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Risk Sources of Small and Medium Sized Commercial Banks in China

ZHANG Hao

Doctor of Management

Supervisors:
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Declaration

I declare that this thesis does not incorporate without acknowledgment any material previously submitted for a degree or diploma in any university and that to the best of my knowledge it does not contain any material previously published or written by another person except where due reference is made in the text.

Signed:  Date: 2022.12.31

Name: ZHANG Hao

作者申明

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Abstract

Commercial banks are risky enterprises, and the level of risk management determines their core competitiveness. The level of risk management depends on prevention rather than treatment. Although there are many literatures on the risk of commercial banks, almost all of them listed banks or large-scale commercial banks (large state-owned commercial banks and joint-stock commercial banks) as the research objects. However, due to the difficulty of data collection for small and medium-sized commercial banks, especially for the fundamental problem of risk sources of small and medium-sized commercial banks, the research depth and breadth of the existing literature is far from enough, and the relevant empirical evidence is little.

This research makes a systematic and in-depth analysis of the risk sources of small and medium-sized commercial banks based on case studies and empirical analysis.

The empirical study find that the share of the largest shareholder and the degree of equity balance are significantly positively correlated with the risk of rural commercial banks. At the same time, the number of independent directors is significantly negatively correlated with the risk of small and medium commercial banks; the proportion of shadow banking is significantly positively correlated with the risk of small and medium commercial banks; the proportion of financial technology (investment) is significantly negatively correlated with the risk of small and medium commercial banks.

Keywords: small and medium-sized commercial banks, credit risk, corporate governance, shadow banking, financial technology, risk-taking
JEL: G21, M21

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Resumo

Os bancos comerciais são empresas de risco, e o seu nível de gestão do risco determina a sua competitividade bancos comerciais. O nível de gestão do risco depende mais da prevenção do que do seu tratamento. Embora exista muita literatura sobre o risco dos bancos comerciais, quase toda tem como objeto de pesquisa bancos cotados ou bancos comerciais de grande dimensão (grandes bancos comerciais estatais e bancos comerciais de capital aberto). No entanto, devido à dificuldade de recolha de dados para bancos comerciais de pequena e média dimensão, especialmente para o problema fundamental das fontes de risco dos bancos comerciais de pequena e média dimensão, a profundidade de pesquisa e amplitude da literatura existente está longe de ser suficiente e a evidência empírica relevante é pequena.

Esta pesquisa faz uma análise sistemática e aprofundada das fontes de risco dos bancos comerciais de pequena e média dimensão com base no estudo de casos e na análise empírica.

No estudo empírico constatou-se que a percentagem de participação do maior acionista e o grau de equilíbrio dos capitais próprios estão significativa e positivamente correlacionados com o risco dos bancos comerciais rurais. Ao mesmo tempo, o número de conselheiros independentes está significativamente correlacionado negativamente com o risco dos pequenos e médios bancos comerciais; a proporção de shadow banking está significativamente correlacionada positivamente com o risco dos pequenos e médios bancos comerciais; a proporção de tecnologia financeira (o valor do investimento) está significativamente correlacionada negativamente com o risco dos pequenos e médios bancos comerciais.

Palavras-chave: bancos comerciais de pequena e média dimensão, risco de crédito, governacão empresarial, shadow banking, tecnologia financeira, assunção de riscos
JEL: G21, M21

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摘要

商业银行是经营风险的企业，风险管理水平决定了商业银行的核心竞争力。而风险管理水平的高低取决于“预防”而不是“治疗”。虽然研究商业银行风险的文献很多，但几乎都是以上市银行或规模较大的商业银行（大型国有商业银行和股份制商业银行）作为研究对象。而中小商业银行由于数据收集较为困难，特别是对于中小商业银行的风险来源这一根本性问题，现有文献的研究深度和广度远远不够，相关经验证据非常缺乏。

有鉴于此，本文采用了案例研究和实证分析相结合的方法，并借助于计量经济分析工具，对中小商业银行风险来源进行了较为系统、深入的分析。

实证发现第一大股东比例、股权制衡度与农商银行的风险显著正相关。同时，独立董事比例与中小商业银行的风险显著负相关；影子银行比例与中小商业银行的风险显著正相关；金融科技（投入）比例与中小商业银行的风险显著负相关。

关键词：中小商业银行，信用风险，公司治理，影子银行，金融科技，风险承担

JEL: G21, M21

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Five years of doctoral life passed in a flash, and my heart is full of emotions when I recall those unforgettable days. During this short but arduous and rich journey of life, my heart is filled with emotions and feelings as I watched the ginkgoes of the school paint the golden ground again. I would like to express my heartfelt gratitude to Professor Pedro Inácio and Professor Ping Li. Over the past five years, they have been dedicated in their academic life; They have guided my research life with their profound academic vision and theoretical thinking, enlightened me when I was confused. Every bit of my achievement is the result of their generous efforts.

I would like to thank my professors, my girlfriend, and my classmates for their help!

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致谢

五年的博士生活一转眼就过去了，回想起那段令人难以忘怀的日子，我的内心充满了感慨。在这短暂而艰辛而又丰富的生命旅途中，看着学校里的银杏一次次地涂满了金色的土地，心中充满了感动。衷心地向 Pedro Inácio 和李平两位教授表示衷心的谢意。五年来，两位老师治学态度认真，学术成就深厚；以博大精深的学术眼界和深刻的学理思维引导着我的人生，使我在迷茫的时候豁然开朗、豁然开朗。我的每一丝成就，都是老师倾注了无数的心血。

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List of Abbreviations

2019-nCoV	2019 new coronavirus
ABC	Agricultural Bank of China
AI	artificial intelligence
BOC	Bank of China
CAPM	capital asset pricing model
CAR	capital adequacy ratio
CBRC	China Banking Regulatory Commission
CCB	China Construction Bank
DDM	dividend discount model
GCB	government-controlled bank
GDP	gross domestic production
ICBC	Industrial and Commercial Bank of China
P2P	peer-to-peer network lending
PCB	privately controlled bank
PE	price-earnings ratio
ROE	return on equity
SOECB	SOE controlled bank
SPDB	Shanghai Pudong Development Bank
FSB	Financial Stability Board

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Chapter 1: Introduction

1.1 Research background

Commercial banks have been playing an important role in the economic system of various countries. Whether they can operate normally is vital for the overall economic and financial development of a country. As an important part of China's banking system, small and medium-sized commercial banks play an irreplaceable role in promoting China's economic and financial development. Firstly, they support the development of small and medium-sized enterprises. The emergence of small and medium-sized banks has satisfied the financial needs of small and medium-sized enterprises, promoted the development of the real economy. Secondly, they improve the quality of banking service. Small and medium-sized banks have broken the monopoly position of our traditional state-owned banks, promoted the competition among banks, improved products and services of the banking industry. Finally, they contribute to financial innovation. Small and medium-sized banks are good at making use of their flat structure organizations to respond quickly to market changes, innovating their original products and services according to their needs, and meeting the diversified financial needs of their customers.

With new normal of Chinese economy, economic growth rate has slowed down, from high speed to medium-high speed (Figure 1.1). The driving factors of development have changed from investment to innovation, and the economic structure is constantly adapting. China's commercial banks are the most affected by the economic downturn. On the one hand, with the optimization and upgrading of the economic structure, some backward enterprises with overcapacity will be eliminated by the market. Because the commercial banks used to pay too much attention to the credit scale rather than the credit quality, the bankruptcy of these backward enterprises would raise the non-performing loan ratio of commercial banks. On the other hand, the driving factors of economic growth shifts from investment to innovation, and the development of financial technology make the phenomenon of bank disintermediation increasingly obvious. These factors make the risk of commercial banks rising rapidly. Compared with large state-owned banks, China's small and medium-sized commercial banks themselves are at a competitive disadvantage, and the new normal has further aggravated the

survival pressure of small and medium commercial banks. Therefore, it is particularly important to effectively help small and medium-sized commercial banks to analyze the current predicament.

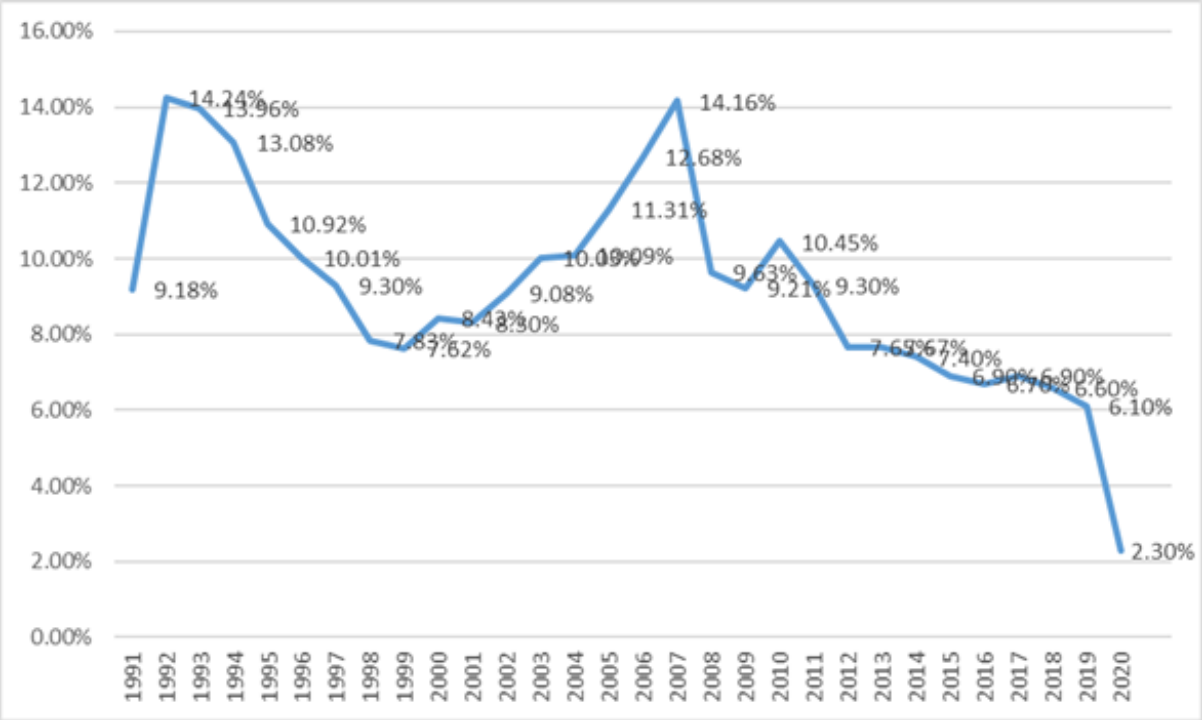

Figure 1.1 1991 - 2020 gross domestic production (GDP) growth rate

Source of data: China bureau of statistics

1.2 Research problem

From Table 1.1 and Figure 1.2, we can see that compared with banks in developed countries, China's banks are relatively high in return on equity (ROE) but low in price-earnings ratio (PE) valuation. What are the reasons behind this? Is there any potential risk? Obviously, this question needs further exploration.

Table 1.1 Major international banks / major banks in China 2019 ROE and February 2020 PE(TTM) comparison

Major international banks	**ROE (2019)**	**February 2020 PE (TTM)**	**Major banks in China**	**ROE (2019)**	**February2020 PE (TTM)**
JPMorgan chase	12.66%	11	Industrial and Commercial Bank of China (ICBC)	13.36%	6.45
Bank of America	10.61%	9.49	Agricultural Bank of China (ABC)	13.10%	5.86
HSBC Holdings	6.70%	11.33	Bank of China (BOC)	11.58%	5.77
Wells Fargo Bank	11.42%	8.88	China Construction Bank (CCB)	13.56%	6.79
Bank of Santander (Spain)	7.27%	7.45	Shanghai Pudong Development Bank (SPDB)	12.47%	5.92
Barclays Bank (Britain)	3.43%	6.89	Bank of Communications	10.75%	5.53
Hang Seng Bank (Hongkong)	15.42%	13.57	China Merchants Bank	15.79%	10.3
Sumitomo Mitsui Banking Corporation (Japan)	5.07%	9.81	Minsheng Bank	12.60%	5.16
Average	**9.07%**	**9.80**	**Average**	**12.90%**	**6.47**

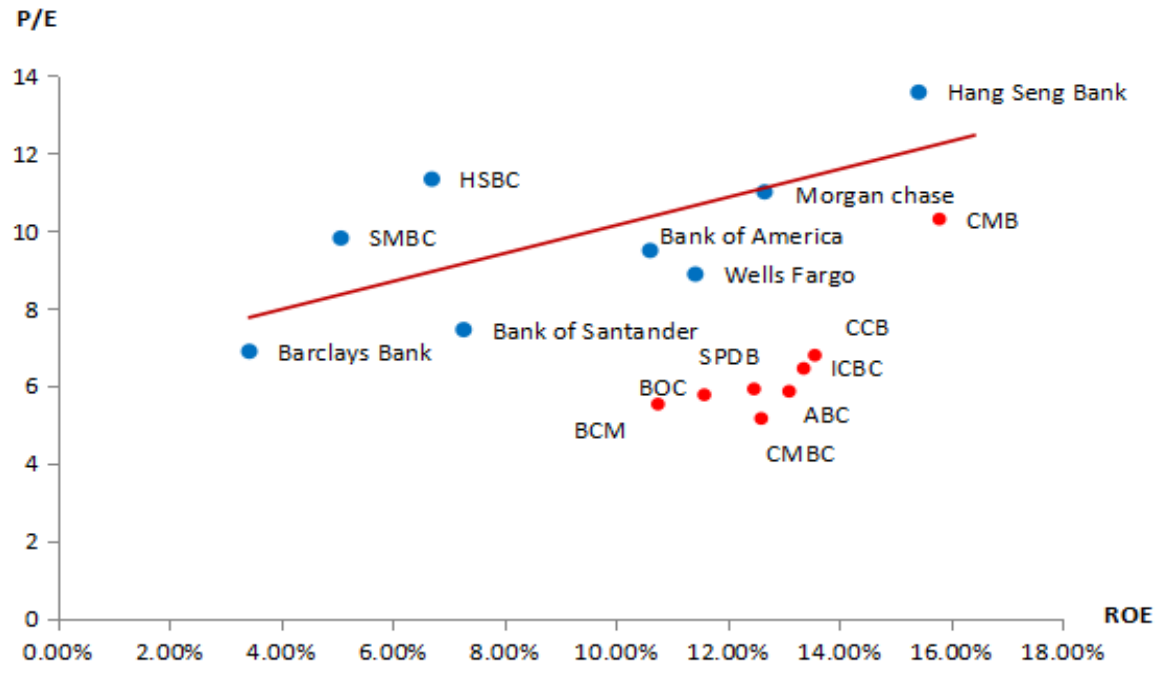

Figure 1.2 Major international banks / major banks in China 2018 ROE and June 2019 PE TTM comparison

Source of data: Wind Database

After comparing the price-earnings ratio (PE) and ROE of international and Chinese large

banks, we will take a further step to see the relevant indicators between the international and China's small and medium-sized commercial banks (Table 1.2). We can notice the same situation from the following Table that the ROE (relative to the international banks) is higher but the valuation is lower compared with that of the international bank (Table 1.1).

Table 1.2 Small and medium-sized commercial banks (international / China) 2019 ROE and February 2020 PE TTM comparison

Small and medium-sized commercial banks (International Banks)	**ROE (2019)**	**February 2020 PE(TTM)**	**Small and medium-sized commercial banks (China)**	**ROE (2019)**	**February 2020 PE (TTM)**
Citizen Finance	8.33%	9.81	Industrial Bank	14.02%	5.70
Allied Bank	16.15%	7.53	Ping An Bank	11.30%	10.72
Fifth Third Bancorp	13.41%	8.75	CITIC Bank	11.07%	5.80
First Republic bank	10.04%	22.47	Everbright Bank	11.77%	5.52
KeyCorp International	12.32%	10.78	Huaxia Bank	10.61%	5.13
Manufacturers and traders banks	10.52%	12.17	Zhejiang Merchants Bank	12.92%	7.24
People united Finance	12.38%	11.96	Bank of Ningbo	17.10%	10.3
PNC Financial Services	7.19%	12.90	Bank of Shanghai	12.94%	5.16
Regional Finance	11.07%	13.20	Bank of Beijing	11.45%	11.52
Silicon Valley bank	10.08%	10.62	Bank of Jiangsu	12.65%	6.21
Truist Financial	19.62%	12.28	Bank of Nanjing	16.53%	5.21
US Bancorp	6.68%	14.00	Yu Nong bank	12.82%	5.28
Zions Bancorp	13.44%	12.67	Bank of Hangzhou	12.15%	5.57
Average	**11.58%**	**12.09**	**Average**	**12.87%**	**6.87**

Source of data: summary of annual reports of Listed Banks

From Table 1.1 and Table 1.2, it is concluded that both large commercial banks and small and medium commercial banks have higher ROE but lower PE valuation (compared with international banks). What exactly has happened in the past ten years in China's banking industry?

First of all, take a look at the valuation of banking industry and the average valuation of all A-shares in China's capital market over the past ten years (from 2012 to 2021). Through Figure A-1, we can see that the valuation of China's banking industry has been far lower than that of all A-shares. Why investors have not been optimistic about this industry? What worries do investors have about the banking industry?

Secondly, Compared with Figure A-1, the result in Figure A-2 and A-3 is just the opposite, and the industry ROE and NPGR of China's banking industry is higher than the average value of all A-shares.

Based on the data above, PE of China's banking industry declined from 2012 to 2021 (Figure A-1), which can be expressed by PE↓, while EPS kept sustained positive growth (Figure A-2 and A-3), which can be represented by EPS↑.

$$PE = P/EPS$$

$$PE\downarrow \text{ and } EPS\uparrow \Rightarrow P\downarrow \quad (1.1)$$

Dividend discount model (DDM): $EV = \sum_{t=1}^{\infty} \frac{D_t}{(1+K)^t}$

$$P \downarrow \rightarrow EV \downarrow \xrightarrow{D_t>0} K \uparrow \text{ (According to Figure A-4, } D_t > 0) \quad (1.2)$$

Capital asset pricing model (CAPM), which is $K = R_f + \beta(R_m - R_f)$

$$R_f \text{ and } R_m \text{ hold } \xrightarrow{K\uparrow} \beta\uparrow \quad (1.3)$$

Finally, we begin to think from either perspective, the model deduction or the comparison of the main indicators of the international capital market, about the reasons why investors lack of confidence in China's banking industry or whether they are concerned that China's banking industry may have a higher risk. Based on the relevant data from 2012 to 2021, and deduction from PE, DDM model and CAPM model, we can deduce systematically and logically that China's commercial banks may have very high systemic risks.

This thesis focuses on small and medium-sized commercial banks so it is necessary to define the research object before specific research. In China, instead of six large state-owned commercial banks (Bank of China, agricultural bank, industrial and commercial bank, construction bank, Bank of Communications, postal savings bank), small and medium-sized commercial banks refer to joint-stock commercial banks, urban commercial banks, rural financial institutions.

Why study small and medium commercial banks in China? Compared with China's large state-owned commercial banks with high scale and social reputation, China's small and medium-sized commercial banks are in a disadvantageous position, and the disadvantage of urban commercial banks and rural commercial banks is even more obvious. The emergence of shadow banking, financial technology, and corporate governance has further weakened their competitiveness. In order to realize the stable and sustainable development of small and medium-sized commercial banks, it is necessary to deeply analyze the risk factors that differentiate small and medium commercial banks from large state-owned commercial banks, and put forward suggestions.

The conclusion of this thesis should help to further clarify the following questions: is there a strong correlation between the risks of China's small and medium-sized commercial banks (mainly credit risk) and the factors such as corporate governance, shadow banking and financial technology development? Will effectively solving these risk factors continuously improve the

performance and comprehensive competitiveness of small and medium-sized banks in China?

Why do we choose governance, shadow banking and financial technology? First of all, with the continuous development of economic globalization, banks are also facing more risks. Many studies have shown that good corporate governance mechanisms play a positive role in preventing bank risks, improving bank risk management and promoting economic stability, but most studies are conducted for large commercial banks. There are few studies on the impact of corporate governance on risk taking in small and medium-sized commercial banks. Second, from the literature of the past five years, compared with the United States, shadow banking in China is more complex. Meanwhile, according to the CSMAR database, Chinese shadow banking is a huge market (16% of global shadow banking assets), which may be an important source of credit risk for small and medium commercial banks. Finally, the rising tide of global financial and technology investment has challenged the traditional management model of commercial banks. The rise of financial technology has changed the development direction of traditional commercial banks and subverted the business model of traditional commercial banks. It will pose a huge challenge to the development model and way of thinking of commercial banks in the financial field. Therefore, the development of financial technology has had a huge impact on commercial banks, especially small and medium-sized commercial banks.

1.3 Research contents and structure

In this thesis, we use the knowledge of corporate governance, finance and risk management. We adopt quantitative research and qualitative research methods. With the help of econometric analysis tools, we analyze the risk sources of small and medium-sized commercial banks.

The research contents include the following six aspects:

In the first chapter, as the opening of the full text, this chapter firstly introduces the background of the topic selection, puts forward the specific problems and significance of the study, and defines the basic concepts and research scope. At the same time, this chapter also exposes the main contents and research logic of the thesis.

The second chapter, from the perspective of risk sources, is the literature review of the previous research related to the whole Chinese banking industry, China’s small and medium commercial banks, international small and medium-sized commercial banks, China’s small and medium-sized commercial banks and large commercial banks. At the same time, it analyzes the relevant concepts of risk management in Basel four and commercial banks.

The third chapter takes the two examples of Chinese small and medium-sized commercial banks of the Bank of Shanghai and Shanghai Pudong Development Bank as case study to better understand that the weakening of corporate governance is the source of risk for the commercial banking industry.

The fourth chapter analyzes the status of China's shadow banking. And on this basis, this chapter further describes that under the pressure of multiple performance appraisal, China's commercial banks appear to be nesting each other in financial products. That is to say that there are layers of off balance sheet or outsourcing business, which also generates capital idling among financial institutions. Under the background that China's regulatory authorities begin to implement strong regulation, China's small and medium-sized commercial banks may have a higher systemic risk.

In the fifth chapter, we analyze the development of China's financial technology in the light of the obvious homogenization of the products of commercial banks. Because compared with large state-owned commercial banks in China, small and medium-sized commercial banks do not have any advantages in terms of financial strength, scope of operation (scope of deposit and loan). The development of financial technology has undoubtedly brought great impact to small and medium-sized commercial banks.

On account of the relationship between commercial bank risk and corporate governance, shadow banking and financial technology, the sixth chapter uses the data from 2011 to 2020 of 116 small and medium-sized commercial banks, and empirically examines the risk impact on commercial banks.

In the seventh chapter, we combined with the theoretical research and empirical conclusions, and put forward suggestions adapted to the reality of small and medium-sized commercial banks in China.

The logical structure of this thesis is shown in Figure 1.3.

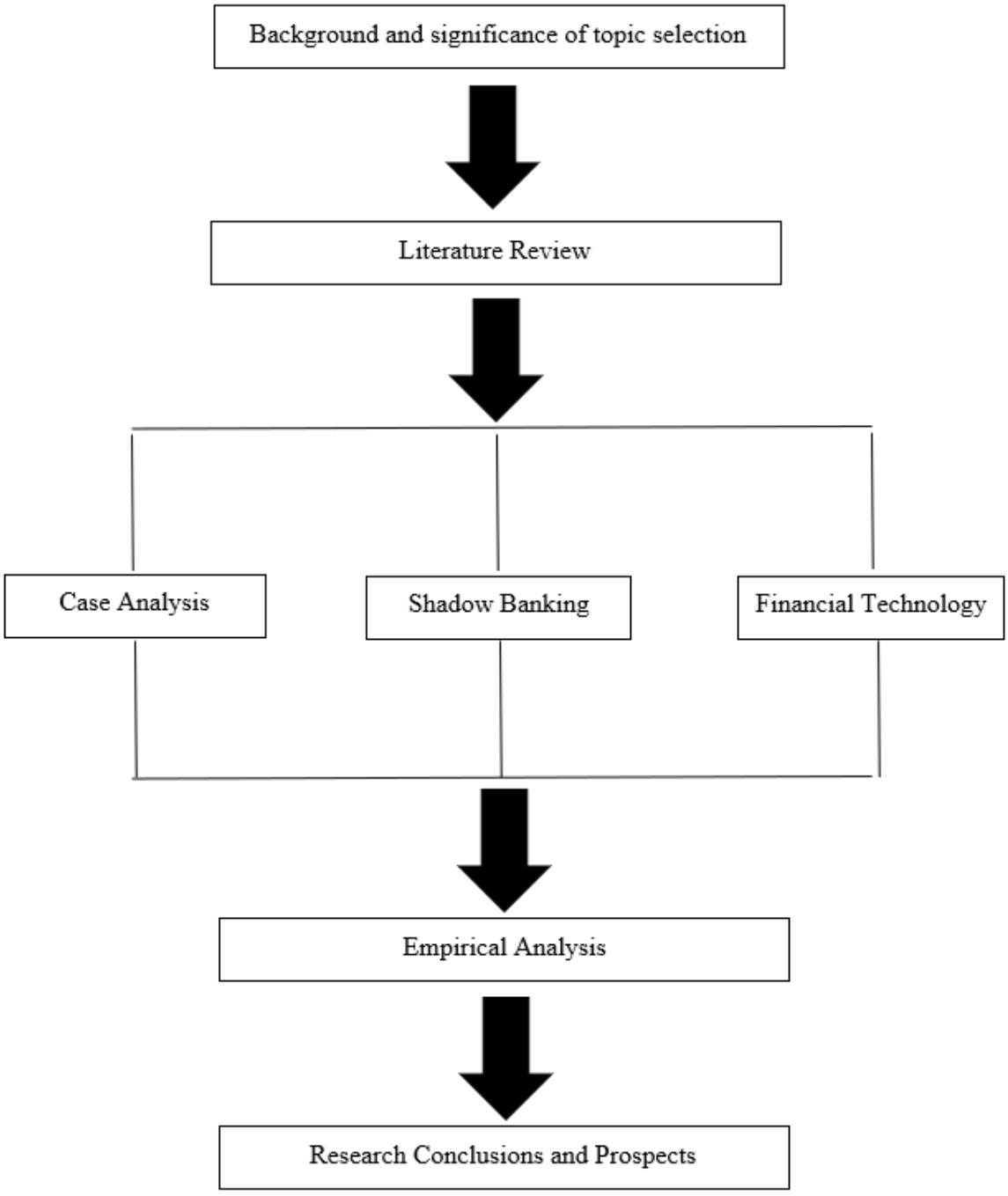

Figure 1.3 Logical structure of this thesis

1.4 The innovation of thesis

On the basis of the existing research, the characteristics and innovations of this thesis are mainly reflected in the following aspects:

(1) The research topic is closely related to the major problems in the development of

China's banking industry. The conclusion is of profound practical significance and important reference value. From the perspective of bank valuation, this thesis compared Chinese commercial banks and international commercial banks. Under the support of the banking industry data from 2011 to 2020, through the derivation of PE, DDM model and CAPM model, systematically and logically launching China's commercial banks may have very high systemic risks. It enriches and expands the relevant literature, and provides an effective basis for exploring the reasonable path for further reform of small and medium-sized banks in China.

(2) The research perspective is new, and the research content has made breakthroughs on the basis of the existing research. Because the information disclosure of Chinese banking industry, especially the non-listed banks, is not perfect and is limited by data, this thesis collects and summarizes the relevant information which is found in the financial news and bank annual reports. These data not only provide valuable information for subsequent research, they also provides new evidence for existing research problems.

(3) The research samples are broad and representative. Due to the difficulty in data collection of small and medium-sized commercial banks, most empirical literature of commercial banks was mainly selected from listed banks or large state-owned commercial banks, leading to the limited significance of the conclusions. In this thesis, Sample data from annual reports released by commercial banks from 2011-2020, China Statistical Yearbook, China Financial Yearbook, National Bureau of Statistics website, WIND database, CSMAR database, and so on This thesis compares and verifies data from different sources, and completes the panel data of small and medium-sized banks from 2011 to 2020.

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Chapter 2: Literature Review

This Chapter starts from the perspective of commercial banks' risk sources and studies the development of corporate governance, shadow banking, financial technology, commercial banks' risk-taking (including credit risk, and so on) and their impact.

Firstly, either the banking crisis that broke out frequently in various countries in the 1990s, or the sub-prime mortgage crisis which broke out in 2007, both have provoked extensive discussions and research on the issue of banks' risk-taking in the academic and practical field. The particularity of corporate governance of commercial banks makes it an important research field to study the risk-taking behavior of commercial banks from the perspective of corporate governance.

Secondly, commercial banks engage in shadow banking business in large numbers, which not only increases their financial leverage, but also increase their own operational risks. The leverage itself is very high. Once the economic growth rate drops, such as the 2019 new coronavirus (2019-nCoV), the bad debt rate of banks begins to rise, and when it reaches a certain threshold, it may easily to lead to systemic financial risks. Therefore, it is necessary to study the main forms of shadow banking business and the possible respective risks.

And finally, the traditional business model of commercial banks is continually being impacted by the swelling tide of investments in global financial technology. The development model and way of thinking of commercial banks in the financial sector have been impacted by the growth of Fintech. It presents a significant challenge that will alter the traditional commercial banks' focus on development, question their conventional style of operation, and ultimately have an impact on their overall management.

Therefore, the development of financial technology may put great pressure on small and medium commercial banks.

2.1 Corporate governance and commercial banks' risk-taking

2.1.1 Related concept on corporate governance

2.1.1.1 Connotation of corporate governance

For general enterprises (non-financial enterprises), the core of corporate governance is to

address the principal-agent issue between shareholders and managers arising from conflict of interest. Shleifer and Vishny (1997) argue that the core of corporate governance is to ensure the maximum profit of shareholders. Due to future uncertainty, shareholders cannot completely solve the principal-agent problem through filing contracts with managers and they need corporate governance mechanism to play a role. Overall, shareholders supervise managers in the following four ways: (1) equity concentration enables major shareholders to restrict managers; (2) shareholders elect directors and supervisors to represent their interests; (3) improve the mechanism design of management compensation so that the interests of managers and shareholders can be aligned; (4) DeHaan and Vlahu (2016) through the manager market, rely on market competition to restrain management.

In a narrow sense, corporate governance is a mechanism of mutual checks and balances, which means that the company has an appropriate allocation of power between the company's managers and the company in terms of its shareholding structure. The purpose of corporate governance is to maximize the benefits to the company's shareholders, thus avoiding the operators' deviation from the owners' rights and interests.

Broadly speaking, corporate governance is not limited to shareholders' constraints on managers, but includes a wide range of stakeholders such as shareholders, creditors, suppliers, employees, consumers and government, social groups and other groups with close ties to the company. Corporate governance is an internal or external system or institution, both formal and informal, to coordinate the interests of the company with those of all parties in order to ensure that the company makes scientific decisions to protect the rights and interests of all parties in the company. At present, China's corporate governance is based on the narrow sense, and gradually expands to the broad sense.

From the perspective of discipline, corporate governance is the common research object of economics and management. In the study of corporate governance, economics focuses on institutional arrangement and mechanism design, which often overlap with the corporate organizational structure design, human resource management, strategic management and so on. From the scope of application, it can be divided into internal governance mechanism and external governance mechanism (Figure 2.1). The internal governance mechanism includes ownership structure, internal balance mechanism and management incentive and restraint mechanism, while the external governance mechanism includes government supervision and market constraint. Of course, corporate governance also includes the combination of culture and system. This section mainly studies the impact of corporate governance on bank risk from the perspective of corporate internal governance.

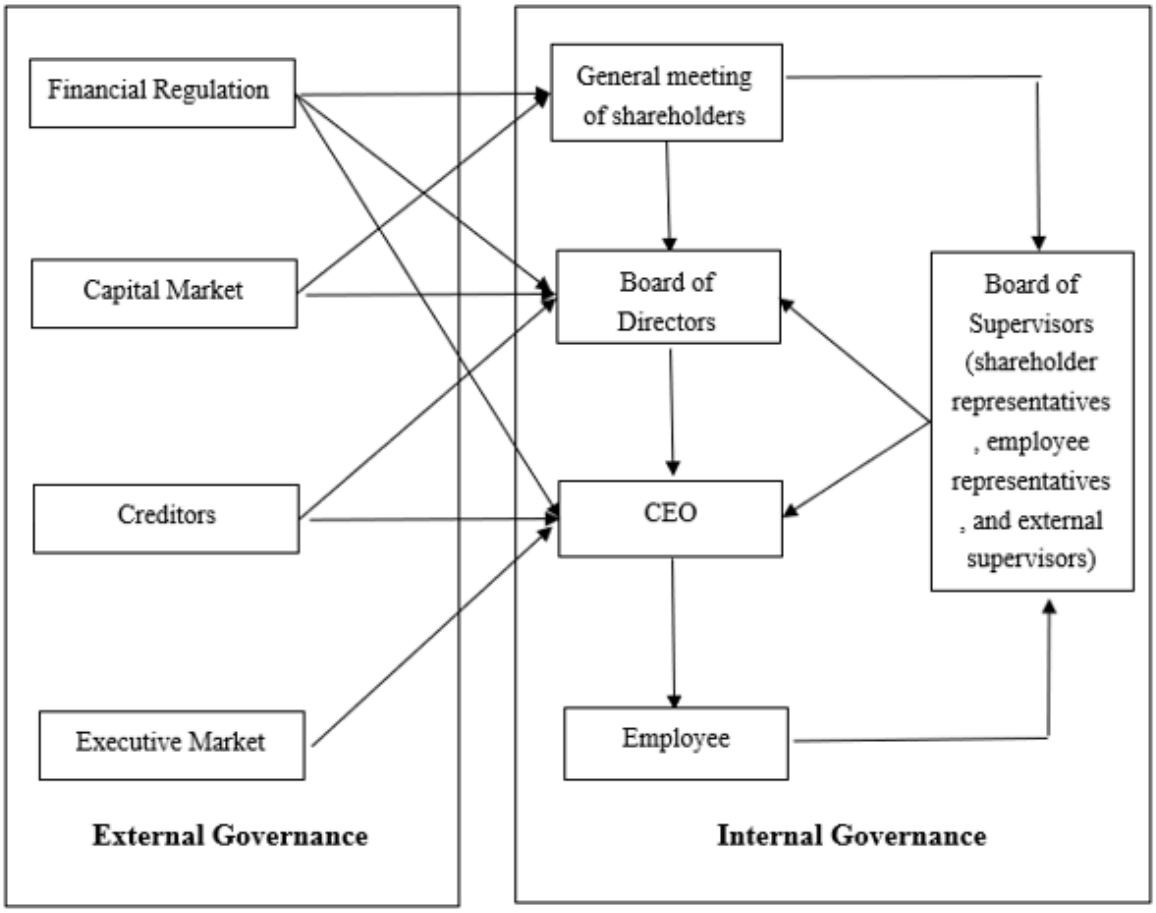

Figure 2.1 External governance mechanism and internal governance mechanism

Source: Summarize by Author

2.1.1.2 Theory of corporate governance

(1) Financial Market Theory

The main point of this theory is that shareholders own the company, and the main goal of management is to maximize the interests of shareholders. Its theoretical basis is the efficient market hypothesis, that is, the stock price is completely determined by the capital market and effectively reflects all relevant information of the company. Therefore, the value of the company is fully reflected in the capital market. Hayes and Abernathy (1980) believe that when a company's stock price conforms to the efficient market hypothesis, its stock price is a sufficient information index to measure the value of the company. At this time, the financial market can effectively solve the agency problem caused by information asymmetry. If the management does not perform well, the market value of the company will decline.

(2) Market Myopia Theory

This theory assumes that the financial market is short-sighted and impatient, and shareholders only consider their own short-term income. When the company invests for

long-term interests (such as continuous investment in R&D and market expansion strategy, which will delay the payment of dividends), shareholders generally sell shares, thus reducing the price of shares. This is easy to force company managers to blindly pursue the company's short-term interests at the expense of shareholders' long-term benefits and the company's competitive potentials, and also lead to the decline of the company's actual performance.

The theory also believes that the basic premise of financial market theory is wrong and unrealistic. There are two main reasons: first, the stock price has the characteristics of random walk. Second, the change of stock price will be affected by the trading behavior of investment managers of some financial institutions, and their compensation is in accordance with short-term performance.

Based on the above views, the market myopia theory puts forward corporate governance reform measures completely different from the financial market theory. Supporters of financial market theory tend to increase shareholders' supervision and management of the company, while short-sighted market theory focuses on how to make the management get rid of the pressure of shareholders' short-term interests.

(3) Conflict of Interest Theory

The basic assumption of conflict of interest theory is that there are conflicts among shareholders, managers and stakeholders. Corporate governance can solve these conflicts through systems and mechanisms.

a). Conflict of interests between shareholders and managers.

The management will not always aim at maximizing the interests of shareholders. Modern enterprise theory generally believes that under the condition of the separation of corporate ownership and control, it is extremely difficult for a large number of minority shareholders to supervise the company. Under information asymmetry, managers tend to sacrifice the interests of shareholders for their own interests. Therefore, the first goal of corporate governance is to coordinate the conflict between shareholders and managers.

b). Conflict of interests between creditors and shareholders.

Most companies now operate in debt. In terms of legal rights, the rights of creditors should take precedence over the rights of shareholders. In order to increase the company's potential investment value and its own interests, shareholders will strongly advocate the management to expand financial leverage, which also increases the bankruptcy risk of the company. Once the capital liquidity of the enterprise is insufficient and the debt cannot be repaid, it will bring great risks to the interests of creditors, and there will be conflict of interests between creditors and shareholders.

c). Conflict of interests between shareholders and the government.

In some cases, the interests of shareholders may also conflict with the interests of the government because the interest of the government may not be consistent with the interest maximization of shareholders of the company. Regulators generally require management to take less risks, but shareholders may adopt incentive compatible compensation schemes to make managers prefer risk-taking behavior.

(4) Shareholder Supremacy Theory

An enterprise's investor is its rightful owner and subject under the law. The investor's wishes and interests should be served by all of the enterprise's economic endeavors. According to the shareholder supremacy idea, shareholders are the true proprietors of the company, and the residual control right and income right of the enterprise also belong to shareholders, while the interests of other potential corporate stakeholders should be strictly excluded.

(5) Insider Control Theory

In corporate enterprises, the supervision of the board of directors and management, the design and operation of incentive and restraint mechanism involve the issue of control. The existence of defects in the supervision mechanism leads to the imbalance of the corporate governance structure. The control power of the enterprise is not really in the hands of shareholders, but in the hands of insiders, which leads to the problem of insider control. As for the definition of insider control, it refers to the behavior of managers occupying the interests of owners due to the inconsistency between "absence of owners" and control rights and residual claims in the corporate governance structure.

It can be generally divided into two categories: insider control in law and insider control in fact. Insider control in law means that insiders, including managers and employees, control the company by holding the equity of the company. In fact, insider control means that although the insiders don’t hold the shares of the company and is not the legal owner, they have the control right of the company. In the period of economic system reform and transition, different insider control phenomena have appeared in some state-owned enterprises in China. For example, although the managers of some state-owned enterprises don’t own most or a large amount of equity, they have the right to control the enterprise, that is, there is de facto insider control.

In addition, there is insider control under government administrative intervention. The state is the ultimate owner of state-owned enterprises, but the enterprise managers have a considerable amount of control. The state only retains the final right to intervene in the enterprise, such as the appointment and removal of managers.

(6) Stakeholder Theory

Freeman (1984) believes that the impact of the company may be one-way or two-way. Stakeholders include both those persons or groups impacted by enterprise activities during the process of achieving enterprise goals as well as those that have an impact on the attainment of enterprise goals, such as government departments, which expands the connotation of stakeholders.

Blair (1995) believes that the company should serve stakeholders rather than shareholders. Because shareholders have only limited liability, the risks borne by shareholders can be solved through investment diversification. In fact, the residual risk has been transferred to creditors and others.

2.1.1.3 The particularity of corporate governance of commercial banks

Compared with non-financial enterprises, banks have three characteristics. First, the bank leverage ratio is relatively high. According to the research of Laeven and Levine (2009), the leverage ratio of banks is generally around 10, which is much higher than that of non-financial companies. Second, the banking business is complex and the degree of information asymmetry caused by information opacity is much higher than that of non-financial enterprises (Grove et al., 2011). Third, banks have strong externalities. As banks play a unique role in financial intermediation and economic system, bank failures often have serious impacts and may bring systemic risks to the economy (Laeven, 2013).

The three characteristics of banking are embodied in the following three aspects: the vulnerability of asset and liability structure, higher information asymmetry and higher externalities.

(1) The vulnerability of asset and liability structure. The vulnerability of asset structure. The vulnerability of assets and liabilities structure of commercial banks is mainly manifested in two aspects: liquidity risk caused by short-term borrowing and long-term use, income volatility caused by high leverage.

a). The liquidity risk of mismatching assets and liabilities on their maturity. Liquidity is very important to banks because of the characteristics of short-term and long-term loans, which has been fully proved in the financial crisis. When the financial crisis occurred, almost all the liquidity resources in the financial system of Europe and the United States were exhausted instantly, and the central bank was forced to provide liquidity and intervene in the banking system.

b). Commercial banks generally have high leverage ratio. Because the bank bears the

liquidity risk caused by the mismatching of maturity, it usually requires a higher premium from the borrower, so the borrower must pay the bank a higher interest rate than the financing. Therefore, the growth of bank profits is directly proportional to the amount of loans.

