 2002; Waddock & Graves, 1997; Wu & Shen, 2013). Simpson and Kohers (2002) reported a positive correlation between CSR and financial performance in US national banks. Wu and Shen (2013) investigated the relationship between CSR and financial performance in the banking industry; they studied 162 banks in 22 countries from 2003 to 2009 and found a positive relationship between CSR and banking return on assets, return on equity, net interest income and non-interest income, which suggests that banks conduct CSR activities for strategic motives. On the contrary, other researchers have claimed a negative relationship between CSR and financial performance due to the cost of engaging in CSR programmes (Jensen, 2002). Multiple countries and various measurement issues could explain the previous contradictory results. However, there are few studies that have investigated the relationship between CSR and financial performance in the Chinese banking context. A better understanding of the impact of CSR on Chinese banking performance would be valuable to bank managers, shareholders and stakeholders, and might be further extended to other emerging markets.

Chinese commercial banks have begun to incorporate CSR practices since 2006, in response to two policies mandated by the State Council in 2005 and 2006. Nowadays, more and more Chinese commercial banks have realised the success of a bank not only depends on its internal management but also depends on its external activities, through which banks provide returns to the public by engaging in different activities and contributing to the economy, environment and societal development (Fukuyama & Tan, 2021). Thus, CSR is expected to have a positive impact on bank performance, because according to the good management hypothesis, based on a stakeholder perspective (Freeman, 1984), the long-term survival and successful development of an organisation requires the stakeholders’ support (van der Laan et al., 2005), and a better relationship with stakeholders results in enhanced financial performance (Waddock & Graves, 1997). Engaging in CSR can improve relationships with stakeholders and satisfy all stakeholders’ interests, ultimately increasing banks’ financial performance. Additionally, Cornell and Shapiro (1987) propose the social impact hypothesis, which implies that satisfying the requirements of different groups of stakeholders will improve social reputation and brand image leads to enhanced financial performance. However, the relationship between CSR and financial performance might also be negative. From a shareholder view, stemming from neoclassical economic theory, according to the trade-off hypothesis the additional costs of engaging in corporate social responsibility such as charity donation projects, supporting employee welfare and minimising environmental damage, might outweigh the benefits and result in deteriorating financial performance.

There are three reasons for exploring the impact of corporate social responsibility on Chinese banks’ financial performance. First, CSR standards and practices in the Chinese banking sector are less developed than in Western countries. Matten and Moon (2004) indicated that CSR practices could be different across various social, political and economic contexts. Thus, the results of previous studies investigated the banking sector using international or US data and may not feature the Chinese banking sector due to different practices and development histories of CSR. For example, Carroll (1979) defined CSR comprehensively as the social responsibility of business including their economic, legal, ethical and discretionary responsibility. Carroll’s definition of CSR is the most widely used in Western countries, particularly in the US and Europe (Crane & Matten, 2004). In the Chinese context, the “Guidelines on Corporate Social Responsibility for the Chinese Banking Sector” (2009) required the CSR of banking institutions to at least include economic responsibility, social responsibility and environmental responsibility. Secondly, only few research studies have investigated the relationship between CSR and Chinese banking performance. The possible explanations might be the short CSR development history and CSR data availability. To my best knowledge, only one study has investigated the link between CSR and Chinese banking performance. Zhu et al. (2017) applied a nonparametric method to investigate the impact of CSR on Chinese banking efficiency and their results indicated that an increase in CSR may have positive impact on banking conditional efficiency. However, due to the data availability, their sample only included 13 Chinese commercial banks with 64 observations between 2008 and 2013. Thus, the sample may have a selection bias issue. The lack of conclusive results on the link between CSR and Chinese banking performance provides a motivation to conduct this investigation. Thirdly, differences might exist in the relationship between corporate social responsibility and bank financial performance among different types of banks. The Big Five state-owned banks have a longer development history and are responsible for piloting China’s financial reforms and leading the industry. There has been no study that has considered the moderation effect of bank ownership. Therefore, a comprehensive understanding of the relationship between CSR and financial performance could be invaluable to bank managers and policy makers.

In this chapter, we examine the impact of CSR on bank performance, since the Chinese banking sector has increasingly incorporated CSR practices. In order to measure the level of CSR, we adopted content analysis which is the first piece of research for the Chinese banking context. The checklist was constructed based on three dimensions: economic responsibility, social responsibility and environmental responsibility, as mentioned in the Guidelines on Corporate Social Responsibility for the Chinese Banking Sector (2009). We followed Simpson and Kohers (2002) and Wu and Shen (2013) and applied two financial ratios – namely, Return on Asset (ROA) and Net Interest Margin (NIM) – to measure bank financial performance, and thereby evaluate how CSR affects commercial banks’ performance. We used different estimation methods, including pooled OLS, fixed effects and random effects to evaluate the relationship. In order to test the potential endogeneity problem of the model, a two-step system Generalized Method of Moments (GMM) method was applied to provide robust results. Using a sample of 59 Chinese commercial banks over the 2008–2018 period, the results for Chinese commercial banks are consistent with stakeholder theory, the good management hypothesis and the social impact hypothesis. Engaging in CSR activities could enhance the bank’s reputation, attract new customers, and increase existing customers’ loyalty. To maintain a good relationship with stakeholders, banks ultimately may increase their financial profits, improve employee productivity and boost product competitiveness. We assume the relationship between CSR and financial performance can vary based on the different types of banks; however the empirical results could not find evidence to support this hypothesis. This might be due to different motives, stages of development, external resources, and management philosophies.

This study aims to examine the impact of CSR on bank financial performance and differs from previous research in a number of ways. First, we applied content analysis to measure CSR performance and the checklist was constructed based on the Chinese banking context. As the social ratings provided by social agencies or databases may not be reliable (Chatterji & Levin, 2008), the content analysis allows researchers to collect information directly from secondary data sources. Thus, our CSR rating is more accurate to reflect the CSR performance of banks.

Second, we extend a larger sample of banking data compared to the previous study by Zhu et al. (2017) and consider the effect of different types of banks. State-owned banks have a longer development history than other banks and still overwhelmingly dominate the Chinese banking industry in terms of the amount of assets, branches and employees. They are responsible for piloting China’s financial reforms and leading the industry and they also receive more policy support from the government than other banks. Thus, we expected different types of banks to have different impacts of CSR on banks’ financial performance. In addition, it is worth noting that it takes time for firms engaging in CSR to realise higher financial returns (Brammer & Millington, 2008) and CSR should be regarded as a long-term investment that benefits from interactions among stakeholders (Barnett & Salomon, 2012). Therefore, we consider the long-term effects of CSR.

Thirdly, we used different estimation methods, including pooled OLS, fixed effects and random effects to evaluate the relationship. In order to test the potential endogeneity problem of the model, a system Generalized Method of Moments (GMM) approach was applied to provide robust results.

The rest of this chapter is organised as follows. Section 3.2 reviews the related literature and hypotheses on the impact of CSR on bank performance. Section 3.3 provides the main model and data samples. Section 3.4 presents the empirical results and discussion and the final section gives the conclusion.

## 4.2. Literature review

### 4.2.1. Definition of CSR

Despite numerous efforts to provide a generally clear and unbiased definition of CSR, the existing academic literature still lacks a consensus. The possible reason for the lack of definitional consensus on CSR might be the abundance of definitions (Geva, 2008), which are often biased by special interests (Van Warrewijk, 2003). Dahlsrud (2008) developed five dimensions of CSR through a content analysis of 37 existing CSR definitions. The five dimensions are environmental, social, economic, stakeholder, and the voluntariness. In addition, Carroll (1991) presented a CSR pyramid, which has been widely used in the CSR literature and is the dominant CSR model in developed countries (Crane & Matten, 2004). This CSR pyramid is shown in Figure 4-1. It is relatively easy-to-understand and has been empirically tested in US and Europe. According to Carroll (1991), CSR includes four different responsibilities, which are economic, legal, ethical and philanthropic. The economic responsibility is fundamental and the highest priority of the pyramid, which expects firms to operate profitably within the framework of law. Thus, the legal responsibility is the next layer in the pyramid, where failure to abide by the country’s law may result in the corporation being penalised. The third is ethical responsibility, in which the society expects organisations to operate ethically. The philanthropic responsibility is the final and top layer, which requires firm to conduct voluntary activities that society desires.



Figure 4‑1 Carroll's Pyramid of Corporate Social Responsibilities

### 4.2.2. CSR in the Chinese banking sector

China has experienced rapid growth over the past four decades and has become the second-largest economic body in the world; however, the economic growth has been accompanied by serious environmental problems and China is a country with one of the highest levels of pollution emissions (Yang et al., 2018). China overtook the US as the world’s largest carbon dioxide emitter in 2007, and air and water pollution have become major threats to the Chinese people and to the state’s stability.

