IMPACT OF INTERNET FINANCE ON OPERATION PERFORMANCE OF COMMERCIAL BANKS IN CHINA: EVIDENCE FROM PRE AND POST COVID-19 PANDEMIC PERIOD

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DECLARATION

I hereby declare that this thesis is based on my original work except for citations and quotations which have been duly acknowledged. I also declare that it has not been previously and concurrently submitted for any other degree or award at Xiamen University or other institutions.

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ABSTRACT

Purpose – The purpose of this study investigates the impact of internet finance on the performance of China's Large Commercial Banks; More specifically, empirically examine how the internet finance influence the five major businesses performance of commercial Bank, which is deposit business, loan business, intermediary business, international business, and the comprehensive performance. Also, the heterogenous impacts internet finance had on different kinds of banks are discussed, making comparation between city commercial banks, state-owned banks and joint-equity banks. Throughout this study, the difference of the impact of Internet finance have on the performance of banks before and after the epidemic will be analyzed. Qualitative and quantitative methods are used to identify the linear and nonlinear relationship between Internet finance and commercial bank performance pre and post the pandemic

Design/Methodology/Sample size - this study will use some financial data disclosed on the database of WIND which representing the performance of banks as dependent variables, and apply the transaction scale of internet finance as independent variable. Finally adopt panel regression to analyze data from 34 The time interval contains two parts, the "2012-2019" represent the pre pandemic period, and the "2020-2022" represent the post pandemic period.

Social implication - this research can advise commercial banks to innovate by learning from the profit model of internet finance and reinforce bank's inherent advantages, thereby improve the comprehensive performance of China's bank industry. Furthermore, it can provide suggestions for financial regulators to further guide the healthy development of Internet finance and deepen the reform and innovation of commercial banks

Research Keywords - Commercial bank, COVID-19 pandemic, Internet Finance

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INTRODUCTION

1.1 Background

1.1.1 Rise of third-party payments

In the past decade or so, we have experienced the innovation of mobile devices, from desktop phones to smartphones with increasingly diverse functions. The rapid development of technology has changed people's consumption and payment habits, and this change in payment habits has directly changed the way financial services are provided (Gu, Jiang & Tan, 2016). The Internet development takes off and the e-commerce market is born and developing rapidly (S. Wang, S. Zheng., 2008), while the mobile payment technology supporting e-commerce is also evolving to realize the customer's requirement to buy online anytime and anywhere (Linck et al., 2006).

Unlike brick-and-mortar transactions, e-commerce does not allow for the simultaneous clearing of money and goods. Therefore, in the early days, there were many scams in which money was received but not shipped, so Taobao established a bank-hosted third-party account to guarantee electronic transactions, and this innovative trust mechanism is the third-party payment, Alipay was officially launched in 2004 and developed into the largest third-party payment platform in China more than ten years later (Jun liu.,2015).

Internet third-party payment is a non-financial institution payment services which provided on a neutral payment platform, it connects bank payment with the

settlement systems of e-commerce transactions, till now its function covers from online settlement to online transfer (People's Bank of China, 2010). Since the emergence of third-party payments such as Alipay and WeChat Pay, they have basically replaced traditional banks' cash deposit business through mobile apps.

Since 2012, financialization has become the main development direction of third-party payment, and mainstream apps have developed investment and wealth management payment services to devote to financial payment services. Financial payment services mainly refers to the settlement services conducted by transactions containing financial attributes, such as funds, insurance, trusts, bank wealth management. Internet financial payments have largely reduced transaction costs because of more convenient operation methods and higher flexibility, so their transaction volume has climbed exponentially and had a transformative impact on the entire real financial industry (Xu.,2015).