(2) Commercial banks have higher information asymmetry. Compared with non-financial enterprises, commercial banks, as financial enterprises, have more prominent information asymmetry due to their professional and complex business. The opacity of the balance sheet of commercial banks is higher than that of ordinary enterprises, and their assets are more easily changed and the scope of information asymmetry is wider.

a). The opacity of the balance sheet of commercial banks is higher than that of ordinary enterprises. The quality of bank loans is more difficult to observe than the assets of industrial enterprises such as machinery and factory buildings. The financial assets invested by banks are more complex.

b). The asset forms of commercial banks are easier to change. Compared with general manufacturing companies, banks hold financial assets such as bonds and loans, which are easier to change. Especially after the introduction of asset securitization, not only they can make the long-term assets short-term, improve the liquidity of assets, but they also can easily change the risk of bank asset portfolio. Therefore, when the salary of managers is based on performance, management may change the risk portfolio of the bank in order to achieve the performance target. Especially when the performance of banks is measured by short-term goals and stock prices, managers will focus on short-term returns and have low risk aversion.

c). The scope of information asymmetry is wider. There are information asymmetries not only between depositors, banks, and regulators, but also between shareholders, boards of directors and management to varying degrees, which in turn makes corporate governance of banks more complex and difficult.

(3) Commercial banks have stronger externalities. The business relationship and interaction between commercial banks are closer, and the risk of contagion is greater. Different from other industries, from the perspective of banking industry, banks are both competitors and business cooperators. Various businesses of banks, OTC market of derivatives and foreign exchange market are interconnected, which will lead to the risk of counterparties. Therefore, the risk of inter-bank contagion is high. If a bank fails, it will infect other institutions, which is likely to cause systemic risk in a short period of time.

Due to the three characteristics, corporate governance of banks is different from non-financial enterprises. a). Under high leverage, banks' shareholders have a strong willingness to operate aggressively. If the radical business succeed, shareholders will receive

the full benefit of the leveraged operation; If the radical business fail, the bankruptcy cost will be shared with creditors, while shareholders often bear only a portion or even a small portion of the cost (Demsetz et al., 1997). b). Due to the complexity and low transparency of banking business, the principal-agent issue in corporate governance is more serious. The high opacity of information makes the design of principal-agent contract more difficult, and it is easier for managers to sacrifice shareholders' and other stakeholders' profit to pursue their own interests (Akerlof et al., 1993; Caprio & Levine, 2002). c). Because of their externalities, banks are often guaranteed by deposit insurance and government implicitly, which makes banks more willing to take risks (DeHaan & Vlahu, 2016; Demsetz et al., 1997). Therefore, the corporate governance of banks should not only consider the interests of shareholders, but we also need to consider other major stakeholders (for example, depositors) (Acharya, 2009). Zeng and Gao (2004) believe that perfect bank corporate governance should include four aspects: shareholder control, financial supervision, government behavior and market environment. Levine (2004) believes that the banking business is extremely special and an effective corporate governance mechanism for general enterprises may have limited effect on banks. De Haan and Vlahu (2016) argue that the empirical evidence in the corporate governance literature of some non-financial enterprises does not apply to banks.

2.1.2 Research on the impact of corporate governance on the risk of commercial banks

The high leverage ratio of commercial banks makes shareholders have strong risk-taking impulse, and the weakening of creditor's restraint mechanism caused by information opacity provides convenience for shareholders' risk-taking behavior. Sannders et al. (1990) empirically tested the relationship between ownership structure and risk using the data of 38 banks from 1978 to 1985. The results showed the higher the equity concentration, the greater the risk of banks.

Laeven and Levine (2009) used data from 296 banks in 48 countries during 1996-2001 to study corporate governance, government regulation, and risk-taking in commercial banks. They measured the risk-taking of banks by three indicators: the volatility of average return on assets (pre-tax), the volatility of return on capital, and the Z value (to measure bank bankruptcy risk). The results show that when the major shareholders have strong control over the company's cash flow, then the existence of major shareholders increases banks' risk level, indicating that the major shareholders have the motivation and ability to urge the bank to take a higher risk level. The results show that the degree of foreign investors' equity has a positive

relationship with the return of commercial banks, but has a reverse relationship with the risks of commercial banks.

Cull et al.(2006) found through empirical analysis that the related-party loan itself is neutral, and its impact on the bank depends on the external institutional constraints of the bank and the degree of perfection of the internal governance structure. However, most literature believe that large shareholders may reduce the quality of bank assets through related-party transactions and damage the interests of small and medium shareholders and depositors (Enriques, 2015; Johnson et al., 2000; Porta & Zamarripa, 2003). Large shareholders may take advantage of their control over the company for their own relatively legitimate interests at the expense of small and medium shareholders (Johnson et al., 2000; Rajan & Zingales, 1995).

The board of directors and stockholders have a principal-agent relationship. The board of directors assumes the responsibility of overseeing the management's business operations to make sure that their conduct complies with the standards for maximizing shareholder value. The board of directors, which serves as the top decision-making body for commercial banks' risk management, is intimately linked to the risk-taking behavior of banks. Pathan (2009) used the data of 212 American banks from 1997 to 2004 to study the relationship between board structure and risk-taking level. In his thesis, total risk, systemic risk and specific risk of bank stock are used to measure the bank’s risk-taking level. The results show that the stronger the board of directors, the higher the risk of banks; CEO’s power is negatively correlated with risk-taking, and CEO’s shareholding ratio is positively related to risk-taking. Specifically speaking, the more the board of directors can represent the interests of shareholders, and the bank tends to take risks; because the CEO has a lower risk preference, the greater the power of the CEO, the lower the risk-taking level of the bank; the higher the CEO’s shareholding ratio, the more consistent their interests are with the interests of shareholders, and the higher the bank’s level of risk-taking.

Lee (2002) empirically studied the relationship between managerial ownership and risk taking by using the data of 65 banks from 1987 to 1996. In this thesis, commercial banks’ executive shareholdings and risk-taking were analyzed. The results show that: an increase in management shareholding in banks with large asset size and relatively stable share prices increases the higher the level of risk-taking of the bank. Relative to managers, the bank’s major shareholders have a higher risk appetite. The highly leveraged capital structure of banks makes shareholders have a strong willingness to operate aggressively, and shareholders can enjoy all the benefits of success, but can amortize the cost of failure to creditors, and only bear a part or even a small part of the cost of failure (DeHaan & Vlahu, 2016; Demsetz et al., 1997). But

managers devote their human capital in the company. If the company goes bankrupt, managers will lose their invested wealth so managers have a lower risk appetite than shareholders (Devriese et al., 2004).

Fortin et al. (2010) selected 83 American banks as samples to study the impact of corporate governance factors on the risk-taking of commercial banks. The results show that: executive compensation is negatively correlated with bank risk-taking, but executive bonus and stock option are positively correlated with bank risk-taking; for banks with low degree of capitalization, higher proportion of external shareholders' shareholding will increase the bank's risk bearing.

Masaru and Yukihiro (2004) studied the relationship between corporate governance and risk-taking of Japanese commercial banks. Based on the data from 1990 to 1999, this thesis draws a more detailed conclusion from the aspects of capital adequacy ratio, board governance and equity structure. They think that increasing the capital adequacy ratio of commercial banks will reduce the risk of banks; government personnel acting as board members of commercial banks will have a significant impact on their risk-taking level.

The research on corporate governance and risk-taking of commercial banks in China started relatively late. Most of them are empirical studies based on relevant corporate governance theories and hypotheses, mainly from the perspectives of ownership structure, board characteristics and management incentive. Among them, the ownership structure mainly includes shareholding concentration and shareholding nature. The former is measured by the shareholding ratio of the largest shareholder and its relative holding capacity, and the latter can be further divided into state-owned shareholding and foreign shareholding; the characteristics of the board of directors mainly include the size of the board of directors and the proportion of independent directors; management incentives include management compensation and management shareholding ratio.

Kong and Dong (2008) conducted an empirical test using data from five publicly traded banks from 2000 to 2007, and it was discovered that board size has a significant negative impact on non-performing loan ratio, the proportion of independent directors has no significant impact on non-performing loan ratio, and the sum of the shareholding ratio of the top three shareholders has a significant positive impact on non-systematic risk. Niu (2015) analyzed data from 16 listed commercial banks, and used the fixed effect model to draw the conclusion that the proportion of the largest shareholder's shareholding is positively related to the bank's risk-taking.

Q. Wang and Li (2012) used 242 samples of 80 urban commercial banks from 2000 to 2009.

They found that the nature of the local government of the largest shareholder and the amount of shares held by the government had a significant positive impact on the bank's risk-taking. L. Liu (2019) believed that although the long-term development of small and medium-sized commercial banks (e.g., replenishing bank capital) requires the active participation of shareholders, there is still a need to conduct compliance checks on shareholders' qualifications.

Ji and Li (2019) believe that with the increase of economic downward pressure, the risks faced by small and medium-sized commercial banks show the characteristics of sudden concentration and expansion. Accordingly small and medium-sized commercial banks should keep a comprehensive awareness of the financial and economic circumstances, alter their viewpoints, move their focus from scale to quality, and significantly raise their level of corporate governance. M. F. Lu (2020) believes that small and medium-sized commercial banks, especially non-listed small and medium-sized commercial banks, are facing practical difficulties such as relatively dispersed ownership and great pressure on equity management, so the equity management system should be improved. Small and medium-sized commercial banks should pay attention to the establishment of internal control and other management systems, strengthen substantive management, realize the networking of shareholders' equity information, and play a synergistic role with shareholders.

Song et al. (2011) used the financial data of 13 commercial banks from 2000 to 2010 to analyze the correlation among executive compensation, risk-taking and bank performance, and found that the relationship between executive compensation and bank risk was inverted, and it was significantly positively correlated with bank performance. Executive compensation not only improved bank performance, but also increased the level of bank risk-taking. After reviewing the theoretical and empirical studies related to bank executives' incentives and risk-taking behavior, S. Li et al. (2012) argued that one of the important reasons for the outbreak of the global financial crisis in 2007 was the high-risk behavior of financial institutions. And this high-risk behavior is related to the executive compensation structure of financial institutions, which is precisely set by those shareholders who prefer short-term risk-taking behavior. Thus, the risky behavior of shareholders amplified the risk level of financial institutions

Y. H. Li and He (2009) studied the relationship between corporate governance and risk-taking of 14 Chinese Listed Banks in 2007. The results show that small board size, unbalanced ownership structure and high-intensity management incentive have a positive impact on the risk control of banks. Hong et al. (2014) analyzed the relationship between bank executive compensation incentive and real estate credit risk, and found that when executive

compensation began to increase, banks had strong risk-taking motivation, and the growth rate of housing loan accelerated. When the salary exceeded a certain threshold, the bank would tend to be conservative and the growth rate of housing loan would decrease. Through empirical research, Y. M. Zhang and Tian (2013) found that the number of board of directors and the proportion of independent directors of China's listed banks are negatively correlated with risk indicators, that is, the larger the board size and the higher the proportion of independent directors, the smaller the risk.

2.2 Shadow banking and commercial banks' risk-taking

2.2.1 The connotation of shadow banking

The concept of "shadow bank" comes from the United States. McCulley (2007) proposed "shadow bank" for the first time. The new term "shadow banking" is defined as a highly leveraged financial intermediary. McCulley and Refleetions pointed out that shadow banking engages in activities that are comparable to typical bank loans, have high leverage characteristics, take place outside of the regulatory framework, and are not under the control of central banks.

In 2010, Bemanke, then chairman of the Federal Reserve, defined shadow banking as a financial institution that is outside the traditional deposit taking institutions, acts as the intermediary of credit and is not regulated. Pozsar et al. (2010) believe that shadow banking is a financial intermediary with term conversion function, credit conversion function and liquidity conversion function, but without liquidity support and credit guarantee from the government or other public institutions.

The Financial Stability Board (FSB, 2011) believes that shadow banking, as a system of credit intermediation, is less regulated and prone to systemic risk. Dechow et al. (2010) regard shadow banking as a non-bank financial institution which participates in commercial banking business by means of complex financial operation and increased leverage.

Allena et al. (2004) proposed that commercial banks should be guided to return to traditional business, the scope of business activities should be strictly controlled, and access standards should be improved. Plantin (2014) draws a conclusion from a macroeconomic mathematical model that although strengthening capital regulation can reduce the negative impact on other economies when banks fail, traditional banks will bypass capital regulation through innovative products and carry out regulatory arbitrage.

Along with the financial development in China, many scholars have started to conduct research on the subject in China. L. P. Zhou (2012) believes that shadow banking in China is different from foreign countries and mainly exists as a substitute for bank credit, with less complexity involved. Z. Cai (2012) believes that the general characteristics of shadow banking are mainly in two aspects. First, it plays the role of deposits and savings; Second, it is unregulated. However, Chinese shadow banking did not attract enough attention at the beginning, but with the growth of its scale, its importance has gradually gained the attention of the regulatory authorities.

Yan (2015) believes that China's shadow banking are mainly engaged in credit business, and they are inseparable credit intermediaries with commercial banks. Ba (2013) believes that China's shadow banking is not an independent department, but relies on commercial banks. Without the support and cooperation of commercial banks, shadow banking business cannot be carried out.

Qiu (2012) believes that commercial banks are at the core of China's shadow banking system, and a large number of funds for shadow banking business are provided by commercial banks, which flow to customers who cannot meet the conditions and cannot obtain loans directly from banks.

S. Y. Chen et al. (2018) compare different shadow banking businesses and believed that different shadow banking tools may have different effects on bank efficiency. Pang (2018) believes that in order to maintain the steady growth of profits and prevent the increase of non-performing loans, commercial banks conduct regulatory arbitrage through innovative financial products and financial tools, thus forming shadow banking.

D. Wu (2018) finds that the capital inflow channels of China's shadow banking system are mainly wealth management products, while the capital outflow channels (fund users) of the shadow banking system are mainly inter-bank business operations, trusts and entrusted loans. Luo and Feng (2012) think that there is a common phenomenon of financial repression in China. Due to the strict financial regulation of our country, banks and other formal financial institutions cannot provide enough for the real economy.

Y. Li (2011) believes that financial innovation is the driving force for the development of the shadow banking system. The shadow banking system continues to grow because it can meet the needs of financiers and investors.

J. G. Li (2017) elaborated the reasons for the formation of shadow banking business of China's commercial banks from three aspects: the huge financing gap in the fund demander, the investment demand in the fund supplier, and the motivation of banks to improve the income.

G. F. Sun and Jia (2015) believe that the core feature of shadow banking in China is the transfer of funds from on-balance sheet to off-balance sheet by commercial banks. Chinese shadow banking is essentially a shadow of commercial banks. The business models of Chinese shadow banking are represented by the channel model and the inter-bank model. Among them, the channel model refers to the cooperation between commercial banks and non-bank financial institutions such as securities, trusts, funds and insurance, and the transfer of funds from on-balance sheet to off-balance sheet with the help of their channels to achieve the purpose of providing financing to target customers. The inter-bank model refers to commercial banks' financing from other commercial banks or non-bank financial institutions through inter-bank lending, inter-bank wealth management, inter-bank payment and inter-bank certificates of deposit for the purpose of providing financing to target customers.

Based on the content of the literature, we can define the concept of shadow banking in China and the United States in the following way. The major feature of shadow banking in the United States is that non-banking firms do comparable financial activities to banks, such as social investment and finance, but because these institutions lack a banking license, they are referred to as shadow banking. The main body of China's shadow banking is commercial banks, which is characterized by banks transferring deposit and loan business to off balance sheet in order to pursue profit while avoiding regulation under financial repression. Commercial banks engage in banking business outside the supervision, and its business nature is essentially "shadow of banks". In other words, there are significant differences in shadow banking between China and the United States, mainly for the following three reasons.

2.2.2 Digital revolution and the rise of shadow banking

The advent of information technology in the 1970s signaled the start of the digital revolution. Typewriters were replaced by computers, and analog channels gave way to digital channels for information transfer. Then, financial institutions started to monitor payments and record credit on electronic systems. They also achieved the automation of background operations and began to use electronic tools to support trading activities. Banks can now deal with more complex and dynamic financial structures with multiple asset liability levels.

The arrival of the digital revolution means that the banking industry is no longer limited to recording and managing money and credit in the traditional way. Information technology gives people more choices, so that we cannot only simply hold loans on the balance sheet until maturity, banks can now split and redistribute credit at a negligible cost on the balance sheet.

The beginning of the digital revolution is accompanied by the rise of shadow banking. If expressed in a more popular way, shadow banking refers to institutions that operate banking business in the dark outside the spotlight of banking regulators. Figure 2.2 describes the number of liabilities of traditional banking and shadow banking from 1950s to 2010. It can be seen that before 1970, there was almost no shadow banking business. Before the 2007-2008 financial crisis, shadow banking was more important than traditional banking.

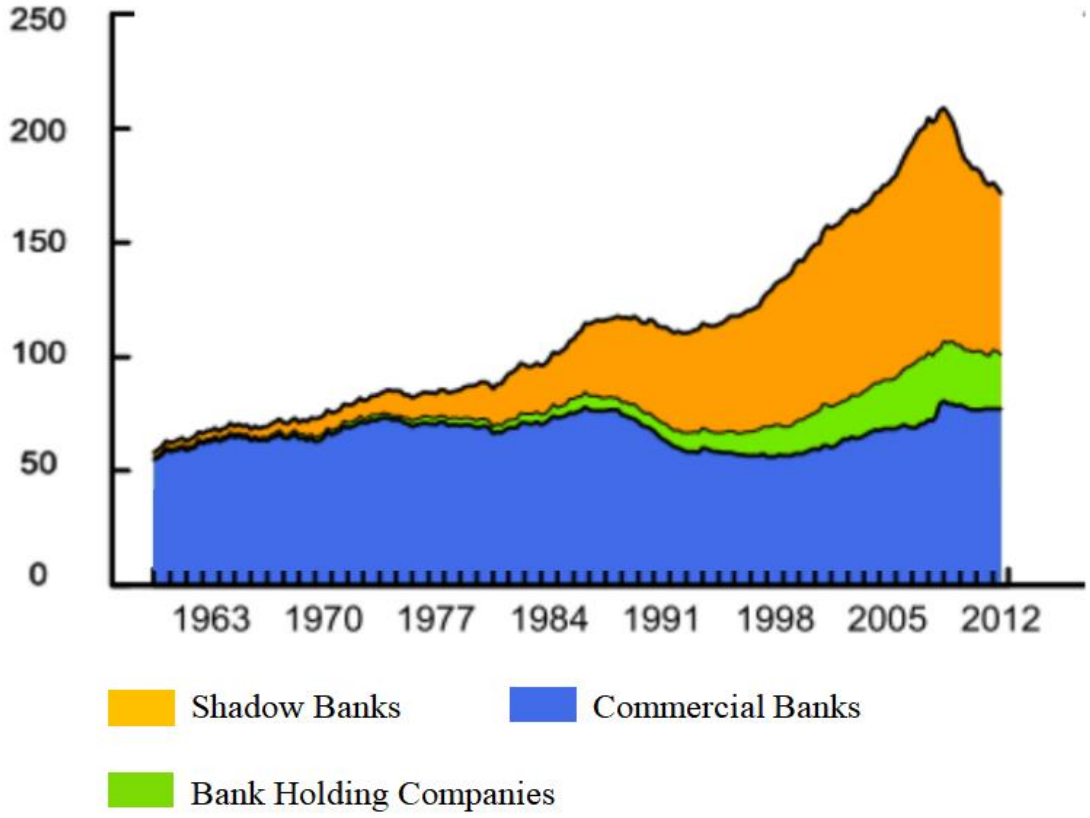

Figure 2.2 Financial sector liabilities (total liabilities as percentage of GDP)

Source: Federal Reserve Flow of Funds Report

2.2.3 Mechanism of shadow banking system risk

From the perspective of the financial system, L. S. Zheng (2009) pointed out that due to the change of credit term structure, there is time-mismatch problem in the financing of shadow banks. For example, when the stock market began to fluctuate and the initial market forecast turned into capital flight, investment banks, trust companies and hedge funds sold their stocks one after another. In this context, financial institutions such as private funds will have a phenomenon similar to "run". Due to the inability to quickly realize their long-term assets, financial institutions will be in a liquidity dilemma.

He and Zheng (2009) pointed out that once there are situations such as the shrinking value

of collateral and lack of market confidence, it will cause the shadow banking system to dispose of high debt businesses in low prices, resulting in the decline of asset prices, making the risks of the financial system continue to accumulate, and may eventually lead to systemic risks.

Yuan (2009) pointed out that the rapid development of the shadow banking system in the United States is mainly due to the vigorous development of the entire economic system driven by the capital market. In the financial system, high leverage operation, excessive financial innovation, excessive trading volume and so on make the financial system extremely vulnerable.

Du and Gu (2010) argue that shadow banking in the United States and even the world has risen and developed rapidly. Because of its high debt and vulnerability, it is a major factor leading to the current global economic crisis.

Y. Li (2011) pointed out that although "shadow banking" has increased the supply of social credit and ensured the effective operation of social economy, it has far exceeded the limitations of financial supervision, and the demand for supervision and management is also increasing.

The research results of Zhong and Xie (2011) show that compared with traditional banks, the shadow banking system has the characteristics of insufficient capital, lack of deposit reserve system, limited own funds, but a wide range of business. Through highly leveraged operations, its credit scale has expanded dozens of times. Due to the lack of supervision, shadow banking can make huge profits in this way, but their risks also accumulate rapidly.

The research results of C. W. Li and Yan (2015) show that different types of shadow banking have different degrees of impact on the financial market, among which the trust industry has the highest degree of risk spillover, followed by the securities industry.

P. Li (2017) points out that shadow banking has aggravated the vulnerability of China's financial system, increased macroeconomic leverage, and increased the cost of social capital. C. Li and Yang (2017) argue that the impact of China's shadow banking system on the real economy is relatively complex, including expanding financing channels, optimizing investment structure, converting idle funds into deposits, and improving capital liquidity.

The research results of C. Liu (2017) show that the role of shadow banking system on financial stability has a significant criticality, which shows an inverted "U" shape. K. Wang et al. (2017) believe that the evolution of China’s shadow banking since 2008 fully reflects the repeated game between financial innovation and financial regulation.

Fang and Quan (2018) shows that the expansion of shadow banking has a positive impact on China's real estate market interest rates, real estate prices, stock prices, the real exchange rate of the RMB indicators. G. Y. Wang and Zhang (2018) point out that expanding the scale of

shadow banking can effectively balance the allocation of funds, and thus promote financial stability in the near future. Because the risks inside the shadow banking system will gradually accumulate and spread to the normal financial system and the real economy, its impact on the financial system has a certain lag. Strengthening financial supervision can prevent risks within the shadow banking system from transferring to each other and weaken their negative effects.

2.2.4 The cause of shadow banking in China

(1) Regulatory Arbitrage

Deposit loan ratio restriction, credit scale control and interest rate control are important factors driving financial institutions to participate in the regulatory arbitrage of shadow banking. Hachem and Song (2021) find that the strong regulatory measures taken by Chinese regulators led to the rapid expansion of China's shadow banking business after 2008. The regulatory red line of 75% deposit loan ratio of commercial banks is the main reason for this phenomenon. Through the comparative study of large banks and small and medium-sized banks, they believe that small banks need to absorb residents' deposits through high-yield financial management under the regulatory pressure of deposit loan ratio, while large state-owned banks restrain small and medium-sized banks from absorbing deposits in disguised form by reducing interbank lending to small and medium-sized banks.

J. H. Cai et al. (2019) believe that bank financial products are the most representative shadow banking business. Commercial banks have effectively reduced the deposit loan ratio by increasing the sale and promotion of financial products.

Acharya et al. (2021) analyzed the reasons for the growth of bank wealth management products and found that regulatory arbitrage under the requirements of capital adequacy ratio and deposit-loan ratio promoted the issuance of wealth management products, which became an important part of shadow banking. Second, credit scale control is also important in the regulatory arbitrage of commercial banks and the development of shadow banking.

Elliott et al. (2015) finds that off balance sheet credit of commercial banks is the main part of the scale of China's shadow banking, and the rest is mainly financed by non-bank institutions. The main reasons for off balance sheet credit are deposit loan ratio, credit flow control and other factors.

T. Li (2014) believes that the strong supervision of commercial banks under various institutional constraints of the government has led to the continuous expansion of shadow banking. The reason is that the enhanced supervision of commercial banks by the government

has led to the reduction of credit financing obtained by private enterprises from the financial market, and the financing gap of private enterprises has forced their demand for shadow bank credit to increase.

Y. P. Huang (2012) studies the relationship between bank deposit and loan interest rates and the scale of shadow banking, and believes that the asset return rate based on deposit and loan interest rate pricing was low, which increased residents' investment demand for high-yield financial management and other asset management products, resulting in the growth of shadow banking business.

(2) Monetary Policy Regulation

There is a strong correlation between the rapid expansion of shadow banking and monetary policy regulation. Gao (2018)verifies that China's shadow banking is counter cyclical from both empirical and model aspects through time series method and DSGE model.

Allen et al. (2021) analyzes the entrusted loan data of listed companies. The results show that the proportion of entrusted loans between nonaffiliated enterprises flowing into the real estate and construction industries is as high as 50%. In other words, the capital demanders of shadow banking are mainly high leverage industries such as real estate and construction. These enterprises obtain off balance sheet loans through shadow banking, and the financing cost is high. They believe that the period of substantial growth of entrusted loans is mainly the period of tightening inter-bank credit resources, that is, there is a reverse relationship between monetary policy and shadow banking.

Y. B. Chen et al. (2018) use micro statistics on the entrusted loan announcement data of listed companies and the accounts receivable investment data of listed banks. Through empirical and theoretical research, they found that on the one hand, the tightening of monetary policy will directly lead to the expansion of on balance sheet shadow banking behavior. on the other hand, it will force banks to transfer on balance sheet assets to off balance sheet. Entrusted loan has become an important way to promote the growth of on balance sheet and off-balance sheet shadow banking scale.

(3) Commercial Bank Competition

Gorton et al. (2010) believed that commercial banks' pursuit of more market share and profit is the main driving force for the development of shadow banking.

By building a theoretical model, Hakenes and Schnabel (2010) find that when the competitive environment of banks is relatively fierce and the information is opaque, banks have stronger motivation to reduce credit standards, which will increase off balance sheet high-risk loans and increase the scale of shadow banking.

This is consistent with the research results of Ahn and Breton (2014) on loan securitization and loan competition. Y. Guo and Zhao (2017) use the issuance of non-breakeven financial products to represent the scale of shadow banking. The results show that deposit competition will significantly increase the scale of shadow banking. At the same time, when the traditional on balance sheet business is subject to regulatory constraints, the increase of regulatory constraints will promote banks to operate more aggressively through shadow banking under competition.

Based on the data of Chinese listed commercial banks, A. Zhou (2019) uses the bank concentration index to measure the bank competition environment, conducts an empirical study on the relationship between bank competition and shadow banking, and finds that the degree of competition of Chinese commercial banks continued to increase, bank competition became one of the important reasons for the expansion of shadow banking scale, and banking competition had a rapid impact on the growth of shadow banking scale for a long time.

(4) Government Financing Demand

Z. R. Zhang (2020) finds that government financing demand also plays an important role in promoting the development of shadow banking. There is a long-term and stable relationship between national shadow banking and local debt. Z. R. Zhang and Zhao (2018) also find that local government debt significantly promotes economic growth and the scale of shadow banking in another study.

Z. Chen et al. (2020) prove that China's local government debt is an important reason for the development of shadow banking. Specifically, China's four trillion stimulus plan driven by bank loans in 2009 faced the pressure of extension after the tightening of local government debt control in 2012, which increased the issuance of urban investment bonds and entrusted loans from 2012 to 2015 and promoted the development of financial products.

2.2.5 Research on the impact of shadow banking on the risk of commercial banks

Delis and Kouretas (2011) believe that shadow banking is under regulated, its operation mode information transparency is not high. Participants' information asymmetry, coupled with its own serious maturity mismatch problem, is leading to increased liquidity risk in the financial market, which may itself lead to systemic risk of banking system.

Gorton et al. (2010) believe that the shadow banking system in developed countries will aggravate the overall systemic risk of commercial banks. Salah and Fedhila (2012) explored the relationship between asset securitization and commercial bank risk by using the data of

American commercial banks from 2001 to 2008. The results show that with the development of asset securitization business, the credit quality will deteriorate, which will lead to the rise of credit risk.

Singh and Pozsar (2011) pointed out that due to the continuous innovation of financial products, shadow banking leads to increased risk, which is more likely to cause systemic risk. Delis and Kouretas (2011) proposed that due to the lack of adequate supervision of the shadow banking system, its business chain is lengthy, debt, information asymmetry among participants, and important information has not been disclosed in time. In addition, due to its endogenous maturity mismatch, the liquidity risk in the financial market has been further amplified, which is likely to cause the whole systemic risk.

Gennaioli et al. (2013) proposed that when banks use shadow banking business such as asset securitization to disperse risks, on the one hand, the requirement of bank adequacy ratio is better met; on the other hand, the market system risk is constantly increasing. Therefore, the unsystematic risk accumulated by the credit default swap and securitization assets held by commercial banks will spread to the whole banking industry by means of herding effect, which will lead to a run crisis in the banking system and eventually lead to the collapse of the banking system.

Dong et al. (2014) classify Chinese commercial banks into three groups: government-controlled, state-owned enterprise controlled and private controlled, using data from 108 commercial banks between 2003 and 2011, it is concluded that government-controlled commercial banks are riskier (relative to the other two larger categories).

P. Y Sun et al. (2011) believe that commercial banks have to provide certain implicit guarantees for their own shadow banking, which requires them to bear the risks of funding and credit caused by the timing mismatch, thus reducing the banks' operational performance.

J. G. Zhu et al. (2016) evaluate the causes and impacts of "shadow banking" by Chinese commercial banks using the scale of "buy-back" activity as an indicator, based on the imbalanced panel data of 161 commercial banks from 2006 to 2012. The development of "shadow banking" by commercial banks increases their operational risks and reduces their overall return on capital. In this context, shadow banking is used by banks to prevent negative effects caused by the limitation of credit scale.

X. M. Lu (2014) believes that shadow banking makes capital flow repeatedly among financial institutions, which will increase the loan cost of enterprises, reduce the profits of enterprises, increase the possibility that enterprises cannot repay and pay interest when they are

due, and increase the risks faced by the banking system.

Xiao and Ruan (2014) analyzed the specific operation mode of interbank business of commercial banks, and concluded that the interbank business weakened the supervision, and the inter-bank business strengthened the operational relevance among financial institutions, which was easy to cause systemic risk.

Using the data of 14 listed banks from 2007 to 2017, S. X. Zheng (2017) empirically concluded that the relationship between shadow banking business and banking system risk of China's commercial banks is a nonlinear U-shaped relationship.

L. P. Zhou (2012) pointed out that, China's shadow banking system and commercial banks have the same credit creation process. Its essence is to transfer the credit and loan business of banks, not involving complex derivatives. China's shadow banking are mainly funded by issuing high-yield instruments to meet the needs of borrowers. However, in this process, the financing cost of the debtor will be pushed up. Therefore, the inherent defects in this process doomed the shadow banking to have its own vulnerability.

Wei et al. (2013) believe that shadow banking is an aggressive and high-risk asset allocation of financial institutions, which is greatly affected by the bank's ownership structure.

N. Guo et al. (2018) believe that commercial banks transfer on balance sheet assets to shadow banking, and also introduce a large number of hidden shadow banking risks into the bank. In the business transactions and capital trading channels between commercial banks, they successfully continue to transfer the risks to the whole commercial banking system, providing a fuse for the formation of systemic risks in the banking industry.

C. S. Wu et al. (2018) find that the main funds of shadow banking are invested in infrastructure and real estate. However, with the gradual slowdown of China's economic growth, the demand for some infrastructure and real estate is getting lower and lower. These trends will lead to the shadow banking business no longer having a high return on investment, and it is difficult to compensate for the high cost of raising funds, resulting in the credit risk of commercial banks.

C. H. Guo (2018) selects the data of 16 listed banks in China and measured the shadow banking business by "the scale of non breakeven financial products issued". However, the part invested in bonds, monetary funds and other fields does not belong to the scope of shadow banking, so it is deducted. The study finds that the core driving force for commercial banks to engage in shadow banking business is to reduce capital consumption, which can be realized by moving the original credit assets into specific items on the balance sheet or even outside the balance sheet. Shadow banking business significantly increases the risk of commercial banks.

In addition, joint-stock banks and urban commercial banks are more inclined to engage in shadow banking business than state-owned banks.

Y. B. Chen et al. (2018) point out that although the shadow banking activities carried out by commercial banks meet the financing needs of some real economies, there are huge hidden risks behind the sharp increase in the scale of shadow banking.

Hou and Huang (2020) point out that under the impact of tightening supervision, commercial banks reduce the capital occupation of corporate loans by holding unregulated shadow banking claims, so as to meet regulatory requirements. These characteristics indicate that the effectiveness of regulatory policies only targeting commercial banks has been weakened.

2.3 Fintech and commercial banks' risk-taking

2.3.1 Related research on financial technology

2.3.1.1 The connotation of financial technology

From a broad perspective, the concept of Fintech may cover the business model of the entire financial industry (Figure 2.3). In the global financial technology report, Lines (2016) argued that Fintech is the dynamic convergence of financial services and information technology instruments.

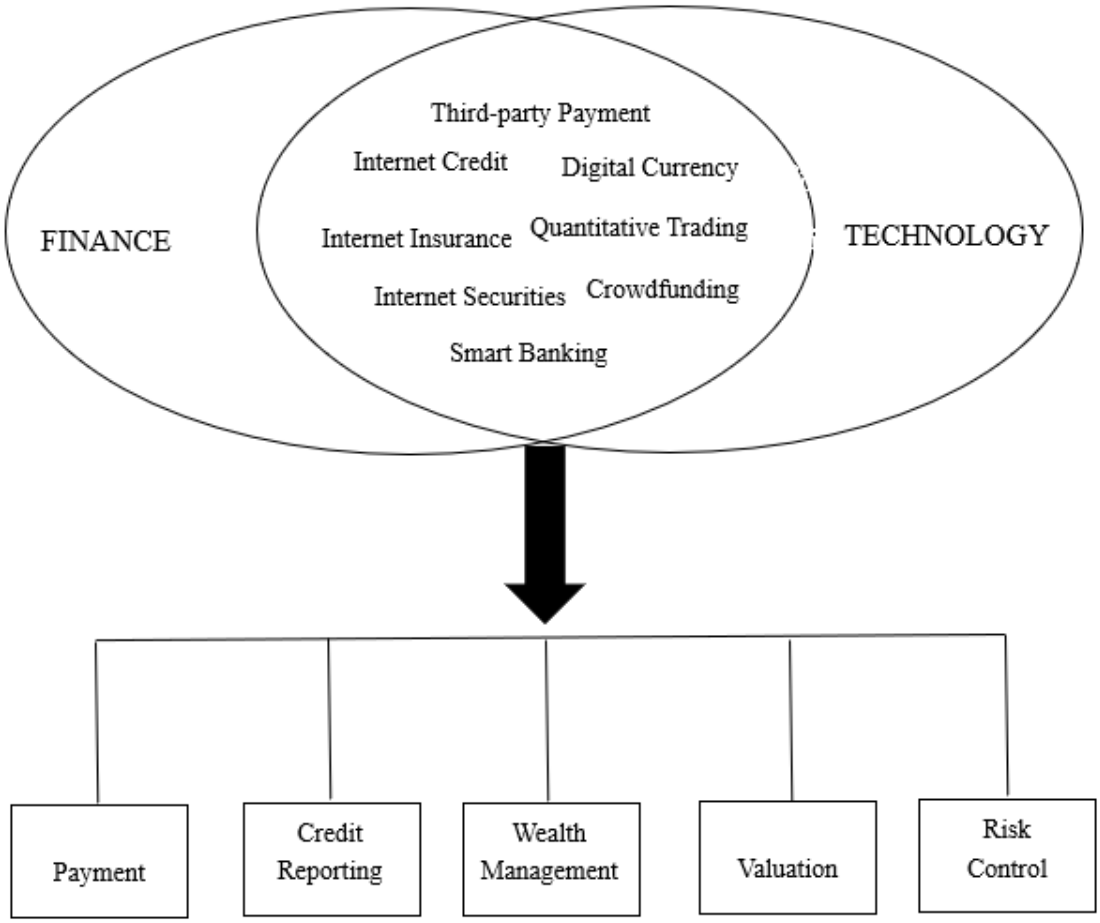

Figure 2.3 New models and tools for Fintech

Source: Summarize by Author

According to M. Li (2016), Fintech is fundamentally a business model, and the intersection and integration of science, technology, and finance is profound and broad. The convergence of finance and technology will increase the efficiency and vitality of the financial industry, hence promoting its development.

According to W. H. Li and Jiang (2017), Fintech can be classified into four categories: payment and settlement, market construction, deposit and financing and investment management. Fintech, according to Yue and Liu (2017), is a series of technologies that affect investment, lending and financial institutions, financing, financial services, and the operation of money.

Puschmann (2017) believes that Fintech integrating advanced technologies such as artificial intelligence (AI) and big data with the business mode of financial industry, creating a new financial product and service.

Zhuang (2019) pointed out that Fintech refers to those series of emerging frontier technologies that can improve financial efficiency, including four technologies: AI, blockchain,

cloud computing and big data.

Mishkin (1999) believes that, on the one hand, technological progress has greatly improved the asymmetry of information, thereby enhancing the liquidity of the financial market. On the other hand, technological progress has also significantly reduced transaction costs, which has promoted the emergence of more financial services, thereby expanding market capacity. Under the joint action of the two driving forces, the efficiency of the financial system has been greatly improved. However, scientific and technological progress has brought major challenges to the regulatory authorities. For example, more complex financial products and services will appear in the market, but the risk management of these products and services may lag behind.

P. Xie and Zou (2012) believe that the Internet financial model can expand the scope of transactions, so that the risks of the financial market can be dispersed to other ways, rather than direct financing. In the framework of CAPM, individual risks are completely allocated and there is only system risk.

Y. Zhao and Zhao (2016) incorporate the structural characteristics of social networks into the consumer-based macro model and analyze the structural characteristics of their social networks. They point out that its impact on the social capital market will increase the volatility of stocks, because it will increase with the expansion of the Internet.

T. H. Zhu and Chen (2016) make a comprehensive analysis of the potential risks and supervision of Fintech, and point out that Fintech can effectively promote resource allocation, enhance risk management ability, reduce risk concentration and promote the stability of the financial market. However, traditional financial risks have become increasingly prominent, especially IT risk. Fintech refers to a kind of emerging enterprises that provide financial services through technology driven mobile or online platforms (Magnuson, 2018).

Greg et al. (2018) analyzed the correlation between financial technology and shadow banking in the United States, and concluded that financial technology plays a critical role in promoting the rapid development of China's shadow banking. Compared with shadow banking that do not use financial technology, shadow banking that use financial technology can allocate its credit resources and invest more to better borrowers, thereby improving resource allocation across the financial system.

Brainard (2017) believes that cooperation between traditional financial institutions and fintech enterprises can achieve a win-win situation. In terms of financial technology companies' access to customer data and payment systems, if these problems can be properly handled, the innovative role of financial technology for traditional financial institutions will far exceed its "destructive".

T. Y. Guo and Ding (2015) believe that Fintech can expand the boundaries of traditional finance, solve the imbalance problem under the existing financial system, and allow financial services to cover customer groups that previously could not obtain financial resources at low cost.

X. Q. Wu (2015) argues that, on the one hand, through technical means, it breaks the traditional space-time limitations and gather the existing capital resources to achieve flexible and fast financial services and improve the effectiveness of resource allocation. On the other hand, financial technology can use frontier technology and big data technology to solve the incompleteness of the relationship between supply and demand, and improve the transparency of financial market.

The Financial Stability Board (FSB) defines Fintech as emerging business models, applications of new technologies, and new goods and services that are driven by cutting-edge technologies with a significant impact on the supply of financial services and financial markets, such as big data, artificial intelligence and cloud computing. People's Bank of China pointed out in the “Fintech Development Plan (2019-2021)” released in 2019 that Fintech is an important element of financial innovation, which aims to promote financial development by innovating and innovating financial products, business models and business processes through advanced technological means. It can be seen that the essence of Fintech is the empowerment of finance by technology, and the improvement of financial capabilities and efficiency is achieved through technology, data and scenarios.

To sum up, Fintech only needs to do two things well, that is, enable and connect. The former includes the realization of services through the support of technology, products, risk control, and big data, thereby improving efficiency and preventing risks. The latter is an organic combination of finance and technology, from business model, product architecture to implementation operations, and so on, to achieve effective operation.

2.3.1.2 The main technology of financial technology

McKinsey Global Institute (2011) proposed that big data technology is high growth rate, diversified information assets, and corresponding data mining analysis technology. Big data refers to the huge data collection which cannot be captured, screened, processed, stored, managed and analyzed by traditional data software. It is often characterized by large scale of data, rapid data flow, diverse data types, and low value density of data. The core value of big data technology lies in prediction, that is, big data combined with cloud computing can enable data analysis and prediction, and help us find relevant relationships from disorderly data

sequences.