The banking sector plays a crucial role in China’s economic development and the financial sector’s share of total Gross Domestic Product (GDP) has increased significantly, from 5.7% in 2008 to 7.8% in 2019. Traditional services and financial innovation contribute to this growth. In order to upgrade industrial structures and better monitor the credit risks of explosive growth in lending for certain industries, the National Development and Reform Commission (NDRC), jointly with the PBC and the CBRC, issued the “Announcement on further strengthening industrial policy and credit policy to control credit risks” in 2004. Then, in 2005 and 2006, the State Council released another two policies, the “Regulation on accelerating adjustment of industrial structure” and the “Announcement on accelerating adjustment of industrial structure with excess capacity”, which required financial institutions to adjust national industrial structures by optimising loan structures. Both policies for regulating banks required them to refuse to provide funding for a project or enterprise that breaches environmental obligations. The Chinese government officially launched the first series of its green finance policies in July 2007, including the “Green Credit Policy”, the “Green Securities Policy” and the “Green Insurance”; these policies are considered a new approach for allowing financial institutions to control their level of pollution or energy usage. Each policy has its own focus. As the names suggest: the “Green Credit Policy” focuses on regulating banks’ lending services and is the core policy of green finance; the “Green Securities Policy” regulates China’s capital markets and monitors the listed companies, while “Green Insurance” regulates insurance enterprises.

In 2009, the banking sector began making efforts to promote social responsibility as the China Banking Association issued the “Guidelines on Corporate Social Responsibility for the Chinese Banking Sector”. These guidelines indicate that the banking sector should take responsibility for economic, social and environmental aspects; they also require banks to issue an annual report on their corporate social responsibility (CSR). The banking sector was also required to support national industrial policies and environmental policies, by saving resources, protecting the natural environment and promoting sustainable development.

In response to this policy, Chinese commercial banks have begun to incorporate CSR practices: for example, the total balance of green loans is growing as a share of the banks’ overall credit balance, expanding from 8.8% in 2013 to 10.4% at the end of 2019. The banking system is the key element in economic development, and it is expected to become more socially responsible (Chambers & Day, 2009). As banks serve as financial intermediaries by facilitating cash flows between lenders and borrowers, their health and soundness can bring financial stability and create external benefits for society (Shen & Lee, 2006). The banking sector is distinct from other industries because banks use and benefit from society’s resources. For example, governments employed public funds to bail out distressed banks during the financial crisis; and to avoid bank runs, many countries adopted full-coverage deposit insurance (Shen et al., 2016).

### 4.2.3. Related literature on the relationship between CSR and bank performance

Explorations of the relationship between corporate social responsibility (CSR) performance and corporate financial performance (FP) have a long history. Friedman (1962, 1970) challenged the idea that ‘a corporation’s social responsibility is to make a profit’, which triggered the interest to prove or disprove the relationship between CSR and FP. Although a large number of empirical research has attempted to assess this relationship, no consensus has yet been reached.

Some studies indicate a positive relationship between social responsibility and bank financial performance (Wu & Shen, 2013; Shen et al., 2016; Platonova et al., 2018; Belasri et al., 2020). Simpson and Kohers (2002) extended earlier studies and provided empirical support for a positive relationship between CSR and FP in the US banking industry. They suggested that it is invaluable for bank managers and stockholders to have a better understanding of the relationship between corporate social performance and financial performance. Their study focused on a unique banking industry which had not been investigated before, and indicated that multiple industries and various measurement issues could explain the previous contradictory results. Wu and Shen (2013) examined the association between CSR and FP for 162 banks in 22 countries from 2003 to 2009, by applying an extended version of the Heckman two-step regression analysis. Strategic banks conducted CSR, and used this advantage to improve their returns on asset, returns on equity and net interest income. Platonova et al., (2018) reported a positive relationship between the CSR disclosure and financial performance of Islamic banks in the Gulf Cooperation Council (GCC) region. Their study also confirmed that the current CSR activities of Islamic banks in the GCC might improve their long-term financial performance. Maqbool and Zameer (2018) employed data of 28 Indian banks that had been on the Bombay Stock Exchange for 10 years, to empirically indicate the positive impact of CSR on financial performance.

By contrast, some studies have argued that there is a negative correlation between social reasonability and financial performance. For instance, Esteban-Sanchez et al. (2017) investigated the effect of corporate social performance on corporate financial performance. Using data from 154 financial institutions in 22 countries between 2005–2010, they specifically focused on periods before and after the financial crisis. Their results indicate that banks did not obtain economic benefits from their CSR performance.

However, some researchers have found no statistically significant link between corporate social responsibility and financial performance (McWilliams & Siegel, 2000; Kim & Choi, 2013; Xie et al., 2017). Soana (2011) investigated the relationship between CSR and financial performance in Italian banks, and reported that bank investment in CSR does not result in financial advantage.

To sum up, the relationship between corporate social responsibility and banking financial performance is still controversial. Simpson and Kohers (1992) indicated that various measurement issues could explain the previous contradictory results. Furthermore, corporations’ different motives for engaging in CSR activities might cause this variation (Wu & Shen, 2013). According to Baron (2001), the altruism motive suggests that corporations do not conduct CSR activities to increase their profit, which may have a negative impact on financial performance. In contrast, the strategic motive may improve banks’ financial performance by engaging in CSR activities. Zhou et al. (2021) suggested that ignoring the differences between long-term and short-term impacts could be the main reason for the contradictory findings. Specifically, if banks spend too much on social responsibility in the short term, they may have limited resources for their normal operations, which may negatively affect their financial performance. However, in the long run, the banks’ responsibility to the government helps to establish a good relationship with the government and obtain its support (Waddock & Graves, 1997). Moreover, the responsibility to employees can enhance their cohesion and improve their productivity; and the responsibility to shareholders is conductive to increasing shareholders’ trust and attracting new shareholders, which supports banks’ long-term development (Ferrell et al., 2016).

### 4.2.4. The relationship between CSR and bank performance

Evidence for whether or not the banking sector should engage in corporate social responsibility activities is inconclusive. The operation of banks has an influence on the environment, society and economic development. Jeucken (2001) identified four phases of action which banks undertake to achieve sustainability: namely, defensive banking, preventative banking, offensive banking, and sustainable banking. These are shown in Figure 4-2.



Figure 4‑2 Jeucken’s typology of banking and sustainable development

The sustainable banking stage encompasses the other three phases and becomes the ideal stage in banking development. In the defensive banking stage, the bank stays inactive or resists environmental regulation. In the preventative banking phase, the bank adopts environmental risk management during its daily business. Finally, during the offensive banking stage, the bank recognises that environmental concerns can potentially improve its competitiveness in the market. Jeucken suggests that during the sustainable banking stage, banks focus on the highest sustainable rate of return, rather than the financial rate of return.

In the World Bank’s view, ‘CSR is the commitment of businesses to contribute to sustainable economic development by working with employees, their families, the local community and society at large to improve their lives in ways that are good for business and for development’ (Starks, 2009). In the Chinese banking context, according to the “Guidelines on Corporate Social Responsibility for the Chinese Banking Sector” (2009), the CSR of banking institutions should at least include economic responsibility, social responsibility and environmental responsibility.

The theoretical debate on the relationship between CSR and financial performance (FP) has continued for decades. Several theories have been applied to offer conflicting views on the impact of CSR on firm financial performance.

The shareholder view stems from neoclassical economic theory, and believes that corporate managers are only responsible for maximising the corporation’s profit within the boundaries of what is permitted by the law (Friedman, 1970). The trade-off hypothesis is fundamental to Friedman’s argument (1970), and suggests that the costs of CSR outweigh the benefits. Engagement in corporate social responsibility activities may incur additional costs such as charity donation projects, supporting employee welfare and minimising environmental damage, which might be expensive (Barnett & Salomon, 2006) and result in reducing corporate profits and shareholder wealth; investment in CSR may reduce the funding allocated to other economic activities which are more profitable (Waddoc & Graves, 1997; Preston & O’Bannon, 1997). Furthermore, the managerial opportunism hypothesis suggests a negative association between CSR and FP; the hypothesis is derived from agency theory (Jensen & Meckling, 1976), indicating that managers may not always be aligned with shareholders and may pursue their own private interests. Preston and O’Bannon (1997) state that bank managers might reduce spending on CSR when financial performance is strong, in order to increase their personal incentives, because the incentive is tied to short-term profitability. Conversely, mangers may shift the focus to conspicuous social activities, for “window-dressing” when financial performance is poor.