Data from IResearch Consulting shows that the third-party payment transactions were 39 billion yuan in 2009, 148 trillion yuan in 2017, and the total scale of third-party mobile payments and third-party Internet payments reached 271 trillion yuan by 2020, which achieving a 7,000-fold growth rate during the decade.The annual growth rate in 2017 and 2018 was as high as 88% and 48%, and it has maintained a high growth rate of about 15% in the following four years, which also confirms the rapid development of Internet finance in the past five years. The transaction size in 2025 is expected to reach 48.92 billion yuan, and it is likely to keep expanding at an annual growth rate of 11%. With its convenient, efficient and secure payment experience, third-party payment will make China's payment market an international leader with a stable and high growth rate.
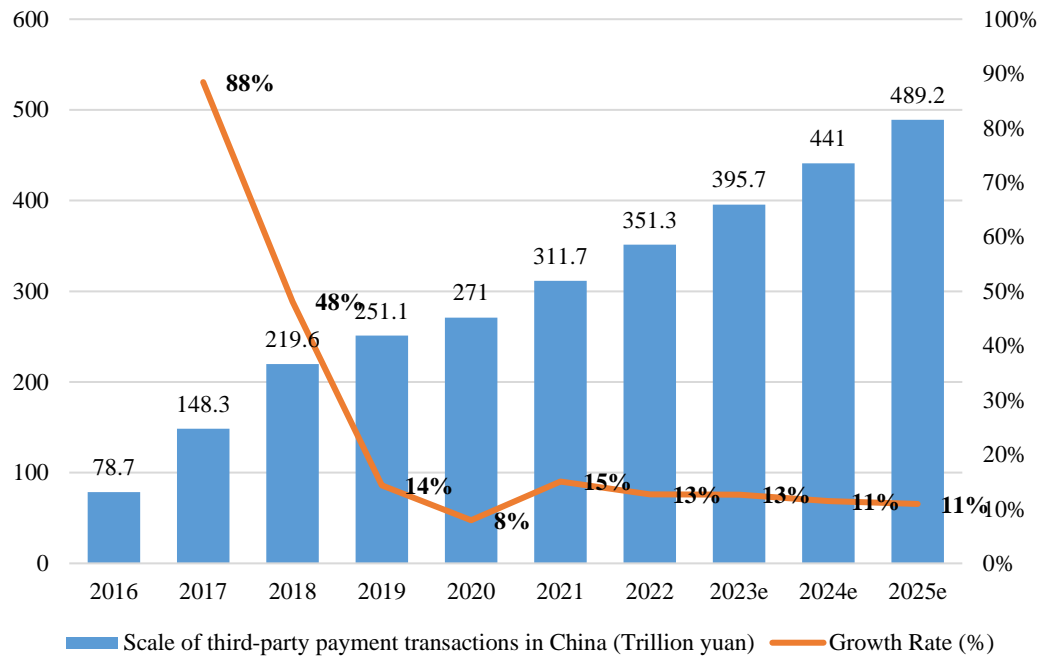
Figure 1.1: Scale of third-party payment transactions in China from 2016 to 2025E

Because of its functional necessity, wide coverage, and the highest technical maturity, third-party payments have become the most important component of Internet finance. In addition, P2P microfinance, crowdfunding, and virtual currency trading are also part of Internet finance.

1.1.2 P2P microfinance, crowdfunding, and virtual currency

P2P microfinance is a direct individual-to-individual credit model in the Internet mode, where borrowers and lenders complete their lending behavior directly on a P2P financing network platform, but its credibility has been affected by the financial fraud problems caused by P2P in recent years. Crowdfunding financing is an Internet financial model that raises funds through the Internet. It raises funds for the public through crowdfunding websites and raises easy borrowing terms for small borrowers. It generally has looser collateral requirements than commercial banks, which allows people with limited funds to raise start-up capital. Virtual currencies are anonymous electronic currencies with no central issuer, such as Bitcoin, which are no longer controlled by traditional banks and offer superb returns and risk.

Compared with traditional financial institutions, Internet finance has electronic payment methods, which no longer requires the complex registration and account opening procedures of physical banks; its dynamic information processing capabilities, supported by cloud computing, can form dynamic changes in the time series and the calculation of the probability of default; in addition, due to its transparent resource allocation, at very low transaction costs, Internet finance can solve the problem of individual fund-raising, which is the problem of information asymmetry and the constraint of small loans.

1.1.3 Commercial banks in China

However, Internet finance is actually a novel thing developed recently. Before that, China's financial industry was always centered on commercial banks. Since China's accession to the WTO, the economy has developed rapidly and the financial system has been improved. The current situation in China has formed with the coexistence of four major state-owned commercial banks, numerous joint-stock commercial banks, and several city commercial banks (CHEN, 2017). Commercial banks act as credit intermediaries in capital transactions in Western capitalist economies, using the savings of all social classes as capital, creating credit as a circulation tool, to provid a boost to financing needs, in addition to providing a signaling mechanism for macro-control policies and implementing regulatory instruments. Commercial banks in China also provide traditional services such as deposits, loans and intermediation services, from which they charge interest and fees for profit. (Chéron, E.J., McTavish, R. and Perrien, J. 1989)

Nowadays, commercial banks in China consist of 6 state-owned commercial banks, 12 nationwide joint-stock commercial banks and 134 city commercial banks. State-owned commercial banks are directly controlled by the State Ministry of Finance, such as Industrial and Commercial Bank of China, Agricultural Bank of

China, and Bank of China, etc. Joint-stock commercial banks are commercial banks in which a variety of investment funds participate, mainly China Merchants Bank, CITIC Bank, and Pudong Development Bank, etc.; and city commercial banks are unique to the Chinese banking industry, formerly known as credit unions in each city, and mainly assist in local economic development, such as Bank of Beijing, Bank of Bank of Shanghai, etc. (Wang., 2022).

Figure 1.2: Classification of Chinese commercial banks

Levine suggests that the country can be divided into bank-led and market-led, with China being included in the former. The late start of China's capital market and the long-term preference for public ownership have made investors trust traditional banks much more than other financial institutions, which, together with the weak development of intermediaries in the securities market and the unregulated operation of brokerage firms, accounting firms, and asset appraisal agencies, have made banks the most creditworthy financial institutions in China and have been undertaking the most capital lending and borrowing services.

1.1.4 Conflict between internet finance and commercial banks

In recent years, under the development trend of Internet finance, traditional commercial banks have established their own e-commerce platforms, developed mobile apps such as mobile banking to replace counter business, and cooperated with e-commerce platforms to try out microfinance business. ICBC has joined hands with Alibaba to launch short-term microfinance business.