Sultan (2013) believes cloud computing is a new IT service model, which refers to the use of networks to deliver IT services (including hardware and software). He says compared with traditional information technology, cloud computing technology also has some new technical features, such as elasticity, pay on demand, resource pool, and so on. These are functional features that traditional information technology does not have. Emerging IT technology will bring new IT capabilities to the enterprise.

Yang (2016) pointed out that the essence of blockchain technology is a kind of distributed accounting technology. Relying on this technology, all transactions on the blockchain will be truly recorded. X. L. Gong et al. (2017) believe that the essence of blockchain is actually a shared information distributed accounting technology formed according to the network.

F. Li (2017) believes that AI has mainly experienced three progressive intelligent stages: calculation, perception, and cognition. According to the optimization degree of AI algorithms, AI is divided into deep learning, reinforcement learning and transfer learning. In the deep learning stage, AI obtains the ability to solve problems, which makes the computer's ability to recognize and judge images, speech and language close to or even surpass the human level; in the intensive learning stage, AI obtains the ability to solve problems better, and the computer learns the behavior that produces the best results through repeated exercises and by adjusting the algorithm; in the stage of transfer learning, AI gains the ability to draw inferences from one instance. Based on the existing models, computers transfer their principles to another related field and play a role. At present, AI has been widely used in financial forecasting and anti-fraud, financing and credit extension of intelligent system.

Y. S. Huang (2017) believes that China's large and medium-sized financial institutions have basically completed the process of financial computerization and started to prepare for financial technology, but some small-scale rural financial institutions are still in the process of gradually promoting electronic informatization. Rise of AI has three pillars (Figure 2.4). Among these three pillars, data is the foundation, algorithms are the engine, and computing is the platform. In Figure 2.5, the relationship between big data, blockchain, cloud computing and AI is summarized.

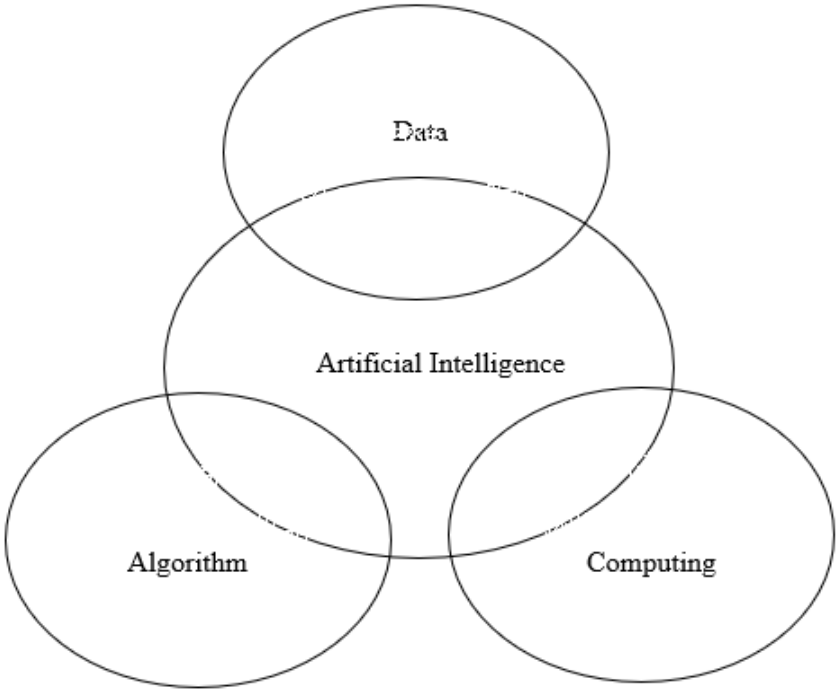

Figure 2.4 Three core pillars of AI

Source: Summarize by Author

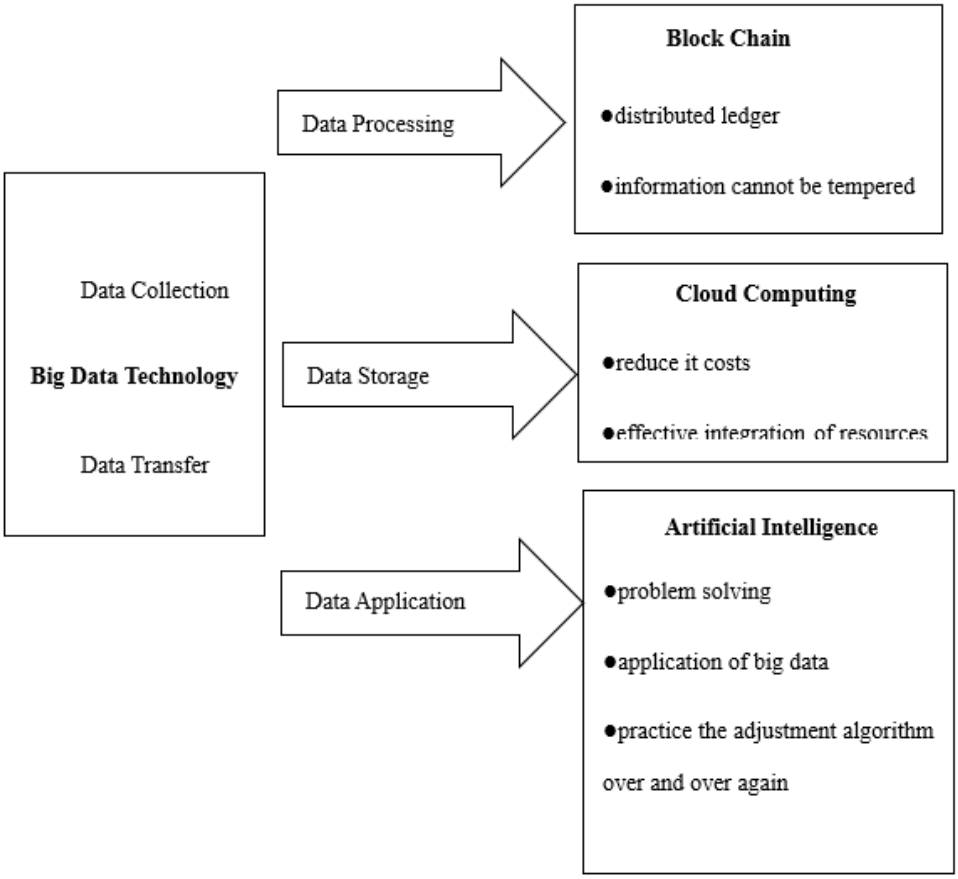

Figure 2.5 The logical relationship diagram of the main technologies of financial technology

Source: Summarize by Author

2.3.1.3 Distinction of internet finance and financial technology

In China, Internet finance was synonymous with financial technology a few years ago. Xi (2016) pointed out that "Internet finance" is actually a new name or new application created by China, and "Fintech" is the most popular one in the world. The “2014 China Financial Stability Report” issued by the people’s Bank of China officially defines Internet finance: “Internet finance is generated by the integration of Internet and financial industry, and becomes a unique financial model including capital circulation and financial intermediary function through Internet technology and mobile communication.” Internet technology can directly build a financing bridge for both the supply and demand of funds, weaken the offline functions of traditional financial intermediaries (such as commercial banks and securities companies), and focus on creating better products and services for financial market participants to adapt to different scenarios. It is an innovation of business model. Under the Internet financial model, transaction costs will decrease, information asymmetry will weaken, information sharing will become much more convenient, capital allocation efficiency will be greatly improved, and the function of the whole financial system will be fully realized.

L. H. Wang (2017) points out that financial technology is developed on the basis of Internet finance, and the literature and results of previous research on Internet finance are still applicable to financial technology. R. Z. Li and Shen (2017) emphasize that Internet finance is only an important part of financial technology. Yi (2017) believes that the concept of “Internet finance” is to use Internet technology to expand traditional finance, and it only reflects the appearance; Fintech not only uses modern technology to improve the efficiency of the whole financial service and create new markets, new business models and new financial service needs, but also changes the way of credit acquisition, rating and credit risk pricing.

As shown in Figure 2.6, Internet finance only focuses on the user application layer. On the one hand, Internet enterprises develop and sell some financial products and services, such as Internet insurance, in the banking business segment with the help of their massive user data. On the other hand, with the help of the Internet, banks are vigorously developing Internet financial products online and expanding online sales channels. Fintech is a deep integration of technology and finance, and further extended to the business layer, risk control layer and basic (clearing) layer (including rule setting, system interaction).

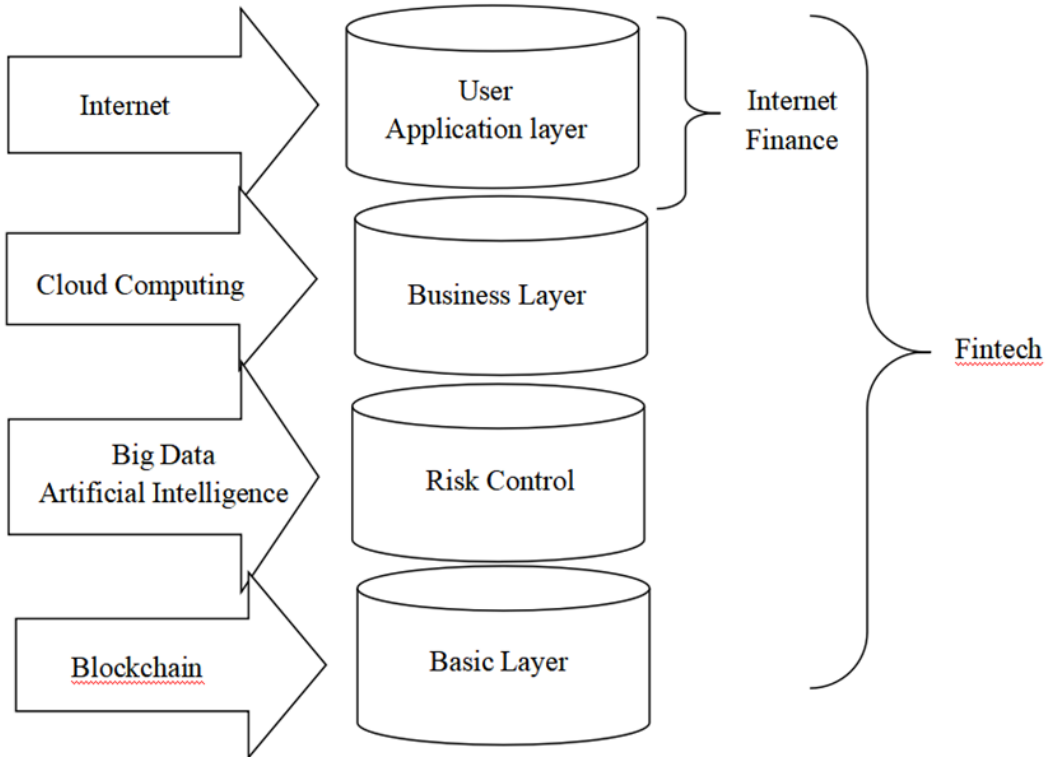

Figure 2.6 The difference between Fintech and Internet finance

Source: Summarize by Author

Therefore, Fintech focuses more on technology. With the help of big data, cloud computing, AI, blockchain and other technologies, it is applied to marketing, risk measurement, investment decision-making, and so on to carry out a series of systematic transformation and innovation in the financial industry. Compared with Internet finance, its impact is more far-reaching and extensive. With the continuous development of technology and the continuous evolution of the characteristics of financial business, the connotation of financial technology is also constantly enriched.

Generally speaking, financial technology includes at least two aspects. On the one hand, the financial industry applies science and technology to transform the existing products, services and business processes; on the other hand, Internet companies and other new market participants provide new products and services, and then impact the existing main operation and competition mode of the financial market. In the context of the existing market and technology, financial technology is usually understood as the improvement of traditional financial business model and process based on cutting-edge technology, so as to reduce costs and improve efficiency, or the financial reform based on technology, creating a new model, fundamentally changing the existing form of financial business.

2.3.2 The integration of technology and finance has gone through three stages

The first stage was financial electronation, that is, financial businesses such as bills are presented in electronic form. The use of computers greatly improves the efficiency of background processing in financial institutions; The second stage was financial networking and financial mobility. The combination of Internet technology and scenarios has greatly changed the way users interact, such as WeChat, Facebook, Skype, and so on, thus expanding the coverage of finance.

(1) The first stage: information technology promotes financial electronation

Generally speaking, the first stage of financial technology development mainly affects the electronic development of financial business, and the positive role is to improve the office efficiency and reduce costs of financial institutions. However, the main financial business has not changed significantly in this stage.

In general, the first stage of financial technology development is mainly to promote the electronic financial business, the positive role is to improve the office efficiency of financial institutions, reduce costs, but the main financial business has not changed significantly.

(2) The second stage: enrich the application of financial business in the Internet era

The rapid popularization of the Internet provides a new idea for the development of the financial industry. The reason is that the Internet can break through the constraints of time, space and geography, so the financial business begins to develop from offline to online. The development of online banking not only further reduces the operating costs of banks and expands the coverage of banks, but also greatly improves the efficiency of information transmission in the whole financial system due to the rapid transmission of information by the Internet. Online banking has become a field of development of major banks. In 1995, the first U.S. security network bank was established, which was the first financial institution in the world to be named after the Internet bank.

Internet banking can be regarded as the migration and expansion of traditional financial business in the channel, and the further innovation of Internet in the financial industry has brought more abundant financial applications. For example, mobile payment, online lending, financial investment, and so on. For example, in 1998, PayPal was founded in the United States. Its advantage lies in helping buyers and sellers solve the payment problems in various transactions. In 2004, Alipay was put into use in China and quickly became the third-party payment platform widely used on the basis of electronic business platform. For another example, the world’s first P2P online lending company named Zopa appeared in the UK,

mainly for borrowers and lenders to be able to directly connect to the online lending platform. The above financial business is the innovation of financial business based on the Internet, which makes finance more abundant and scenario application in daily life.

(3) The third stage: frontier technology promotes financial change

We can regard the "second stage" as the era of Internet finance, which focuses on the use of Internet technology to achieve more financial applications and provide more scenario-based services. And this third stage is to put technology in a more important position, because this stage has higher requirements for technology, not only limited to the Internet, but also including a series of cutting-edge technologies, such as big data, blockchain, cloud computing, AI, biometrics, and so on. People use these cutting-edge technologies to actively promote the reform of financial business. Some technologies have been successfully applied to specific financial business processes, such as big data and cloud computing, which have played an important role in credit reference, credit rating and wealth management. Some technology applications are still at an exploratory stage, such as the decentration of blockchain accounting or its information storage. In order to become a more mature financial business model, more time needs to be spent on R&D and improvement, including the synchronous follow-up of relevant laws and financial supervision.

2.3.3 Three stages of banks' development from traditional finance to Fintech

(1) Market Perception Stage

In this phase, banks slowly realized that the main reason for developing Fintech in the face of a competitive and dynamically changing market environment is because they have strong dynamic capabilities (X. Zhang et al., 2019). Dynamic capabilities include, among others, organizational innovation capabilities, which are the ability of firms to respond to changes in the market environment by integrating or reorganizing resources with the aim of gaining core competencies (Day, 2011). According to dynamic capability theory, after perceiving that the market share of small and medium-sized customers is gradually occupied by Internet companies, banks have to think about how to reduce costs and improve efficiency, and in this process, it is found that resource integration based on information technology can achieve the expansion of long-tail customers.

(2) Resource Input Stage

With the investment of resources in information technology, banks began to gradually integrate technology with traditional financial services and products. However, this phase can

be characterized by high fixed cost investment (e.g., early online products required significant investment in development, design, testing) (P. Xie, 2015).

(3) Value Creation Stage

After the first two stages, the advantages of Fintech start to become significant. First, Fintech makes it easier for banks to gain insight into customer behavior. Banks accumulate data continuously, thus reducing information asymmetry to customers and, to some extent, reducing moral and default costs. Second, Fintech enhances network externalities (Van den Bulte, 2000). Given the same or similar transaction costs, customers will prefer banks that have more channels that are more convenient and faster. For example, banks continue to expand their branches to achieve better networked results. According to Metcalfe's Law, the value of the Internet is equal to the square of the number of network nodes, i.e., as the number of online users grows, the value added by banks will become larger and larger. The purpose of developing Fintech is to expand the coverage of financial services and expand the customer network. Finally, Fintech, as the foundation and carrier, promotes the diffusion, absorption and application of knowledge, which can significantly improve the learning curve and promote the innovation and development of business. For example, the application of mobile banking enables banks to collect more feedback and user needs, prompting the bank's product teams to get closer to the market faster and better in the subsequent product development process and meet the individual needs of users, while creating value for the bank itself (X. Zhang et al., 2019).

2.3.4 Motivations for the rise of Fintech in China

(1) Insufficient Growth Momentum of Traditional Finance

For a long time, China's financing channels and financing means are relatively single, most of the financing channels are bank loans, while most small and medium-sized enterprises is difficult and expensive. Although private financing can solve part of the credit demand, but there are more problems, which is not good for the stability of the financial system. At the same time, the interest rate differential on deposits has created a natural monopoly for banks within a certain range, limiting Chinese residents' need for diversification of investments and funds and making China's financial system more deformed. In such a general environment, the level of China's traditional financial market is still low and the traditional financial system lacks sufficient inclusiveness, which provides an objective environment for the development of Fintech (J. Z. Li, 2015; J. L. Wu, 2017).

(2) Fintech Enhances Financial Functions

Resource allocation effectiveness and information transparency have significantly enhanced under the financial technology environment to a certain extent (X. L. Gong, 2013; J. L. Wu, 2017). Fintech can, on the one hand, lower costs and increase the effectiveness of financial services. Fintech, on the other hand, has significantly increased market information openness. For example, big data credit collection, Fintech platforms can collect information directly from both parties involved in potential financial transactions through data collection and modeling techniques, thus expanding the coverage of customer groups.

(3) Fintech Promotes Financial Inclusion

For a long time, China's financial industry has been facing the problem of imbalance, and its resource allocation is characterized by the law of two-eight, that is, the vast majority of funds are occupied by 20% of consumers and 80% of long-tail needs are not well met, which leads to a large gap between the breadth and depth of financial services and expectations (T. Y. Guo & Ding, 2015). This situation will further imbalance the development of the financial market structure, which will in turn hinder the upgrading of the economic and social structures. The emergence of open platforms such as cloud computing, big data, AI, and blockchain can provide more financial products to more enterprises and individuals (S. G. Wang, 2013).

2.3.5 Evolution of risk characteristics of China’s Fintech development

The risk evolution law of China’s Fintech development is inseparable from the overall development stage of the industry (Figure 2.7). In the initial stage of the financial technology industry, the public still lacks sufficient understanding of the technological innovation and business model behind financial technology. Some enterprises organize Ponzi schemes and illegal fund-raising in the name of financial technology. Financial fraud has become the main risk at this stage. In the rapid growth stage, cross business and cross market financial technology innovations are emerging rapidly. Financial risks and science and technology risks are intertwined. Regulatory arbitrage and even systemic financial risks have become the main risk in this stage. In the highly competitive stage of the industry, the competition among enterprises is becoming more and more intense, and the data elements have gradually become the core competitiveness of financial technology enterprises. Some enterprises over collect and abuse consumers’ personal data in the name of big data credit investigation, and data security has become the main risk at this stage.

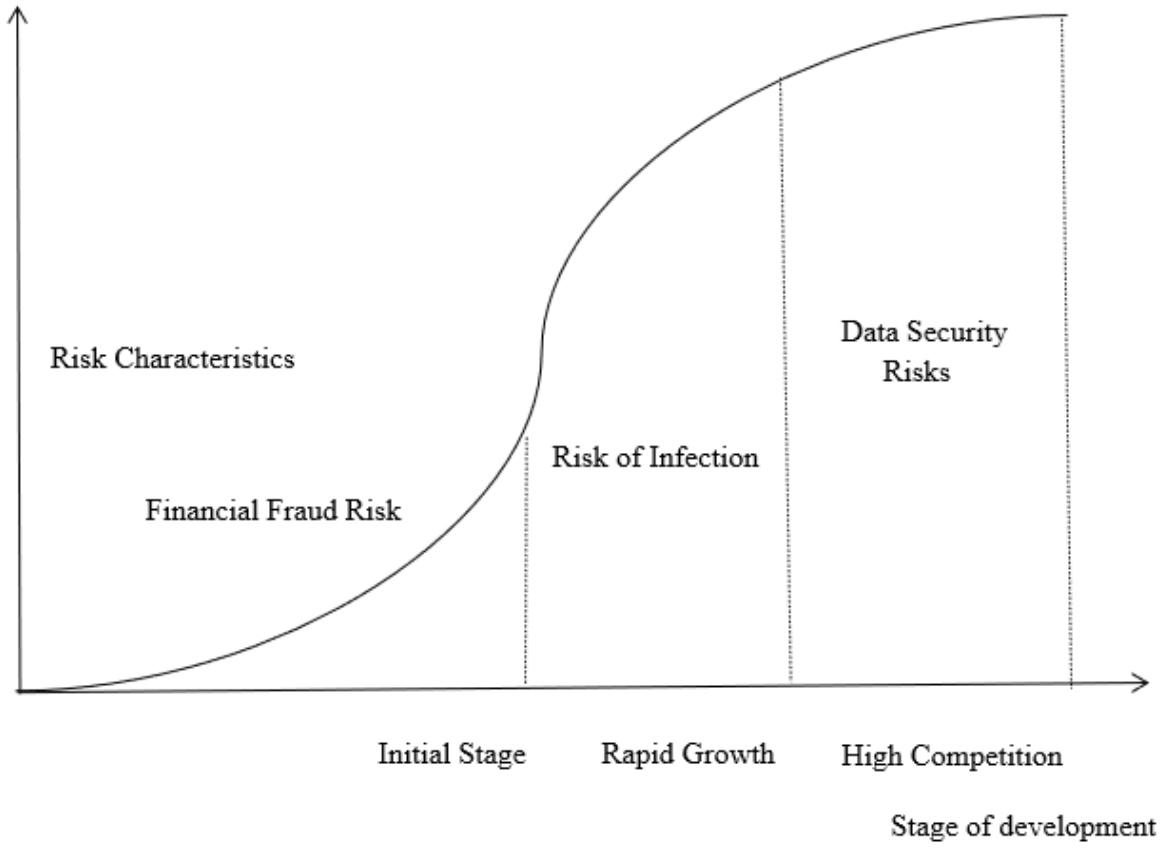

Figure 2.7 The main stages and corresponding risk characteristics of Fintech development in China

Source: Summarized by the Author

(1) Initial Stage - financial fraud risk

In the initial stage of the development of China's financial technology industry, the concept of financial technology has just entered the public view. Technology users, investors, regulators and other market subjects generally lack sufficient understanding of this new thing, which provides an opportunity for some bad enterprises. Among them, bad enterprises seize the public's disadvantage of asymmetric information about new things and they carry out traditional financial fraud such as Ponzi scheme and illegal fund-raising in the name of financial technology.

In this "mixed" market situation, these enterprises often use high-yield as the bait to attract investors, while enterprises really interested in financial technology innovation are "driven out of good money by bad money". Typical risk areas include peer-to-peer network lending (P2P) and virtual currency. These two risk areas have a large number of financial fraud cases, a large amount of money involved and a wide range of victims.

According to the report released by Net Credit Eye in 2018, since the "thunder year" in 2014, self-financing, capital pool and Ponzi financing have emerged one after another in the online loan industry. P2P online lending institutions began to face problems such as large-scale

bankruptcy, abandonment and difficult capital turnover. During the three years from 2015 to 2017, the number of newly closed and problem platforms in China was 1017, 1430 and 924 respectively. The number of virtual currency financial fraud cases has doubled year after year, and financial supervision is facing great challenges. According to the data of China judicial documents network (Figure 2.8), since 2009 there have been more than 5500 documents related to "virtual currency", and the number of documents is increasing year by year.

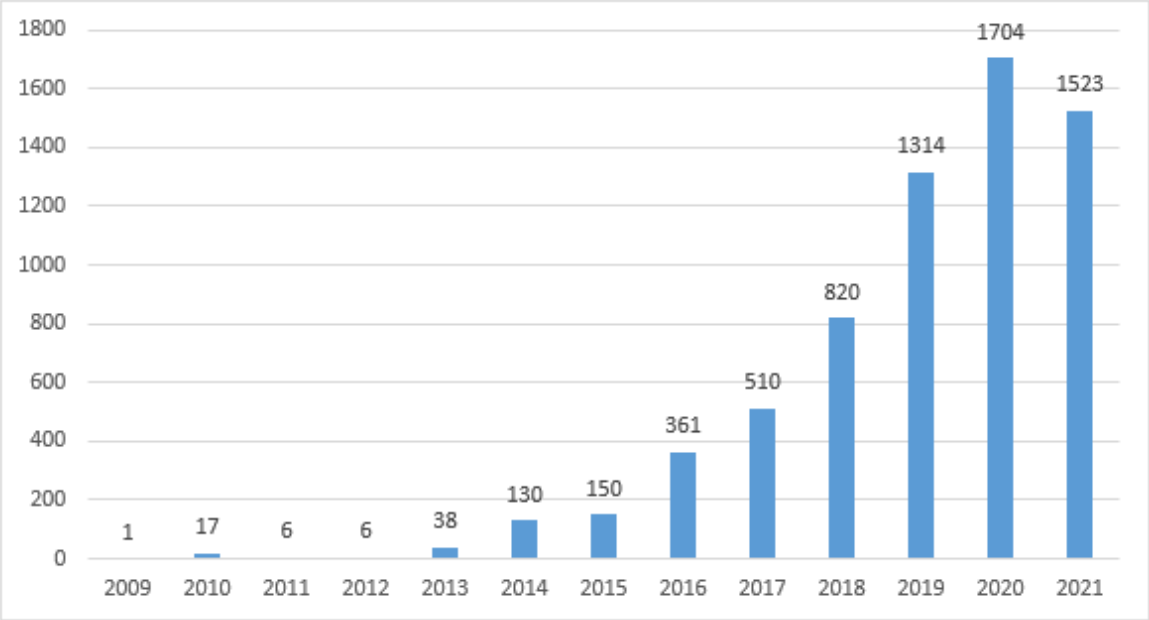

Figure 2.8 The number of documents related to "virtual currency" on China judicial documents network

Source: China Judicial Documents Network

(2) Rapid Growth Period - Causing Risk Infection

Financial technology has entered a period of rapid growth. Although explicit risks such as financial fraud have been valued and preliminarily controlled by the regulatory authorities, hidden risks such as regulatory arbitrage in the industry may still induce systemic financial risks. During this period, financial technology has made comprehensive innovation and development in payment, credit, financial management and other financial services. Due to the gradual increase of cross business and cross market business, the financial technology risk is more hidden and infectious. Once the financial risk accumulates for a long time, it may lead to systemic risk. For example, in the joint loan business, commercial banks have the advantage of capital cost, and the proportion of capital contribution is usually high. Some institutions are often able to leverage large-scale bank funds with extremely high leverage. Taking micro loan as an example, it was disclosed in the 2019 annual report (Social Responsibility Report) that the cumulative loans of micro bank reached RMB 3.7 trillion, but the 2019 annual report (balance sheet) showed that the balance of various loans was only RMB 162.9 billion, accounting for

about 4.4%. In other words, more than 3.5 trillion of lending funds are provided by other cooperative commercial banks. Once the risk control ability of Webank is insufficient, the risk of joint loan business will occur and spread to the commercial banks participating in joint loan.

(3) Highly Competitive Period - Prominent Data Security Risks

In the highly competitive period, the competition among financial technology enterprises is becoming more and more fierce, and more attention is paid to the core competitive resource of data elements. Relying on massive user data information, Fintech Enterprises can more accurately customize user portraits, so as to accurately analyze customers' potential financial needs and improve the marketing efficiency of financial services; At the same time, user portraits also help financial institutions fully understand customers' credit risks and further perform better risk control. However, in the process of collecting and using data, Fintech Enterprises also cause huge data security risks, which seriously infringe on the legitimate rights and interests of consumers. G. Z. Li (2020) points out that due to the general lack of privacy protection awareness of users, in many cases, they are even willing to obtain certain convenience at the expense of personal privacy, which will further aggravate the violation of personal privacy by enterprises.

2.3.6 Research on the impact of financial technology on the risk of commercial banks

First, some scholars believe that Fintech can increase the risk of commercial banks. Roger (1999) believes that Internet finance can change the traditional business model of commercial banks, and it also increases the risk-taking of commercial banks. X. Lin ((2014) believes that Internet finance forces the marketization of interest rates, promotes financial disintermediation, facilitate means of payment to be completed without the involvement of banks, challenges traditional service methods, and transmits market risk and technical risk to banks.

P. Guo and Shen (2015a) empirically investigated the relationship between Internet finance and risk-taking of commercial banks. The study found that Internet finance increased the risk-taking of commercial banks, and systemically important banks responded more prudently and soundly than non-systemically important banks.

Z. Y. Liu and Huang (2015a) believe that technology dependence, credit deficiency and operation failure of Internet finance will infect commercial banks and aggravate their risk-taking. Man (2016) believes that Internet finance has reduced the spread space of commercial banks and forced commercial banks to adjust their income structure to achieve more diversified income.

Y. Huang and Huang (2016) pointed out that due to the spillover of Internet technology, the operating efficiency of Chinese commercial banks has been significantly improved, and they will face a more severe market environment. Therefore, the operation and management of the banking industry will be increasingly challenged.

Cao et al. (2018) believe that Internet finance has changed the systemic risk of capital market, and the impact on small and medium-sized banks is more obvious.

Secondly, according to several studies, commercial banks' risk-taking is decreased by Fintech. Lapavitsas and Dos Santos (2008) believe that the advancement of Internet financial technology will relieve the problem of information asymmetry between banks and borrowers, hence assisting in the control of bank risks.

X. Q. Wu (2015) believes that with the help of big data, cloud computing and other technologies, commercial banks can improve their risk awareness of banks, reduce the bank's bad debt rate, and reduce the bank's failure risk.

Z. L. Liu and Lin (2016) conduct an empirical research of Internet finance and risk taking in China's banking business from the perspectives of risk management, operational efficiency, earnings level, and risk spreading. Internet finance improves commercial banks' operating efficiency, compensates for their negative influence on profitability and risk, and thereby reduces their risk burden. At the same time, there are differences in the risk-taking of Internet finance for different types of commercial banks.

Xing (2016) pointed out that according to the theory of banking system vulnerability, the three main factors affecting bank credit risk are competitive pressure, macroeconomic fluctuation and information asymmetry. Financial technology affects bank credit risk mainly by intensifying competition and reducing information asymmetry of commercial banks.

M. F. Lu (2019) believes that when a commercial bank makes a major decision, due to the subjective initiative of people, each decision-making subject will analyze from different perspectives (such as financial perspective, market perspective, and so on), resulting in great differences in the company's decision-making, which is not conducive to the company's long-term development. With the development of technologies such as AI, machine learning, and big data applications, it is easier for each decision-making body to reach consensus, thus improving operational efficiency.

Finally, several researches have discovered a two-way relationship between financial technology and commercial bank risk. According to Arnold and Saskia (2011), while Internet banking can cut operational costs and increase economic gains, it will also confront more concentrated market risks.

P. Guo and Shen (2015b) Based on information from China's banking sector, the link between Internet finance and commercial banks' risk-taking was experimentally investigated. The study discovered a U-shaped relationship between Internet finance and commercial banks' risk-taking, with early Internet finance development helping to improve the technical level of commercial banks and reducing risk-taking; and later, with capital cost increases for commercial banks, increasing risk-taking.

Y. J. Wang et al. (2016) find that in the early stage of the development of Internet finance, banks can improve their reserve absorption capacity and liquidity, but in the long run, Internet finance will increase bank financing costs and liquidity risks.

Gu and Yang (2018) conducted an empirical analysis on the role of Internet finance from an empirical perspective, and the results that Internet finance not only reduces the interest rate level, but also increases the risk burden of banking industry. However, the role of the former is greater than that of the latter, and is generally reflected in the way of its risk burden.

K. Wang et al. (2017) proposed that in the early stage of financial technology development, the risk-taking level of commercial banks was increased by compressing the profits of commercial banks, intensifying price competition, improving technical level and weakening intermediate costs. However, as the traditional commercial banks pay more attention to financial technology and increase cooperation with external institutions, banks can not only improve their efficiency, but also reduce their own risk-taking. In addition, to further promote the coordinated development between financial technology and banks, effectively improve the efficiency of banks and reduce risks, so the impact of financial technology on the risk of commercial banks is an inverted U-shaped.

D. Wang (2014) stratified banks, that is, large commercial banks have relatively high bargaining power in the deposit market, while small and medium-sized commercial banks may increase their financing costs due to the development of Internet finance, thus indirectly increasing their loan interest rates.

S. W. Wu et al. (2015) pointed out that Internet finance companies compete with commercial banks by weakening the payment and settlement functions of commercial banks and diverting the deposit business of commercial banks, increasing the risks of commercial banks.

Cuesta et al. (2015) analyze that the shift in consumer perceptions and behavior has prompted the banking industry to adopt new ways of doing business. And in the face of a multitude of fintech companies hounding them, banks have to respond appropriately so as not to lag behind their competitors. In the digitalization process of the banking industry, they

propose three successive stages of development: the first is the innovation and development of financial products; the second point is to make adjustments to the technological architecture; and the third is the system and institutional reform to determine their own strategic position in the digital process.

T. H. Zhu and Chen (2016) conducted a systematic analysis of the risks and supervision of financial technology, and pointed out that fintech can improve risk management capabilities, improve resource allocation efficiency, strengthen financial stability, and reduce risk concentration. But traditional risks will be more hidden in Fintech business.

Ye et al. (2018) believe that financial technology has become a common and important trend in the current global financial development, with the remarkable characteristics of financial disintermediation. Through the integration with various emerging cutting-edge technologies, it will affect the market concentration and change the financial market access threshold and market structure.

Meng and Su (2020) believe that the “market crowding out” effect and “technology spillover” effect of financial technology have compressed the original “system dividend” and “price dividend” of commercial banks, and exacerbated the market competition behavior of commercial banks.

Using 16 banks' financial indicators from 2013-2018 as empirical evidence, Xu (2020) investigates the impact that the development of Fintech has on the banking industry through this model. The results show that under the reform of China's financial system, Fintech companies have a greater impact on the traditional business of commercial banks such as lending and capital pooling due to their convenience and disruptive nature.

Xia and Tang (2020) argue that the development of Fintech has expanded the transmission channels of financial risks, making them more hidden and complex and regulation more difficult.

2.4 Summary

This chapter analyzes the connotation and characteristics of corporate governance, shadow banking and financial technology (including the differences between China and the United States) and their impact on the risk of commercial banks. But we need to think about the following issues:

(1) Why study small and medium-sized commercial banks? Because in literatures, almost all take listed banks or large-scale commercial banks (large state-owned commercial banks and

joint-stock commercial banks) as the research object. Small and medium-sized commercial banks have little research because of the difficulty of data collection. The author collected and sorted out the financial data and related information of 116 small and medium-sized commercial banks in China from 2011 to 2020, and also used WIND database, China Financial Yearbook, China Statistical Yearbook and other public information data.

(2) Why study the risks of commercial banks? Because commercial banks are enterprises operating risks, the level of risk management determines the core competitiveness of commercial banks. The level of risk management depends on "prevention" rather than "treatment". Therefore, the research on the risk sources of commercial banks is very important.

(3) Why the three dimensions of corporate governance, shadow banking and financial technology were studied as the research sources of small and medium-sized commercial bank risk? The reason is that corporate governance reflects the operation and management of commercial banks, and shadow banking measures the degree to which commercial banks actively increase leverage in pursuit of profits. Financial technology measures the risk-taking of commercial banks from the perspective of external forces impacting the profits and business model of commercial banks.

Through the literature review, we analyze the connotations and characteristics of corporate governance, shadow banking, and Fintech, and their impact on commercial bank risk. However, the existing literature does not provide clear conclusions on the impact of corporate governance, shadow banking, and Fintech on the risk of small and medium-sized commercial banks, and further in-depth research is needed.

To answer the above questions, the following chapters will discuss separately the three aspects of corporate governance, shadow banking, and Fintech. In terms of corporate governance, taking Baoshang Bank and Shanghai Pudong Development Bank, two small and medium-sized commercial banks in China as examples, it is analyzed that the weak links of corporate governance are the fundamental reasons for the risks of small and medium-sized commercial banks. For profit-driven and regulatory avoidance, comparing to large state-owned commercial banks, the nesting of shadow banking among types of commercial banks has resulted in more risk-taking for small and medium-sized commercial banks. From the perspective of changing the financial model through technology, Fintech combined with the market competitiveness of commercial banks further shows the development of financial technology has undoubtedly brought a huge impact on small and medium commercial banks.

The above three factors affect the risk of commercial banks from different dimensions (Figure 2.9). In the following chapters, we can have a preliminary understanding of their

relevance by discussing the impact of corporate governance, shadow banking and financial technology on risk. Then, the agency variables and control variables of corporate governance, shadow banking and Fintech are introduced into the same equation for regression, and the factors affecting the risk of commercial banks are considered as much as possible to reduce the endogenous problems caused by omitted variables.

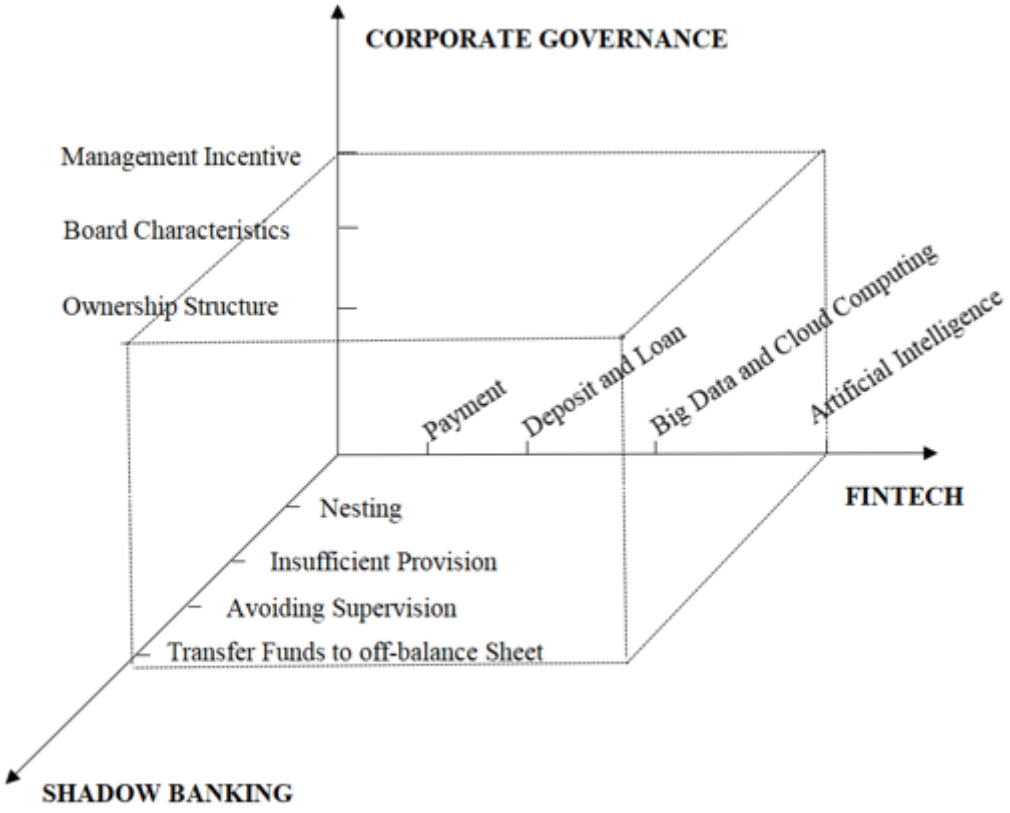

Figure 2.9 Three dimensional risk model

Source: Summarize by Author

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Chapter 3: Case Analysis

3.1 Why Baoshang Bank was suddenly taken over

Why study Baoshang Bank? The reason is that the Baoshang Bank is the third commercial bank to go bankrupt since the founding of the People's Republic of China (the first one to go bankrupt was Hainan Development Bank. The reason for bankruptcy was that Hainan development bank merged many rural credit cooperatives. These credit cooperatives were illegal lending, and the Shanghai real estate foam burst, so the Hainan development bank went bankrupt in 1998. The second bankrupt is the rural credit cooperatives in Shangcun, Suning County, Hebei Province, which went bankrupt in 2012. Since this rural credit cooperative had little debt when it went bankrupt, it basically had no impact). Considering the timeliness (on February 7, 2021, the First Intermediate People's Court of Beijing ruled that the Baoshang Bank was bankrupt) and the amount involved (about 156 billion yuan occupied by major shareholders), the author chose the Baoshang Bank as a typical case for analysis.

3.1.1 Case background and development

3.1.1.1 Background and ownership structure of Baoshang Bank

As can be seen from Table B-1 in Annex B, the top ten shareholders of Baoshang bank are all corporate shareholders, with a total shareholding of 48.93%, and it is also claimed in the audit report that there is no connection between the top 10 shareholders. However, the actual situation is just the opposite. On June 2, 2019, the relevant person in charge of the central bank said in reply to the reporter of the Financial Times that "the major shareholder of Baoshang Bank is Tomorrow Holding Limited Company, which holds 89% of the equity of Baoshang Bank. As a large amount of capital of Baoshang Bank is illegally occupied by the major shareholders, it is overdue and difficult to change for a long time. The serious credit crisis of Baoshang Bank triggered the legal takeover conditions to be taken over according to law. " As a non-listed city commercial bank, and the main shareholders are the affiliated companies of Tomorrow Holding Limited Company, once there is a problem in the concentration of shareholders, it will be more difficult to supplement the external capital at the due time.