On the other hand, from a stakeholder view, CSR and profit maximisation are not mutually exclusive and can be compatible. According to the good management hypothesis, based on stakeholder theory, the long-term survival and successful development of an organisation requires the stakeholders’ support (van der Laan et al., 2005), and a better relationship with stakeholders results in enhanced financial performance (Waddock & Graves, 1997). Engaging in CSR can improve the relationships with stakeholders and satisfy all stakeholders’ interests, ultimately increasing firm performance. Jo and Harjoto (2011) suggest that CSR engagement can help managers settle conflicts among stakeholders and thereby improve shareholders’ wealth. In a similar vein, Cornell and Shapiro (1987) propose the social impact hypothesis, which implies that satisfying the requirements of different groups of stakeholders will improve performance and create a positive link between CSR and FP. The impact of CSR includes improved employee productivity (Preston & O’Bannon, 1997), increased social reputation and trust through public donations (Zhang et al., 2010), and enhanced brand image and product competitiveness (Lambertini & Tampieri, 2015).

Furthermore, some studies report a neutral association between CSR and financial performance (Freedman & Jaggi 1986; McWilliams & Siegel, 2001; Soana, 2011). Waddock and Graves (1997) argue that a direct linear relationship between CSR and financial performance is not possible due to the existence of many variables that intervene in the relationship. Table 4-1 summarises the relationship between CSR and financial performance.

Table 4‑1 Theoretical relationship between CSR and FP

|  |  |  |
| --- | --- | --- |
| Theory  | Relationship  |  |
| Neoclassical economic theory | Negative  | The costs of CSR outweigh the benefits. Investment in CSR may reduce the funding allocated to profitable activities |
| Managerial opportunism hypothesis | Negative  | Managers may pursue their own interests  |
| Good management hypothesis | Positive  | Meet the expectations and demands of stakeholders  |
| Social impact hypothesis | Positive  | Increase social reputation and enhance brand image |

### 4.2.5. Impact of CSR on banking performance

CSR may affect bank performance in terms of income and cost (Figure 4-3). Firstly, banks that conduct CSR may increase the amount of financial services, such as deposits, loans and wealth-management products. According to Minor and Morgan (2011), CSR banks attract more deposits and loans than those that do not engage in CSR activities, which increases the former’s interest income. Corporate engagement in social activities can improve the bank’s value and image, promote its reputation (Gary et al., 1995; Li et al., 2010), and develop the trust and goodwill of stakeholders (Jizi et al., 2014). As a result, CRS helps banks to differentiate their wealth management products, and ultimately increases their non-interest income.

From the bank expenses perspective, there is no doubt that CSR activities can increase bank costs in terms of charitable donations or supporting national programmes. However, CSR can help banks to reduce information asymmetry and thus resolve conflict among stakeholders (Cui et al., 2012). Loannou and Serafeim (2010) reported that CSR banks experience a decreased number of lawsuits and improved employee retention rates, which reduces hiring and training costs. Thus, CSR could be a double-edged sword for bank overhead costs.

Figure 4‑3 Impact of CSR on commercial banks

### 4.2.6. The characteristics of the Chinese context

In 2009, China’s banking association issued the “Guidelines on Corporate Social Responsibility for the Chinese Banking Sector”. The guidelines state that the banking sector should at least take responsibility in economic, social and environmental aspects, and require banks to issue an annual report on their corporate social responsibility (CSR). The economic responsibility states that commercial banks shall maintain a fair, safe and stable competition order in the banking sector, and create economic values for the country, shareholders, employees, customers and general public; the social responsibility requires banks to follow the requirements of social ethics, protect the interests of public consumers, advocate charitable activities and promote social harmony; and environmental responsibility includes supporting the national industrial and environmental policy to save resources, protect the natural environment and develop a sustainable society.

Therefore, Chinese commercial banks engage in CSR activities for three reasons. First, to comply with national policies and initiatives. Following the guidelines, banks should pay more attention to their economic, social and environmental responsibilities. Second, the government allows a soft budget and implicit guarantees in the banking sector: banks should give back to society or the community more than other industries, because banks employ considerable resources from society (Wu & Shen, 2013). For example, to solve problems of non-performing loans, the State Council provided $45 billion to help the Bank of China (BOC) and China Construction Bank (CCB) restructure in 2003; and in 2005 the state unloaded RMB 705 billion of NPLs from the Industrial and Commercial Bank of China (ICBC) and injected $15 billion of fresh capital into the bank. Engaging in CSR activities might be a method for banks to compensate for the use of resources from society. Finally, according to the social impact hypothesis, CSR can enhance the banks’ reputation and brand image. As competition in the Chinese banking sector is intensive, it is difficult to distinguish between the financial services offered by each bank. Thus, bank recognition and gaining customers’ trust have become important factors for sustainable development. However, the question about the relationship between adopting corporate social responsibility (CSR) and financial performance is not clear.

Furthermore, in the context of China, the five biggest commercial banks are state owned; they play a crucial role in economic development, and are responsible for piloting China’s financial reforms and leading the industry. The government tends to give more implicit guarantees to the Big Five. In addition, all other banks started up much later than the state-owned banks and receive less government support. Thus, the differences between the Big Five and other banks might lead to differences in their stages of development, management philosophies, and the relationship between CSR and financial performance.

### 4.2.7. Main hypotheses to explain the relationship between CSR and bank performance

As explained above, commercial banks in China have increasingly engaged in CSR activities in recent years. However, studies on the relation between CSR and bank financial performance are rare. Numerous studies have investigated the effect of CSR on bank financial performance (Wu & Shen, 2013; Shen et al., 2016; Esteban-Sanchez et al., 2017; Platonova et al., 2018; Belasri et al., 2020). However, most of these studies used international data, whereas the Chinese banking sector has unique characteristics. Zhu et al. (2017) found a trade-off between CSR and Chinese bank performance; Fukuyama and Tan (2021) indicated that CSR is beneficial for Chinese banks’ reputation and image. Thus, the trade-off hypothesis, the managerial opportunism hypothesis, the good management hypothesis and the social impact hypothesis could all be applicable to the Chinese banking sector. Zhou et al. (2021) suggested that CSR may have a negative impact on bank financial performance in the short term, but this relationship becomes positive in the long run. Therefore, under the arguments of the good management hypothesis and the social impact hypothesis, we propose hypothesis 1, and based on trade-off hypothesis, the managerial opportunism hypothesis, hypothesis 2 has been proposed:

H1: Conducting CSR has a positive impact on bank financial performance

H2: Conducting CSR has a negative impact on bank financial performance

## 4.3. Methodology

### 4.3.1. Measuring CSR

In the CSR literature, several different approaches have been used to assess and measure CSR. Ehsan (2018) indicated three valid methods, namely: social ratings or reputational indices, content analysis, and questionnaire surveys.

Social ratings or reputational indices provided by social agencies or databases are the most widely used approaches to measure companies’ CSR performance. The social agencies collect information about companies’ CSR activities and rate them through different sources, such as surveys and interviews from public respondents, knowledgeable observers, business professionals, employees, the firm’s website, and financial annual reports. The Kinder, Lydenber, Domini (KLD) database, the Fortune Reputational Index and the Sustainalytics database are popular examples of this method. Bolton (2013) applied data from the KLD database to measure CSR performance, to analyse the relationship between CSR and the financial performance of US banks during 1998–2010. The KLD database is regarded as one of the most accurate databases for corporate social responsibility (Kim, Park & Weir, 2012). KLD lists companies that trade on the US stock exchange, based on seven major categories: community issues, governance issues, diversity issues, employee relations, environmental issues, human rights, and product issues. Sustainalytics is another database that rates the environmental, social and corporate governance performance of listed companies. Belasri et al. (2020) used data from Sustainalytics to assess CSR’s impact on the banking efficiency of 184 banks around the world.

The second approach broadly used in the literature is the content analysis of company publications. In this method, researchers attempt to measure CSR by converting textual information on the firm’s social activities published in various sources (e.g. financial annual reports, CSR reports, websites, media, newspapers or magazines, and mail or letters to the shareholders) into a quantitative scale, to draw inferences about firms’ social performances. Szegedi (2020) applied content analysis to measure the corporate social responsibility of Pakistani listed banks, and investigated the relationship between CSR and financial performance.

The third alternative method is using a questionnaire survey to measure CSR. The researchers conduct questionnaires or interviews with the corporation’s executives, employees or knowledgeable respondents, to collect information on the company’s performance of CSR activities. Many researchers have used this approach to develop a CSR measurement (Aupperle & Carroll, 1985; Rettab & Brik, 2009; Fatma & Rahman, 2014).