3.1.1.2 Asset quality analysis

On June 28, 2018, the official information disclosure of Baoshang Bank said that it planned to introduce strategic investors, and the equity of major shareholders might change, so the 2017 annual report was not publicly disclosed for the time being. On May 24, 2019, the People's Bank of China and the China Banking and Insurance Regulatory Commission took over Baoshang's Bank for a period of one year. Therefore, only the financial data of Baoshang Bank from 2014 to 2017 are summarized (some of the financial data in 2017 are from China Financial News Network). In that financial data from 2014 to 2017 (Figure A-6), one notices the credit risk of Baoshang Bank is increasing, and its indicators are different from those of the listed city commercial banks in the same period. Since 2016, the credit risk of Baoshang Bank has increased even more, and there have been a number of illegal lending events.

According to the 2011-2016 financial reports (Figure A-5), from the perspective of its asset quality indicators: (1) non-performing ratio: the non-performing rate of Baoshang Bank increased from 0.45% to 1.68% from 2011 up to 2016. The non-performing rate of non-performing financial indicators in 2017 was 1.72%, which was still on the rise. (2) Non-performing pressure and non-performing identification: the proportion of special-mentioned loans increased from 0.82% in 2011 to 2.91% in 2016. From the perspective of non-performing identification, the proportion of overdue loans over 90 days in non-performing loans tended to rise, indicating that the identification of non-performing loans tended to be relaxed. (3) Provision coverage ratio: the coverage ratio dropped from the highest 332.20% in 2011 to 176.77% in 2016, while the average coverage rate of listed city commercial banks was 251% in the same period.

3.1.1.3 Analysis of capital adequacy ratio

As of the end of September 2017, the capital adequacy ratio of Baoshang Bank was basically equivalent to that of the end of June. In order to steadily promote the implementation of Capital Management Measures of Commercial Banks (Trial Implementation), the China Banking Regulatory Commission (CBRC) has also made regulation for the supervision of capital adequacy ratio during the transitional period. According to the relevant regulations, as of the end of 2017, the capital adequacy ratio requirements of non-systemically important banks were 7.1%, 8.10% and 10.1% respectively. According to the 2014-2017 (third quarter) report (Figure A-6), the tier one capital adequacy ratio and capital adequacy ratio of Baoshang Bank have been in a continuous downward trend since 2014, which shows that there were serious problems in the corporate governance ability and business abilities. As a matter of fact, at the

end of 2017 (Table B-2), the capital adequacy ratio of Baoshang Bank was only 9.30%, the requirement of tier 1 capital adequacy ratio was 7.28%, and the core tier 1 capital adequacy ratio was 7.28%. That is to say, compared with the third quarter of 2017 (Table B-3), it was still in a downward trend, and the first two items did not meet the relevant requirements of the capital approach.

3.1.1.4 Profitability analysis

Through the analysis of the most relevant indicators of profitability from 2014 to 2017 (Table B-4) (Figure A-7), it shows that the year-on-year growth rate of its operating income, net interest income and net profit decreased significantly from 17.96%, 11.21% and 18.43% at the end of 2015 to - 3.44%, - 14.75%, - 23.25% at the end of 2017 respectively, and the profitability showed a further downward trend.

3.1.1.5 Debt management capability analysis

Regulators say that banks under takeover have serious credit risks, that is, they question whether the banks under takeover can repay their debts in time. Therefore, the study of debt capacity of banks taken over should be the top priority of our analysis. Through the analysis of the relevant indicators from 2014 to June 2017 (Table B-5) (Table B-6), it can be clearly found that the debt scale of Baoshang Bank continued to increase. From the perspective of the debt level, Baoshang Bank was too radical in 2017, but went against the trend in reducing leverage in the interbank, and continued to increase liabilities. Compared with other items, deposit taking project has always been considered as the lowest cost source of funds for commercial banks. As can be seen from the Table B-5 and B-6, the proportion of deposits taken by Baoshang Bank has been declining since 2014, which are 58.38%, 54.42%, 48.20% and 42.80%, respectively.However, since 2017, the proportion of interbank liabilities in the total liabilities of the company has increased significantly, from nearly 71.7 billion yuan in 2016 to nearly 154 billion yuan in June 2017 (Table B-5), more than doubled. It can be seen that the company’s dependence on interbank funds is high, and the potential business adjustment pressure in the future is heavy.

3.1.2 Risk source analysis

3.1.2.1 Overall failure of corporate governance

In an interview with People’s Daily in January 2018, Guo Shuqing (Chairman of CBRC) said, "the main problem at present is that standardized shareholder management and corporate

governance do not keep in accordance. There are not only shareholders' inaction and action not in place, which leads to the problem of "insider" control, but also the problem of minority shareholders' disorderly offside and arbitrary interference in the normal operation of the bank. Some shareholders even regard the bank as their own ATM, wantonly carry out improper related party transactions and interest delivery". There are several serious problems in the following aspects, which led to corporate governance failure of Baoshang Bank.

First of all, the ownership structure is the key to the effectiveness of governance of commercial banks. It directly affects the distribution of control rights and the relationship between shareholders and managers. However, in practice, the phenomenon of "Tomorrow Group" and "one share dominance" makes its decision-making lack of science and democracy. Because Baoshang Bank's shares are too concentrated, according to the basic principles of "one share, one vote" and "capital majority system", it legally manipulated the company's board of directors and turned the company into a major shareholder. The formalization or "walking through the stage" of shareholders' meeting has become the legal cover for large shareholders to intervene and empty out the Baoshang Bank, and the shareholder supervision mechanism exists in name only. Since 2005, Tomorrow Group has carried out interest transfer by means of a large number of improper related party transactions, capital guarantee and fund occupation, and the Baoshang Bank has been gradually "hollowed out".

Secondly, for a long time, the supervisory board of the Baoshang Bank was a decoration, its inspection and supervision function had not really played a role. Among the seven supervisors (one shareholder supervisor, four employee supervisors and two external supervisors) of Baoshang Bank, the supervisors were all middle and high-level managers of Baoshang Bank. Due to their dual identities, the employee supervisors had to obey the orders of the board of directors or from management to a large extent; some supervisors lacked the necessary professional knowledge and ability to perform their duties well; The board of supervisors was not equipped with supervisors with financial professional background. As a result, the board of supervisors was not responsible to the company, nor to all shareholders, especially small and medium-sized shareholders, but was completely subjected to the orders of major shareholders, board of directors or management.

Finally, due to the failure of the Corporate governance structure of "three meetings and one level", the lack of check and balance mechanism and effective supervision, management not only provided help for the "Tomorrow Group" of the major shareholders to obtain huge amount of funds in violation of regulations, but also obtained credit funds through the bank's trade union registered enterprises, the establishment of small and medium-sized group companies

and development of strategic customers and other related transactions. These loans were basically non-performing, and most of the related transactions were not approved by the board of directors. Before the taking over, the non-performing loan rate of the related party loans approved by the "green channel" and "special affairs office" was as high as 98%; some related party transactions were collectively resolved by the senior management and issued based on the minutes of the bank's business meetings. The appointment and removal of cadres was not subject to organizational inspection. Performance appraisal and salary adjustment were based on relationship and personal preference of leaders. Large amount procurement was not subject to bidding and collective research, and leaders were above the system.

3.1.2.2 Asset side and liability side pressure is much higher than that of similar banks

As can be seen from Table B-6, from 2014 to June 2017, the "deposits from banks and other financial institutions" and "bonds payable" of Baoshang Bank increased by approximately RMB 75 billion and RMB 95 billion respectively. It can be seen that the bank made use of these 2 instruments of active liabilities to increase the size of liabilities (and assets at the same time) in a very blind (or purposeful) manner. In addition to part of the idle in the interbank market, a large number of inflows into the real economy was made. At the same time, due to the extension of the capital chain and the arbitrage link, the inflow part of the entity needs to carry out credit settlement. For the consideration of asset quality management, banks are generally motivated to keep enterprises and loans with good asset quality on the balance sheet, while off balance sheet assets are not included in the scope of non-performing loans, which is more convenient for hiding. Therefore, the credit risk of interbank certificates of deposit is more severe than that of on the balance sheet through the credit extension of outsourcing.

3.1.3 Summary

3.1.3.1 The whole process of Baoshang Bank

When the takeover group intervened in the case of "Tomorrow Group" in May 2017, it was found that since 2005, only the major shareholders had occupied the funds and accumulated up to 150 billion yuan, and the annual interest was as high as 10 billion yuan. It was unable to repay the principal and interest for a long time, and the degree of insolvency was beyond imagination. In the next two years, the Tomorrow Group and Baoshang Bank will carry out self-help and use all means to finance everywhere to prevent run. On May 24, 2019, it was taken over in accordance with the law. The takeover group fully exercised the operation and management rights of Baoshang Bank and entrusted China Construction Bank to trust the

business of the Baoshang Bank.

In June 2019, in order to thoroughly understand Baoshang Bank's background, underwriters adopted a market-oriented approach and hired a professional company to conduct in-depth investigations into Baoshang Bank's external and interbank business including its assets, financial status and business status. The results of assets and capital verification confirm that there is a huge insolvency gap in Baoshang Bank, and there is a serious credit risk when taking over. Without the intervention of public funds, ordinary creditors can only get the protection of up to 500000 yuan.

In September 2019, the reform and reorganization of Baoshang Bank was officially launched, but the market-oriented restructuring could not be carried out due to the huge loss gap and lack of investor participation. In order to ensure that the financial services of Baoshang Bank will not be interrupted during the reform and reorganization period, the takeover group learned from the experience and practice of international financial risk disposal, and according to “the Deposit Insurance Regulations” and other existing domestic legal systems, finally decided to adopt the way of acquisition and undertaking of new banks to promote reform and reorganization.

Mengshang Bank officially opened on April 30, 2020. On that day, the takeover team announced that Baoshang Bank would transfer the relevant business, assets and liabilities to Mengshang Bank and Huishang Bank (four regional branches).

Baoshang Bank filed for bankruptcy on November 17, 2019, citing the company's inability to repay its debts as they fell due and all of its liabilities. The first Intermediate People’s Court of Beijing ruled to accept the application on November 23, 2019.

On February 7, 2021, The First Intermediate People’s Court of Beijing made a Civil Ruling, ruling Baoshang Bank bankrupt.

3.1.3.2 The enlightenment of Baoshang Bank case to small and medium-sized commercial banks

Most of China’s small and medium-sized banks have established corporate governance structures, but it is only similar in shape but not in spirit. The key is that there is no governance mechanism of power balance and effective supervision, and the problem of large shareholders’ disorderly behavior or inaction is serious. To establish a good corporate governance mechanism, we should first have a good shareholder structure. Small and medium-sized banks should introduce qualified strategic investors with financial management capabilities, thoroughly solve the ownership structure of "one share dominating the stock", and prevent the major

shareholders from inaction or disorderly action. In fact, a good shareholder structure is not only conducive to the formation of a good governance mechanism, but also conducive to the formation of a stable channel for capital replenishment, so as to improve the risk prevention ability and credit rating of commercial banks, and make commercial banks win the full trust of investors and customers.

Facing the increasingly severe competition situation and regulatory requirements, small and medium-sized banks must adhere to the development strategy of differentiation and characteristics, accelerate the innovation of products and services, and improve the level and ability of serving the real economy. Meanwhile, small and medium-sized banks must keep the bottom line of compliance operation, put prevention and control risk in a more prominent position, better serve the real economy at the same time, find their own foothold and market segmentation, and win their own development space. Keep the bottom line of compliance operation firmly. Compliance is not only an important premise to prevent financial risks, but also the bottom line of small and medium-sized banks. At present, the financial industry is still in the process of "strict supervision", the compliance supervision of small and medium-sized banks will be stricter, and the punishment for illegal acts will be greater. Compliance operation can reduce or avoid the risk or loss of violation of regulations. The reduced or avoided risk or loss can also be regarded as the value created by compliance to the enterprise.

3.2 The end of the myth of “zero bad debt” in Chengdu Branch

From the information disclosed by the CBRC in January 2018, Shanghai Pudong Development Bank (SPDB) once again fell on the internal control of its branches. In 2016, Guangdong Development Bank also had a similar situation (Qiaoxing’s private debt event). There are many similarities between the two banks. For example, in order to cover up non-performing loans, both branches finally embarked on the road of fraud through internal and external collusion.

Several major cases reflect that branches often take risks in disregard of internal control mechanism in order to cope with various performance indicators and assessment. However, in terms of the amount of money involved and the impact, the branches of the two banks has exceeded most major financial cases in history. The branch of Guangdong Development Bank (Huizhou Branch) involved 12 billion yuan. The Chengdu Branch of SPDB (hereinafter referred to as Chengdu Branch) is involved in nearly 80 billion, behind which 1,493 shell companies were created due to it, and the potential losses are incalculable.

3.2.1 Overview and process of the case

3.2.1.1 Overview of Chengdu Branch

SPDB was established in August 1992, its Chengdu Branch was established in March 2002. At present, Chengdu Branch has a business department and 16 secondary sub branches. It has 987 employees and a capital scale of 126.728 billion yuan. Its scale strength ranks first among the same type of joint-stock commercial banks in the province.

Chengdu Branch has always been a bank with good operating efficiency among all branches of SPDB. It was rated as a "Star Bank" because of its "zero bad debt" for many years. It has been awarded as an excellent risk management unit for four consecutive years. It has been ranked first in the comprehensive evaluation of the head office and has been taken as a model for other branches to learn from. Before the case occurred, there was no major accident case in Chengdu Branch. The staff quality was high, the performance appraisal was excellent, and there was no bad record. It can be said that it was "the myth of the bank". Even in the local joint-stock commercial banks, the performance was outstanding.

However, at the beginning of its establishment, Chengdu Branch had only 75 employees. Compared with other banks that have established their foothold, the strength of Chengdu Branch is relatively weak. Because people’s recognition and trust of joint-stock commercial banks were not high at that time, they generally chose to go to state-owned banks to handle business, which brought certain difficulties to Chengdu Branch in developing the local market. In the face of this situation, Chengdu Branch has opened up a new way to carry out loan business for heavy industrial enterprises such as iron and steel, coal and so on, which other banks have not paid attention to. At that time, it coincided with the "golden decade" of coal industry. With the rapid development of heavy industrial enterprises such as iron and steel, coal and so on, Chengdu Branch obtained rich profit returns due to providing a large number of loans to them, and its business performance surpassed other local banks for a time. After 2012, the "golden decade" of coal has ended, and the coal price favored by Wang Bing (former president of Chengdu Branch) has been falling all the way. At the same time, the rapid development of heavy industrial enterprises has resulted in relative overcapacity. Since 2015, the country has implemented supply side structural reform and gradually eliminated industries with high pollution, high energy consumption and high emission. Heavy industrial enterprises such as steel and coal have become the key reform targets of the state. The operating profits of these enterprises have declined seriously, and their ability to repay loans has been relatively weakened, and chain reactions have occurred, their main source of operating profit has shrunk

seriously. Before the case was exposed, Chengdu Branch's long-term "zero bad debt" record created the industry myth at that time and became a star branch in the circle. With the rapid development of its business, Chengdu Branch had no bad records and no violation cases. Perhaps they just wanted to maintain their good image, after the coal, steel and other industries were no longer booming, Chengdu Branch managers not only did not strengthen the post loan follow-up investigation on the heavy industrial enterprises which they had lent before, and made new loans more prudently. Instead, they chose to make false use of loans, split credit granting, ultra vires approval and other illegal means of lending.

3.2.1.2 Definition of shell companies and non-performing loans

The so-called shell company, also known as "ready-made company", is a kind of company without appointed directors, no business, no debt, with only a company name and relevant legal documents. It is legal to register shell companies according to the formal process, and now more and more enterprises register shell companies to help their further operation development. However, because of the ease of operation and low cost of registered shell companies, some criminals use shell companies to defraud. Because the responsible person is not clear, it often leads to large property losses and endangers social security.

Nonperforming loan refers to that when the loan contract matures, the borrower is unable to repay the loan and interest as agreed in the contract, or there are obvious signs that the borrower will definitely be unable to repay the bank loan principal and interest on time before the repayment date stipulated in the contract. The bad debts arising therefrom are called nonperforming loans. China's commercial banks implemented the five level classification method for loans.

3.2.1.3 Case process of Chengdu Branch

From the case development flow chart (Table B-7), we can see that the Chengdu Branch was established in 2002. Wang Bing, as the president of Chengdu Branch, has always adopted the "investment bank" business model. Wang Bing thought that the resource industry should be regarded as a pillar project for development. At that time, the development of the steel and coal industry was not prosperous, and many banks were not willing to extend loans to this industry, but Chengdu Branch issued 600 million loans to the industry. In the ten years (2002-2012) of China's economy, it is known as the "golden decade" of coal industry and steel industry. Only one year after Wang Bing took office, the deposit balance of Chengdu Branch reached nearly 7 billion yuan, the profit was nearly 80 million yuan, the per capita profit was nearly 1 million

yuan, and the deposit loan ratio was less than 48%. There were no non-performing loans of "concern and below" level. By 2012, the asset scale of Chengdu Branch had increased nearly ten times compared with the initial stage of its establishment, and Wang Bing was also praised as a benchmark.

However, after 2012, the regional real economy went down, the coal industry lost production capacity, and the performance was sluggish. Many coal mining enterprises became "zombie enterprises", which led to the failure of Chengdu Branch to recover loans and the accumulation of non-performing loans. To this end, Chengdu Branch established 1,493 shell companies through 7 real estate companies and mineral enterprises to take over the nonperforming loans in the form of debt purchase. The so-called debt purchase means that when an enterprise's loan is overdue, it should have lowered the respective loan grade. However, in order to prevent the loan from becoming a nonperforming loan, the bank instructs the enterprise to establish a shell enterprise. The bank will then issue a loan to the shell enterprise. The shell enterprise will use this loan to purchase the bad debt enterprise and repay the bad loan with the new loan from the bank. Such a circulation of funds covered up the original nonperforming loans. The banks did not seem to have violated the rules, but in fact they were "robbing the east wall to pay the west wall" (Figure A-8). In order to provide credit to these shell companies, Chengdu Branch illegally handled credit, interbank, letter of credit, factoring and other businesses by fabricating false purposes, splitting credit, and ultra vires approval.

In fact, as early as April 2017, there was a rumor that Chengdu Branch used shell companies to transfer 100 billion nonperforming loans. SPDB immediately declared that the facts were inconsistent, but admitted that the asset quality of Chengdu Branch was indeed under certain pressure. After the media exposure, the Sichuan Banking Regulatory Commission sent an investigation team to Chengdu Branch for on-site inspection, and found that there were serious violations, and the head office of SPDB ordered the Chengdu branch to rectify immediately. In January 2018, the headline on the CBRC's official website reported in detail the case of covering up nonperforming loans of Chengdu Branch, and announced the punishment results. Chengdu Branch was fined 462 million yuan, the former president Wang Bing was dismissed, two former vice presidents were demoted, and all 195 internal responsible persons of the branch were held accountable.

Firstly, when company A may not be able to repay the loan principal and interest in Chengdu Branch, that is, it has been or will be overdue.

Secondly, Chengdu Branch learned that company A may not be able to repay the loan

principal due, and required its related parties to establish a shell company, company B.

Thirdly, Chengdu Branch issued a loan to shell enterprise B.

Fourthly, after getting the loan, company B acquired company A through equity transaction, and company B became the shareholder of company A.

Fifthly, after company A gets the acquisition funds, it repays the due loans of Chengdu Branch.

3.2.2 Cause analysis of serious credit risk and operational risk in Chengdu branch

3.2.2.1 Serious lack of corporate governance

On the one hand, because Wang Bing had been the president of the branch for a long time, the internal restraint mechanism of SPDB was invalid. In terms of loan approval, SPDB stipulates that loans less than 100 million yuan can be approved at the branch level, and only loans higher than 100 million yuan must be approved by the head office. In order to bypass the supervision of the head office, Chengdu Branch divided these loans into many batches of loans less than 100 million yuan for organized and planned transfer. In this process, the branch approval center did not play a practical role. The branch leaders had a certain voice in the loan approval. They used their own authority to conduct loan approval, which gave the branch leaders the opportunity to conduct illegal operations. Due to the relatively simplified personnel composition, although to a certain extent, the operating costs had been reduced, the per capita wages and salaries had been increased, and the competitiveness of the bank had been maintained. However, many working procedures of SPDB had become a mere formality and had not been implemented in place. The current credit mechanism of SPDB paid more attention to pre-loan and in loan. The post loan inspection was conducted by the branch customer manager to collect and analyze the data and form a formatted investigation report to complete the post loan supervision. The head office failed to track the borrowers of each branch after loan, thus neglecting the post loan risk management.

On the other hand, due to Wang Bing personally serving as the branch president for a long time, the external restraint mechanism of SPDB Bank also failed. There are few references to the risk of off-balance sheet loan in the information disclosure of loans of SPDB. There are many non-standard "quasi loans" of off-balance sheet investment in the non-performing loans of resource enterprises covered up by Chengdu Branch. "Basel Accord" points out that "information disclosure can make banks minimize moral hazard and reduce the social cost of supervision." The case of SPDB exposed the moral hazard of the bank staff. For 77.5 billion

non-performing loans, it was first exposed by the external media. It was impossible to hide the collective concealment from the branch executives to the customer manager. If there was a strict loan information disclosure system, even when the internal control system of SPDB failed and the strict restriction of external market could also have avoided huge loan losses.

3.2.2.2 One sided pursuit of business performance and relaxation of compliance awareness

Some parents pursue their children's test scores excessively, while they neglect or relax their children's growth and progress in other aspects. The evaluation and incentive system for senior executives and business managers set by the head office of SPDB was more inclined to the evaluation of business performance. The nonperforming loan ratio is an important indicator to measure the operating performance, which has an important impact on the performance of senior executives and the performance pay of loan managers. SPDB's financial statements can also bring a good performance to the bank. Over the years, Chengdu Branch's operating performance, asset scale and profit margin have ranked higher in the financial institutions of SPDB and Sichuan Province. This was due to the branch's high-intensity performance objectives and incentive system, but it also gave incorrect guidance to grass-roots staff. When the actual operating performance was difficult to maintain as in the previous operating conditions, in order to get the same high salary and reward as in the past, in order to maintain the image of "Star Bank" of Chengdu Branch, the branch leaders conducted illegal operation at all costs.

With the advent of the era of strong financial supervision, compliance and prudent operation should be put in the first place by banking financial institutions. The violation cases of Chengdu Branch largely reflect the serious lack of awareness of compliance in the operation process. First of all, the compliance operation documents formulated by the head office of SPDB only stayed on the surface, and the branches only accepted them in form. Under the pressure of performance appraisal of branches, they often ignored them. Secondly, the risk management objectives and plans formulated by SPDB mainly included the non-performing loan ratio and overdue loan control amount. When the branch completed the plan, it was difficult to identify the specific risk points and potential risk items. Finally, the branch leader's power was too large to realize the separation of powers. When approving loans, they had excessive power and intent to interfere. As long as they could meet the assessment standards, they could take all kinds of illegal means to remedy.

3.2.3 The impact of the case of Chengdu Branch

3.2.3.1 Impact on the overall of SPDB

In January 2018, CBRC punished Chengdu branch with RMB 462 million. After the Chengdu Branch incident, the average year-on-year output of SPDB in the first two quarters of 2018 was negative (Table B-8). As of the end of 2018, the net profit of SPDB increased by only 2.75% year on year, far lower than that of other similar commercial banks (Figure A-9). At the same time, the ratio of non-performing loans is also at a high level in the same type of commercial banks (Figure A-10).

3.2.3.2 Impact on investors

The illegal lending incident of Chengdu Branch was exposed by the media on the morning of April 5, 2017. Through the stock trading information from April 2017 to April 2018 (Table 3.1), we can find that the stock price of SPDB fluctuated greatly. After the CBRC officially announced the punishment decision on Chengdu Branch's violations in January 2018, its stock price and trading volume went down all the way. In April 2018, the trading volume of SPDB's shares shrank by more than 80% compared with the month with the highest trading volume. It can be seen that the illegal operation cases of Chengdu branch had a certain impact on the behavior of investors, and people's trust in them has decreased.

Table 3.1 Stock trading information of SPDB from 2017 to 2018

Date	Closing price (RMB)	Opening price (RMB)	Highest price (RMB)	Lowest price (RMB)	Trading volume	Up and down range
April 2017	11.70	12.35	12.45	11.42	553.85M	-4.99%
May 2017	12.84	11.70	13.05	11.16	1.26B	9.74%
June 2017	12.65	12.78	13.20	12.22	1.33B	-1.48%
July 2017	13.36	12.64	14.02	12.41	1.32B	5.61%
August 2017	12.71	13.42	13.60	12.41	1.37B	-4.87%
September 2017	12.87	12.68	13.15	12.65	742.80M	1.26%
October 2017	12.61	13.27	13.29	12.58	522.53M	-2.02%
November 2017	12.91	12.63	13.44	12.38	1.19B	2.38%
December 2017	12.59	12.93	13.27	12.51	630.34M	-2.48%
January 2018	13.17	12.61	14.00	12.60	2.53B	4.61%
February 2018	12.46	13.14	13.90	12.24	1.47B	-5.39%
March 2018	11.65	12.40	12.60	11.45	600.35M	-6.50%
April 2018	11.61	11.68	12.02	11.49	384.72M	-0.34%
Highest price：14.02		Lowest price：11.16		price difference：2.86		Up and down range：-5.73%

Source: Wind Database

3.2.4 Enlightenment of Chengdu branch incident to small and medium sized commercial banks

The overturning of commercial banks' buildings often leads to big mistakes due to the weak implementation of the system. This is the truth proved by the repeated occurrence of major cases in banking institutions in the past, which caused local financial risks. The replacement system of Chengdu Branch's senior executives was in vain. The president was reorganized from 2002 to 2017, and there was no replacement for about 15 years. Under such preconditions, it made great convenience for the subsequent fraud. In order to complete its own business assessment, Chengdu branch did not hesitate to cover up non-performing loans by means of debt taking acquisition, which affected the normal business operation of Chengdu Branch. From the case of Chengdu Branch, we can see that SPDB had a serious lack of governance ability, ignored or lowered the compliance awareness in pursuit of business performance, the head office's control of the branch was invalid, and the performance appraisal mechanism and credit approval system were far from perfect.

Of course, the case of Chengdu branch is more like a mirror for other banks and a window for us to pry into many diseases of the banking industry. Perhaps we should be glad that these problems are exposed under the strong supervision of the CBRC, and timely correction can avoid greater risks. In the process of deepening the reform of commercial banks, banks should establish a risk management and control mechanism suitable for their business development capabilities, take safety as the first principle of operation and management, weigh up various major risk factors, and formulate feasible risk management schemes, so as to stand out in the market competition during the transformation period.

Chapter 4: Shadow Banking

Shadow banking is not an enterprise or an organization. It is more like a tool. Why study shadow banking? Because it involves too much capital and, more importantly, it is not regulated (off-balance sheet assets). It exists like "shadows" in various financial industries (including commercial banks and other non-bank financial institutions), which makes the risk of the whole banking industry (mainly credit risk) essentially larger, and it is more difficult to measure its scale.

The beginning of this chapter is the introduction of the connotation of shadow banking in China and the United States. The reason why China and the United States are chosen as entry points is that China and the United States have the highest proportion of shadow banking assets in the world (Figure A-11). Second, we will first analyze the characteristics and cause of shadow banking in China. Thirdly, we will further divide models of shadow banking in China into two parts: shadow banking of commercial banks and non-banking financial institutions. Purpose of the distinction is that we should describe and introduce the former (shadow banking of commercial banks) more specifically, which is more in line with the theme of the paper. Finally, we will analyze the assets and liabilities of small and medium-sized commercial banks and large state-owned commercial banks, and then use the scale of non-guaranteed wealth management as the minimum size of shadow banking to compare the risks they face.

4.1 Connotation of shadow banking

In 2010, Ben Bemanke, then chairman of the Federal Reserve, defined shadow banking as a financial institution that is outside the traditional deposit institutions, acts as a credit conversion investment intermediary and is not regulated. Z. Cai (2012) believes that the general characteristics of shadow banking are mainly manifested in the following aspects: first, it acts as a deposit and savings; second, it is unregulated or unregulated. The basic function of Chinese-style shadow banking is born in the banking system and received less attention in the early stages of its development. But with the continuous expansion of its scale, it has formed a certain threat to the financial supervision. Yan (2015) believes that China’s shadow banks are mainly engaged in credit business, and they are inseparable credit intermediaries with commercial banks. Qiu (2012) believes that commercial banks are at the

core of China's shadow banking system, and a large number of funds for shadow banking business are provided by commercial banks, which flow to customers who cannot meet the conditions and cannot obtain loans directly from banks. Shao (2012) believes that Banks often engage in shadow banking business in order to meet customer demand, occupy market share. We find that China's shadow banking is centered around commercial banks and engaged in "quasi credit" business.

4.2 Three characteristics of China's shadow banking

4.2.1 Commercial banks are the center of shadow banking in China

Commercial banks are the main participants of shadow banking in China. They are often the link between the providers of funds and borrowers. For example, commercial banks issue Financial Products and provide funds to other shadow banking entities (such as trust companies) (Figure A-12). Banks are also holders of shadow banking instruments (such as beneficial rights of trust).

In addition to direct intervention, commercial banks in China have also adopted various means to promote the development of shadow lending. Banks, for example, act as intermediaries for trust funds because they are legally unable to provide direct credit to non-financial corporations.

More recently, they have combined existing shadow credit tools to ease the regulatory burden. Through the structured form of shadow banking (Figure A-16), they reclassify assets as investment receivables. As a result, they can lower restrictions such as provisions for non-performing loans.

4.2.2 Shadow banking connects financial industry closely

Shadow banking not only closely connects commercial banks with nonbank financial institutions, but also establishes close ties with China's bond market. The funds for issuing financial products mainly flow to nonbank financial institutions (usually trust companies) either held by the investment or wealth management departments of banks (removed from the balance sheet of commercial banks), that is, a large part of the funds obtained from financial products have been invested in the bond market. Originally, direct access to the Inter-bank bond market was limited to financial institutions, but now you will find that financial products effectively provide retail investors with a channel to invest in bonds. In recent years, the new

form of "structured" shadow banking is booming, especially related to commercial banks' investment in "receivables investment". Commercial banks reclassify assets as "receivables investment", which makes them closer, more complex and opaque with non-bank financial institutions.

4.2.3 The assurance of perception and reality is everywhere

In China, shadow banking is driven by banks' profit-making motivation. Buyers of financial products or other products usually assume that the issuing bank will provide compensation in case of any loss. However, in fact, commercial banks have no legal obligation to do so, because any right of recourse is explicitly excluded from the contract. However, past experience has taught us that financial regulatory authorities will give priority to maintaining financial market and social stability, and investors have also taken a fancy to this implicit guarantee of commercial banks. If state-owned banks are involved, investors may think that the product is ultimately backed by government guarantees. In a highly competitive banking environment, banks also have an incentive to encourage this assumption. In addition, credit guarantee companies provide clear guarantees for various shadow banking businesses in China. In fact, these new guarantee companies have a limited role in helping them enter the market.

4.3 Causes of shadow banking in China

4.3.1 Social financing gap

With the tightening of China's macro-economic policy and the gradual implementation of the central bank's steady monetary policy, the bank's credit supply is limited, the market is in a state of tight liquidity, and the liquidity fund is seriously insufficient. The current situation of China's rapid economic development and the central bank's policy choice of tightening monetary policy led to the existence of social financing gap.

First of all, at large state-owned enterprises and local financing platform level. After the financial crisis in 2008, in order to stimulate the market and stimulate China's economic development, the government invested 4 trillion yuan in local infrastructure construction and large state-owned listed enterprises to boost China's domestic demand. However, excessive capital inflow into the market led to the high CPI index, which exceeded the government's expectation. The central bank acted to curb the trend of inflation, and then turned to control

by increasing deposit and loan interest rates and raising the legal deposit reserve ratio. These measures of the central bank made the projects established under the four trillion plan unable to obtain follow-up support of funds, and these enterprises had to obtain funds through other ways in order to operate normally.

Secondly, small and medium-sized enterprises. In a long time, they have not been favored by bank lending departments because of their small scale, poor credit rating, poor collateral quality and high bad debt rate. Although the state has adopted a series of policies for small and medium-sized enterprises in recent years, the shortage of funds is still the most important problem. China's financial system has not yet fully developed, which makes China's small and medium-sized enterprises still indirect financing. Therefore, small and medium-sized enterprises need to obtain funds through new channels other than traditional credit.

Finally, the real estate industry is restricted by the government supervision. From the beginning, in order to stimulate the economy, the government introduced a number of policies to support the real estate industry, resulting in a large amount of capital inflow, and the real estate prices continued to rise. Then it turned to macro-control, which created a tight liquidity situation in the real estate industry in recent years. In order to obtain funds for stable operation, real estate enterprises can only obtain funds through other ways other than traditional credit to meet their own development needs, which promotes the development of shadow banking business to a certain extent.

Through the measurement of the gap of social financing scale (FORMULA: Social Financing Scale Gap = social financing scale − RMB loan − foreign currency loan − stock of non-financial enterprises − enterprise bond − government bond), it can be seen from (Table 4.1) that the gap of social financing scale in China is relatively balanced, with an average capital scale of 29 trillion. That is to say, when there was a big gap between social financing demand and capital supply, enterprises began to turn to informal channels to obtain funds, which also gave birth to the emergence of shadow banking.

Table 4.1 Measurement of the scale of China's social financing gap (unit: trillion)

Date	Social Financing Scale	RMB loan	Foreign Currency Loan（convert into RMB）	Stock of Non-Financial Enterprises	Enterprise Bond	Government Bond	Gap
2017-01	184.14	107.50	2.61	5.89	18.12	22.64	27.37
2017-12	205.91	119.03	2.48	6.65	18.85	28.15	30.75
2018-12	227.04	134.69	2.21	7.01	20.70	33.01	29.42
2019-12	251.31	151.57	2.11	7.36	23.47	37.73	29.08
2020-06	271.78	163.90	2.49	7.60	26.78	41.52	29.49
2020-12	284.83	171.60	2.10	8.25	27.62	46.06	29.20
2021-06	301.56	184.54	2.32	8.74	28.58	48.50	28.88
2021-12	314.13	191.54	2.23	9.48	29.93	53.06	27.89
2022-01	320.05	195.71	2.26	9.63	30.45	53.67	28.33

Source of Data: Wind

4.3.2 Pursuing profits and avoiding supervision

Profit seeking is the source of any economic activity, especially in the financial industry. After the global "subprime crisis", China started the "four trillion" economic stimulus plan. The financing demand of local financing platforms, real estate and the majority of small and medium-sized enterprises expanded, and the income of non-standard investment increased, which was the direct driving force for the development of shadow banking at that time.

The credit business of China's commercial banks has always been faced with a series of regulatory indicators, such as the provision of venture capital, the deposit loan ratio, and the capital adequacy ratio, even restricting the industries to which they are targeted. The loose monetary policy environment provides sufficient capital supply for commercial banks, and with the continuous development of economy, the investment demand of residents is also rising. Therefore, in the past, commercial banks had a serious problem of strong willingness to lend but limited lending, which gave birth to shadow banks that bypassed regulation and provided credit.

4.4 Shadow banking business within China's commercial banks

4.4.1 Regulatory policies and regulations

Based on the literature review, China's commercial banks are the center of shadow banking, so let us first take a look at the relevant regulations issued by the regulatory authorities over the years for the shadow banking business of commercial banks (Table B-9). According to the

Table below, we can find that the regulatory authorities formulate corresponding regulatory policies according to the types of shadow banking, but commercial banks also make continuous adjustments to shadow banking business according to the introduction of regulatory measures. There is a financial game between regulators and commercial banks. In this process, the types of shadow banking business are constantly changing. Therefore, we will introduce them one by one according to the time when shadow business types occur.

4.4.2 Types of shadow banking in China (in chronological order)

4.4.2.1 Cooperation mode between bank and trust

There are two types of bank credit cooperation modes, the first type appeared from 2008 to 2009, called credit asset transfer business. Mainly with the help of trust companies, the process of converting the bank's unexpired credit assets into financial products is the transfer of credit assets. This means that the bank's own deposits can be simply transformed into financial funds, and the bank's own loan assets can be transformed into off-balance sheet assets. This kind of mode lasted for a short time and was basically banned in 2009 (Table B-9, "No. 111 document" issued by CBRC).

The other is called trust loan products. The business in which commercial banks deliver funds to trust companies in the form of purchasing trust plans through trust companies as intermediaries, and then the trust companies issue funds to actual lending enterprises is called trust loan business (Figure A-13). In fact, this kind of lending business that banks and trust companies cooperate with belongs to the off-balance sheet business, the commercial banks did not make provision for loan losses, which makes the bank's credit risk underestimated. Bank financial products can be divided into breakeven financing and non-breakeven financing according to the degree of risk taking. The principal guaranteed financial products are included in the bank balance sheet and corresponding provisions are made. Non-breakeven financial products belong to the off-balance sheet business of the bank. However, the rapid expansion of bank financing fund scale has attracted the attention of regulatory authorities. In 2013, the CBRC issued "No. 8 document" (Table B-9), which controls the total amount of financial funds invested in non-standard assets with the help of channel business.

4.4.2.2 Inter-bank payment mode

The original intention of Inter-bank payment mode is to reduce the trouble of trade payment for their own customers or peers, and provide convenient business for their payment according to their needs. As the business belongs to its off-balance sheet business, it is not included in the

balance sheet. Therefore, this natural advantage of this business enables banks to hide their real credit scale on the one hand, and on the other hand, it can avoid relevant supervision. The Inter-bank payment mode is shown in Figure A-14. In this business, firstly, the entrusting bank (such as bank A) opens the letter of credit, which belongs to off balance sheet business and does not affect the bank loan scale; secondly, when the entrusted bank (such as bank B) makes its own payment, the accounting treatment is recorded in the "Inter-bank" or "accounts receivable" account, which will not affect the credit scale. At the same time, through this business, the actual borrower obtained loans, which were not recorded in the loan account of the balance sheet. However, after the "237 document" (Table B-9) issued by CBRC in 2012, the scale of Inter-bank payment business began to decrease significantly.

4.4.2.3 Buy back sale mode

As a kind of Inter-bank business, Buy Back Sale business is essentially a process of capital financing. The underlying financial assets of Buy Back Sale can be bills, securities, trust beneficial rights, and so on in 2013, the CBRC issued "No.8 document" (Table B-9), which restricts the financial management business, but does not restrict the Inter-bank business and does not restrict the beneficial right of trust. Commercial banks take advantage of this "opportunity" to disguise credit assets as noncredit assets for loan business through repurchase business of trust beneficial right.

The specific operation process is shown in Figure A-15. Bank A wants to make loans to the enterprises in need of funds, but due to some limitations, it cannot directly lend to them, and it has to achieve that purpose through other ways. At this time, Bank A often cooperates with trust companies by means of "bridge passage" called Bank B. The trust company will set up a single fund trust, and the trust company will issue trust loans to enterprises in need of funds.

In essence, this mode is equivalent to that Bank A achieves the purpose of lending to its customers (enterprises to be financed) through Inter-bank business. In this process, the credit assets are packaged as noncredit assets to achieve the purpose of regulatory arbitrage. The trust company and Bank B play the role of "bridge channel" in the whole process, from which they get the channel fee, Bank A is the credit bank, which charges the financial consultant fees, and all three parties can get income from it. However, after the CBRC issued the "127 document" (Table B-9) in 2014, the resale business of trust beneficial rights began to be restricted.

4.4.2.4 Inter-bank and outsourcing combination mode

This mode has become the mainstream mode of shadow banking after 2014 (that is, the Buy Back Sale Mode began to be restricted). The main operation mode is shown in Figure A-16. Banks issue inter-bank certificates of deposit to other financial institutions to raise funds. The purchasing bank of inter-bank deposit receipts is included in "trading financial assets" at the asset side, and the issuing bank is included in "bonds payable", and these funds are invested in Inter-bank financial products (at this time, the buying bank is counted as "investment in receivables" at the asset end). And the funds obtained by the issuing banks of Inter-bank financial products entrust funds, securities companies and other institutions to carry out outsourcing investment.

This mode has become the mainstream mode of shadow banking after 2014. That is to say, the appearance of "No.127 document" interrupted the path of the repurchase business investing in credit assets. So far, the same trade business has entered a new peak. As shown in Figure A-17, at the end of 2013, the stock size of NCD was only RMB 34 billion, but in November 2021, it had more than 13 trillion RMB, an increase of 380 times.

4.4.3 Summary

Based on the theory of market demand and supply, the gap of China's social financing scale (the demand side) and the shadow banking caused by commercial banks' pursuit of profits and avoidance of supervision (the supply side). As shown in Figure A-18, shadow banking has gone through four types of development process (i.e., Cooperation Mode between Bank and Trust, Inter-bank Payment Mode, Buy back Sale Mode and Inter-bank and Outsourcing Combination Mode). The reason is that regulators (mainly CBRC) began to pay attention to shadow banking and actively issued corresponding regulatory policies, while commercial banks were constantly trying to avoid these regulatory policies, which led to various types of shadow banking. In other words, there has been a financial game between regulators and commercial banks. In this process, the types of shadow banks are constantly changing in this financial game.