### 4.3.2. Constriction of CSR performance

In this study, we apply the content analysis approach to measure the CSR performance of Chinese commercial banks, for two reasons. Firstly, content analysis is one of the most widely used methods for measuring CSR, as it allows researchers to collect information directly from secondary data sources, which in this study includes banks’ annual financial reports and annual corporate social responsibility reports. Secondly, the social ratings or reputational indices generally rate China’s listed companies, and there is no special standard for the banking industry. Thus, the data from international rating databases are insufficient for the Chinese banking sector.

A checklist has been constructed to examine the extent of CSR based on three dimensions: economic responsibility, social responsibility and environmental responsibility, as mentioned in the Guidelines on Corporate Social Responsibility for the Chinese Banking Sector (2009). The checklist is also combined with the Global Reporting Initiative (GRI) indicator categories, which provide international guidelines for the financial sector (Farneti & Guthrie, 2009). Brown et al. (2009) stated that the GRI sets out the principles and indicators for measuring and reporting the economic, environmental and social dimensions of organisations’ activities, products and services. Since 1997, it has become the leading template for voluntary disclosure of sustainability. We collected data from 59 Chinese commercial banks from 2008 to 2018. A total of 30 items are included; if the item is reported, the CSR index value is 1, whereas 0 is assigned for non-disclosure. The CSR index is then calculated as follows:

$$CSR Index= \sum\_{j=1}^{}\frac{rj}{n}$$

where

rj = 1 if item j is reported

rj = 0 if item j is not disclosed

n = total number of items

‘To make valid inferences from the text, it is important that the classification procedure be reliable in the sense of being consistent’ (Weber 1990, p.12). Thus, it is crucial to address validity and reliability in content analysis.

The following steps were applied in this study. First, two coders calculated the CSR score for five random banks; secondly, the differences of the scoring were checked and the decision rules of codification were discussed; thirdly, the content analysis was conducted for the random five banks again after a week; finally, the decision rules were established and the content analysis was conducted for all sample banks. Minor changes in the decision rules were accepted.

### 4.3.3. Regression model

In this study, we attempted to examine the impact of corporate social responsibility on bank performance. In order to conduct an empirical analysis, we followed the previous studies (Wu & Shen, 2013; Gangi et al., 2018; Belasri et al., 2020) and specify the equation expressed below.

$Per\_{it}=β\_{0}+β\_{1}CSR\_{it}+β\_{2}Cap\_{it}+β\_{3}Size\_{it}+β\_{4}Liq\_{it}+β\_{5}Nii\_{it}+β\_{6}Risk\_{it}+β\_{7}LoanDep\_{it}+ε\_{it}+Year Dummies (1)$

Subscripts i and t denote the cross-sectional dimension across banks and the time period respectively. Accounting-based measures of profitability have been widely used in previous empirical studies to examine the relationship between corporate social performance and financial performance, because they are the most accurate way to represent bank financial performance (Waddock & Graves, 1997; Simpson & Kohers, 2002). Per denotes the bank financial performance, which is proxied by the return on assets (ROA) and net interest margin (NIM). The ROA is defined as the profit earned per unit of asset. This measure represents a bank’s ability to generate returns from its portfolio of assets (Athey & Imbens, 2006); The NIM is defined as the ratio of net interest revenue to total earning assets (Angbazo, 1997) and represents the bank’s ability to charge an interest margin as one of its main income sources. The primary explanatory variable CSR denotes the corporate social responsibility performance of the bank.

For the controlled variables, existing research has addressed the importance of mediators in the impact of CSR on financial performance. However, certain other variables should be included in the relationship. We follow a set of variables used in the previous literature (Wu & Shen, 2013; Shen et al., 2016; Belasri et al. 2020). The bank-specific variables comprise Leverage (Cap), Bank size (Size), Liquidity (Liq), Non-interest income (Nii), Risk (LLR) and the ratio of loan to deposit (LoanDep). Leverage refers to the ratio of equity to total assets, Size denotes the total assets after the logarithmic transformation, Liq represents the ratio of net loans to total assets, Nii denotes the non-interest income to total revenues, the ratio between loan-loss provision and total loans represents the bank risk, and LoanDep denotes the loan to deposit ratio. They are viewed as the most important factors in the relationship between CSR and financial performance. Table 4-2 summarises all variables applied in this research.

The leverage (Capitalisation) has been viewed as an important factor to explain the performance of banks. The equity to assets ratio is a measure of the capability of the bank to withstand losses. The well-capitalised banks are able to cover the unexpected losses of financial distress and crisis (Berger, 1995), which can reduce the cost and result in a positive relationship with performance. The empirical evidence for this can be found in several studies (Athanasoglou et al., 2008; Kosmidou, 2008).

Bank size has been strongly suggested to be correlated with bank performance (Lin & Zhang, 2009; Berger et al., 2010) because large banks may exert market power from a stronger brand image or implicit regulatory protection (too-big-to-fail) and benefit from scale economies (Goddard et al., 2004; Heffernan & Fu, 2010; Sufian & Habibullah, 2012). However, Athanasoglou et al., (2008) argued that the profitability initially increases with size and then declines due to increased bureaucracy and other reasons.

In addition, we follow Goddard et al. (2013) and Tan (2016) in using the ratio of net loans to total assets to measure bank liquidity, which is a direct indicator of the earning power of the bank. Higher levels of this variable implies lower levels of liquidity. The Chinese banking sector still relies on traditional financial methods where loans are the main sources of revenue. A higher level of liquidity ratio might imply better bank performance due to more interest income being generated. On the other hand, a very high ratio could raise liquidity risks due to increased default risk, which might have a negative impact on bank performance for banks with a weak risk management system. Thus, it is expected the net loan ratio will have an impact on financial performance.

The level of commercial banks business diversification is measured by the ratio of non-interest income (such as service charges, fee income, profits from securities investment or foreign exchange) to total revenues. This variable is generally expected to exhibit a positive relationship with bank performance due to more income being generated when commercial banks participate in varied business activities (Sufian & Habibullah, 2009; Tan & Floros, 2012). However, Fang et al., (2019) suggest that more funds and resources used in non-interest business reduces the amount of the traditional loan business, which has a negative impact on net interest income. Thus, there is not a prior expectation for this variable.

We used the ratio between loan-loss provision and total loans to measure bank risk. Higher levels of this ratio reflects that fact that the bank has a higher risk, which suggests it is more likely to have loan losses in the future, thus we expect a negative relationship between bank risk and performance.

Table 4‑2 Summary of variables and descriptions.

|  |  |  |  |
| --- | --- | --- | --- |
| Variables  | Acronym | Definition | Expected effect |
| Performance | ROA | Return on Assets |  |
| NIM | Ratio between net interest income and earning assets |  |
| CSR performance  | CSR | Corporate social responsibility score | +/- |
| Capital  | Cap | Book value of capital to total assets | + |
| Bank size | Size | Logarithm of total assets | +/- |
| Bank liquidity | Liq | Net loans/ Total assets | +/- |
| Bank diversification | Nii | Ratio of non-interest income to total revenues | +/- |
| Risk | LLR | Loan-loss provision as a fraction to total loans | - |
| LoanDep | LoanDep | The ratio of loan to deposit | +/- |

### 4.3.4. Data and basic statistics

To examine the impact of corporate social responsibility on bank performance, we created a panel data sample including 59 Chinese commercial banks from 2008 to 2018. The sample is obtained from various sources. As mentioned above, the CSR performance of each bank is measured using content analysis. The financial ratios were obtained from BankScope and the individual banks’ annual reports. The sample period started in 2008, because of the significant changes to regulations; and when the Chinese government officially launched the first series of green finance policies in July 2007, the Chinese commercial banks began to consider the concept of corporate social responsibility.

Table 4-3 reports the summary statistics of all variables in this study. According to the values of the CSR index, the difference in banks’ CSR performance is relatively large, with the lowest values of 0.03 and the highest of 0.8. The explanation could be that some banks comply with government regulations to conduct only basic CSR activities, while other banks engage in more voluntary CSR.