It is worth noting that commercial banks add multi-layer "nesting" in the actual operation process for the purpose of avoiding supervision or idle arbitrage, which lengthens the capital chain like a "chain of chains", thus aggravating the credit risk and liquidity risk in the banking system. The shadow banking business within China's commercial banks is the focus of this chapter. In the following content, we need to further distinguish large state-owned commercial banks from small and medium-sized commercial banks, so as to truly meet the purpose and

requirements of this thesis.

4.5 Shadow banking business outside China's commercial banks

The shadow banks outside China's commercial banks are mainly shadow banks that have nothing to do with commercial banks, including entrusted loans, trust loans, P2P and so on. It should be noted that although this part is not the content of this chapter, but from the perspective of introducing the integrity of China's shadow banking, we will also introduce and analyze the entrusted loan, trust loan and P2P.

As shown in Figure 4.1, we can intuitively see the source of funds and how to invest in the capital market or ultimate borrowers through intermediaries (companies), due to the shadow credit provided by trust loan and entrusted loan to the ultimate borrower. At the same time, based on the rapid development of the Internet, P2P loans are growing rapidly, but the proportion of shadow credit in China is still relatively small, so the impact is limited. In addition, there are some private and small financial informal credits, which cannot be quantified, so they are not considered.

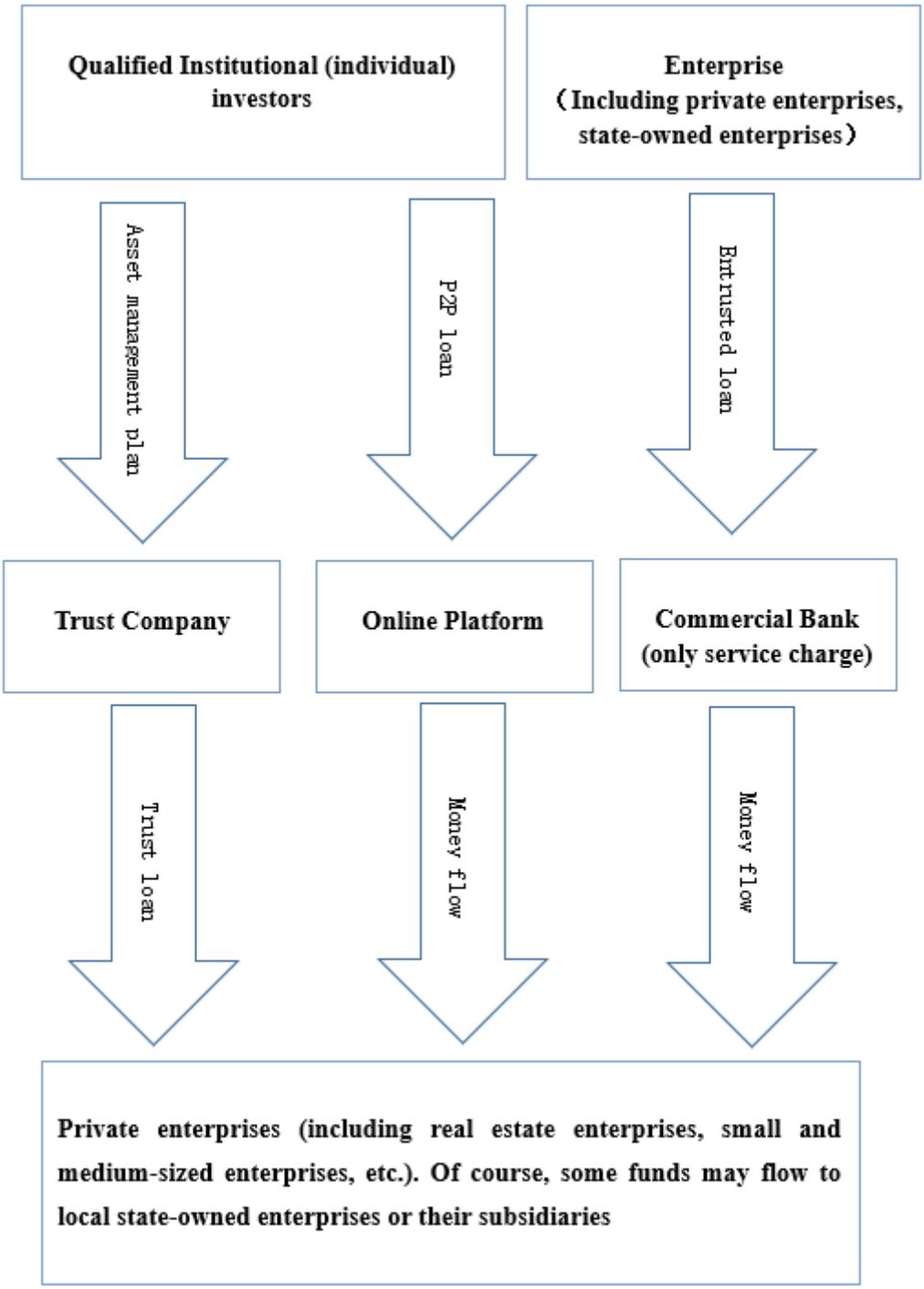

Figure 4.1 Shadow banking business outside China's commercial banks

Source: Summarized by the Author

4.5.1 Entrusted loan and trust loan

As shown in Table B-10, in the past five years, the total amount of entrusted loans and trust loans has been relatively stable. The scale of entrusted loans has increased from 9.67 trillion yuan in 2015 to 10.93 trillion yuan in 2022. The new scale is no more than 1.3 trillion yuan in seven years, and the growth rate is slowing down. However, the scale of trust loans increased

from 5.35 trillion yuan in 2015 to 4.28 trillion yuan in 2022. Generally speaking, the total amount of entrusted loans and trust loans has been controlled.

4.5.2 P2P lending

Figure A-19 shows the trend of P2P since 2014. It can be seen from the figure that, based on the rapid development of the Internet, P2P loans had a rapid growth at the beginning, but after 2018, with the regulatory authorities starting to standardize and rectify P2P loans, the scale showed a significant downward trend. At the same time, compared with bank credit, the overall scale of P2P credit is still very small, because some P2P platforms are specialized in consumer credit business.

4.6 Risk transmission mechanism and total scale influence of shadow banking business of Chinese commercial banks

4.6.1 Risk transmission mechanism of shadow banking

Understanding the structure of China's shadow banking system is very important to analyze China's financial system. The main patterns of shadow banking and the relationship between the financial system have been introduced before. One of the key features is that commercial banks are actually the leader of China's shadow banking system. In recent years, China's shadow banking has changed rapidly in addition to its scale. For example, the main area of growth has shifted from the provision of shadow credit (mainly loans to private enterprises) to alternative savings tools (for instance, wealth management products and trust products). Similarly, with the "step-by-step pressure" of regulatory measures, new and more complex "structured" shadow banking business has emerged and rapidly reached the scale. This is because commercial banks try to reduce regulatory burden (such as the provision of reserves) by reclassifying existing bank assets as "receivables investment". The increasingly close ties between financial sectors further increase the possibility of transmitting financial shocks among depositors, banks and bond markets. China's shadow banking system has become more and more complex, which makes the systematic risk of China's commercial banks (especially small and medium-sized commercial banks) gradually expand.

As shown in Figure 4.2, on the one hand, the high leverage ratio magnifies the operational risk of commercial banks. Because shadow banking is not restricted by capital adequacy ratio, reserve ratio and leverage ratio, it expands financing scale by increasing leverage ratio, and

obtains more capital and income by using less self-owned capital, which makes credit over expansion and causes liquidity overflow. Once the economic recession comes, the market liquidity will shrink, which will lead to the fall of asset prices and the situation of insolvency, which will expose the risk position of investors. Commercial banks that carry out shadow banking business may be run, which enlarges the operational risk of banks, and then easily leads to systemic risks.

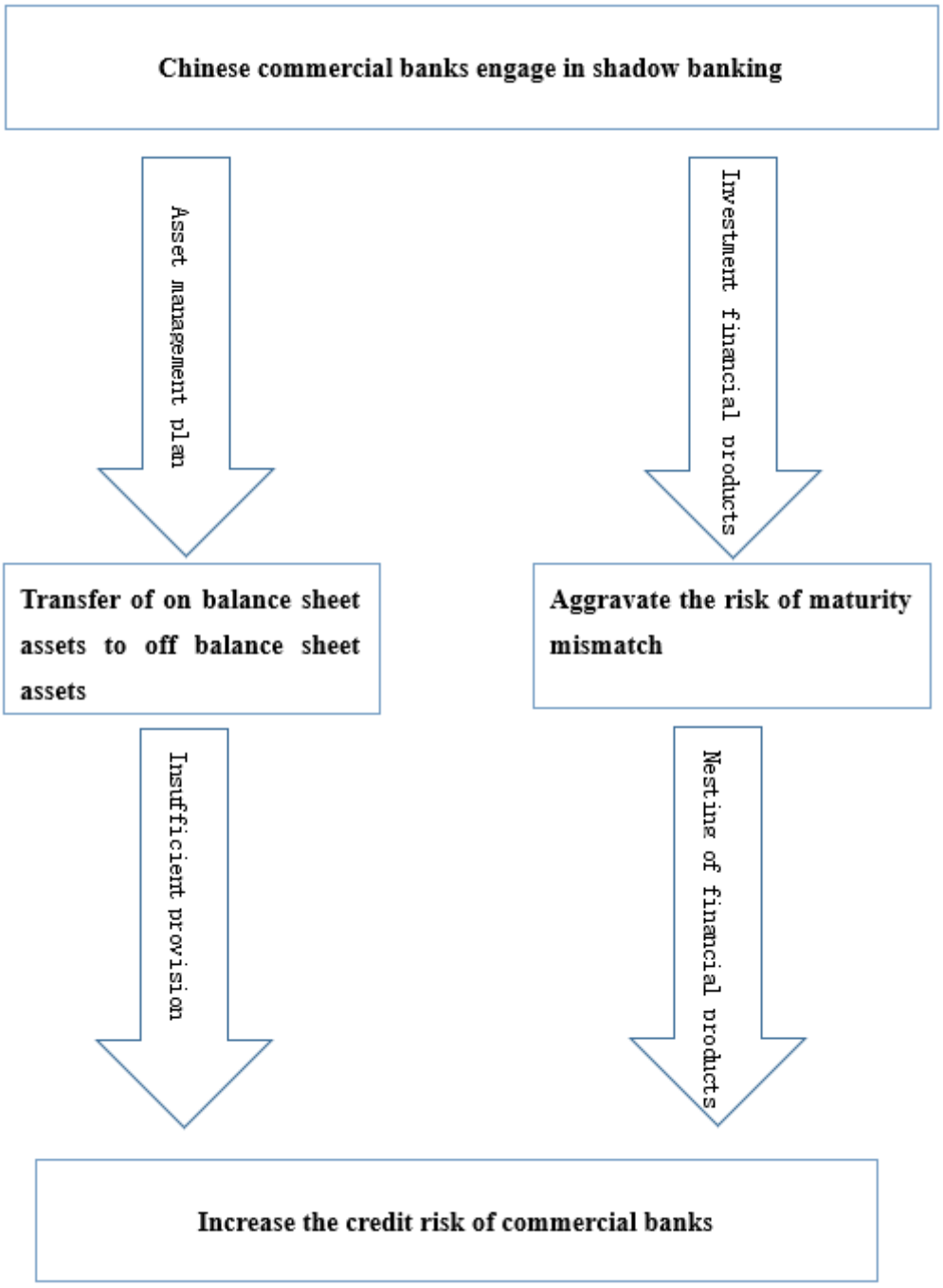

Figure 4.2 Credit risk transmission path

Source: Summarized by the Author

On the other hand, the fund pool of shadow banking products is likely to be mismatched in

the source and use of funds. If China's real economy fluctuates periodically and the industrial structure changes, or investors' confidence is insufficient, this operation mode of shadow banking will lead to the failure to fully recover the investment funds after the maturity of long-term assets, or the newly issued financial products cannot be sold in full on schedule. Either result will lead to a serious cashing crisis in China's commercial banks (especially small and medium-sized commercial banks), which will lead to bank liquidity risk.

4.6.2 Total scale impact

4.6.2.1 Assets and liabilities of China's commercial banks

As shown in Table 4.2, as of Dec 31, 2021, the net assets (accounting equation: Assets-Liabilities=Net Assets) of large state-owned commercial banks are RMB 11.81 trillion, and the total net assets of small and medium-sized commercial banks are RMB 12.03 trillion.

Table 4.2 Balance sheet of different types of commercial banks (unit:100 million)

Date	2021 Years			
Item	**First quarter**	**Second quarter**	**Third quarter**	**Fourth quarter**
Large state-owned Commercial Banks				
Total assets	1,341,345	1,361,845	1,371,996	1,384,000
Total liabilities	1,231,628	1,251,106	1,257,658	1,265,835
Net assets	109,717	110,740	114,338	118,165
Joint Stock Commercial Banks				
Total assets	591,741	603,186	608,220	621,873
Total liabilities	544,512	555,250	558,974	571,117
Net assets	47,229	47,936	49,247	50,756
City Commercial Banks				
Total assets	422,319	436,365	442,252	450,690
Total liabilities	390,328	403,083	408,607	415,734
Net assets	31,991	33,282	33,645	34,956
Rural financial institutions				
Total assets	437,376	443,291	452,438	456,947
Total liabilities	405,061	410,490	418,744	422,308
Net assets	32,315	32,801	33,694	34,639

Notes:
1.Rural financial institutions include rural commercial banks, rural cooperative banks, rural credit cooperatives, and so on
2.Small and Medium-Sized Commercial Banks includes Joint Stock Commercial Banks, City Commercial Banks and Rural financial institutions.

Source of Data: CBRC

4.6.2.2 The influence of total scale of shadow banking in China's commercial banking industry

After knowing the "family background" of China's commercial banks, we can calculate the scale of shadow banking. This result can help commercial banks (especially small and

medium-sized banks) know the actual situation they are facing and whether the impact of shadow banking scale is important or not.

According to the provisions of the guiding opinions on the supervision of bank financial management business in 2014 (No. 39 document) issued by CBRC in 2014, capital guaranteed financial management is usually on balance sheet financing, which is subject to strict supervision. Non-breakeven financial management is usually off-balance sheet financial management, which only needs to be "truthfully reflected in the statements of off-balance sheet business, credit concentration and liquidity risk", and does not need to be included in the statement, nor does it need to make provision for risk assets and calculate capital adequacy ratio. Therefore, the non-breakeven financing funds should be included in the scale of shadow banking.

According to the above analysis, it is concluded that the shadow banking scale of China's commercial banks is equal to non-breakeven financing + repurchase funds + receivables investment - Inter-bank financing (adjustment and double calculation). Among them, the data of non-breakeven financing and Inter-bank financial management comes from China banking financial market report and wind. The resale funds and receivables investment come from the financial statements of commercial banks. We will calculate from the perspective of minimum caliber, that is, "shadow banking scale = non-breakeven financing", and the calculation of other contents will continue in the chapter of empirical research.

As of December 31, 2021, the non-breakeven financial balance of China's commercial banks totaled 29.003 trillion (Figure A-20), including 11.04 trillion large state-owned commercial banks, 11.38 trillion joint-stock commercial banks, 5.23 trillion urban commercial banks, and 1.27 trillion rural financial institutions (Table 4.3). Based on this, we conclude that large state-owned commercial banks have 11.04 trillion of net assets, corresponding to 11.81 trillion of net assets (Table 4.3), while the remaining balance of non-breakeven financial management of small and medium-sized commercial banks is 17.88 trillion, and the corresponding net assets are 12.02 trillion (Table 4.3). If the non-breakeven financing is regarded as credit risk, the higher the ratio of N (Table 4.3), the higher the risk level of commercial banks. According to the calculation in Table 4.3, the ratio of N of large state-owned commercial banks is 93.48% in 2021, while the ratio of N of small and medium-sized commercial banks is between 148.75%. Therefore, it can be considered that the risk of small and medium-sized commercial banks engaging in shadow banking business is far greater than that of large state-owned commercial banks.

Table 4.3 Comparative analysis of large commercial banks and small and medium sized commercial banks (unit: trillions)

Bank Type / Project	Non-breakeven Financing Scale (unit: trillions)	Net Assets (unit: trillions)	Risk Pressure Index of Shadow Banking
Large state-owned Commercial Banks	11.04	11.81	93.48%
Joint Stock Commercial Banks	11.38	5.07	224.45%
City Commercial Banks	5.23	3.49	149.85%
Rural Financial Institutions	1.27	3.46	36.70%
Small and Medium Sized Commercial Banks(total)	17.88	12.02	148.75%

Notes:
1.Small and Medium Sized Commercial Banks include Joint stock commercial bank, City Commercial Bank and Rural financial institutions.
2.Risk pressure index of shadow banking refers to the ratio of non-breakeven financing to net assets. The larger the index is, the higher the risk pressure of shadow banking is.
The index formula (N)= Non-breakeven financing scale/ Net assets

Source: Summarized by the Author

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Chapter 5: Financial Technology

This chapter begins with an overview of financial technology and defines its connotation with Internet finance. Secondly, it analyzes the background and development process of the rise of financial technology, and further expounds its impact on social economy. Thirdly, it examines the influence of financial technology development on Chinese commercial banks' payment, deposit, and loan businesses. Finally, the chapter compares financial technology development successes between China's large commercial banks and small and medium-sized commercial banks, and evaluates the obstacles and difficulties that small and medium-sized commercial banks will encounter in the future.

5.1 Introduction

5.1.1 Overview of financial technology

The application fields of global financial technology include payment, lending, trading or investment, wealth management and credit reference. As shown in Figure A-21, financial technology is gradually rising in the world. In 2020, many venture capitalists were worried that COVID-19 would trigger a sharp downturn in the economy and tightened equity investment decisions, leading to many financial technology investment being shelved. However, as the US loose monetary policy and active fiscal stimulus plan began to stabilize and rebound in the second half of the year, their interest in investment suddenly increased.

5.1.2 Technical means of financial technology

5.1.2.1 4G and 5G technology

The fourth and fifth generation mobile communication technologies (4G and 5G for short) can quickly transmit data, high-quality video and audio, and have the advantages of fast communication speed, compatibility with a variety of devices, high efficiency and low cost 5G is the extension of 4G. On December 4, 2013, the Ministry of Industry and Information Technology officially issued 4G licenses to China’s three major communication equipment operators, marking that China’s communication industry has officially entered the 4G era.

So 4G and 5G used in payment business have the following advantages. (1) Promote the development of third-party payment platform. 4G network mode provides a reliable and secure trading platform for e-commerce, and the development of e-commerce provides the necessary service guarantee for consumers' online consumption, thus further promoting the development of mobile payment. (2) Based on 4G technology, mobile payment can be purchased online through PC or app. And behind app, there are other financial technologies. (3) 4G technology is more efficient and flexible. 4G network transmission speed is faster and more convenient. With the support of mobile terminals, the business processing efficiency of e-commerce can be improved to a higher level. With the development of 4G network, WeChat, Alipay and so on can be used more and more widely, such as bus, subway, vending machines, movie tickets and so on. They gradually infiltrate into all kinds of life scenes. (4) 5G technology is coming. With the popularity of smart phones, high-speed wireless networks gradually meet the real-time needs of the Internet, and mobile payment is growing rapidly. Compared with 4G network, 5G network overcomes the shortcomings of network speed and coverage. At the same time, with the development of AI, big data and other technologies, there is a huge development space in the field of payment risk control. Therefore, the safety factor of mobile payment will be further improved.

5.1.2.2 Big data

McKinsey first proposed the concept of "big data", which means that data has become an important factor of production. Using big data technology to mine and effectively use massive data can create value in various fields of the world economy in a variety of ways. Big data is a kind of information asset with high growth rate, diversification and large amount of data. Under the new mode of processing, this kind of information asset can help enterprises make high-quality decisions.

It is worth noting that big data can obtain information at a faster speed, and can process a large amount of information to obtain high-value data. In addition, big data has a variety of storage formats (such as square book, image and sound) to store data.

5.1.2.3 Cloud computing and artificial intelligence

Cloud computing uses the Internet to connect a series of independent computers and servers to form a "cloud", and then distributes computing on each distributed computer. Different users can access the network at any time through the computer or smart phone terminal to obtain the required resources. The essence of "cloud" is a huge resource pool, which has powerful

computing power. It can run in a virtualized way, and users can enjoy services through terminals in any area. "Cloud" has the ability of automatic and centralized management, supporting a variety of applications to run at the same time, meeting the needs of users.

AI field includes face recognition, image recognition, language recognition and natural language processing. For example, face-scanning payment is realized with the help of biometric technology, and the password in the payment process is facial image or video, which can improve the accuracy of recognition and the security of payment by accurately extracting facial features. Voice payment is made through the combination of voice recognition technology and payment system. After users bind information and input voice in advance, they can complete the payment through voice instructions on relevant banks and third-party apps. At the same time, the machine learning technology in AI can be based on the analysis of historical payment data and constantly improve the algorithm, so as to continuously optimize the field of intelligent payment.

5.2 Rise of financial technology

5.2.1 Background of the rise of financial technology

The application of science and technology in the financial industry has a long history. From manual account book to computer system, from counter service to ATM, e-banking and other self-service, from stockbroker’s manual password to electronic order, are all cases of application of technology in the financial industry. Looking back at the history of finance, we can find that the financial industry has been actively absorbing cutting-edge scientific and technological achievements in the process of development. In other words, the development of the financial industry and the promotion of science and technology are mutually integrated and mutually beneficial. Finance needs information to support its function as a resource allocation intermediary. The development of technology provides finance with more comprehensive and accessible information. Through the integration of technology and finance, the quality and efficiency of financial services have made great progress, promoting the development of financial industry towards a more scientific, intelligent and efficient direction.

From a global perspective, the rise of the concept of financial technology can be traced back to the 1980s in the United States. At that time, the information technology in the United States was in the stage of rapid development. Financial institutions relied on the computer application system established by information technology personnel to realize the electronic

and automatic operation of office and part of business. However, until recent years, the concept of "financial technology" appears to be separated from traditional finance. This leads to a question: why in the past the integration of finance and technology has not attracted widespread attention, but now it has become so hot? Is it that financial technology has given birth to many new financial formats, which did not exist in the past? The answer is no. In fact, before the concept of "financial technology" appeared, there was the concept of "financial engineering", which uses computer and communication technology to engage in financial transactions. The amount of information processing is extremely large, and the transaction frequency is also very fast. An important reason why financial technology is widely concerned today is due to the popularity of modern financial technology, such as payment, lending and so on. Because more and more individuals or institutions are used, more and more financial institutions or Internet and other non-financial institutions are involved, which promotes the extension of financial technology to a wider field.

5.2.2 Social and economic impact of the rise of financial technology

The rise of financial technology has brought positive effects for social development. Financial technology companies have technical advantages, focus on customer experience, and provide more convenient products and services. For example, Alipay (third party payment platform) has penetrated into every aspect of people’s daily life, including passport information, car service, charging of mobile phone calls, movie performances, and so on, and customer experience has been greatly improved. At some time, banks cannot match the advantages. All these benefits from the economies of scale effect of big data technology and Internet, because financial technology reduces the cost of financial services and extends traditional financial services to long tail customers (long tail customers refer to individuals or small and medium-sized enterprises with small amount of funds owned and controlled by individuals, and banks often do not pay enough attention to these customers). At the same time, in the past, banks had difficulties in credit investigation of small enterprise borrowers. The unit loan cost in the examination and approval process was high, and many banks simply did not do it. However, big data technology helped some financial technology companies to do it. These institutions completely relied on their own business ecosystem to collect the credit data of borrowers and build their own rating models, Through the computer program, we can provide low-cost and efficient small loan service. With the popularity of the Internet in the world, digitization has become a way of life. Compared with the traditional channels, the Internet reduces costs,

improves efficiency and promotes the occurrence of financial transactions through the operation mode of data and online. Therefore, the rise of financial technology is conducive to the emergence of Inclusive Finance.

Is the rise of financial technology always a positive influence? The answer, of course, is no. In fact, technology itself is neutral. The combination of technology and finance can promote social and economic development if it is used well, and vice versa. For example, big data credit reference, on the one hand, makes a good supplement to the shortcomings of traditional credit reference business, greatly expands the data sources and processing means of credit reference, and is conducive to the realization of the purpose of Inclusive Finance. But on the other hand, if this kind of technology is used unreasonably, it may violate the rights of citizens. For another example, China's P2P online lending platform was originally used as a financial innovation for financial disintermediation, but it was used by those enterprises that illegally operated or raised funds under the banner of Internet finance or financial technology, resulting in huge social and economic losses.

5.3 Impact of financial technology on payment business of commercial banks

Payment business has always been the basic business of the financial industry, because payment business is the entrance of the financial technology ecosystem and the gateway for innovators to build a closed-loop ecosystem and find other business models. The development of payment business is always accompanied by technological innovation. For example, big data technology is mainly applied in the following aspects in the field of payment. (1) Consumption. By analyzing the consumption amount and types of different age groups, gender and different regions, we can understand the consumption habits and preferences of consumers, which is helpful to optimize the marketing strategy. (2) Pricing. Through payment data, different consumer groups can be distinguished, and products with different functions and prices can be produced more specifically, so as to meet the needs of consumers at different levels. (3) Credit reference link. This is also the most important part. The Internet payment platform continuously optimizes the big data credit system by collecting and analyzing personal historical credit data and granting users a certain amount of credit, which in turn serves the payment business. With the development of 4G and 5G, big data, cloud computing, AI and other financial technologies, commercial banks are facing more challenges and opportunities.

5.3.1 Payment business of China's commercial banks (online banking and mobile banking)

Online banking is a virtual counter set up by banks on the Internet. Compared with traditional banks, online banking has the characteristics of virtual similarity and risk. In 1997, the Bank of China first launched Internet banking, which relies on the Internet to handle traditional banking business. Later, other banks (such as ICBC and CCB) also launched the Internet banking business.

As shown in Figure A-22, although China's online banking business started late, it has developed rapidly. With the development of more than 20 years, the transaction scale has increased significantly, and the types of business are rich and diverse.

Characteristics or advantages of mobile banking are mainly mobility, quickness and real-time. With the continuous improvement of the Internet, China's mobile banking is also in the trend of rapid growth. As shown in Figure A-22, compared with online banking, the growth rate of mobile banking in China is more obvious, which benefits from the popularity of smart phones and the development of network (4G network and predictable 5G network).

5.3.2 Third party payment

With the development of social and economic activities, due to the time required for the circulation and turnover of goods or services, there is often a phenomenon that delivery and payment are not synchronized, which may lead to moral hazard. The traditional payment methods, such as cash, bills or telegraphic transfer, are all instant payment, which cannot solve the game between the buyer and the seller in the whole process from payment, delivery to inspection. Therefore, the third-party payment arises at the historic moment. At present, third-party mobile payment institutions around the world mainly have "multi-dimensional scenarios of payment accounts", and realize the transfer of funds between the bank accounts of both parties through mobile technology. The most representative of the world is the PayPal of the United States, in China, Alipay and TenPay.

PayPal started from e-mail payment at first, and then carried out mobile payment through SMS (Short Message Service). It mainly grasped the market opportunity of poor mobility of traditional payment and difficult to meet the demand of personal micro payment, and launched creative and subversive payment products.

PayPal has developed into an international online payment giant with the help of eBay's powerful e-commerce platform. From relying on eBay to independent development, PayPal

has developed into an international payment instrument, which is widely used in various cross-border transactions to facilitate international settlement.

As shown in Figure A-23, the company has maintained a growth rate of about 25%. According to the financial report data of 2019, PayPal has more than 400 million active accounts and the payment scale has reached 712 billion US dollars.

In China, under the leadership of Alibaba (Alipay) and Tencent (TenPay) Inc, after more than 10 years of development, third-party payment has become more and more important in the payment market. As shown in Figure A-24, the scale of third-party mobile payment has increased from 1.22 trillion RMB in 2013 to 226.10 trillion RMB in 2019.

It can be seen from Figure A-24 that the rapid growth of payment business in the field of mobile payment is mainly due to the technical dividend brought by the rapid development of 4G and 5G. Since 2013, third-party mobile payment has shown rapid growth, and increasingly formed a duopoly (Alibaba and Tencent) market pattern. According to the statistics of WIND in 2019, the total market share of Alipay and TenPay was 94%, occupying the absolute leading position (Figure A-25).

At the initial stage of development, Alipay mainly relied on its own electronic business platform to serve Taobao transactions (this mode of operation is very similar to PayPal). In 2004, Alipay began to transform and started the strategy of mobile phone business in 2008, and launched smartphone payment. In addition to online e-commerce transactions, Alipay business began to invest in finance, life payment, education, public interest and other areas of development, and become a diversified integrated payment platform.

TenPay began on WeChat social networking platform, starting from the social needs of mutual transfers between individual users, and has stronger social attributes than Alipay. Among them, the businesses most used by customers and most sticky businesses are offline small amount collection and payment between individuals and merchants and online WeChat red envelope transfer. Therefore, TenPay focuses more on the dimension of life and is widely used in various social scenes.

5.3.3 Comparative analysis of third-party payment and commercial bank payment

5.3.3.1 Differences in the payment process

The physical card payment and mobile banking payment of commercial banks are based on the customer settlement account. Peer payment is transferred between different accounts by various institutions in the internal, while cross bank payment is to complete the fund

settlement by means of the people's bank system and other organizations such as China UnionPay.

The network third-party payment is divided into gateway mode and account mode according to its functions. Under the gateway mode, the third-party organization acts as an intermediary to integrate the online banking entrance of each bank. After receiving the customer's payment instructions, it jumps to the relevant bank website to complete the payment. While the account mode, is a third-party organization that undertakes the functions of fund custody and part of credit intermediary. The payment of the payer (customer) needs to complete a circulation in the virtual account of the third-party organization before it reaches the bank account of the payee. The third-party platform guarantees the successful completion of the transaction with its own credit.

The payment business of commercial banks is generally considered to have higher security, but there are too many transaction steps, and the electronic payment also needs to be opened at the outlet to use, and the mobile app of a single bank can only be bound with peer card. The third-party mobile payment can apply to open online, support binding multiple bank cards, and users only need to install an app to act as the online banking entrance.

5.3.3.2 Differences in customer groups

Commercial banks have been operating on the basis of physical outlets for a long time, with the characteristics of high operating costs, strong capital practice and close contact with major customers. They have obvious advantages in developing high-end business such as large-scale institutional business and private banking business. Therefore, banks tend to aim at the main customer groups in large and medium-sized institutions and high net worth individuals, ignoring the financial needs of a large number of long tail customers. With the development and promotion of financial technology, commercial banks begin to transform intelligently and pay attention to the long tail market, so inclusive finance emerges as the times require.

In contrast, the Internet third-party platform generally does not have physical outlets, and generally serves the small customer market. With the help of financial technology such as big data and its own channel advantages, it can gain customers and quickly occupy the long tail market. As shown in Figure A-26, China's mobile payment users show obvious small features. Alipay relies on e-commerce, TenPay has strong social background. Both of them accumulated a large number of individual user resources in the long-term development process. Although the main customers are small in scale, the number is very large, which is consistent with the current mobile payment market.

5.3.3.3 Different scenarios

The payment of commercial banks is only limited to the payment itself, and the purpose is to reach a transaction, which has a strong instrumental attribute. But the three-party payment platform such as Alipay and TenPay creatively use the payment link to create an ecological closed-loop. With the payment flow records the customer's basic information and behavior characteristics, create more new scene experiences for users, and continuously tap the profit point from the payment.

The key to the successful breakthrough of the third-party platform lies in its continuous development of the scene. Since the launch of Yu'E Bao in June 2013, Alipay has been continuously adding the value-added services in finance and life to the development of various fields. TenPay makes use of the wide spread of WeChat red envelope to closely integrate payment and scene.

5.3.4 Impact of third-party payment on payment business of commercial banks

5.3.4.1 Fast-growing third-party platform grabs business share

Payment and settlement business is the most typical intermediary business, with considerable handling charges and low risk. The rise and development of third-party payment weakens the absolute power of commercial banks in this market. The process of the buyer charging, shopping and receiving goods from the third-party account itself is a kind of settlement business. At the same time, life services such as mobile online shopping, public utilities and daily payment are accelerators of the rapid development of third-party payment in recent years.

At the same time, third-party payment not only has a low fee, but also can achieve most of the payment needs with smart phones. Therefore, third-party payment is more and more favored by users, which poses a certain challenge to the bank payment business.

5.3.4.2 It will affect the collecting and paying business of commercial banks

Bank outlets are widely distributed in the community and around the business circle. The purpose is to strengthen the communication with customers while carrying out the business of collecting and paying on behalf of customers, so as to gain revenue and increase customer loyalty. With the development of third-party payment, people can complete the collection and payment operation on the Internet, saving time and effort. Third-party payment is popular with young people. At the same time, the third-party payment platform develops market segments, and provides personalized services for different groups, such as the launch of student card

recharge service.

On the whole, the innovation ability of third-party payment is strong, while in contrast, the work of commercial banks in the collection and payment business is insufficient.

5.3.4.3 Rapid loss of customer group

This is the most difficult point for commercial banks. With the rapid development of third-party payment, the increase of online transactions leads to a sharp decrease in the number of offline cards, which affects the number of bank cards. And with the convenience of online shopping, offline stores have become similar to “experience stores”, people’s demand for bank cards is less and less. At the same time, the personalized and comprehensive service of third-party payment is increasingly recognized in the huge customer group, and produces stickiness. In contrast, the improvement of user experience has always been a pain point in the development of banks, which has a great impact on customer diversion.

5.4 Impact of financial technology on deposit business of commercial banks

The liability business of commercial banks is the basis of all other business development, which is generally divided into non-deposit sources and deposit sources. The former includes discount loan from central bank, loan from central bank and bond financing. The access threshold of these financing methods is very high, so commercial banks have strong initiative and control in these areas. The formation of deposits (including resident deposits and enterprise deposits) is relatively passive.

As shown in Figure A-27, the proportion of deposits in the total liabilities of China’s commercial banks decreased year by year, from 67.83% in 2010 to 58.49% in 2020, a decrease of nearly 10 percentage points. In the balance of commercial bank deposits, the proportion of residents’ savings deposits decreased from 31% in 2010 to 29.68% in 2020.

Compared with enterprise deposits, the amount of resident savings deposits is small, the use of deposits is more flexible, the acceptance and adaptation of new Internet finance is higher, and it is more vulnerable to the impact of financial technology. In 2003, Taobao launched Alipay for the first time. In August 2007, China’s first P2P lending platform, PPDS(NYSE), was established in Shanghai. In June 2013, Alipay launched Yu’E Bao (It is a financial product, the same below) with the Tianhong Fund (the first value-added product based on the Internet platform). Although it is impossible to infer that the change of deposit business of commercial banks depends on the development of financial technology, the rapid growth of these financial

technology products coincides with the general trend of the change of debt structure of commercial banks.

5.4.1 Analysis on the current situation of deposit business of China's commercial banks

At present, the deposit business of China's commercial banks is facing many challenges. From the perspective of macroeconomic adjustment, the slowdown of China's overall macroeconomic growth and the deleveraging strategy of regulatory authorities have led to the further weakening of deposit growth of China's financial institutions (Figure A-28). From the perspective of microeconomics, the aging population and the rising leverage ratio of residents (Figure A-29), which are the reasons for restricting the deposit growth rate. More importantly, with the development of financial technology and the gradual reduction of financial management threshold, savings deposits are gradually transformed into financial products. At the same time, because bank financial products cannot meet people's financial needs, Internet finance, third-party payment, monetary fund and other financial asset products gradually divert bank deposits.

5.4.2 "Baby" Internet financial products appear

In June 2013, Alipay launched Yu'E Bao with Tianhong fund. As can be seen from Figure A-30, its scale has been expanding, from 4.2 billion RMB just launched to 1093 billion RMB (as of December 31, 2019). At the same time, Yu'E Bao's great success in the financial market has led to the imitation of major Internet and fund companies. In a short period of seven years from 2014 to 2019, the trading scale of Internet funds has grown rapidly, and the "Baby" Internet monetary fund has been the main force to detonate the Internet fund market.

So why are customers willing to invest in "Baby" Internet financial products.The biggest feature of "Baby" Internet financial products is low risk and high yield. For example, when Yu'E Bao was first launched, the current deposit interest rate of commercial banks in the same period was 0.35%, while the 7-day annualized yield of Yu'E Bao (Figure A-30), the lowest yield was 1.76%, and the highest was 6.76%, far exceeding the current deposit interest rate of commercial banks. At the same time, the nominal initial purchase amount of this kind of product only 1 RMB, which basically means no investment threshold, and supports transferring to the bank card at any time, which is almost the same as a current deposit in the bank.

Today, mobile payment and E-banking are becoming more and more popular. More and

more users choose to transfer their funds deposited in the bank current deposit account to the "Baby" Internet financial products. There are two reasons. On the one hand, commercial banks are limited by outlets and working hours, unable to provide customers with the fastest and most convenient service, and gradually lose the advantage of flexibility and convenience in the battle for deposits. On the other hand, a large number of "Baby" Internet financial products have attracted a large number of small and Micro customers by virtue of their high yield, which has brought a great impact on the deposit business of commercial banks. Of course, in recent years, the rate of return has declined, and the attractiveness of monetary funds has slightly declined.

Under the condition that China's interest rate marketization has not been fully realized, there is a big gap between the deposit interest rate of China's commercial banks and the return rate of the financial market. Therefore, a large number of commercial bank deposit customers indirectly invest in monetary funds through "Baby" Internet financial products. Under China's financial deleveraging policy, the yield of financial market continues to be high, and the money fund will absorb the funds to invest in low-risk financial assets such as inter-bank certificates of deposit, thus providing a source of funds for inter-bank liabilities of commercial banks. That is to say, the original deposit business was a relatively simple "customer—commercial bank" model (Figure 5.1, ①), but now it has become a "customer—Monetary Fund—commercial bank" model (Figure 5.1, ②). This change of business model makes the financing chain of commercial banks longer, and then leads to the increase of capital cost of banks. It is worth noting that although the business model has changed, in fact, money still flows into commercial banks.

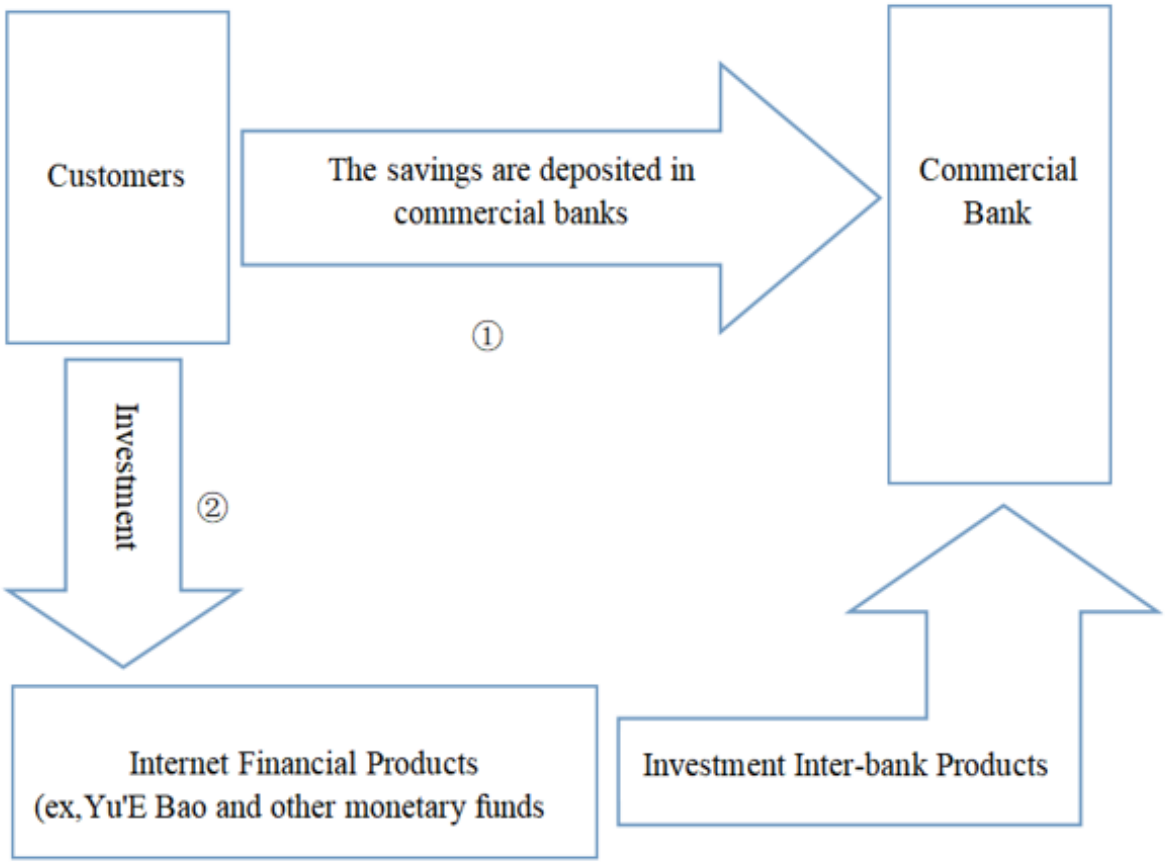

Figure 5.1 "Customers—commercial bank " and "customers—monetary fund—commercial bank " mode

Source: Summarized by the Author

5.5 The impact of financial technology on the credit business of commercial banks

This section mainly analyzes the impact of Fintech on bank credit business from the perspective of big data, cloud computing and AI. On the one hand, big data and cloud computing enable bank credit business to create incremental business while revitalizing the stock, and bring new growth points to bank performance. On the other hand, the deep learning algorithm developed by AI based on the powerful computing power of computer can identify and discover valuable information, improve credit security by using automatic coding products, and optimize the allocation of credit assets.