Table 4‑3 Descriptive statistics for full sample

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Variable  | Obs | Mean | S.D | Min | Max |
| ROA | 602 | 1.032 | 0.391 | 0.050 | 2.700 |
| Nim | 608 | 2.922 | 1.013 | 0.190 | 6.930 |
| CSR | 406 | 0.460 | 0.191 | 0.033 | 0.800 |
| Capital | 607 | 6.772 | 1.767 | 3.090 | 23.590 |
| Size | 606 | 5.561 | 0.784 | 4.020 | 7.442 |
| Liquidity | 607 | 45.309 | 9.103 | 16.550 | 66.070 |
| Nii | 606 | 17.048 | 14.130 | -14.63 | 91.200 |
| Risk | 592 | 2.786 | 0.861 | 0.550 | 7.990 |
| LoanDep | 607 | 0.675 | 0.119 | 0.237 | 1.095 |

Table 4‑4 Correlation Matrix for full sample

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Variables | ROA | NIM | CSR | Cap | Size | Liq | Nii | LLR | Loandep |
| ROA | 1 |  |  |  |  |  |  |  |  |
| NIM | 0.696\* | 1 |  |  |  |  |  |  |  |
| CSR | 0.014 | -0.213\* | 1 |  |  |  |  |  |  |
| Cap | 0.245\* | 0.259\* | -0.093 | 1 |  |  |  |  |  |
| Size | -0.076 | -0.359\* | 0.677\* | -0.181\* | 1 |  |  |  |  |
| Liq | 0.294\* | 0.366\* | 0.269\* | 0.124\* | 0.055 | 1 |  |  |  |
| Nii | -0.248\* | -0.599\* | 0.318\* | -0.045 | 0.318\* | -0.027 | 1 |  |  |
| Risk | -0.159\* | 0.048 | -0.112 | 0.237\* | -0.035 | -0.135\* | -0.006 | 1 |  |
| Loandep | -0.082 | -0.134\* | 0.428\* | 0.056 | 0.365\* | 0.576\* | 0.333\* | 0.007 | 1 |

Table 4-4 shows the matrix of correlation coefficients among the independent variables. All coefficients are less than 0.70, which suggests the model has no serious multicollinearity problems, as previous studies have shown that multicollinearity problems occur only if Pearson correlations are above 0.80 (Farrar & Glauber, 1967; Gujarati, 2003).

Table 4-5 reports a comparison of state-owned commercial banks and other commercial banks in full sample. The level of CSR has a significant difference between state-owned banks and other banks. The state-owned banks have a relatively better CSR performance score, which is 0.588; possibly because other commercial banks started to develop later than other banks, from the late 1990s; financial growth was still their priority, and they had the best financial performance in terms of the net interest margin. Although the deposit interest rate for the different types of banks is almost the same, the loan rate of city and rural commercial banks is significantly higher than the state-owned banks. On the other hand, state-owned commercial banks have the highest level of CSR performance because they are responsible for leading the industry and complying with national policy. In addition, they may give back to society or the community due to the government injecting huge amounts of capital to solve their non-performing loans issues. The state-owned commercial banks have relatively higher profitability with higher ROA ratios. In addition, the state-owned banks are much bigger than other banks in terms of assets, with the advantage of scale economies, they engaged in various businesses and generated more profit from the diversity of their interests.

Table 4‑5 Comparison the mean for state-owned banks and other banks

|  |  |  |  |
| --- | --- | --- | --- |
| Variables  | State-owned commercial banks | Other commercial banks | T-statistics |
| ROA | 1.153 | 1.020 | 2.405\*\* |
| NIM | 2.745 | 2.939 | -1.360 |
| CSR | 0.588 | 0.440 | 5.539\*\*\* |
| Capital | 6.817 | 6.768 | 0.195 |
| Size | 7.088 | 5.409 | 19.204\*\*\* |
| Liquidity  | 51.205 | 44.721 | 5.142\*\*\* |
| Nii | 22.420 | 16.512 | 2.976\*\*\* |
| Risk | 2.718 | 2.793 | -0.620 |
| LoanDep | 0.708 | 0.671 | 2.202\*\* |

## 4.4. Empirical results

### 4.4.1. The relationship between CSR and bank profitability

To test the first hypothesis, pooled ordinary least squares (OLS), fixed effects (FE) and random effects (RE) were used in this study, which are three main methods of analysis for panel data. Breusch-Pagan LM test and Hausman test were conducted in the empirical process to select the most appropriate approach for the model. Fixed effects method was selected after different tests. Table 4-6 reports the empirical results from running the three methods. The pooled OLS regression method pools all observations without considering the variations of the coefficients within any specific bank. The key assumption of the pooled OLS is the non-stochasticity of the explanatory variables, and the independent and identical distribution of the error term with zero mean and constant variance (Gujarati, 2009); this assumption ignores the individual effects or uniqueness of different individual units. The fixed effects regression model allows for individual heterogeneity by adopting a dummy variable technique to allow each individual to have their own intercept value. Each intercept varies from each other and does not vary over time. The random effects model takes a disturbance term approach by treating the intercept as a random variable with a mean value. However, a strict condition of the random effects model is that the composite error term is not correlated with any of the explanatory variables within the model, in order to avoid inconsistent estimation of the regression coefficients (Gujarati, 2009, pp. 602–603).

Table 4‑6 Results of the relationship between ROA and CSR

|  |
| --- |
| ROA |
| Variables  | Pooled OLS | Random effect | Fixed effect |
| CSR | -0.079(-0.79) | 0.155(1.63) | 0.221\*\*(2.16) |
| Capital | 0.091\*\*\*(9.35) | 0.065\*\*\*(7.23) | 0.060\*\*\*(6.24) |
| Size | 0.114\*\*\*(4.38) | 0.083\*(1.89) | 0.398\*\*(2.11) |
| Liquidity | 0.013\*\*\*(5.07) | 0.009\*\*\*(3.52) | 0.011\*\*\*(3.50) |
| Nii | -0.003\*\*(-2.25) | 0.001(0.73) | 0.002\*\*(2.07) |
| Risk | -0.050\*\*(-2.49) | -0.062\*\*\*(-3.66) | -0.071\*\*\*(-4.07) |
| Loan/Deposit | -0.744\*\*\*(-4.05) | -0.623\*\*\*(-3.44) | -0.495\*\*(-2.51) |
| Constant | 0.257(1.51) | 0.228(0.90) | -1.628(-1.48) |
| Year effects | Yes | Yes | Yes |
| R2 | 0.447 | 0.496 | 0.507 |
| Observations | 393 | 393 | 393 |

According to the results presented in Table 4-6, the relationship between the primary variable CSR and bank performance is inconsistent among the three methods. Pooled OLS indicates a negative relationship between the CSR and ROA of the sample; however, there is an inverse result under both fixed effect and random effect methods. The possible explanation could be that the pooled OLS model ignores the individual effects or uniqueness of different individual units.

The results of the Breusch-Pagan LM test (Table 4-7) rejects the null hypothesis and suggests that the random effects model is more appropriate than the pooled OLS model, because of the evidence of significant uniqueness across the individual banks.

Table 4‑7 The result of Breusch-Pagan LM test

|  |
| --- |
| Breusch and Pagan Lagrangian multiplier test for random effects |
| Null hypothesis: No significant difference/panel effect across units |
| ROA[id,t] = Xb + u [id] + e [id,t] |
|  | Var | Sd = sqrt(Var) |
| ROA | 0.1234 | 0.3512 |
| E | 0.0278 | 0.1666 |
| U | 0.0404 | 0.2011 |
| Test: Var (u) = 0 |
| Chibar2 (01) = 348.43 |
| Prob > chibar2 = 0.0000 |

In order to select the best model from fixed effects and random effects, the Hausman test was applied and completed using STATA, as reported in Table 4-8. The result rejects the null hypothesis and indicates that the fixed effects model is the preferred model.

Table 4‑8 The result of Hausman Test

|  |
| --- |
| Hausman Test |
| Null hypothesis: difference in coefficients not systematic |
| Chi2(7) = (b-B)'[(V\_b-V\_B)^(-1)](b-B) |
| Chi2(7) = 30.61 |
| Prob>chi2 = 0.0000 |

Table 4-9 presents the results with net interest margin as the dependent variable. The same tests have been conducted to select the best fit model among pooled OLS, fixed effect and random effect methods. The results also confirm that the fixed effects method is more appropriate among other methods.

Therefore, the results report that the coefficients of the CSR are significantly positive for two financial measures (ROA and NIM), which suggests that CSR improves the financial performance of Chinese commercial banks. The result supports hypothesis 1 and is consistent with previous studies by Simpson and Kohers (2002); Wu and Shen (2013) and Platonova et al., (2018). This finding in Chinese commercial banks is consistent with stakeholder theory, the good management hypothesis and the social impact hypothesis. Thus, Chinese commercial banks engaging in CSR activities see their financial performance positively impacted through enhanced bank reputation, the attraction of new customers and the maintenance of good relationships with stakeholders. Banks may ultimately increase their financial profits, improve employee productivity and boost product competitiveness. Although conducting CSR activities might increase the bank’s costs, its revenues will improve even more.

For the controlled variables, well-capitalised banks experience a higher level of financial performance, which is consistent with the finding of Athanasoglou et al. (2008). The finding implies that Chinese commercial banks have a sound capital position and are able to deal with unexpected losses, which leads to improved bank profitability. Furthermore, the coefficients of liquidity are significantly positive with ROA and NIM, which implies that banks with lower levels of liquidity tend to have better financial performance. This result is consistent with the findings of Tan (2016) and a possible explanation could be that banks can deal with higher degrees of loan exposure through good monitoring and risk management.

Table 4‑9 Results of the relationship between NIM and CSR

|  |
| --- |
| NIM |
| Variables  | Pooled OLS | Random effect | Fixed effect |
| CSR | -0.035(-0.19) | 0.641\*\*\*(3.63) | 0.802\*\*\*(4.19) |
| Capital | 0.085\*\*\*(4.68) | 0.073\*\*\*(4.36) | 0.072\*\*\*(3.97) |
| Size | -0.114\*\*(-2.34) | -0.157\*\*(-1.98) | 0.237(0.68) |
| Liquidity | 0.056\*\*\*(12.19) | 0.041\*\*\*(8.35) | 0.039\*\*\*(6.59) |
| Nii | -0.028\*\*\*(-13.25) | -0.024\*\*\*(-12.00) | -0.022\*\*\*(-9.89) |
| Risk | 0.167\*\*\*(4.52) | 0.169\*\*\*(5.38) | 0.162\*\*\*(5.00) |
| Loan/Deposit | -1.448\*\*\*(-4.25) | -1.277\*\*\*(-3.84) | -1.015\*\*\*(-2.78) |
| Constant | 1.369\*\*\*(4.12) | 1.908\*\*\*(4.17) | -0.333(-0.16) |
| Year effects | Yes | Yes | Yes |
| R2 | 0.678 | 0.744 | 0.747 |
| Observations | 396 | 396 | 396 |

In addition, McGuire et al., (1988) proposed that firms incorporated with CSR activities might impact their long-term financial performance. Table 4-10 reports the results of the fixed effect model to test the impact of corporate social performance on a bank’s future financial performance by using CSR from year t-3 to t-1. All coefficients are inconsistent, which implies no significant impact of CSR on a bank’s future performance.

Table 4‑10 Results of the relationship between lagged CSR and financial performance

|  |  |  |
| --- | --- | --- |
| Variables  | ROA | NIM |
| CSR | 0.387\*\*\*(2.78) | 1.006\*\*\*(3.54) |
| L.CSR | 0.092(0.63) | 0.632\*\*(2.12) |
| L2.CSR | -0.026(-0.17) | 0.208(0.69) |
| L3.CSR | 0.316\*\*(2.26) | 0.448(1.57) |
| Capital | 0.105\*\*\*(5.68) | 0.151\*\*\*(4.02) |
| Size | 0.444\*(1.70) | 0.506(0.96) |
| Liquidity | 0.008\*(1.85) | 0.045\*\*\*(5.38) |
| Nii | 0.001(0.68) | -0.024\*\*\*(-9.82) |
| Risk | -0.097\*\*\*(-3.87) | 0.051(1.01) |
| Loan/Deposit | -0.780\*\*\*(-3.58) | -1.754\*\*\*(-3.95) |
| Constant | -1.993(-1.26) | -2.322(-0.73) |
| Year effects | Yes | Yes |
| R2 | 0.647 | 0.829 |
| Observations | 244 | 245 |

### 4.4.2. Endogeneity

However, the relationship between CSR and bank financial performance might suffer from endogeneity issues. According to Waddock and Graves (1997), firms which are financially successful and well-managed have slack resources to devote to social responsibility performance. Preston and O’Bannon (1997) suggested a positive association between CSR and financial performance; however, the causal relationship is from financial to social performance. Thus, it may be unclear whether CSR improves performance or whether performance drives CSR scores. In this case, equations (1) could be subject to endogeneity problems, which may lead to biased and inconsistent estimates. Therefore, a two-step system Generalized Method of Moments (GMM) method was applied to address the possible endogeneity problem and the variable of CSR score is the endogenous variable.

The two-step GMM estimator has been proposed by Arellano and Bover (1995) and Blundell and Bond (2000). The system GMM estimator combines the regression difference with the regression in levels to reduce the potential biases and imprecision associated with the difference estimator (Arellano and Bover, 1995).

Therefore, the GMM estimator is used to address potential endogeneity that fixed effects methods could not solve. Our endogenous variable is the CSR score. Other variables do not suffer any endogenous problem. A one-year lagged dependent variable is included in the regression. We used up to 4 years of lagged dependent and endogenous variables as instruments. Sargan and Hansen over-identification AR(1) and AR(2) are applied to test the validity of instrumental variables. Tables 4-11 present the results using the fixed effects and two-step GMM methods.

The results from the GMM estimator are similar to our early findings from the fixed-effect model. The one-year lagged dependent variables are strongly significant which support the profit persistence in the model. Chinese commercial banks conducting CSR activities have a significant positive impact on financial performance. The CSR coefficient is 0.852 in the ROA model and 0.885 in the NIM model respectively, which implies a 1% increase in CSR raises profitability by 0.852-0.885%. In addition, there is no second order autocorrelation in the regression model and the Sargan test and Hansen test confirm the instrument’s validity.

Table 4‑11 Results with fixed effect model and two-step GMM model.

|  |  |  |
| --- | --- | --- |
|  | ROA | NIM |
| Variables  | Fixed effect | GMM | Fixed effect | GMM |
| L.ROA/ L.NIM |  | 0.868\*\*\*(13.88) |  | 0.597\*\*\*(30.10) |
| CSR | 0.221\*\*(2.16) | 0.852\*\*\*(6.79) | 0.802\*\*\*(4.19) | 0.885\*\*\*(2.99) |
| Capital | 0.060\*\*\*(6.24) | 0.072\*\*\*(3.87) | 0.072\*\*\*(3.97) | 0.037(1.25) |
| Size | 0.398\*\*(2.11) | -0.175\*\*\*(-4.15) | 0.237(0.68) | -0.204\*\*(-2.39) |
| Liquidity | 0.011\*\*\*(3.50) | 0.006(1.18) | 0.039\*\*\*(6.59) | 0.025\*\*\*(2.79) |
| Nii | 0.002\*\*(2.07) | 0.003\*\*\*(2.88) | -0.022\*\*\*(-9.89) | -0.011\*\*\*(-3.50) |
| Risk | -0.071\*\*\*(-4.07) | 0.108\*\*\*(4.66) | 0.162\*\*\*(5.00) | 0.081\*\*\*(2.66) |
| Loan/Deposit | -0.495\*\*(-2.51) | -0.703\*\*(-1.99) | -1.015\*\*\*(-2.78) | -1.235\*(-1.89) |
| Constant | -1.628(-1.48) | 0.065(0.34) | -0.333(-0.16) | 1.148\*\*(2.29) |
| Year effects | Yes | Yes | Yes | Yes |
| AR(1) p-value |  | 0.069 |  | 0.012 |
| AR(2) p-value |  | 0.188 |  | 0.673 |
| Sargan test of over-identification  |  | 0.131 |  | 0.127 |
| Hansen test of over-identification |  | 0.886 |  | 0.822 |

### 4.4.3 Additional check of the relationship between CSR and bank performance: the moderating effect of bank ownership

We found that Chinese commercial banks conducting CSR activities have a significant positive impact on financial performance. However, large differences might exist in the relationship between corporate social responsibility and bank financial performance among different types of banks due to different nature and development stages. The Big Five banks are the systemically important banks, which are owned by the central government, and are responsible for piloting China’s financial reforms and leading the industry. Other types of banks are owned by local government, enterprises or residents, and are mainly medium-sized and small enterprises. The Big Five banks have a longer development history than other banks, and still overwhelmingly dominate the Chinese banking industry in terms of the amount of assets, branches and employees. The development of other types of banks accelerated after the early 2000s, because of the relaxation of geographical constraints. As previously mentioned, the business operations of state-owned banks receive more policy support from the government. Jiang et al. (2013) indicated that banks may be less efficient and issue more risky loans because of implicit guarantees. The governments tend to use public resources to help state-owned banks solve their non-performing loan problems.