5.5.1 Impact of big data on bank credit business

As a subversive information processing mode, big data has a huge impact on all walks of life,

including the financial industry. The essence of big data technology is to mine the information behind the data to help analysis and decision-making. As a financial institution with rich data precipitation and highly dependent on data analysis, banks have inherent advantages and motivation to use big data technology to optimize their business model. Credit business is an important field for banks to use big data technology. After time accumulation and control, they have also explored some mature big data application models.

For example, in terms of customer access. This is one of the core applications of big data in bank credit business. At the same time, as an important part of bank risk control, credit approval has a significant impact on the scale and quality of bank assets. At present, banks mainly give credit according to customers' credit rating. With the application of big data technology, banks begin to expand the scope of data collection, and then optimize their own customer credit rating model. On the one hand, the data dimension of customer rating model based on big data is wider and has more variables. Unstructured data, such as online consumption data and user preference data, will be added on the basis of customer balance sheet, income, transaction flow and credit reference. Financial data and non-financial data are reorganized into machine learning model to make the rating results more realistic. On the other hand, big data rating model is more complex than traditional model, which may introduce nested model and dynamic adjustment mechanism. The nested model can process the information layer by layer to achieve a better differentiation effect, and the dynamic adjustment mechanism makes the model continuously optimized and more practical.

5.5.2 Impact of artificial intelligence on bank credit business

AI is a deep learning algorithm based on the powerful computing power of computer. In many tests, AI, as a new algorithm with epoch-making significance, surpasses the traditional algorithm. Because of its self-learning and self-iteration characteristics, it is widely used in financial practice. With the advent of alpha go, AI has been applied in many fields of financial industry.

5.5.2.1 Artificial intelligence reduces the operating costs of banks

The impact of AI on bank credit is first reflected in the replacement of its basic work, especially the basic financial work in the middle line of credit business. With the further combination of AI and financial industry, offline outlets will tend to be unmanned and automatic, greatly reducing the cost of commercial banks to provide services for customers. For example, the application of convolutional neural network greatly promotes the development of image

recognition technology, and improves the accuracy of LFW (labeled faces in the wide) from 64.8% of the traditional algorithm to 99.7%. It makes the application of face recognition possible.

It is the development of convolutional neural network that makes it possible for financial institutions to provide offline unmanned services, which also greatly shortens the time and labor cost for commercial banks to handle credit services. In addition, the convolutional neural network can effectively distinguish the difference between photos, videos and real images, which ensures the security of customer identification when banks provide services on mobile clients. At present, many emerging network banks rely entirely on online customers to handle loan business, which is bound to be inseparable from the identification of customers and identification information, and all of this is inseparable from the AI represented by convolution neural network, which is becoming an important guarantee of security in the process of combining finance with science and technology.

5.5.2.2 Intelligent identification of valuable information

The recurrent neural network in AI is developed with reference to the memory characteristics of human brain. It can continuously process the information based on the historical information of time series and provide the possibility for reducing the cost of bank credit business. A very important application of recurrent neural network is to identify and screen the key content of the article, and form the corresponding document. The data that commercial banks need to store and analyze in order to provide credit services for small customers is too large, so it is urgent to use the recurrent neural network algorithm to realize the classification of documents and data information and the identification of important information. Because the recurrent neural network can find the semantic reflection of the key bytes through the network, and combine them with the pointer network.

In the loan business to enterprises, the application scenarios of recurrent neural network are more diversified. With the help of recurrent neural network, banks can analyze the financial and operating information of loan objects, which greatly reduces the pressure of bank loan analysis. The bank can also quickly calculate the financial report data of the loan object, and quickly compare the text materials such as the contract with the original law, so as to reduce the credit risk of the bank. These fast analysis tools of documents and reports based on recurrent neural network can reduce costs and improve the efficiency of banks.

5.5.2.3 Automatic encoder improves credit security

Compared with the fraud detection model built manually in the past, the automatic encoder of AI can make the model automatically learn the rules behind the fraud records, so as to train the algorithm to continuously improve the anti-fraud ability. What commercial banks need most is massive credit data, so it is especially conducive to the application and development of this technology.

The role of automatic encoder is not only reflected in the improvement of business security. With the deepening of learning, the efficiency of information processing of automatic encoder algorithm can also be rapidly improved, which is reflected in the loan business, that is, the time of risk identification is constantly shortened, the time cost of loan business processing is reduced, and the bank loan is faster and more efficient. Automatic encoder improves the accuracy of credit fraud identification of commercial banks, which is reflected in the identification of high-risk borrowers. The automatic encoder expands the number of people that can be served by bank credit, and enables many loan objects that cannot be served by traditional methods to obtain financing times. Credit services are not only safer and more efficient, but also significantly improved in terms of inclusiveness.

5.6 Challenges and difficulties faced by small and medium sized commercial banks

Financial technology innovation brings convenience, inclusiveness and efficiency and attract more customers. It has a profound impact on commercial banks: First, the business concept of commercial banks has changed. The traditional banking management thinking pays more attention to the relationship between big customers and high-end customers, and for such customers, as long as they are provided with security and stability, banks can generate benefits. However, with the development of fintech, the old concept of the banking industry has changed, and new technologies continue to erode traditional business. At the same time, the credit intermediary role of bank credit institutions has also been weakened. In the past, the bank was the most reliable and stable financing method, and enterprises' payment depended on the banks. Now, the emergence of Internet finance and big data has made various financing platforms and mobile payment platforms all with their convenience. The efficient way attracts a large number of users. Big data and blockchain technology have established a more accurate credit evaluation system for themselves, thus breaking the exclusive advantage of the banking industry in

financial institutions.

Whether large commercial banks or small and medium-sized commercial banks, the development of financial technology is inseparable from the investment of a large number of funds (including the investment of cooperative projects) and the investment of financial technology talents. This section analyzes the current situation of large commercial banks and small and medium-sized commercial banks in the field of financial technology. The purpose is to find out where and how big the gap is in the field of financial technology of small and medium-sized commercial banks.

5.6.1 Analysis of financial technology status of large commercial banks in China

As can be seen from Table 5.1, China's large commercial banks have invested huge funds in the field of financial technology (Information Technology). According to the data, the total investment in science and technology of the six state-owned big banks exceeds 70 billion RMB, among which the investment of four big banks, Bank of China, Agricultural Bank of China, Industrial and Commercial Bank of China and China Construction Bank has exceeded 10 billion RMB. In addition to a large amount of capital investment, it can be seen from Table 5.1 that large commercial banks also attach great importance to the introduction and training of financial technology talents.

Table 5.1 Investment of large state-owned commercial banks in 2019

Large State-owned Commercial Banks	Investment in Financial Technology (Billion RMB)	Proportion of Investment	Number of financial technology staff	Proportion of Fintech Staff
ICBC	16.37	2.20%	34800	7.80%
ABC	12.79	2.16%	7351	1.60%
BOC	11.65	2.12%	7016	2.58%
CCB	17.63	2.50%	10178	2.75%
BCM	5.05	2.57%	3460	4.05%
PSBC	8.18	2.96%	-	-

Notes:
1. Proportion of Investment=Investment in financial technology/ Operating revenue
2. Proportion of Fintech staff=Number of financial technology staff/ Total number of staff
3. the PSBC was listed on the Shanghai Stock Exchange on December 10, 2019, but the data on the number of financial talents is too small

Source: Annual Report of Commercial Banks in 2019

5.6.2 Analysis of financial technology status of small commercial banks

Small and medium-sized commercial banks are also aware of the importance of financial technology in the future competition of commercial banks. Small and medium-sized commercial banks have also invested a lot of money in the field of financial technology (Table

5.2). From the perspective of investment in financial technology, according to the disclosed annual report information, the proportion of Fintech investment in the revenue of listed banks continued to increase in 2019, among which China Merchants Bank is the largest one in the small and medium-sized commercial banks. In 2019, the investment in it was 9.36 billion RMB, accounting for 3.72% of the revenue. In terms of the number of financial technology personnel, small and medium-sized commercial banks have also made considerable investment. According to the disclosed annual report, Ping An Bank has more than 7500 (include the staff of Ping An Technology) scientific and technological staff, which is the largest number of small and medium-sized commercial banks. However, whether it is the investment of capital or personnel, small and medium-sized commercial banks cannot be compared with large commercial banks. In the wave of financial technology, large banks take the lead to strengthen technological innovation by using their own advantages, but small and medium-sized banks are difficult to compete with them.

Table 5.2 Investment of small and medium-sized commercial banks in 2019

Small and Medium-sized Commercial Banks	Investment in Financial Technology (Billion RMB)	Proportion of Investment	Number of financial technology staff	Proportion of Fintech Staff
CMB	9.36	3.72%	3253	3.84%
CITIC	4.90	2.61%	3182	5.58%
CEB	3.40	2.56%	1542	3.38%
JSBANK	0.69	1.53%	-	-
QDBANK	0.03	0.31%	152	3.69%
CSCB	0.47	2.76%	-	-
Ping An Bank	1.09	0.79%	7500	21.90%
CSRCB	0.22	3.41%	712	11.07%
CIB	3.57	1.97%	1910	3.16%
LUZHOU BANK	0.11	3.92%	-	-
WeBank	1.47	9.80%	1080	53.73%
CQRCB	-	-	370	2.47%
MYbank	-	-	439	52.20%

Note 1: WeBank and MYbank are the two largest Internet banks in China, so the proportion of capital and personnel investment is high.

Note 2: Ping An Bank include the staff of its subsidiary (Ping An Technology)

Source: Annual Report of Commercial Banks in 2019

5.6.3 Difficulties of small and medium sized commercial banks

With the promotion of mobile Internet technology, the battle for customers of banks has shifted from offline outlets to online ones. Commercial banks have launched online banking, mobile banking and other products, making it possible for users to experience banking services anytime and anywhere. The integration of technology with web page, mobile client and WeChat

not only helps to improve the bank's sales channels, but also helps to provide personalized customer service. Web page and mobile app are welcomed by the younger generation with low operating cost, all-weather service and innovative technology, and gradually enhance their influence. The investment of capital and personnel of major commercial banks is different, and the effect on the field of financial technology is also different. As shown in Figures A-31 and A-32, the total transaction share of online banking market of small and medium-sized banks is 38.9%, while the total transaction share of mobile banking market is only 29.50%.

From the above data analysis, it can be seen that China's commercial banks actively layout online channels, large commercial banks have obvious advantages in channels, and joint-stock banks such as China Merchants Bank and Minsheng Bank have developed rapidly in channel expansion. Nevertheless, the online channel service ability of most small and medium-sized banks is very limited, and the competitiveness of financial technology cannot be compared with that of leading banks. At the same time, Fintech companies provide personalized and inclusive services for different customers through technical means, firmly grasp the "long tail customers" in their hands, divert part of the customer resources of small and medium-sized banks, and compete with the advantageous business of small and medium-sized banks. Small and medium-sized banks are suffering from the double attack of large banks and Fintech companies, and the development of Fintech has caused a great impact on small and medium-sized banks.

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Chapter 6: Empirical Research

The third chapter introduced Baoshang Bank and Shanghai Pudong Development Bank (Chengdu Branch) in the form of case analysis. Due to the deficiency of corporate governance, the non-performing rate of the two small and medium-sized commercial banks increased significantly. The result was that Baoshang Bank declared bankruptcy, and Shanghai Pudong Development Bank (Chengdu Branch) was heavily fined 460 million yuan by the regulatory authorities. After introducing the differences between China and the United States on shadow banking, the fourth chapter deeply analyze that China's commercial banks are actively and directly participating in shadow banking business. For example, Funds from bank financial products enter the trust business. In other words, China's commercial banks are the main participants in China's shadow banking. By studying the risk transmission mechanism of shadow banking business, combined with the scale of large commercial banks and small and medium-sized commercial banks engaged in shadow banking, it is concluded that the risks faced by small and medium-sized commercial banks in shadow banking business may be far greater than that of large commercial banks. After comparing capital investment (including cooperative research) of large commercial banks in financial technology, the fifth chapter finds that small and medium-sized commercial banks cannot be compared with large commercial banks in terms of capital investment. Therefore, compared with large commercial banks, small and medium-sized commercial banks may face greater risks. Based on the qualitative analysis of the first three chapters, this chapter uses the data of 116 small and medium-sized commercial banks for quantitative analysis to further verify whether the risk sources of small and medium-sized commercial banks are related to corporate governance, shadow banking and financial technology, and their impact.

6.1 Research hypothesis

6.1.1 Corporate governance

Kong and Dong (2008) conducted an empirical test using the data of five listed banks from 2000 to 2007 and found that the sum of the shareholding ratios of the top three shareholders had a significant positive impact on the non-performing loan ratio and nonsystematic risk.

Sannders et al. (1990) empirically tested the relationship between ownership structure and risk using the data of 38 banks from 1978 to 1985. The results showed that the banks directly controlled by shareholders have a higher risk, indicating that the higher the ownership concentration, the greater the risk the banks are bearing. Laeve and Levine (2009) showed that the existence of large shareholders with a large amount of cash flow control rights increases the risk level of the bank, indicating that large shareholders have the motivation and ability to urge bank management to take action to increase the risk of the bank. Cull et al. (2006) found through empirical analysis that the related-party loan itself is neutral, and its impact on the bank depends on the external institutional constraints of the bank and the degree of perfection of the internal governance structure. However, most literature believe that large shareholders may reduce the quality of bank assets through related-party transactions and damage the interests of small and medium shareholders and depositors (Enriques, 2015; Johnson et al., 2000; Porta & Zamarripa, 2003). From the existing academic achievements, most of them are from the perspective of China's listed banks or take commercial banks in the United States or Europe as samples. There is a gap in the research on the risk of small and medium-sized commercial banks in China. Therefore, this thesis puts forward the following assumptions:

Hypothesis 1: the higher the shareholding ratio of the largest shareholder, the higher the risk level of small and medium-sized commercial banks.

Haw et al. (2010) found that in banks with high concentration, managers represent the risk appetite of controlling shareholders and take excessive risk behavior. Faccio and Stolin (2006) believed that equity concentration promotes controlling shareholders to plunder minority shareholders, and the resulting agency conflict leads to greater risks. La Porta et al. (1999) found that the centralized ownership structure and the internal opacity of bank assets make it difficult for external supervision. The limited liability of shareholders makes them motivated to take greater risk behavior. Although most of the literature believed that the more concentrated the equity the higher the risk of banks, the literature does not take China's small and medium-sized commercial banks as the research object. This thesis puts forward the following hypothesis:

Hypothesis 2: the weaker the equity balance, the greater the overall risk of small and medium-sized commercial banks.

Y. M. Zhang and Tian (2013) found through empirical research that the number of boards of directors and the proportion of independent directors of listed banks in China are negatively correlated with risk indicators, that is, the larger the size of the board of directors

and the higher the proportion of independent directors, the smaller the risk.

X. L. Zhou (2010) believed that an effective independent director system can make the interests of agents consistent with the interests of shareholders and reduce investment risks. A. L. Liu et al. (2017) found that independent directors did not affect bank risk behavior. Therefore, we cannot draw one consistent conclusion from the existing literature, and most of them take listed banks as samples for analysis, and do not take China's small and medium-sized commercial banks as the research object. This thesis puts forward the following hypothesis:

Hypothesis 3: The greater the share of independent directors, the better the board of directors and management supervision, lowering the risk level of small and medium-sized commercial banks.

6.1.2 Shadow banking

Delis and Kouretas (2011) pointed out that due to the lack of adequate supervision of the shadow banking system, the information asymmetry of all participants, the timely disclosure of important information, and its endogenous maturity mismatch, the liquidity risk in the financial market has been further amplified, which is likely to lead to the whole systemic risk. Gennaioli et al. (2013) find that by shadow banking, such as asset securitization, banks can diversify their own risks and meet regulatory requirements, such as bank adequacy ratios. However, this has increased the systemic risk in the financial market. X. G. Zhou (2018) found that with the development of shadow banking business, commercial banks tend to allocate more high-risk assets, which will lead to the increase of non-performing loans and the decline of asset quality.

Shadow banking disguises credit assets as noncredit assets to hide the assets that may have an impact on regulatory indicators. This behavior of banks is not conducive to the management and control of banks by regulatory authorities. Commercial banks engaged in shadow banking business need to cooperate with multiple institutions. Due to information asymmetry, moral hazards such as adverse selection may occur among institutions. A large amount of funds is frequently circulated in the financial system, which makes institutions linked to each other and form a close capital chain and deepen the degree of correlation. The following hypothesis is made:

Hypothesis 4: the larger the scale of shadow banking, the higher the risk faced by small and medium-sized commercial banks.

6.1.3 Financial technology

Z. Y. Liu and Huang (2015b) believed that the technical dependence, lack of credit and business failure of Internet finance will infect commercial banks and aggravate their risk-taking. Cao et al. (2018) believed that Internet finance has changed the systemic risk of the capital market, and the impact on small and medium-sized banks is more obvious.

Xing (2016) pointed out that according to the theory of banking system vulnerability, the three main factors affecting bank credit risk are competitive pressure, macroeconomic fluctuations and information asymmetry. Fintech mainly affects bank credit risk by intensifying the competition of commercial banks and reducing their information asymmetry. Therefore, the existing research cannot reach a consistent conclusion, nor take China's small and medium-sized commercial banks as the research object. This thesis puts forward the following hypothesis:

Hypothesis 5: the greater the investment in financial technology, the lower the risk of small and medium-sized commercial banks.

6.2 Model selection and construction

6.2.1 Model selection

Panel data analysis is the recently developed statistic method. Panel data considers the dimension of cross section and time, which can make in-depth examination of the influence of corporate governance, shadow banking, financial technology on the risk of small and medium banks. Due to the unique advantage of panel data, this thesis chooses the panel data model in the empirical analysis.

6.2.2 Model construction

Based on the above analysis, we use the fix effect regression model to make further analysis of the influence of corporate governance, shadow banking, financial technology on small and medium sized banks' risks. Models are listed as follows:

$$RISK_{it} = \alpha_0 + \alpha_1 * Cr1_{it} + \alpha_2 * SIZE_{it} + \alpha_2 * MG_{it} + \alpha_2 * CAR_{it} + \varepsilon_{it} \quad (6.1)$$

$$RISK_{it} = \alpha_0 + \alpha_1 * EB_{it} + \alpha_2 * SIZE_{it} + \alpha_2 * MG_{it} + \alpha_2 * CAR_{it} + \varepsilon_{it} \quad (6.2)$$

$$RISK_{it} = \alpha_0 + \alpha_1 * IDP_{it} + \alpha_2 * SIZE_{it} + \alpha_2 * MG_{it} + \alpha_2 * CAR_{it} + \varepsilon_{it} \quad (6.3)$$

$$RISK_{it} = \alpha_0 + \alpha_1 * Shadow_{it} + \alpha_2 * SIZE_{it} + \alpha_2 * MG_{it} + \alpha_2 * CAR_{it} + \varepsilon_{it} \quad (6.4)$$

$$RISK_{it} = \alpha_0 + \alpha_1 * FinTech_{it} + \alpha_2 * SIZE_{it} + \alpha_2 * MG_{it} + \alpha_2 * CAR_{it} + \varepsilon_{it} \quad (6.5)$$

Risk is the risk level of banks and in this thesis, we use Z to measure it; α_0 is the constant value. The independent variables for structure of equity and investment ratio are the concentration of equity (Cr1), equity balance (EB), proportion of independent directors (IDP), shadow banking (Shadow), financial technology (FinTech). Meanwhile, the control variables include the size of banks (SIZE), macroeconomic effect (MG), capital adequacy ratio (CAR); i for bank i, t for year t and ε_{it} for random error.

6.3 Variable selection

6.3.1 Selection of explained variables

In this chapter, Z index is used as the explained variable to measure the risk level of commercial banks. The commonly used ratio measuring bank risk are stock return volatility, conditional value at risk (CoVaR) and Z ratio. Y. Zhang and Luo (2013)review the risk indicator of commercial banks in the literature. They think Z ratio data is available and can be used to approximately measure the risk of commercial banks. The sample of this thesis are mostly unlisted banks so there is no stock data and therefore we cannot calculate the volatility of stock return and conditional value at risk. Thus, in this thesis we use Z ratio to measure the bank risk. J. Huang and Zhang (2010), J. H. Zhang and Wang (2012) use Z ratio to measure the bank risk.

$$Z = [ROA_{it} + (E/A)_{it}] \div \sigma_{it} \quad (6.6)$$

In equation, ROA is the return on assets, E/A is the value of equity over assets, is the standard error of asset return ratio. High asset return ratio and equity asset ratio will directly influence the stability of banks. High standard error of asset return ratio means the instability of return. Thus, Z ratio is interpreted as bank risk indicator: the higher Z ratio is, the more the stability of banks and less risk.

6.3.2 Selection of explanatory variables

6.3.2.1 Corporate governance

This thesis uses three variables to measure corporate governance: Shareholding ratio of the largest shareholder, equity balance ratio and the ratio of independent directors. Reasons are as follows: firstly, the equity concentration allows large shareholders to influence management decisions, through which they might pursue the maximum value of their interests at the

sacrifice of depositors' and small shareholders' interests. Secondly, equity balance ratio will directly influence the decision making and development of banks. Weak equity balance, which means strong power of the first shareholders and a weakened democratic decision making. Lastly, a large number of directors does not necessarily have a positive influence on the banks. Too many people make it difficult to reach a coordinated decision so as to weaken the supervision and restrain their effect on management. Therefore, this thesis does not take the size of the board of directors as the variable of corporate governance. Compared to other types of companies, banks lack the supervision of independent directors, which is prone to the situation that internal directors control the board of directors and not conducive to make reasonable decisions, and make banks bear risks.

6.3.2.2 Shadow banking

The current literature mainly measures the scale of shadow banking from two aspects: the first is from a macro perspective to measure the scale of all shadow banks in the financial system. The second is from a micro perspective because commercial banks are the center of shadow banking in China, therefore, the size of shadow banking can be measured from the asset side of commercial banks. This thesis follows the research of G. F. Sun and Jia (2015) and J. G. Zhu et al. (2016) and focus on the relationship between bank risk and scale of shadow banking in the balance sheet, analyzes the accounting subjects involved in the shadow banking business from a micro perspective, and then determines the variable of shadow banking.

The shadow banking variable in this thesis is from the balance sheet of commercial banks from the perspective of capital utilization. The relevant account title includes financial assets purchased for resale, financial assets available for sale and accounts receivable investments. Therefore, the variable of shadow banking is calculated as follows:

$$(A+B+C)/\text{Total Assets} \tag{6.7}$$

Among them:

A=Financial assets held under resale agreement

B=Available-for-sale financial assets

C=Investment securities classified as receivables

6.3.2.3 Financial technology

The previous research on the variables of the development of Internet finance has inspired the construction of variables of financial technology, which is the core independent variable in this thesis. However, it is not applicable in this thesis to just follow the previous research. For

example, it is not comprehensive to only use the indicators such as the ratio of the amount of third-party payments on that of online banking transactions. Because payments and transactions play an important role in financial technology, they cannot represent the whole of financial technology.

P. Guo and Shen (2015a) Use Baidu's keyword search, counted the number of news releases for keywords such as Fintech or Internet finance, and concluded that the more news releases it had, the higher the level of development of Fintech was also proved. However, if a number of P2P platform failures occur, major media will also compete to report them, but the increase in the number of these news releases has nothing to do with the level of development of Fintech.

Financial technology cannot be simplified as investment in AI, big data, block chain but also investment in infrastructure, such as software purchase and equipment upgrade, which is the foundation and premise of financial technology implementation. In the past, in order to measure the development level of Internet finance, scholars chose different indicators as proxy variables to carry out empirical research. In the process of data acquisition and usage, it has too much uncertainty and subjectivity. Taking all into consideration, this thesis takes the ratio of capital investment of Fintech to operating income as its proxy variable. The greater the ratio, the greater importance attached to financial technology.

$$(D+E)/\text{Operating Income} \tag{6.8}$$

Among them:

D=The capital investment of commercial banks in operation system, database software and innovative technology

E=The capital investment of commercial banks in electronic equipment and other hardware equipment

6.3.3 Control variables

There are many risk factors in commercial banks, not only macro factors but also micro factors at bank-level. Based on the risk of corporate governance, shadow banking and financial technology to small and medium-sized commercial banks, we have chosen the following variables.

Firstly, the logarithm of bank size: the logarithm of bank asset is an important index to measure the development of banks. The previous research has showed that the scale of commercial banks will influence the risk of banks to a certain extent. Banking is an industry

with strong economies of scale. With the expansion of a bank, its competitiveness will be enhanced.

Secondly, capital adequacy ratio (CAR): it is the ratio of a bank's total capital to its risk weight, which is necessary to ensure its continuous operation and development, while a high capital ratio indicates a better risk resistance; a bank must not have less than 8% capital ratio. By ensuring a certain level of capital adequacy, the awareness of risk resistance of commercial banks can be enhanced, thus promoting the healthy development of commercial banks. Therefore, we believe that the capital ratio of the banking industry has a negative relationship with the risk it faces.

Thirdly, MG: MG is the ratio of M2 over gross domestic production (GDP), and it measures the liquidity of money. On the one hand, excess liquidity lowers the yield of traditional financial assets and on the other hand may lead to irrational excess social capital flows to real estate and stock market, resulting in asset price bubbles. Table 6.1 summarizes variables used in this study.

Table 6.1 Variable description

The Variable Name	Variable Symbol	Unit	Formula
Explained Variable			
Risk	Z		See Formula (6.6) for details
Credit Risk	NPL	%	See Formula (6.9) for details
Explanatory Variables			
Shareholding ratio of the largest shareholder	Cr1	%	
Equity Balance	EB		See Formula (6.10) for details
the Ratio of Independent Directors	IDP	%	See Formula (6.11) for details
Shadow Banking	Shadow	%	See Formula (6.7) for details
Financial Technology	FinTech	%	See Formula (6.8) for details
Control Variables			
Macroeconomic Effect	MG		M2/GDP
the Logarithm of Bank Size	SIZE		LN(SIZE)
Capital Adequacy Ratio	CAR	%	

Source: Summarize by Author

NPL=non-performing loan amount/the total amount of the loan (6.9)

EB=the first largest shareholders (shareholding ratio)/the second largest shareholders (shareholding ratio) (6.10)

IDP= number of independent directors/number of board members (6.11)

6.4 Data and samples

Considering the availability of data, this paper collects data from 116 small and medium commercial banks from 2011 to 2020, including 10 joint-stock banks, 51 city commercial banks and 55 rural commercial banks. The total asset of the sample banks was 90.3 trillion yuan, while the total assets of China's small and medium-sized banks totaled 137.3 trillion yuan. The sample data comes from the annual reports released by commercial banks from 2011 to 2020, China Statistical Yearbook, WIND database, National Bureau of Statistics, CSMAR database and China Financial Yearbook.

6.5 Empirical results and analysis

6.5.1 Descriptive statistical analysis

Table 6.2 shows the descriptive statistical result. (1) mean of Z ratio is 44.62, median is 37.12 and the standard deviation is 22.52. This shows that the overall risk of the sample banks is not high, but the minimum risk of the sample banks is 13.00 and the maximum risk is 117.9, indicating that there are significant differences among the risk of commercial banks; (2) significant differences exist among the shareholding ratio of the largest shareholder, with maximum value of 78.38% while the minimum value is only 4.36%; (3) the maximum of equity balance ratio (the ratio of shareholding of largest shareholders on that of the second largest shareholders) is 31.22; the maximum of the ratio of independent directors is 46.67% which means almost half of board of directors are independent directors. (4) the maximum and minimum of shadow banking are 45.95% and 0.36% respectively indicating obvious differences. (5) for the ratio of financial technology, comparing to 3.795% being the maximum, the minimum of financial technology investment is 0.03% indicating obvious differences among the financial technology investment of commercial banks.

Table 6.2 Descriptive statistics of main variables

variable	Sample size	mean	median	Standard Deviation	minimum	maximum
Z	517	44.62	37.12	22.52	13.00	117.9
Cr1	517	21.58	19.02	14.62	4.360	78.38
EB	517	2.818	1.529	4.405	1	31.22
IDP	517	32.70	33.33	7.929	6.667	46.67
Shadow	517	17.07	15.14	10.50	0.36	45.95
FinTech	517	1.145	0.968	0.819	0.03	3.795
SIZE	517	13.02	12.80	1.284	10.50	15.78
MG	517	1.988	2.010	0.109	1.740	2.150

CAR	517	13.13	12.93	1.572	9.900	17.38

Source: Summarize by Author

6.5.2 Correlation coefficient test

To test the multicollinearity, the correlation test is carried out on the relationship between variables. Table 6.3 shows the result of correlation test. From the overall test results, the correlation coefficient between variables does not exceed 0.5 which indicates that there is no serious multicollinearity. In addition, the VIF test is carried out and the test result is no more than 10, which proves again that there is no multicollinearity and the regression result is robust.

Table 6.3 Correlation coefficient matrix

	Z	Cr1	EB	IDP	Shadow	FinTech	SIZE	MG	CAR
Z	1								
Cr1	0.129***	1							
EB	0.086*	-	1						
IDP	0.022	-	-	1					
Shadow	0.009*	-	-	-	1				
FinTech	-0.186***	-	-	-	-	1			
SIZE	0.328***	0.382***	0.238***	0.417***	-0.160***	0.001	1		
MG	-0.002	-0.054	-0.107**	0.185***	0.042	-0.012	0.048	1	
CAR	0.192***	-0.277***	-0.228***	-0.067	0.017	-0.356***	-0.288***	0.090**	1

Source: Summarize by Author

6.5.3 Analysis of regression results

6.5.3.1 Baseline regression

Table 6.4 is the baseline regression result. (1) when the independent variable is the shareholding ratio of the largest shareholders, the coefficient is 0.1000 which is not significant. (2) when the independent variable is equity balance ratio, the coefficient is 0.2947 which is also not significant. (3) when the independent variable is the ratio of independent directors, the coefficient is 0.4377 which is significant at the 1% confidence level. It indicates that the higher the proportion of independent directors, the smaller the bankruptcy risk. (4) when the independent variable is shadow banking, the coefficient is -0.1856 which is significant at the 5% confidence level. The larger scale of shadow banking the higher bankruptcy risk. Although shadow banking can improve the profitability of commercial bank, the expansion of shadow

banking increases the bankruptcy risk and non-performing loan ratio and prompts commercial banks to bear greater risks. (5) when the independent variable is financial technology, the coefficient is 2.0675 which is significant at the 10% confidence level. The higher the proportion of financial technology investment, the smaller the bankruptcy risk. The reason is that financial technology not only improves the operation efficiency, but also significantly improves bank's risk management ability. In addition, it can be seen from Table 6.4 that the impact of bank size on bankruptcy risk (Z ratio) is negative and significant indicating the larger the bank size, the smaller the bankruptcy risk. The impact of capital adequacy ratio on bankruptcy risk (Z ratio) is also negative and significant, indicating that the higher the capital adequacy ratio, the stronger the bank's anti risk ability.

Table 6.4 Baseline regression

Variable	(1) Z	(2) Z	(3) Z	(4) Z	(5) Z
Cr1	0.1000				
	(1.49)				
EB		0.2947			
		(1.39)			
IDP			0.4377***		
			(3.52)		
Shadow				-0.1856**	
				(-2.04)	
FinTech					2.0675*
					(1.88)
SIZE	7.0199***	7.2018***	8.5358***	7.2302***	7.6291***
	(9.14)	(9.75)	(10.86)	(9.94)	(10.40)
MG	-9.8382	-9.3507	-5.4271	-10.0567	-11.3987
	(-1.19)	(-1.13)	(-0.66)	(-1.23)	(-1.39)
CAR	4.7197***	4.6908***	4.6423***	4.0726***	4.5968***
	(7.82)	(7.80)	(7.89)	(6.38)	(7.75)
Cons	-91.3267***	-92.9568***	-1.0e+02***	-79.8113***	-94.7520***
	(-4.51)	(-4.58)	(-5.04)	(-3.83)	(-4.66)
N	517	517	517	517	517
Adj-R^2	0.2032	0.2028	0.2187	0.2062	0.2053
F	0.1970	0.1966	0.2126	0.2000	0.1991

Note: *、**、***Significant at the level of 10%, 5% and 1%, respectively.

Source: Summarize by Author

6.5.3.2 Robustness test

In this section, we check the robustness by adopting a different definition of the dependent variable. The replacing dependent variable is non-performing loan rate because non-performing loan ratio has always been considered as an important index for bank's risk. The larger the value of non-performing loan rate, the greater the banks' risk.

We can see from the robustness test that the shareholding ratio of the largest shareholder and the equity balance ratio are both insignificant in the sample (Table 6.5). The coefficient of

independent directors is -0.01333 and significant at the 1% confident level. It shows the negative correlation and statistical significance between ratio of independent directors and non-performing loans. The coefficient of shadow banking is 0.0547 and significant at the 10% confidence level, which indicates that the expansion of shadow banking increases the bankruptcy risk and ratio of non-performing loan thus commercial banks bear more credit risk. The coefficient of financial technology is -0.0087 and significant indicating that commercial banks take advantage of financial technology and effectively offset the adverse impact of the substitution effect of financial technology through innovation. Therefore, financial technology has played a positive role in reducing the non-performing loan ratio of commercial banks. The robustness test result is consistent with the baseline model.

Table 6.5 Robustness test

Variable	(1)	(2)	(3)	(4)	(5)
	NPL	NPL	NPL	NPL	NPL
Cr1	0.0007				
	(0.34)				
EB		-0.0075			
		(-1.25)			
IDP			-0.0133***		
			(-3.76)		
Shadow				0.0547*	
				(2.15)	
FinTech					-0.0087***
					(-3.39)
SIZE	-0.1071***	-0.0995***	-0.1390***	-0.0986***	-0.1126***
	(-4.90)	(-4.74)	(-6.23)	(-4.73)	(-5.48)
MG	2.4876***	2.4517***	2.3271***	2.4609***	2.5069***
	(10.61)	(10.43)	(9.92)	(10.53)	(10.82)
CAR	-0.0555***	-0.0600***	-0.0592***	-0.0555***	-0.0793***
	(-3.23)	(-3.51)	(-3.55)	(-3.29)	(-4.40)
Cons	-1.3928**	-1.3255**	-1.0295*	-1.4993***	-0.8854
	(-2.42)	(-2.30)	(-1.79)	(-2.59)	(-1.50)
N	517	517	517	517	517
Adj-R^2	0.2048	0.2070	0.2260	0.2093	0.2220
F	0.1986	0.2008	0.2200	0.2032	0.2160

Note: *、**、***Significant at the level of 10%, 5% and 1%, respectively.

Source: Summarize by Author

6.5.4 Further research

6.5.4.1 Shareholding ratio of the largest shareholder

Whether in the baseline model (Table 6.4) or robustness test (Table 6.5), the shareholding ratio of the largest shareholder is insignificant. We further divide the 116 commercial banks into three groups: joint-stock commercial banks, urban commercial banks and rural commercial

banks and analyze the influence of the shareholdings of the largest shareholders. Table 6.6 shows the result.

The first column is joint-stock commercial banks group. The largest shareholder's shareholding ratio coefficient is 0.1225, which is insignificant. The second column represents the group of urban commercial banks. The coefficient of the largest shareholder's shareholding ratio is 0.1678 and significant at the 10% confidence level, demonstrating a negative association between the largest shareholder's shareholding ratio and bankruptcy risk. The third column is a grouping of rural commercial banks. The coefficient of the largest shareholder's shareholding ratio is -1.0906 and significant at the 1% confidence level, demonstrating a positive link between the largest shareholder's shareholding ratio and bankruptcy risk. It shows that in rural commercial banks, a higher shareholding ratio of the largest shareholder may weaken banks' corporate governance ability and increase bankruptcy risk.

Table 6.6 Grouping regression

Variable	Joint-Stock Commercial Banks Z	Urban Commercial Banks Z	Rural Commercial Banks Z
Cr1	0.1226	0.1678*	-1.0906***
	(1.35)	(1.91)	(-4.79)
SIZE	1.5481	12.2824***	5.7123***
	(0.50)	(7.57)	(3.10)
MG	-1.8029	-26.8311**	-1.5729
	(-0.11)	(-2.17)	(-0.10)
CAR	5.1340***	4.9029***	2.6182**
	(3.53)	(5.24)	(2.54)
Cons	-33.8303	-1.3e+02***	-70.8008*
	(-0.83)	(-4.27)	(-1.75)
N	94	287	136
Adj-R^2	0.1763	0.2161	0.3494
F	0.1393	0.2050	0.3296

Note: *、**、***Significant at the level of 10%, 5% and 1%, respectively.

Source: Summarize by Author

6.5.4.2 Equity balance

Whether in the baseline model (Table 6.4) or robustness test (Table 6.5), the equity balance ratio is insignificant. We further divide the 116 commercial banks into three groups: joint-stock commercial banks, urban commercial banks and rural commercial banks and analyze the influence of equity balance ratio. Table 8 shows the result.

The first column of Table 6.7 is joint-stock commercial banks group. The coefficient of equity balance ratio is 0.7647 and significant at 1% confidence level. The second column is urban commercial banks group. The coefficient of equity balance ratio is 0.1737 and insignificant. The third column is rural commercial banks group. The coefficient of equity

balance ratio is -3.4438 and significant at the 1% confidence level indicating a positive correlation between s equity balance ratio and bankruptcy risk. It shows that in rural commercial banks, the higher the equity balance ratio (the ratio of shareholdings of the largest shareholders on that of the second largest shareholders), the weaker the balance of equity. It will reduce banks' corporate governance capacity and increase bankruptcy risk.

Table 6.7 Grouping regression

Variable	Joint-Stock Commercial Banks Z	Urban Commercial Banks Z	Rural Commercial Banks Z
EB	0.7647***	0.1737	-3.4438***
	(3.28)	(0.50)	(-2.88)
SIZE	1.6431	11.9351***	12.5125***
	(0.57)	(7.39)	(6.72)
MG	-4.3906	-25.4545**	-22.8612
	(-0.27)	(-2.04)	(-1.43)
CAR	6.1962***	4.7795***	0.7913
	(4.33)	(5.09)	(0.71)
Cons	-43.2089	-1.2e+02***	-63.9710
	(-1.12)	(-4.04)	(-1.50)
N	94	287	136
Adj-R^2	0.2503	0.2096	0.2810
F	0.2166	0.1984	0.2591

Note: *、**、***Significant at the level of 10%, 5% and 1%, respectively.

Source: Summarize by Author

Chapter 7: Research Conclusions

7.1 Research conclusions

Based on the panel data, this thesis examines the relationship between corporate governance, shadow banking and financial technology and commercial bank risks. Commercial banks are risky enterprises. Using the data of 116 small and medium-sized banks in 2011 to 2020, this chapter empirically tests the impact of corporate governance, shadow banking and financial technology on their risk-taking. At the same time, the sample banks are grouped according to banks' nature to further study different effects of corporate governance on different types of commercial banks. The main conclusions are as follows.

7.1.1The impact of the shareholding ratio of the largest shareholder on the risk-taking of small and medium-sized commercial banks

Whether in baseline regression (Table 6.4 in Chapter 6) or robustness test (Table 6.5 in Chapter 6), when the independent variable is the shareholding ratio of the largest shareholder, it is not significant for the sample as a whole. After grouping the sample banks (Table 6.6 in Chapter 6), we find that the shareholding ratio of the largest shareholder of urban commercial banks is negatively correlated to the bankruptcy risk and the coefficient is 0.1678. The proportion of the largest shareholder of rural commercial banks has a positive correlation with bankruptcy risk, and the regression coefficient is -1.0906, which is highly significant. It shows that the higher the shareholding proportion of the largest shareholder in rural commercial banks, the greater the bankruptcy risk of commercial banks.

7.1.2 The influence of equity balance on the risk-taking of small and medium-sized commercial banks

Whether in baseline model (Table 6.4 in Chapter 6) or robustness test (Table 6.5 in Chapter 6), when the independent variable is equity balance ratio, it is not significant for the sample as a whole. After grouping the sample banks (Table 6.7 in Chapter 6), we find that the equity balance ratio of joint-stock commercial banks is negatively correlated to the bankruptcy risk, it shows that the worse the equity balance, the smaller the bankruptcy risk. It may be because

there are 12 joint-stock commercial banks in China. Except Ping An Bank, the largest shareholders of the other 11 are state-owned. When the largest shareholder of a bank is state-owned, the bank's debts and bankruptcy losses are usually guaranteed by the state's credit. The state often gives banks policy support, invisible subsidies, and even acquires non-performing loans, which reduces the bank's bankruptcy risk. In addition, the equity balance ratio of rural commercial banks is positively correlated with bankruptcy risk, and the regression coefficient is -3.4438, which is highly significant. It shows that in rural commercial banks, the worse the equity balance, resulting in a significant decline in the level of corporate governance and an increase in its bankruptcy risk.