On the contrary, other types of banks start up later and receive less government support. All these factors lead to different stages of development, external resources, and management philosophies, and affect the relationship between CSR and banks’ financial performance (Zhou et al., 2021). In addition, according to Wu and Shen (2013), corporations’ different motives for conducting CSR activities might be the reason for the different impacts of CSR on financial performance. The strategic motive indicates that CSR may improve financial performance. However, the altruism motive implies that corporate conduct CSR are not aiming to increase financial performance (Baron, 2001). The greenwashing motive attempts to enhance the corporate image without significantly changing the business (Frankental, 2001). Different types of banks may have different motives to engage in CSR activities. Banks incorporating CSR practices with strategic motives could attract more customers, enhance brand recognitions and improve profitability. However, banks conducting CSR activities with altruistic or greenwashing motives might not increase profitability. Therefore, the study will investigate if there is any different impact of CSR on bank performance among different types of banks.

To explore the different impacts of CSR for the Big Five and other banks, we introduce two variables namely, Bigfive and the interaction term, CSR × Bigfive. A positive value of the interaction term implies that Big five banks engaging in CSR activities could produce a more improved financial performance than other types of banks. We used CSR, Bigfive and their interaction term as endogenous variables. As can be seen the results in table 4-12 could not find a significant and consistent relationship between interaction term and bank financial performance. However, banks conducting CSR are still positively significantly related to commercial banks’ financial performance. The finding shows that compared to other banks, Bigfive banks could not improve financial performance through conducting CSR activities. The possible reason could be engaging in more social responsibilities might increase financial burdens for all types of commercial banks and state-owned banks engaging in CSR activities might not intend to increase their financial performance; financial stability might be their priority. Overall, the result support that Chinese commercial banks conducting CSR activities positively impact financial performance.

Table 4‑12 Results of two-step GMM model on the effects of different types of bank

|  |  |  |
| --- | --- | --- |
|  | ROA | NIM |
| Variables  | GMM | GMM |
| L.ROA/ L.NIM | 0.817\*\*\*(21.03) | 0.560\*\*\*(15.36) |
| CSR | 0.253\*\*(2.11) | 1.221\*\*\*(2.65) |
| Bigfive | -0.003(-0.03) | -0.123(-0.22) |
| CSR × Bigfive | 0.058(0.29) | -0.344(-0.44) |
| Capital | 0.059\*\*\*(2.80) | 0.108(1.48) |
| Size | -0.025(-0.33) | -0.118(-0.73) |
| Liquidity | 0.001(0.12) | 0.029\*\*\*(3.37) |
| Nii | -0.001(-0.14) | -0.012\*\*\*(-2.66) |
| Risk | 0.024\*(1.67) | 0.094\*\*(2.04) |
| Loan/Deposit | -0.049(-0.15) | -1.833\*\*(-2.54) |
| Constant | -0.246(-0.77) | 0.321(0.33) |
| Year effects | Yes | Yes |
| AR(1) p-value | 0.049 | 0.024 |
| AR(2) p-value | 0.121 | 0.556 |
| Sargan test of over-identification  | 0.253 | 0.707 |
| Hansen test of over-identification | 0.998 | 0.996 |

## 4.5. Conclusion

The purpose of this chapter was to examine the relationship between CSR and financial performance in the Chinese banking sector after more and more banks had begun to incorporate CSR practices since 2006. The investigation of the impact adopting corporate social responsibility (CSR) on financial performance of a corporation has a long history but the results remain ambiguous. The previous research focused on non-financial industries, while only a limited number of studies investigated the banking sector using international or US data. The existing findings in developed countries may not feature in the Chinese banking sector due to different practices and development stages of CSR.

This chapter adopted content analysis to measure the level of CSR, which is the first piece of research for the Chinese banking context. The checklist was constructed based on three dimensions: economic responsibility, social responsibility and environmental responsibility, as mentioned in the Guidelines on Corporate Social Responsibility for the Chinese Banking Sector (2009). We used different estimation methods, including pooled OLS, fixed effects and random effects to evaluate the relationship. In order to address the potential endogeneity problem of the model, a two-step system Generalized Method of Moments (GMM) method was applied to provide a robust result. Using a sample of 59 Chinese commercial banks over 2008–2018, the results for Chinese commercial banks are consistent with stakeholder theory, the good management hypothesis and the social impact hypothesis. Engaging in CSR activities could enhance the bank’s reputation, attract new customers, and increase existing customers’ loyalty. To maintain a good relationship with stakeholders, banks ultimately may increase their financial profits, improve employee productivity and boost product competitiveness. However, the results could not find evidence to support the hypothesis that CSR has a different impact on bank financial performance according to different types of banks. It might be that engaging more social responsibilities might increase the financial burden for all types of commercial banks, whereas financial stability might be state-owned banks’ first priority.

Overall, this study reveals that CSR has a positive impact on banks. Governments and bank managers should encourage banks to conduct CSR activities as a long-term sustainable development strategy to satisfy the stakeholders and improve their financial performance.

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# Chapter 5. Summary and conclusion

## 5.1 Research summary

The current research contains three parts. Firstly, using the panel data of Chinese banks from 2004 to 2018, this study contributes to the investigation of bank performance in China and explores the determinants that influenced Chinese banks’ profitability and efficiency. Second, the thesis aims to examine the relationship between capital, risk and efficiency in the Chinese banking industry. Thirdly, the study investigates the relationship between adopting CSR and bank financial performance. A content analysis is adopted to measure the level of CSR for commercial banks. Different estimation methods are applied to examine the relationship.

Using the panel data of Chinese banks from 2004 to 2018, the empirical results of chapter 2 demonstrate that all the determinants’ variables have a statistically significant impact on Chinese banks’ performance. In particular, credit risk is significantly and positively contributed to the NIM and Cost-efficiency, due to managers becoming temporarily engaged in skimping and postponing their costs for loans in exchange for more attractive financial results in the short term while liquidity risk makes a convincingly positive contribution to both the NIM and Cost-efficiency. Moreover, banks with a higher capital adequacy tended to exhibit higher levels of profitability, which supports the Signalling and Expected bankruptcy cost hypotheses. Non-interest income has a negative impact on all three performance measures, indicating that costs from bank diversification might exceed the incomes in the Chinese commercial banks. The positive impact of bank size on performance may occur through economies of scale such as cost advantage and more advanced technologies.

Chapter 3 and chapter 4 investigate the significant changes in the Chinese banking sector in two areas, these being based on the new regulation Governing Capital Adequacy of Commercial banks and the Guidelines on Corporate Social Responsibility (CSR) introduced for the Chinese banking sector. Both regulatory reforms, implemented by the Chinese government in early 2000s, aim to improve corporate governance, enhance banking risk management and achieve long-term sustainable development. The banking system is essential to the foundation of a healthy and sound economy. The Chinese banking sector has experienced several rounds of reform in past decades. However, with the extensive growth, the Chinese banking sector accumulated many problems in the early 2000s. Low capitalisation and a large amount of non-performing loans have become a significant problem due to the banking sector supporting inefficient state-owned enterprises for a long period. Additionally, serious environmental problem accompanied rapid economic growth in China. To develop a healthy and sustainable banking system to support national economic development, the government issued a series of new regulations for the banking sector including regulations on capital adequacy requirements and guidelines on corporate social responsibility such as:

1. The ‘Regulation governing the capital adequacy of commercial banks’ (2004)
2. ‘Guidelines for Implementing New Regulatory Standards in the PRC Banking Industry’ (2011)
3. “Announcement on further strengthening industrial policy and credit policy to control credit risks” (2004)
4. the “Regulation on accelerating adjustment of industrial structure” (2005)
5. the “Announcement on accelerating adjustment of industrial structure with excess capacity” (2006)
6. the “Green Credit Policy”, the “Green Securities Policy” and the “Green Insurance” (2007)
7. “Guidelines on Corporate Social Responsibility for the Chinese Banking Sector” (2009)

These government regulations resulted in significant adjustment of capital adequacy ratios in the Chinese banking sector and commercial banks begun to incorporate CSR practices after 2006.

Bank capital is one of the significant factors that impact the safety and soundness of commercial banks. It not only acts as a cushion against unexpected losses and bank insolvency but can also affect banks’ competitive position. The study on the relationship between bank capital, risk and efficiency has a long history; however, the previous literature presented inconclusive results. To empirically examine the relationship between capital, risk and efficiency in the Chinese banking industry, the study proposed five hypothesis:

Hypothesis 1a: The level of bank efficiency is positively associated with the banks’ risk-taking.

Hypothesis 1b: The level of bank efficiency negatively contributed to the banks’ risk-taking

Hypothesis 2: The level of bank capital is positively associated with the banks’ risk-taking.

Hypothesis 3a: The level of bank capital has a negatively impact on banks’ risk-taking.

Hypothesis 3b: banks’ risk-taking is negatively contributed to bank capital level.