7.1.3 The influence of the proportion of independent directors on the risk-taking of small and medium-sized commercial banks

The independence of the board of directors is critical to ensuring that the board's functions are carried out effectively. It can be seen in Table 6.4 in Chapter 6 that the proportion of independent directors is negatively correlated with the risk-taking of small and medium-sized commercial banks, and is significant. The introduction of independent director system can effectively improve the independence of board governance and give better play to the supervision and restraint role of independent directors. Therefore, to improve commercial bank corporate governance, we should work to ensure the independence of the board of directors and to strengthen the independent director system.

7.1.4 The influence of shadow banking on the risk-taking of small and medium-sized commercial banks

An empirical study is conducted on 116 state-owned commercial banks using fixed-effect panel data. The results show that, on the one hand, due to the development of shadow banking, it has an obvious negative effect on the risk-taking of banks; On the other hand, due to the development of shadow banking, its asset allocation behavior has undergone significant changes, resulting in a decline in asset quality, an increase in credit risk, and ultimately an increase in the overall risk level.

7.1.5 Impact of financial technology on risk-taking of small and medium-sized commercial banks

The development of financial technology has a significant negative effect on the risk-taking of

small and medium-sized commercial banks, which means that the development of financial technology can significantly reduce the risk. The corresponding risk taking of financial technology to various types of commercial banks has a similar trend, and they are in line with the overall empirical analysis. But at the same time, the magnitudes of the coefficients are different; In this sense, it shows that financial technology has a great impact on the risk taking of different commercial banks.

7.2 Policy recommendations

According to the theoretical and empirical analysis, the following policy suggestions are put forward:

7.2.1 Improve the internal governance mechanism of commercial banks

The reform of ownership diversification is only the first step in the transformation of banks. In the future, commercial banks should further deepen the reform of bank governance and enhance risk control ability. First, commercial banks should decentralize the equity ratio appropriately, form equity balance mechanism, and reduce the excessive risk-taking behavior of major shareholders of banks.

Second, improve the independent director system. In addition to meet the legal requirements the independent director mechanism, we should also improve the responsibility, accountability, supervision and other management systems of independent directors, reduce the control of major shareholders on the board of directors, and strengthen the independence and professionalism of independent directors, so as to ensure that the risk-taking behavior of banks can be restrained.

7.2.2 Improve the quality of information disclosure and strengthen the role of market constraints

A perfect corporate governance mechanism of commercial banks should not only improve its internal governance mechanism, but also have a better external governance mechanism. Therefore, it is necessary to continuously improve the quality of information disclosure and give full play to the role of external governance mechanisms (for instance, market constraints and information disclosure). And in Basel New Capital Accord, the role of market constraints in corporate governance has been paid more and more attention, and has become one of the

three pillars. The Basel Committee has proposed to strengthen the information disclosure of the banking industry, and to effectively restrict it through market self-discipline, so as to effectively ensure that information users fully and timely understand the changing trend of banking business and risk status.

7.2.3 Enhance the differentiation and effectiveness of supervision

In order to effectively control the risk-taking behavior of small and medium-sized commercial banks, regulators should change their regulatory ideas and carry out classified and differentiated regulatory strategies for banks with different capital conditions, different governance structures and different risk levels: first, banks with serious capital shortage should strictly implement the minimum capital requirements to make capital adequacy control a rigid constraint on bank business behavior; Second, implement differentiated supervision strategies. On the one hand, the formulation of capital supervision policy needs to consider the differences of bank micro governance structure. On the other hand, the formulation and implementation of supervision policy should also consider the differences between different types of banks, avoid the negative impact of "one size fits all" and improve the effectiveness of supervision policy.

7.2.4 Improve the accuracy and transparency of commercial bank statements and strengthen the cooperation between regulatory authorities

China's shadow banking structure is evolving, changing from the provision of shadow credit to the provision of alternative savings vehicles (such as financial products and trust products). Then came the more complex "structured" shadow credit intermediaries. Regardless of the type of shadow banking, the purpose is either to pursue profits or to avoid regulation. Since the development of shadow banking business has broken through the operation boundary among the securities industry, insurance industry and banking industry, and the supervision of a single department is easy to lead to a blind spot in supervision, we should strengthen the cooperation and cooperation of the people’s Bank of China, the CSRC, the CBRC and other relevant departments, enhance policy coordination and information sharing, and solidly promote the comprehensive coverage of financial risk supervision and comprehensive financial statistics, Effectively prevent and resolve systemic financial risks.

7.2.5 On the basis of effective risk control, commercial banks should encourage financial technology innovation

For small and medium-sized commercial banks, actively embracing financial technology is an inevitable choice in the future. In this way, they can improve business efficiency and reduce various costs by changing business model and improving technical level, and deal with the fierce competition. Moreover, commercial banks and Internet technology companies can also try to carry out two-way exchanges and mutually beneficial cooperation, so as to improve financial technology and business operation ability of both sides. In addition, for different types of commercial banks, the optimal methods of using financial technology may be different. Therefore, all kinds of commercial banks should have the courage to explore various ways such as independent development and cooperative development, so as to find another way and find the path of financial technology most suitable for them.

7.3 Research prospects

Although this thesis researches on the risk sources of China's small and medium-sized commercial banks, this study still has some limitations, which need to be improved in the future research.

7.3.1 Long-term effects of ownership reform

Some deep-seated impacts caused by ownership changes may take longer to fully reflect, such as whether the optimization of ownership structure will inevitably improve the quality of corporate governance. Can we really help domestic banks improve corporate governance and take reasonable risks? With the continuous improvement of China's capital market, these problems need more in-depth and long-term research in the future.

7.3.2 Impact of irrational behavior of management on the risk of commercial banks

This thesis uses the traditional "rational man" hypothesis to study bank risk behavior, but managers' ability to process information is not always completely rational, which will make them overestimate or underestimate the future cash flow and risk, thus affecting the bank's risk decision-making and risk behavior.

7.3.3 Limitations of data

Due to the short implementation time of China's commercial banks' information disclosure system, the recording time of important data is short, data disclosure of some banks is incomplete, and data availability limitations may impair the accuracy and reliability of the empirical results. The sample size can be raised in the future for further research.

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Annex A: Other Figures

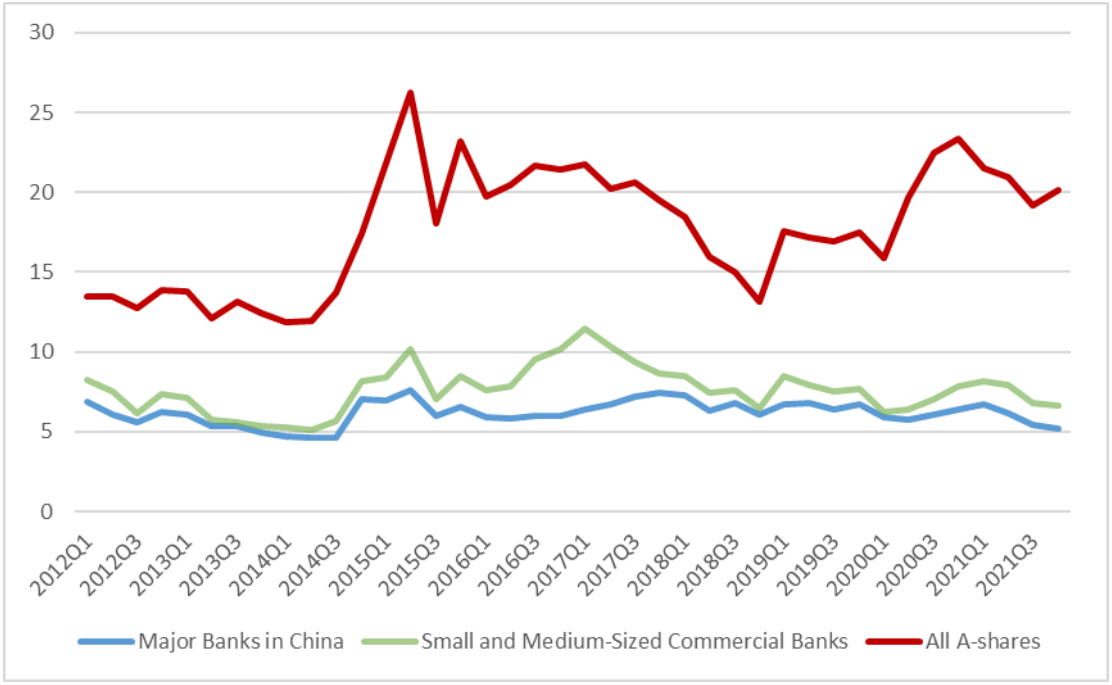

Figure A-1 2012 - 2021 Commercial Bank/ all A-share (PE)

Source: WIND

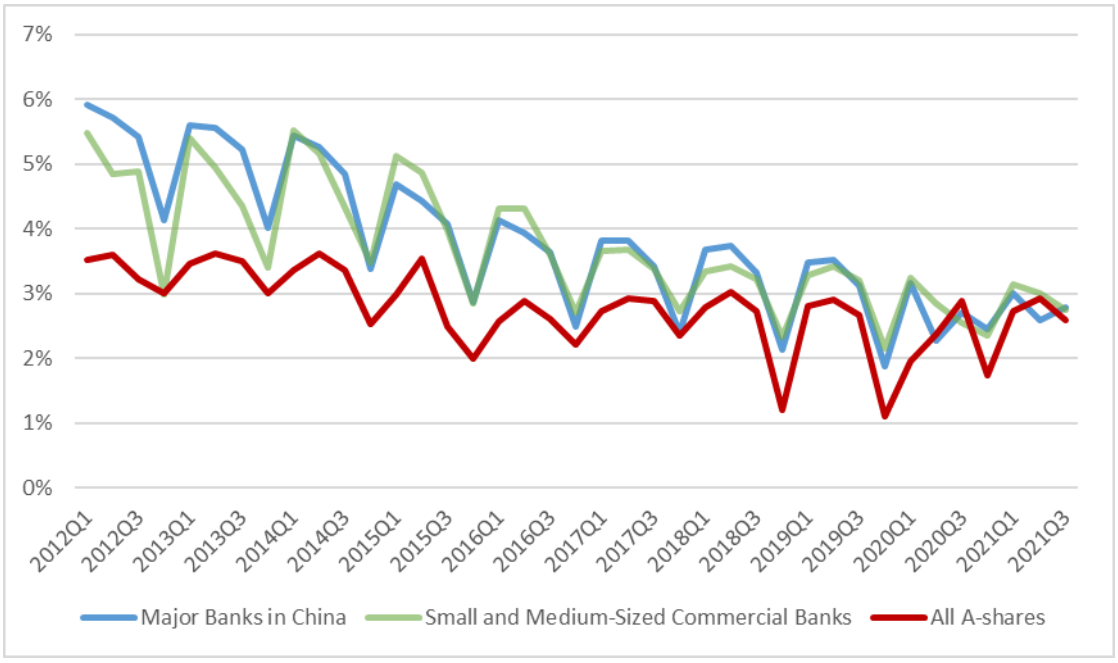

Figure A-2 2012 - 2021 Commercial Bank/ all A-share (ROE)

Source: WIND

Figure A-3 2012 - 2021 Commercial Bank/ all A-share (Net Profit Growth Rate)

Source: WIND

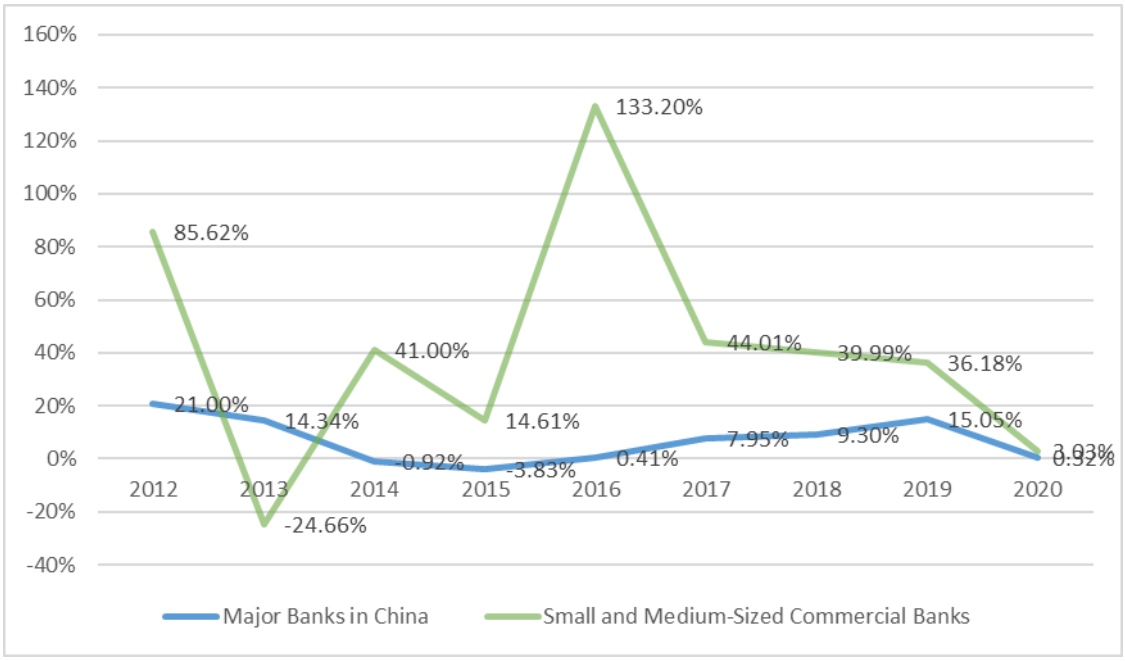

Figure A-4 The Annual Cumulative Dividend Growth Rate of Commercial Banks

Source: WIND

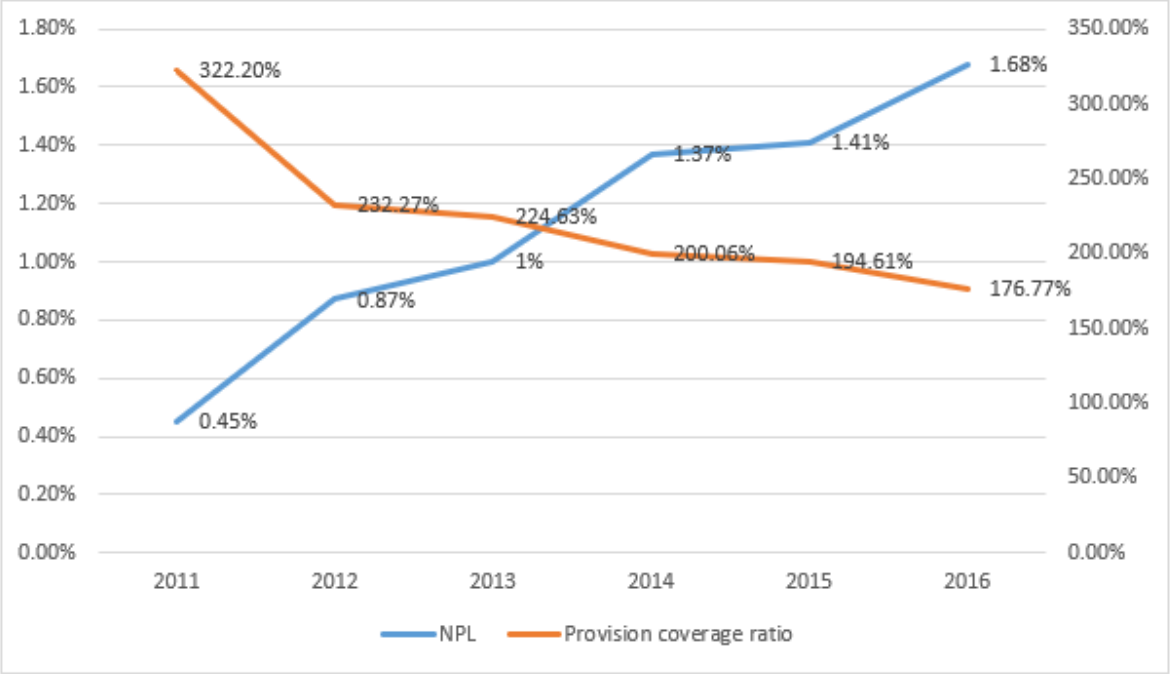

Figure A-5 Non performing loan ratio and provision coverage ratio of Baoshang Bank from 2011 to 2016

Source of data: Financial Report of Baoshang Bank

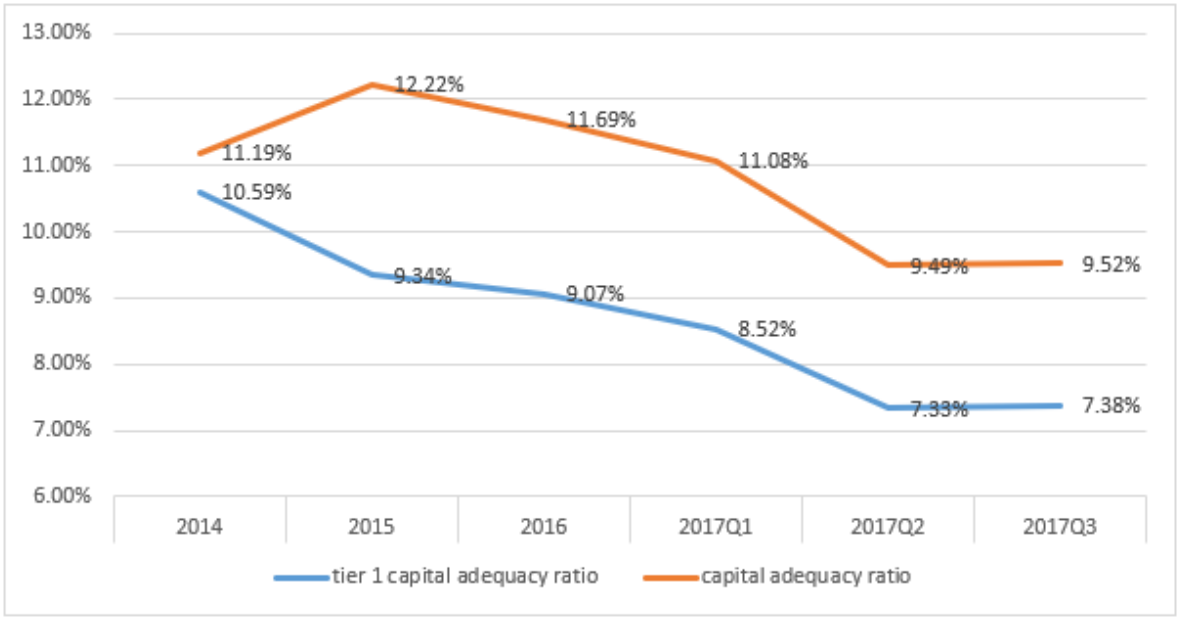

Figure A-6 Capital Adequacy Ratio of Baoshang Bank

Source of data: Financial Report of Baoshang Bank

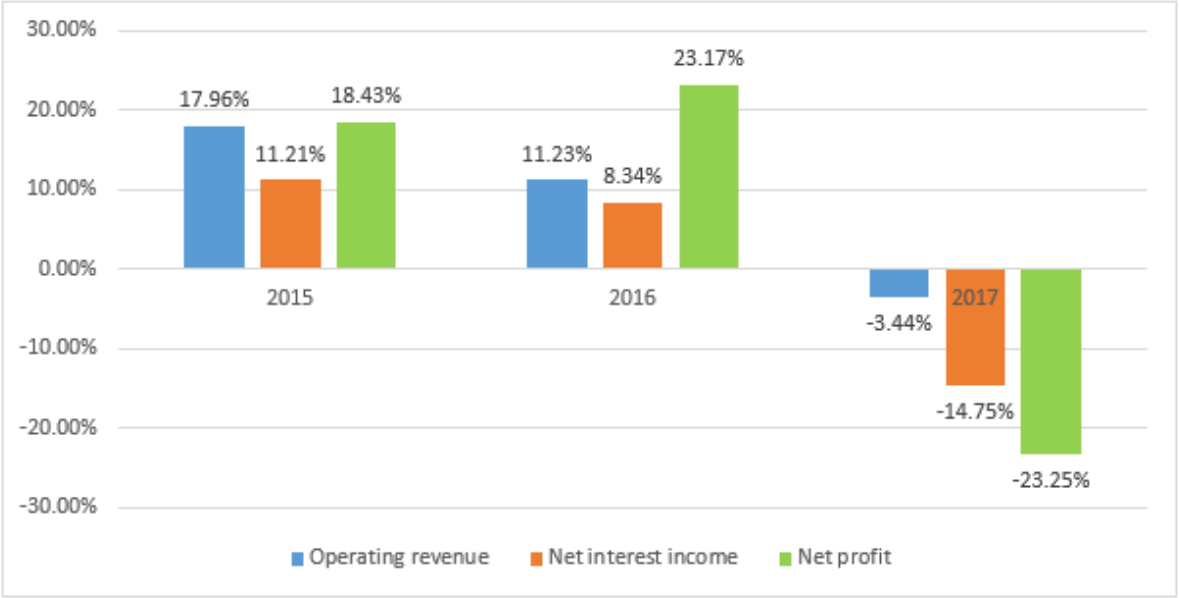

Figure A-7 Year-on-year growth rate of Baoshang Bank from 2014 to 2017

Source of data: Financial report of Baoshang Bank

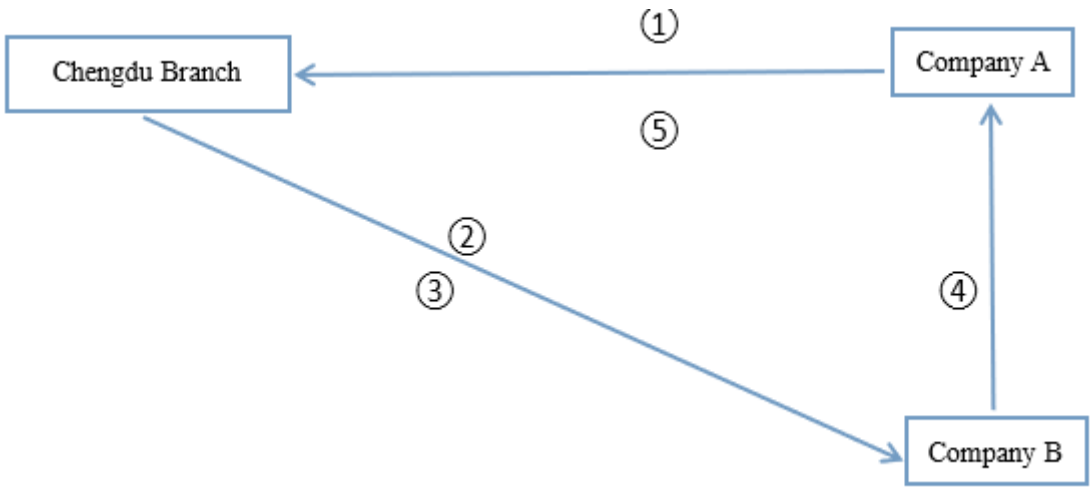

Figure A-8 Operation flow chart of debt commitment acquisition

Source: Summarized by the Author

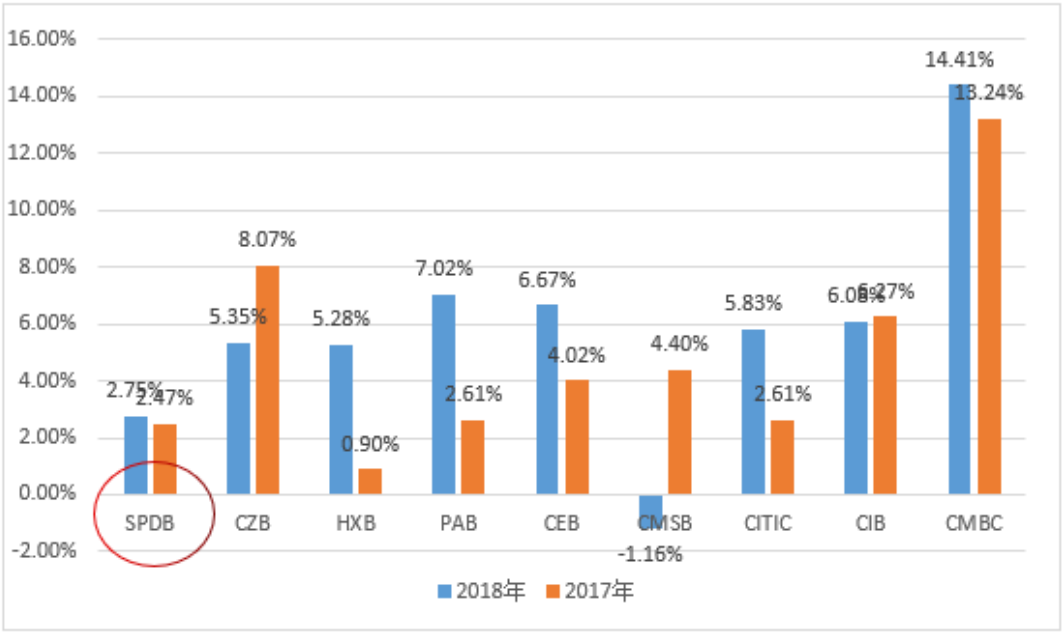

Figure A-9 Comparison of SPDB with similar banks (net profit growth rate in 2018 and 2017)

Source: WIND

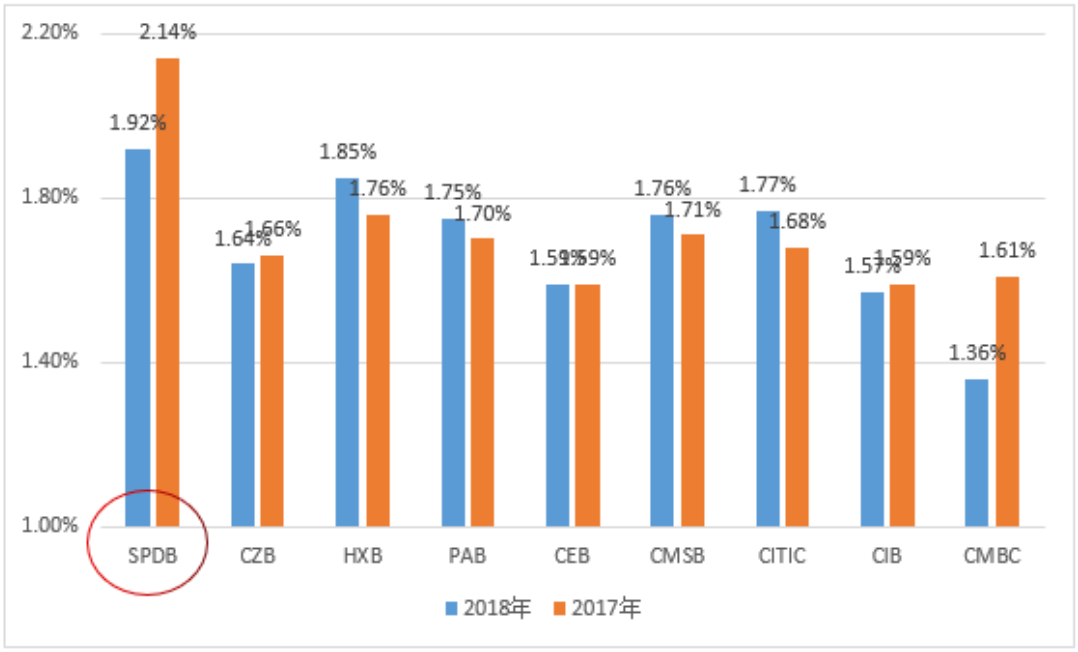

Figure A-10 Comparison of SPDB with similar banks (non-performing loans rate in 2018 and 2017)

Source: WIND

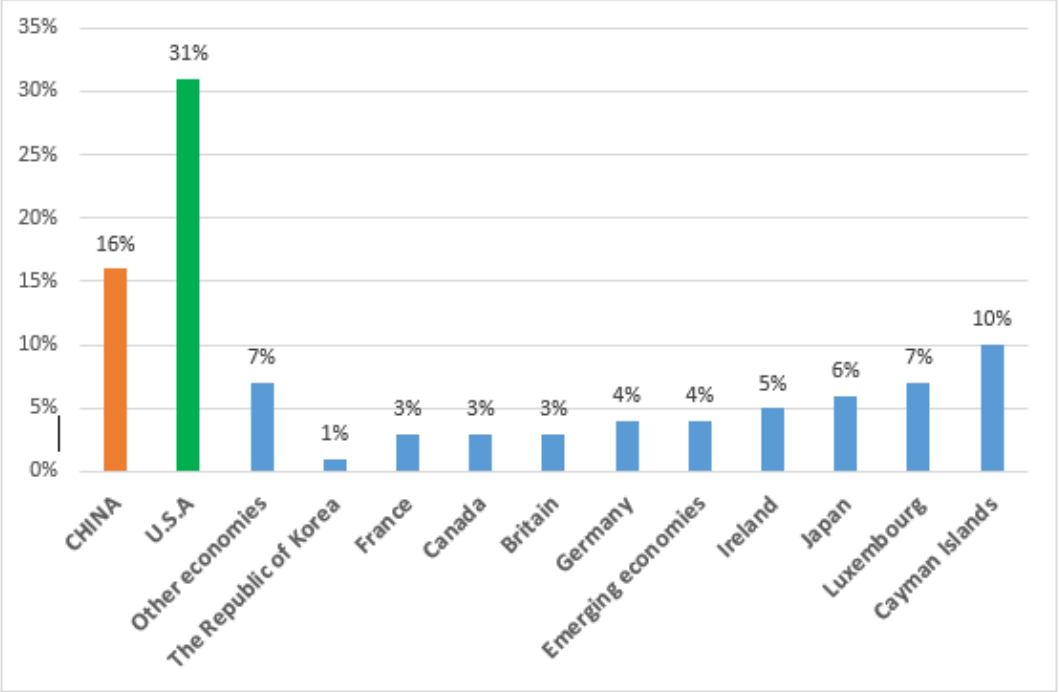

Figure A-11 Proportion of Shadow Banking Assets in Major Economies in 2016

Source of Data: CSMAR

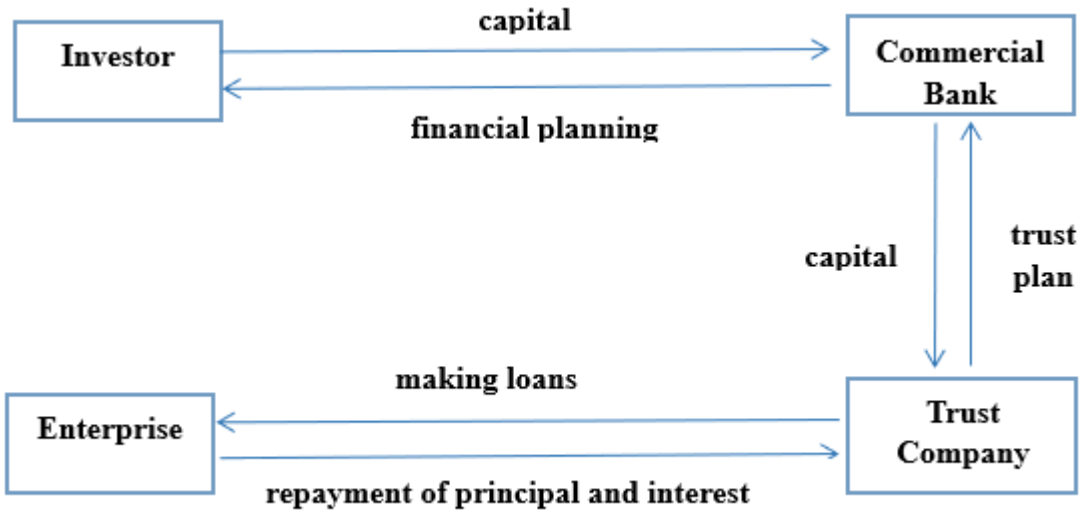

Figure A-12 Transaction process of bank trust cooperation

Source: Summarized by the Author

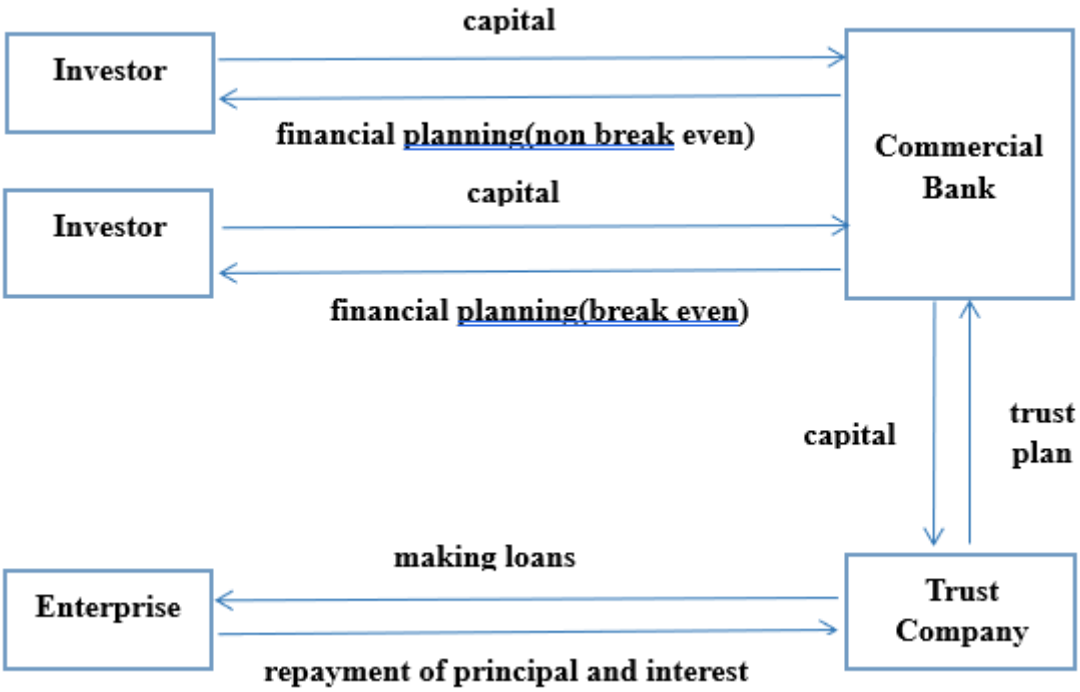

Figure A-13 Cooperation Mode between Bank and Trust

Source: Summarized by the Author

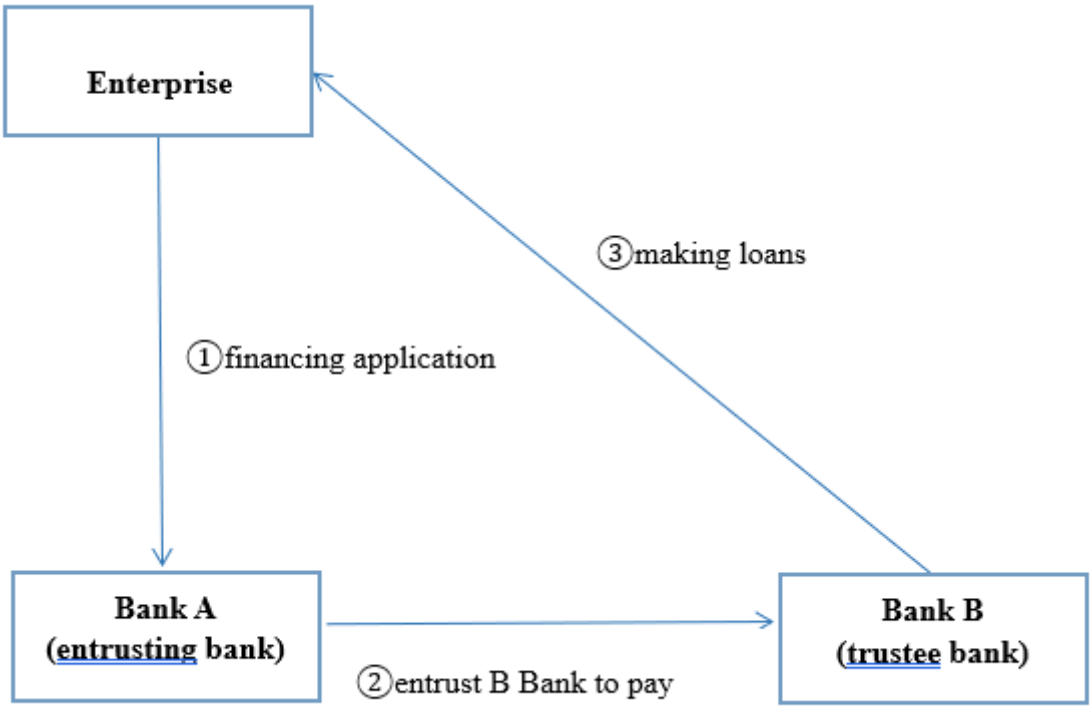

Figure A-14 Inter-bank Payment Mode

Source: Summarized by the Author

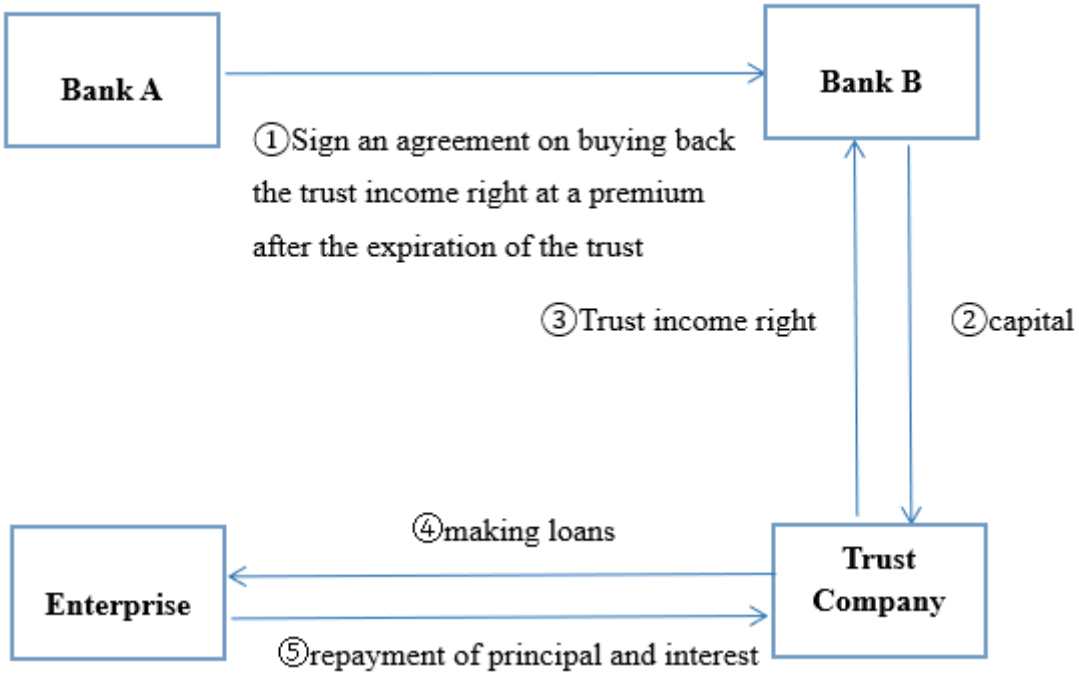

Figure A-15 Buy Back Sale Mode

Source: Summarized by the Author

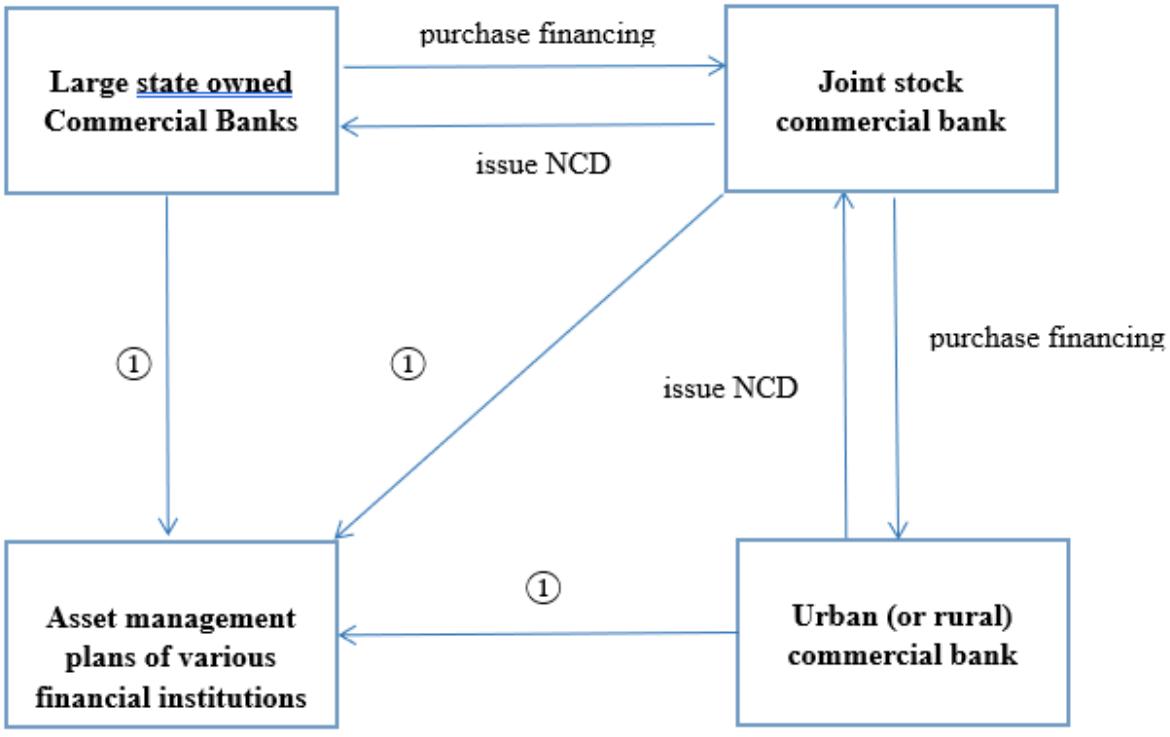

Figure A-16 Inter-bank and Outsourcing Combination Mode

Explain:

1.① refer to entrust external investment

2.NCD refer to negotiable certificates of deposit

3.After the capital flows to the Asset Management Plan, it will invest in various financial products, such as bonds, factoring, bank acceptance bills, etc

Source: Summarized by the Author

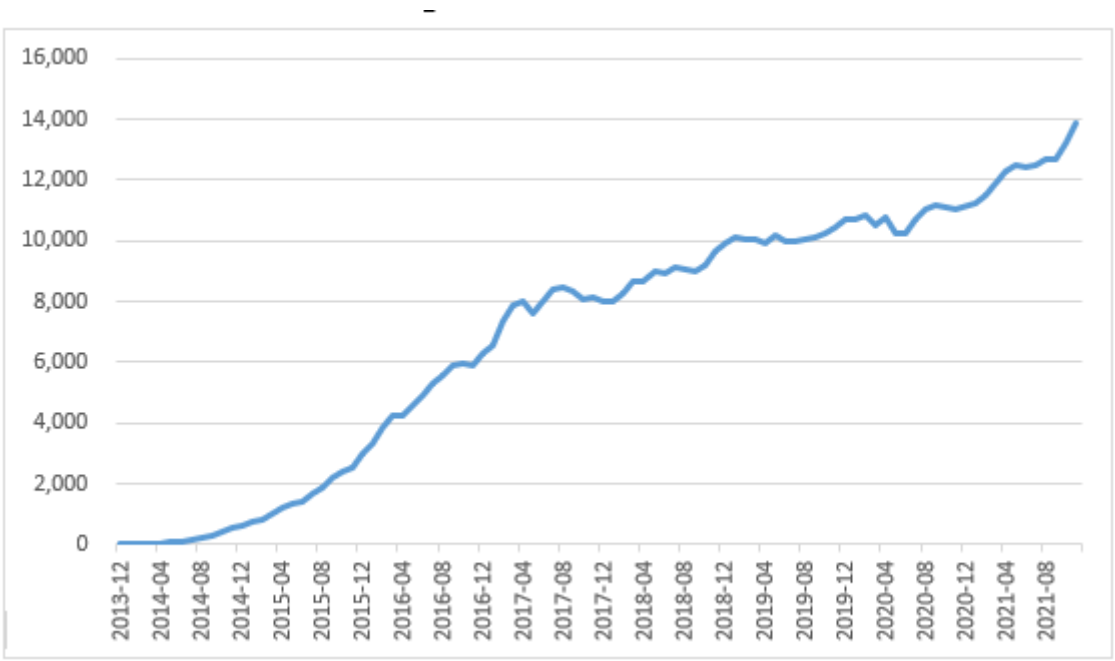

Figure A-17 NCD SCALE

Source of Data: WIND

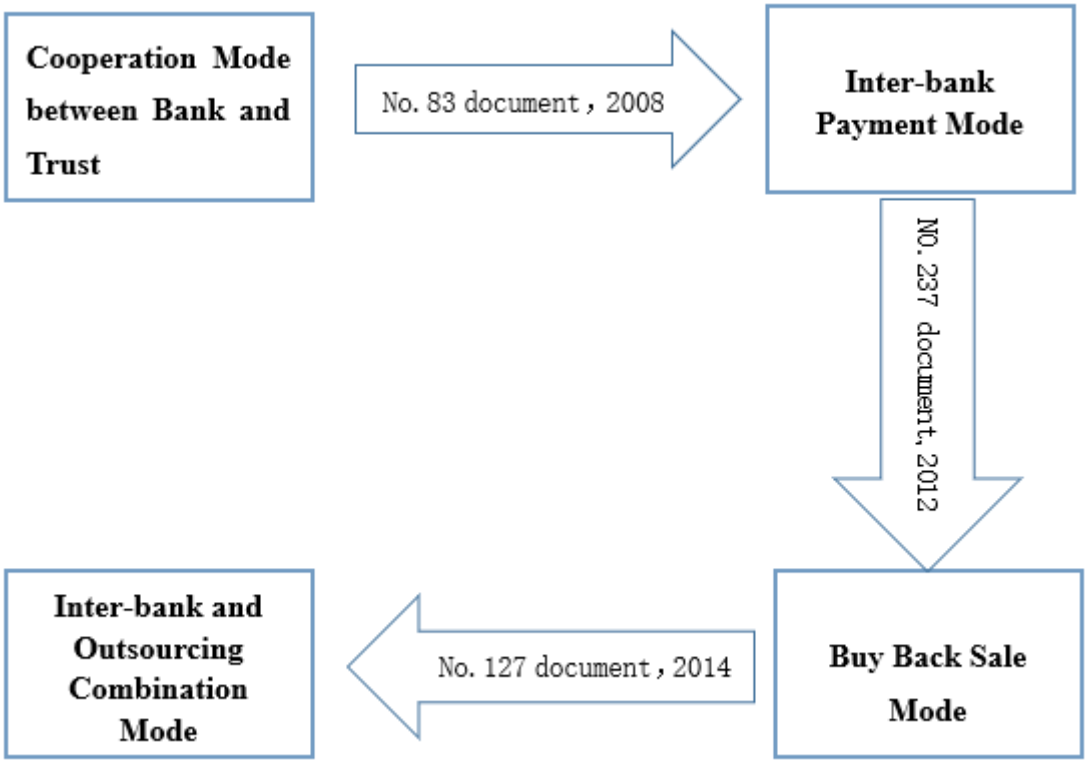

Figure A-18 The development of shadow banking in China

Source: Summarized by the Author

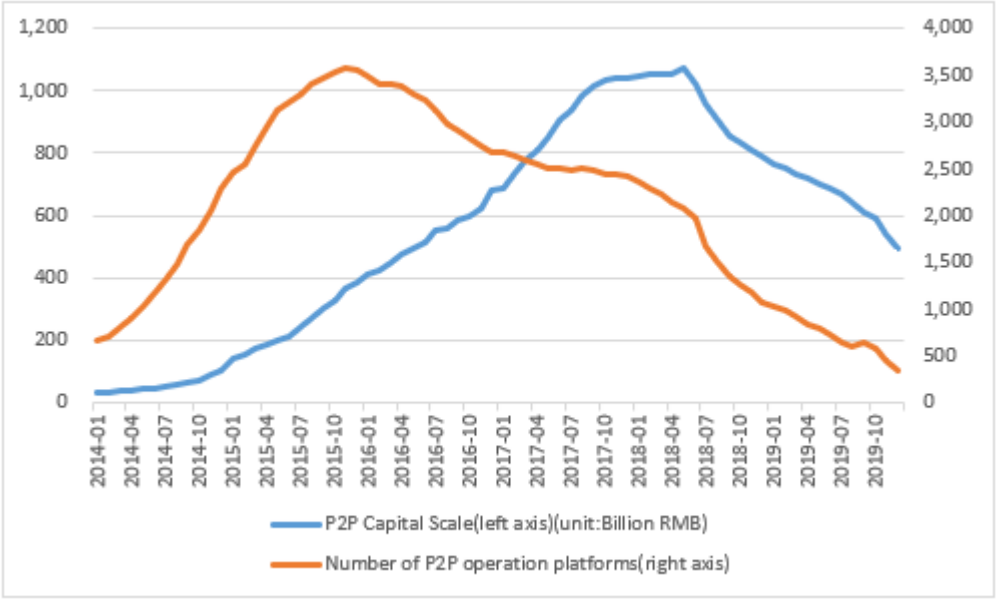

Figure A-19 P2P Capital Scale

Source of Data: WIND

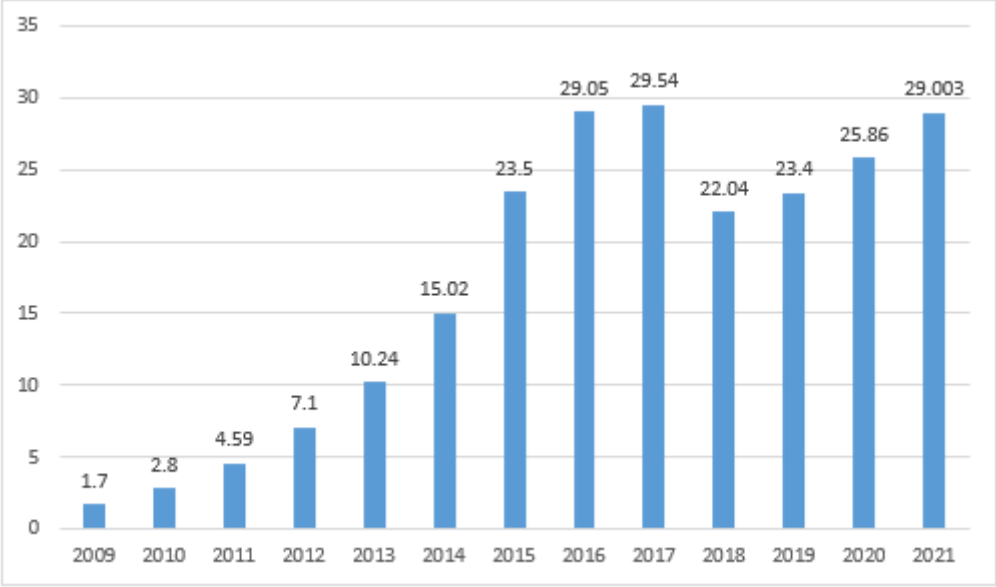

Figure A-20 Non-breakeven Financing Scale (unit: trillion)

Source of Data: Financial Market Report of China's Banking Industry

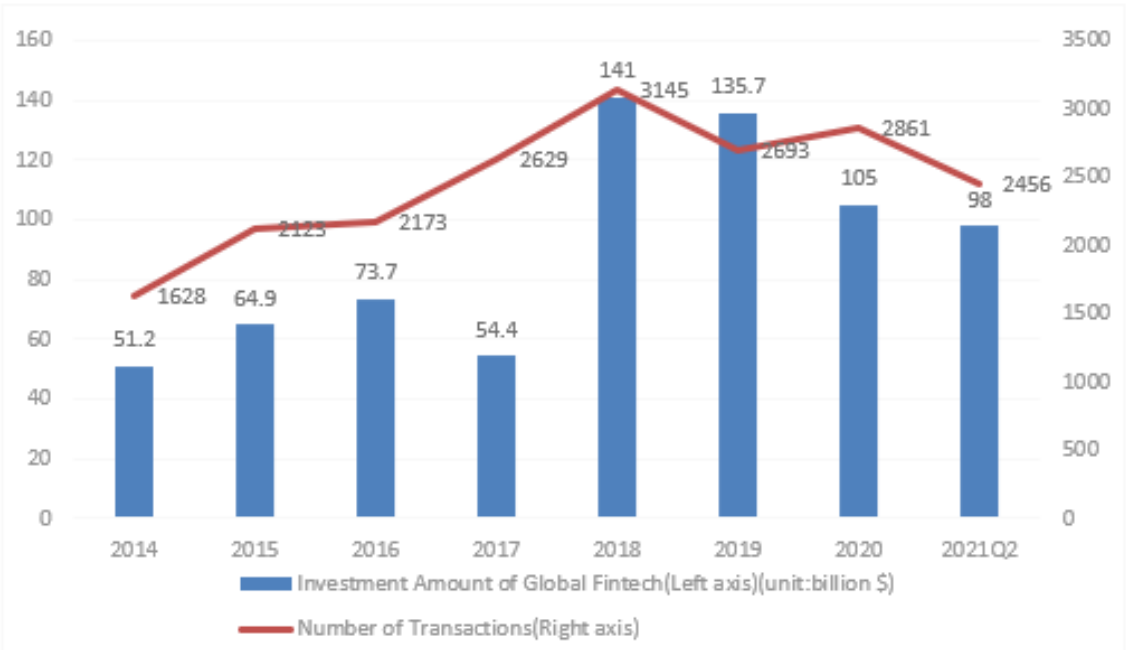

Figure A-21 Global Financial and Technological Investment

Data Source: Global Analysis of KPMG International Financial Technology Investment

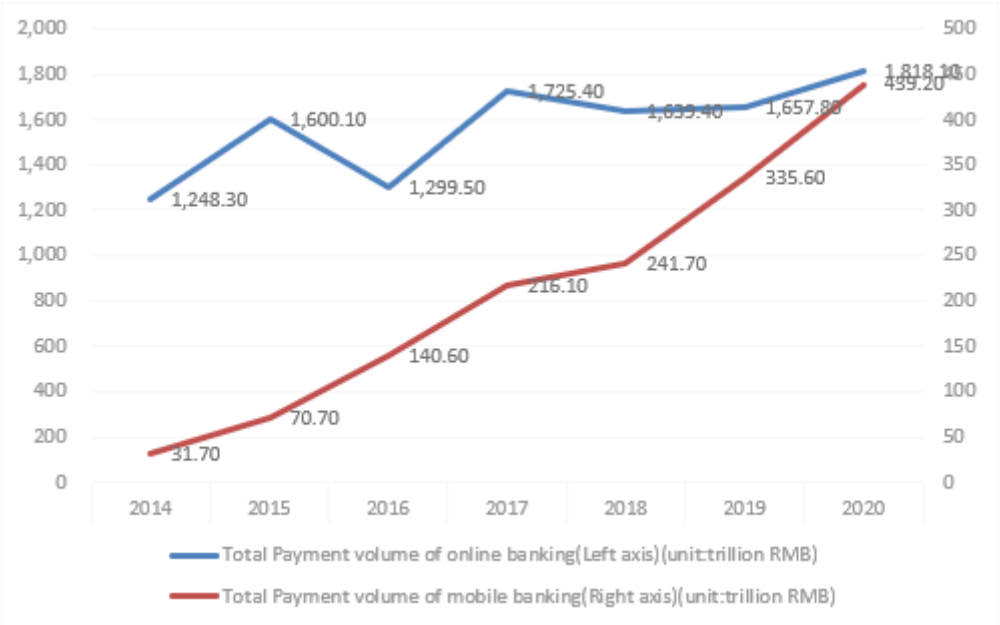

Figure A-22 Online Banking and Mobile Banking in China (Transaction Amount)

Data Source: China Industrial Information Network

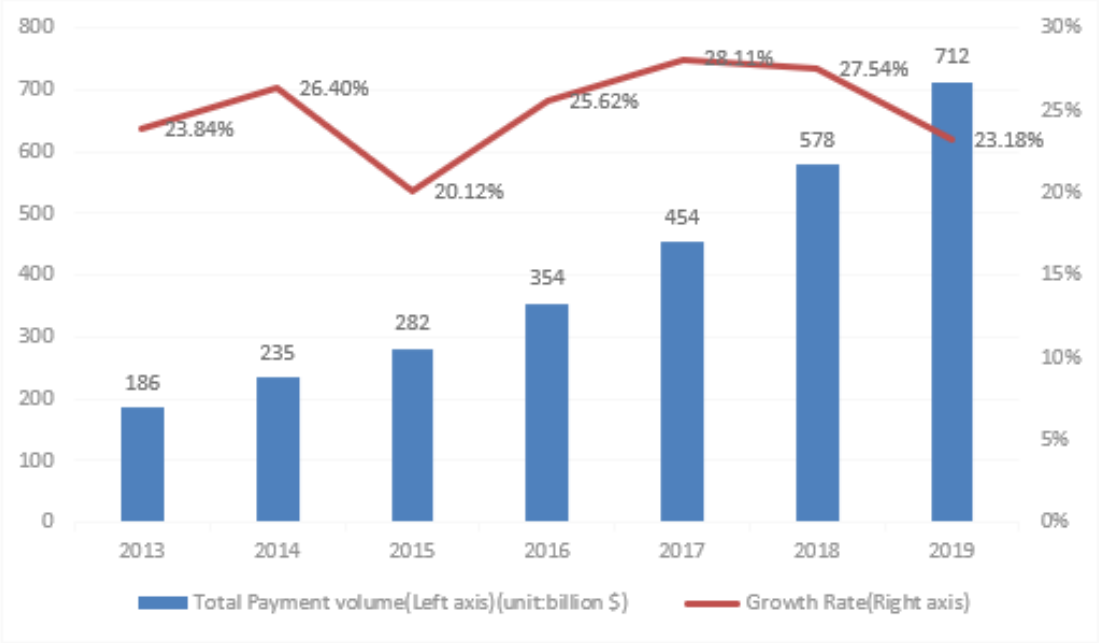

Figure A-23 Total Payment Volume and Growth Rate of PayPal

Data Source: Financial Report of PayPal from 2013 to 2019

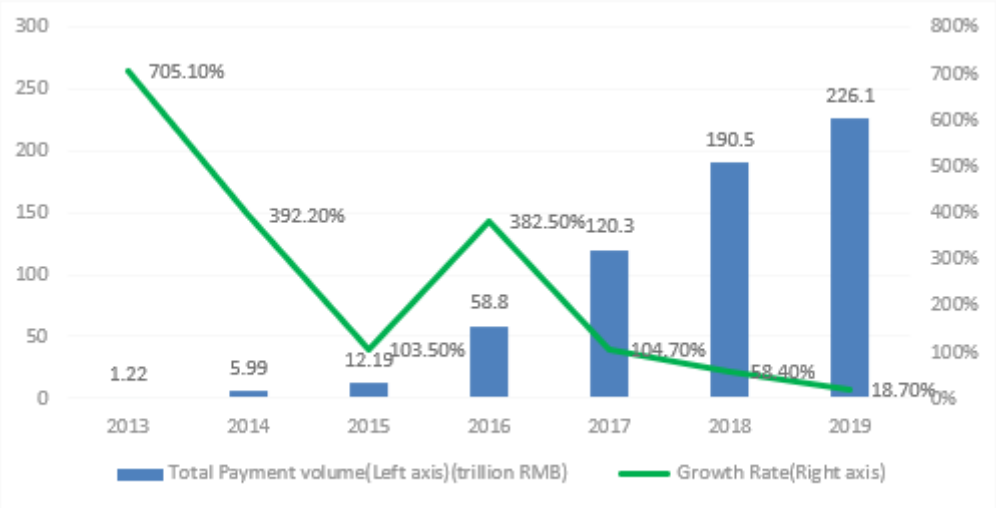

Figure A-24 Transaction Scale of China's Third-Party Mobile Payment

Data Source: WIND

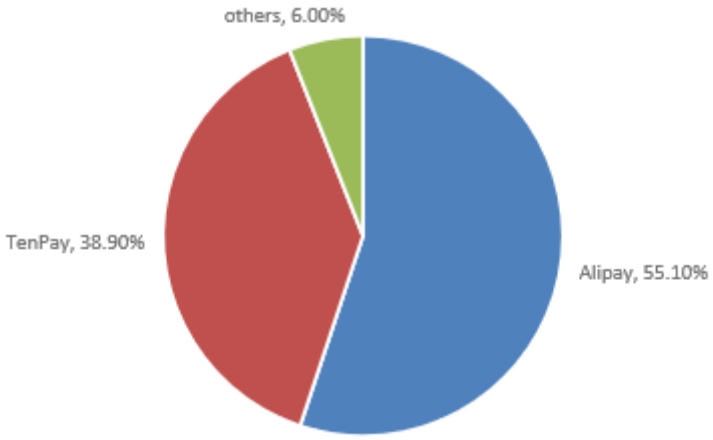

Figure A-25 Market Share of China's Third-Party Mobile Payment in 2019

Note. Others include Baidu Wallet, Fast Money, SuNing Finance, etc

Data Source: WIND

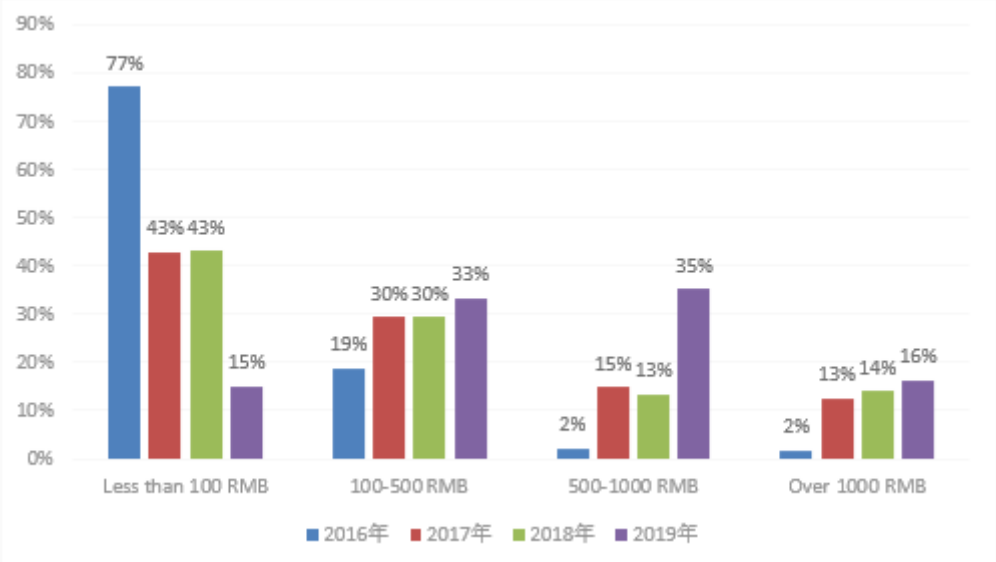

Figure A-26 Single Mobile Payment from 2016 to 2019

Data Source: Mobile Payment User Survey Report 2016-2019

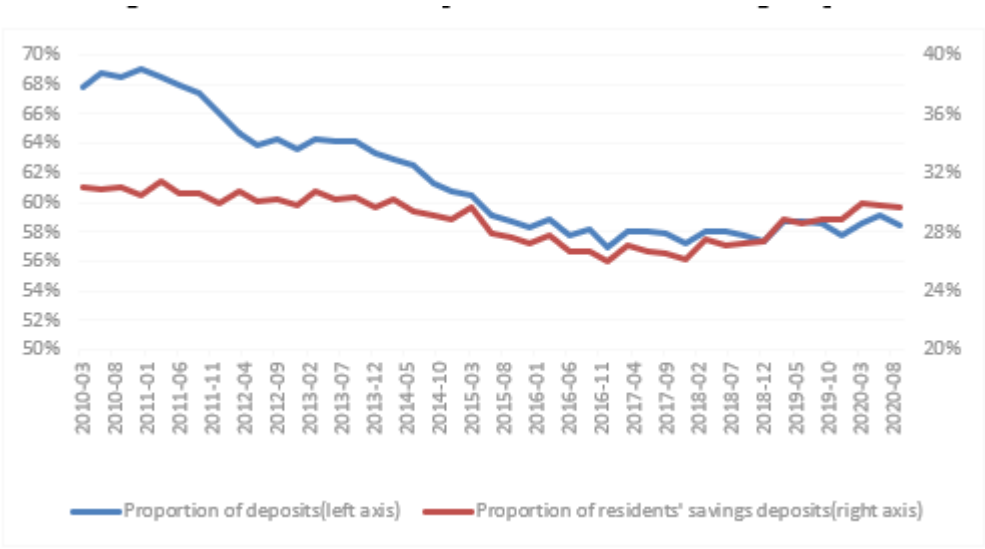

Figure A-27 Ratio of Total Deposits to Household Savings Deposits

Notes:

1.Proportion of deposits= $\frac{\text{total deposits}}{\text{total liabilitie s}}$

2.Proportion of residents' savings deposits= $\frac{\text{residents' savings deposits}}{\text{total liabilitie s}}$

Data Source: WIND

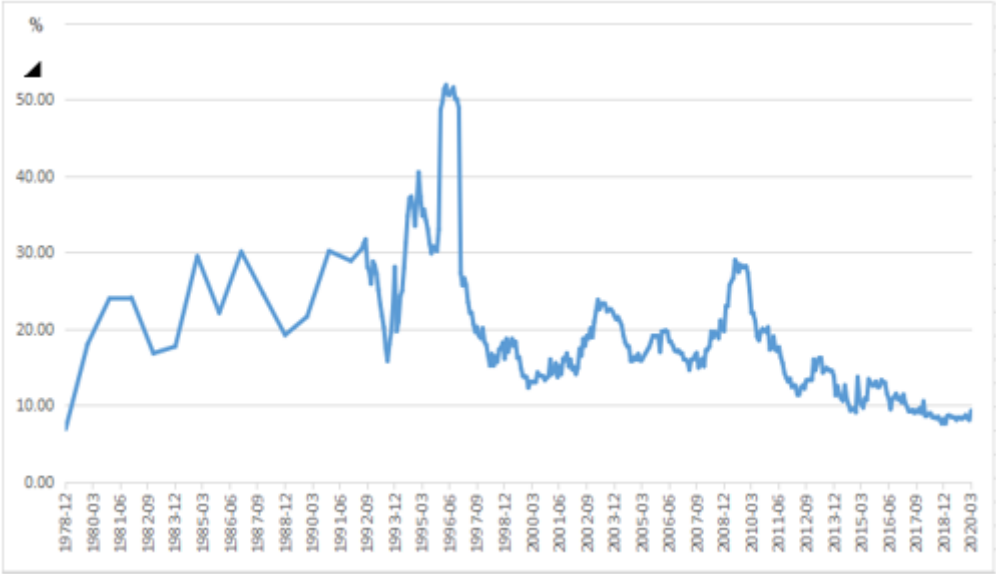

Figure A-28 Yearly Growth of Deposit Balance of China's Financial Institutions

Data Source: WIND

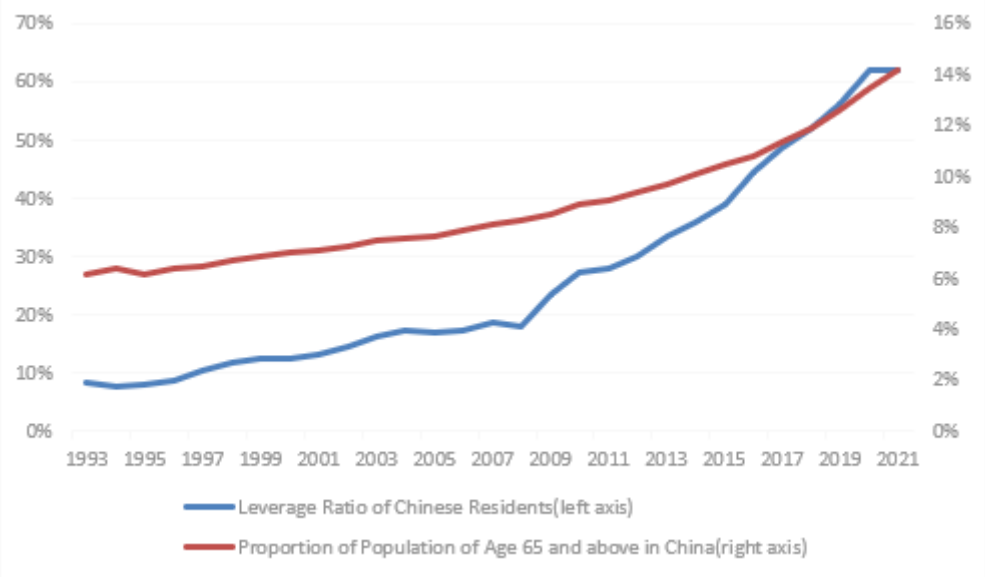

Figure A-29 Leverage Ratio of Chinese Residents and Population Aging

Source: WIND

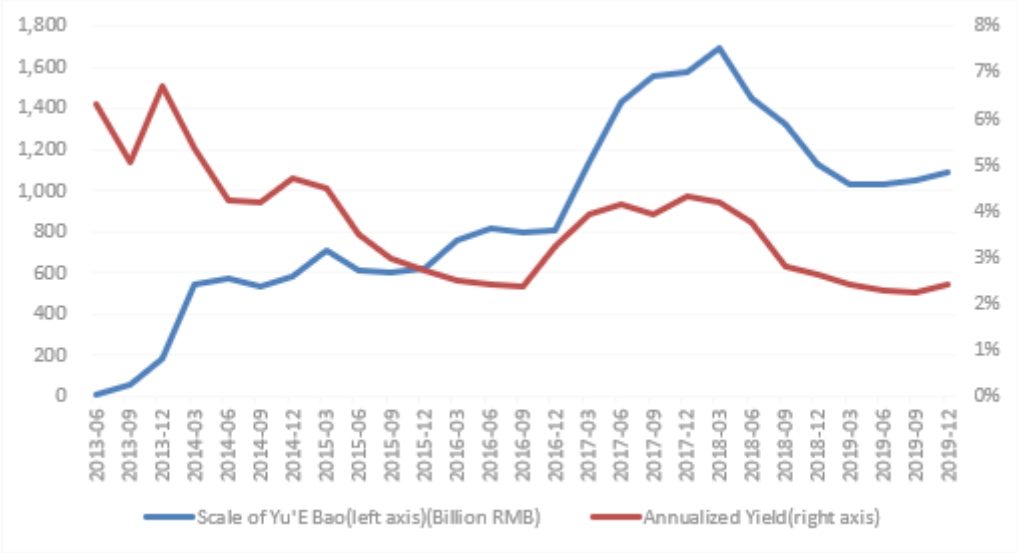

Figure A-30 Scale and Annualized Yield of Yu'E Bao

Data Source: WIND

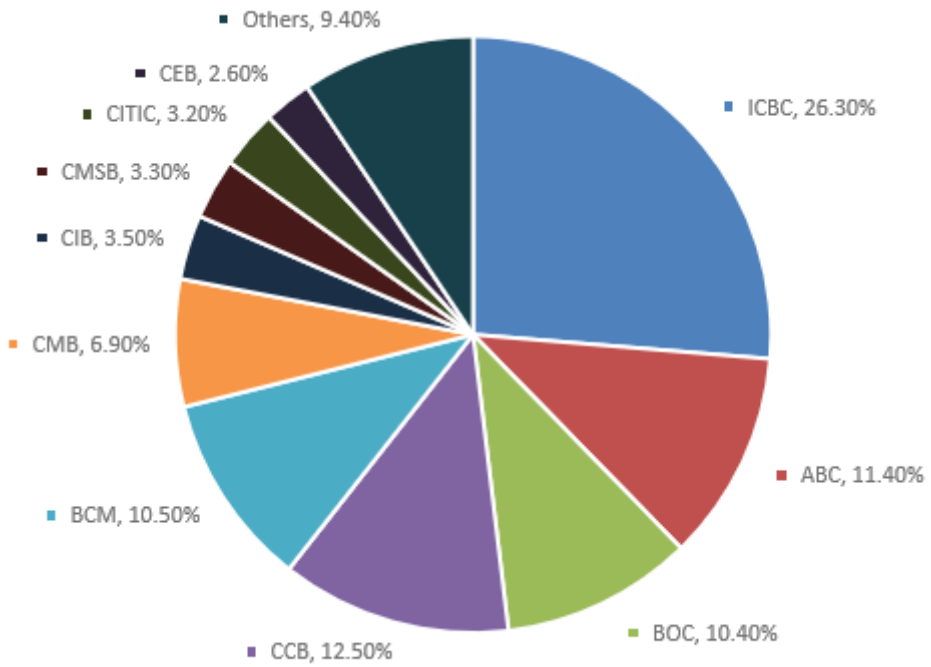

Figure A-31 China's Online Banking Market Share in 2018

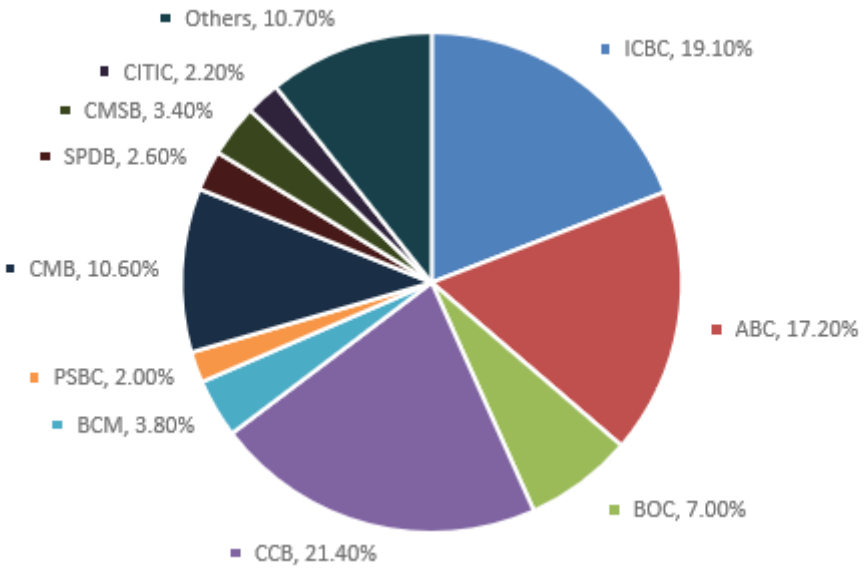

Figure A-32China’s Mobile Banking Market Share in 2018

Data Source: YiGuan Think

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Annex B: Other Tables

Table B-1 Statement of Equity Structure of Baoshang Bank at the end of 2016

Source of data: Financial Report of Baoshang Bank

List of shareholders	Shareholding amount (ten thousand shares)	Share proportion (%)
Baotou Taiping Trade Group Co., Ltd	42,894.50	9.07
Baotou Daan Investment Co., Ltd	26,090.63	5.51
Baotou Jinggong Technology Co., Ltd	25,150.46	5.32
Baotou Baichuan Investment Co., Ltd	23,601.05	4.99
Baotou Haohan Technology Industry Co., Ltd	23,506.81	4.97
Inner Mongolia Netcom Computer Co., Ltd	22,956.73	4.85
Inner Mongolia Senhai Xuteng Trade Co., Ltd	19,904.50	4.21
Baotou Jingxiang Printing Co., Ltd	18,340.58	3.88
Erdos Tianhong Weike Trade Co., Ltd	15,730	3.32
Baotou Kangan electromechanical Co., Ltd	13,310	2.81

Table B-2 Core financial indicators of Baoshang Bank

Source of data: Financial Report of Baoshang Bank

PROJECT	2017	2016	2015	2014
Total assets (million)	555,940	431,582	352,595	312,864
Deposit balance (million)	255,220	192,643	177,612	169,525
Loan balance (million)	221,123	156,501	121,776	94,805
EPS	0.69	0.87	0.77	0.72
Net asset value per share	6.70	6.11	5.93	5.58
Return on net assets(%)	10.19	15.11	14.05	13.81
Core tier 1 capital adequacy ratio(%)	7.28	9.07	9.33	10.58
Tier 1 capital adequacy ratio(%)	7.28	9.07	9.34	10.59
Capital adequacy ratio(%)	9.30	11.69	12.22	11.19
NPL(non-performing loan)(%)	1.72	1.68	1.41	1.37
Provision coverage ratio(%)	NA	176.77	194.61	200.06

Table B-3 Capital Adequacy Ratio Data in the First Three Quarters of 2017

Source of data: Information Disclosure Report of the Third Quarter of 2017

Item	2017 Q3	2017 Q2	2017 Q1
Core tier 1 capital adequacy ratio(%)	7.38	7.33	8.52
tier 1 capital adequacy ratio(%)	7.38	7.33	8.52
capital adequacy ratio(%)	9.52	9.49	11.08

Table B-4 Summary of profitability index of Baoshang Bank

Source of data: Financial report of Baoshang Bank

Profit and loss account (million)	2017	2016	2015	2014
Operating revenue	11,975	12,402	11,150	9,452
Net interest income	8,010	9,396	8,673	7,799
Net profit	3,231	4,210	3,418	2,886

Table B-5 Summary of Liabilities Accounts of Baoshang Bank

Source of data: Financial Report of Baoshang Bank

Liability Account (million)	June 2017	2016	2015	2014
Deposit taking	220,414	193,643	177,613	169,526
Deposits with banks and other financial institutions	153,958	71,615	58,871	78,747
Bonds payable	95,023	76,274	39,964	247
Subtotal	469,395	341,532	276,448	248,520
Total Liabilities	514,960	401,783	326,360	290,408

Table B-6 Summary of the Proportion Liabilities Accounts of Baoshang Bank

Source of data: Financial Report of Baoshang Bank

Liability Account (%)	June 2017	2016	2015	2014
Deposit taking	42.80	48.20	54.42	58.38
Deposits with banks and other financial institutions	29.90	17.82	18.04	27.12
Bonds payable	18.45	18.98	12.25	0.09
Subtotal	91.15	85	84.70	84.58
Total Liabilities	100	100	100	100

Table B-7 Case development time flow chart of Chengdu Branch

Year	What happened to China’s economy	Events in Chengdu Branch
2002		Chengdu branch established
2002-2012	"Golden decade" of China’s coal industry and steel industry	Chengdu branch’s assets scale expanded rapidly
2013	China’s coal and steel prices began to fall	Chengdu Branch’s non-performing loans began to appear
End of 2015	Significant changes in China’s economic policies (including policies to reduce excess capacity)	Chengdu Branch’s scale of non-performing loans gradually expanded
April 2017		Chengdu Branch’s illegal lending case exposed
January 2018		CBRC officially announced punishment results

Source: Summarized by the Author

Table B-8 SPDB profit analysis for four quarters in 2018

Type	2018Q1	2018Q2	2018Q3	2018Q4
Operating revenue (million yuan)	39,629	82,256	127,109	171,542
Year on year growth rate(%)	-6.45%	-1.32%	1.88%	1.73%
Net profit (million yuan)	14,305	28,569	43,207	55,914
Year on year growth rate (%)	-1.09%	1.43%	3.14%	2.75%

Source: Annual Report of SPDB in 2017 and 2018

Table B-9 China's shadow banking related regulatory policies and regulations

Year	Regulatory Policies and Regulations	Primary Coverage
2008	Guidelines for business cooperation between banks and trust companies (No.83 document issued by CBRC)	Standardize the cooperation between banks and credit, prohibit banks from providing guarantee
2009	Notice on further standardizing the cooperation between banks and credit (No.111 document issued by CBRC)	The transfer of credit assets to banks is prohibited in the cooperation between banks and trust companies, after which trust loans play a dominant role
2010	Notice on standardizing bank credit financial cooperation business (No.72 document issued by CBRC)	Bank letter cooperation transferred into the balance sheet, limited financing business, bank letter cooperation arbitrage space reduced
2012	Notice on bill trust business of trust company (No.70 document issued by CBRC)	Stop the bill trust business, and forbid the transfer of bill assets
2012	Notice on standardizing the management of Inter-bank payment business (No.237 document issued by CBRC)	The Inter-bank payment business should be included in the form, which requires real trade background
2013	Notice on standardizing the investment and operation of financial management business of commercial banks (No.8 document issued by CBRC)	Control the total amount of non-standard assets invested by financing raised funds
2013	Circular of the general office of the State Council on strengthening the supervision of shadow banking (No.107 document issued by general office of the State Council)	Put forward higher normative requirements
2014	Notice on regulating Inter-bank business of financial institutions (No.127 document issued by PBOC)	It is prohibited to buy the resale business of the beneficial right of the trust, and it restricts the investment in non-standard assets by the funds of the same industry
2016	Notice on standardizing the business of transferring the usufruct of credit assets of banking financial institutions (No.82 document issued by general office of CBRC)	The transfer of usufruct of credit assets makes full provision of capital, which limits the supervision behavior of banks concealing non-performing assets through financial management business
2016	Measures for supervision and administration of financial management business of commercial banks (Draft for comments)	Limit the investment direction of financial management funds, put forward the requirements of third-party trusteeship and risk preparation
2017	Guidance on improving the quality and efficiency of banking services for the real economy (No.4 document issued by CBRC)	Improve the ability and level of banking system to serve the real economy and avoid capital idling

Source: Summarized by the Author

Table B-10 Entrusted Loan and Trust Loan (unit: trillion)

Date	**Entrusted loan**	**Trust loan**	**Date**	**Entrusted loan**	**Trust loan**
2015-03	9.67	5.35	2018-06	13.19	8.29
2015-06	9.87	5.38	2018-12	12.38	7.79
2015-09	10.35	5.41	2019-06	11.89	7.88
2015-12	10.93	5.39	2019-12	11.44	7.45
2016-06	12.06	5.73	2020-06	11.22	7.32
2016-12	13.20	6.31	2020-12	11.06	6.34
2017-06	13.80	7.52	2021-06	10.93	5.64
2017-12	13.99	8.47	2022-01	10.93	4.28

Source of Data: WIND

Table B-11 Sample bank

Category	Banks
JOINT-STOCK COMMERCIAL BANK	HUI XIA BANK、PING AN BANK、SPD Bank、INDUSTRIAL BANK、CMB、CZBANK、CEB、CMBC、CNCB、CGB
CITY COMMERCIAL BANK	HARBIN BANK、HZBANK、HUISHANG BANK、BANK of JIANGSU、BANK OF JINZHOU、NJBK、SHENGJING BANK、BANK of TIANJIN and so on
RURAL COMMERCIAL BANK	CHANGSHUBANK、JRCB、WUXI BANK、SZRCB、ZRCBANK、ZJB、BRCB、GRCB、SRCB、TRC BANK、ZHUHAI RURAL COMMERCIAL BANK and so on

Source: Summarize by Author