To empirically examine the relationship between capital, risk and efficiency in the Chinese banking industry, we considered a panel of 69 commercial banks for the period of 2004–2018. Compared with the previous studies, this study applied both parametric (SFA) and non-parametric (DEA) frontier techniques to measure Chinese banks’ cost- and profit-efficiency. Both the ratio of loan-loss provision to total loans and the Z-score were employed to measure bank risk. Seemingly Unrelated Regression (SUR) was specified to estimate the relationship between capital, risk, and efficiency, because it allows simultaneous regression equations for banks’ capital, risk and efficiency; each equation has its own dependent variable. Moreover, the two-step system GMM technique was adopted to provide robust results and to address potential endogeneity problems in the data, as the estimator combines the regression difference with the regression in levels to reduce the potential biases and imprecision associated with the difference estimator (Arellano and Bover, 1995).

The empirical results found a bidirectional negative relationship between capitalisation and banking risk, which suggests that banks with higher capital are more capable of absorbing losses and reducing risk. The fact that the State Council injected a large amount of capital into commercial banks in order to reduce NPLs could explain this finding. In addition, large banks were not willing to take on higher levels of risk than small banks; this could be because they play the role of the agents of the government and are responsible for piloting China’s financial reform and leading the industry. Furthermore, the results suggest a negative association between liquidity and bank capitalisation, because there might be a trade-off between higher capital ratios and liquidity: holding more capital may harm banks’ liquidity (Horvath et al., 2014). Finally, this study found a significantly positive relationship between capital and risk over the period of 2012–2018. After most of the banks met the capital adequacy requirements, banks that hold higher level of capital with large capital buffers tend to keep their capital buffers and increase risk when they increase capital.

Furthermore, an increasing number Chinese commercial banks have realised that it is important to engage in different activities and contribute to the economy, environment and society development. However, the question about the relationship between adopting corporate social responsibility (CSR) and financial performance is not clear. According to the good management hypothesis, based on a stakeholder perspective (Freeman, 1984), the long-term survival and successful development of an organisation requires the stakeholders’ support (van der Laan et al., 2005), and a better relationship with stakeholders results in enhanced financial performance (Waddock and Graves, 1997). Engaging in CSR can improve the relationships with stakeholders and satisfy all stakeholders’ interests, ultimately increasing banks’ financial performance. Additionally, Cornell and Shapiro (1987) propose the social impact hypothesis, which implies that satisfying the requirements of different groups of stakeholders will improve social reputation and brand image and leads to enhance financial performance. However, the relationship between CSR and financial performance might also be negative. From a shareholder view, which stems from neoclassical economic theory, according to the trade-off hypothesis, the additional costs of engaging in corporate social responsibility such as charity donation projects, supporting employee welfare and minimising environmental damage, might outweigh the benefits and result in deteriorating banks’ financial performance. To examine the impact of CSR on bank performance since the Chinese banking sector has increasingly incorporated CSR practices, this study proposed:

H1: Conducting CSR has a positive impact on bank financial performance

H2: Conducting CSR has a negative impact on bank financial performance

This research adopted content analysis to measure the level of CSR, which is the first piece of research for the Chinese banking context. Different estimation methods had been used, including pooled OLS, fixed effects and random effects to evaluate the relationship. In order to address the potential endogeneity problem of the model, a two-step system Generalized Method of Moments (GMM) method was applied to provide a robust result. Using a sample of 59 Chinese commercial banks over 2008–2018, the results for Chinese commercial banks are consistent with stakeholder theory, the good management hypothesis and the social impact hypothesis. Engaging in CSR activities could enhance the bank’s reputation, attract new customers, and increase existing customers’ loyalty. To maintain a good relationship with stakeholders, banks ultimately may increase their financial profits, improve employee productivity and boost product competitiveness. However, the results could not find evidence to support the hypothesis that CSR has a different impact on bank financial performance according to different types of banks.

## 5.2 Contribution

Based on the research that was investigated, this thesis contributes to the research on bank performance, especially the major regulatory reforms in the Chinese banking sector. The study contributes to understand determinants that influenced Chinese banks’ profitability and efficiency; the relationship between capital, risk and efficiency in a developing country by extending the empirical literature to investigate the China context with the latest panel data and providing robust results, while the extant studies have drawn considerable attention to developed markets. In addition, the thesis contributes to the literature on the impact of CSR on bank financial performance in developing markets. Content analysis was applied to measure the CSR performance, which is the first piece of research for the Chinese banking context. Compared to the previous studies, this study accounted for the potential endogeneity problem of the model by using a system Generalized Method of Moments (GMM).

## 5.3 Limitations

This thesis has limitations that should be addressed:

First, increasing sample size might increase the amount of information used to test a hypothesis (Brooks, 2008). The CSR data availability is the main difficulty due to the low level of CSR transparency and no unique standards of CSR reporting. This could be a limitation on measuring the level of CSR for commercial banks.

Second, the content analysis used in the process of collecting the CSR index did not account for different items possibly having differential impacts on decision making. In our study, the items were weighted equally. In addition, future studies could consider CSR disclosures in annual financial reports, official websites, and other media channels. We collected data only from banks’ annual CSR reports.

Thirdly, the input and output variables for measuring the level of bank efficiency might not be exhaustive, bank efficiency could be effected by other unquantifiable variables, which were not computed in the model, and this may have an impact on the results.

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# Appendix Dimensions and sub-dimensions of the CSR index

|  |  |
| --- | --- |
| CSR dimensions | Sub-dimensions |
| Economic responsibility  | Supporting the development of local industries or community programmes and activities |
| providing quality professional services for the national economy (e.g. National project) |
| Banking institutions shall actively improve their operation effectiveness according to law |
| Number of employees |
| Employee health and safety |
| Equal opportunities in employment (e.g. minorities, women) |
| Training and education provided to employees (training policies and nature of training) |
| Employee assistance and benefits |
| Diversity of social products (e.g. climate products, educational loans etc.) |
| Service quality, development and research |
| Customer complaints/feedback/satisfaction |
| Provision for disabled, frail and difficult-to-reach customers, financial services for elderly customers |
| Investments in social responsibility activities |
| Strategies and plans for future expansion in social products and services |
| Social responsibility  | Donations type, amount and beneficiaries |
| supporting customers to improve their knowledge of financial and risk management |
| supporting to develop a banking credit system |
| supporting community self-help activities |
| sponsoring public, sporting or recreational activities |
| Creating job opportunities  |
| Environmental responsibility. | Environmental policy statement |
| Environmental goals and targets |
| General environmental considerations (noise, air, water, visual quality) |
| Environmental projects such as recycling and protection of natural resources |
| Environmental investment policies |
| Environmental considerations in lending policies |
| Sustainability (any mention of sustainability or sustainable development) |
| Environmental aesthetics (designing facilities harmonious with the environment) |
| Environmental training |
| Company’s energy policies |

# Abbreviations

ABC -Agricultural Bank of China

ADBC- Agricultural Development Bank of China

AMCs-Assets Management Companies

BCBS- Basel Committee on Banking Supervision

BCC- Banker, Charnes and Cooper

BIS- The Bank for International Settlements

BOC-Bank of China

BOCOM-Bank of Communication

CBRC-China Banking Regulatory Commission

CCB-China Construction Bank

CCBs-City Commercial Banks

CCR- Charnes, Cooper, and Rhodes

CDB-China Development Bank

CEB- China Everbright Bank

CEIB- China Export-Import Bank

CGB- China Guangfa Bank

CIB- China Industrial Bank

CITIC- China CITIC Bank

CMB- China Merchants Bank

CMBC- China Minsheng Banking

CRS-Constant Return to Scale

CSR- Corporate social responsibility

DEA-Data Envelopment Analysis

DMU- Decision-making unit

FSI- The Financial Stability Institute

GLS-General Least Square

HFB- Hengfeng Bank

HXB- Hua Xia Bank

ICBC-Industrial and Commercial Bank of China

IPO-Initial Public Offering

JSCBs-Joint-stock Commercial Banks

MEP- Ministry of Environmental Protection

NDRC- National Development and Reform Commission

NIM-Net Interest Margin

NPLs- Non-performing loans

OBS- Off-balance sheet

OECD- The Organisation for Economic Co-operation and Development

OLS-Ordinary Least Square

PAB- Ping An Bank

PBOC-People’s Bank of China

RCBs- Rural Commercial Banks

ROA-Return on Assets

ROE-Return on Equity

SFA-Stochastic Frontier Approach

SOCBs-State-owned Commercial Bank

SOEs-State-owned enterprises

TE- Technical efficiency

VRS-Variable Return to Scale

WTO-World Trade Organization