These attempts represent an overlap in the business areas of traditional commercial banks and Internet finance, but both have some significant problems. 2021 the People's Bank of China issued a notice regulating commercial banks' Internet business, which requires commercial banks not to conduct deposit business through unofficial networks and need to strengthen network security protection to protect the legitimate rights and interests of consumers (People's Bank of China, 2021) The problem of irregularities in Internet finance has become more serious, with about 2,457 P2P platforms defaulting in 2018, which adversely affects the development of the Internet finance market.

The impact of Covid-19 cannot be ignored, as regions in China have frequently had COVID-19 lock-downs since 2019, that made a huge negative impact to physical commercial banks. The closure brought about by the epidemic may greatly increase the difficulty for customers to handle business at the physical sites of commercial banks, but Internet Finance allows remote, online transactions. The epidemic has made the conflict between Internet finance and commercial banks more intense.

Internet finance seems to be a formidable rival to banks. Thus, this research is going to examine the impact of internet finance have on the profitability, liquidity, security, growth and comprehensive performance of commercial banks. To check whether internet finance is a promotion for the innovation or a beast which will seize the market share of commercial banks in China.

Previous study holds different opinions. Funk (2019) argues that Internet finance has captured the Chinese financial services market, influencing the activities of commercial banks and changing their operational systems. However, Gonzalez and Loureiro (2014) offer the opposite opinion, arguing that Internet finance teaches commercial banks how to innovate and reform to transform to the form of the Internet. Internet technology has led to the expansion of financial markets, not only an increase in the variety of financial products, but also a better financial system (Srivastava, 2014). It is confirmed that there is a technological spillover effect of Internet finance on commercial banks, which has a significant positive relationship on the overall performance of commercial banks (Shen. and Guo., 2015). It has also been suggested that innovative financial products and services are key elements for the future development and competition of financial institutions (Zhao.,2015; Arnold and Ewijk, 2011).

This research aims to empirically investigate the interrelationship between internet finance and commercial banks in China by adopting panel regression model to analyze, make innovations in the analysis of heterogeneity in the impact on different kinds of banks.

1.2 Problem Statement

Today, China's financial system has undergone tremendous changes. Before the advent of Internet finance, China has always maintained a financial system centered on the People's Bank of China and commercial banks as the main participants. But now, Internet finance has become a new entrant that cannot be ignored in terms of the number of users and transaction volume. Under the huge changes in the overall pattern, some contradictions and industry issues have become more and more obvious, and how to deal with the relationship between Internet finance and

commercial banks has become particularly important.

Therefore, how to reconcile the functions of Internet finance and commercial banks, and how to make suggestions for the harmonious development of the two are the core issues of this research, which need to be supported by more sophisticated data evidence and theory. Internet finance and commercial banks both have a wide range of products and services. If this article wants to make suggestions for the cooperation between the two, it cannot only analyze the impact of Internet finance on the overall performance or performance indicators of commercial banks. The current industry issue can be solved only by elaborating the quantitative research and analyzing its impact on the specific business of the bank segment.

The development process of Internet finance in China is much shorter than that of developed economies such as the United States and Europe. The overall process can be divided into three stages. The first stage was the trend of e-commerce of the traditional financial industry from 1990 to 2005, that is, entity commercial banks carried out functions such as online banking and mobile apps. The second stage is the booming stage of third-party payment from 2005 to 2012. At this stage, third-party payment platforms such as Alipay, Tenpay, and WeChat Pay appeared. The last stage is the development stage of Internet substantive financial business since 2012. Various forms of Internet financial products have emerged, such as P2P, crowdfunding, digital currency, small and micro loans, etc. It can be seen that from the second stage, Internet finance has gradually encroached on the business field of commercial banks. Using online payment to take away the business of commercial banks that were originally used as payment intermediaries for collection and payment, and to provide payment guarantee for the most popular online shopping transaction process. By the third stage, Internet finance has penetrated into many financial service fields of commercial banks, but has made innovations from different angles. (Zheng Liansheng, 2014)

Taking P2P as an example, P2P is essentially a form of loan launched by Internet finance in which lenders directly contact borrowers, which is similar to but different from the traditional loan form of commercial banks. P2P omits the complicated procedures for banks to identify borrowing qualifications, and lowers the borrowing threshold to a certain extent. This nature made P2P the first choice for small and micro enterprises and individual borrowers at that time, and seized a certain share of the loan business of commercial banks.

With the rapid development of Internet finance and its penetration into the physical financial industry, physical commercial banks have also rushed to launch many online financial products. Since its development, the homogeneity of Internet finance and commercial banks in terms of products and services has become more and more serious. The homogenization problem has caused the vicious competition between the two to emerge one after another, and it has also caused the business development of both parties to be too large, and each has problems in management and operation.

There are many problems in Internet finance, and the key word is security. At present, the advantage of Internet finance is that there is no traditional intermediary, which greatly simplifies the credit screening procedures before the transaction, and also has a variety of financial products, which can be applied for loans through computer processing on the open platform. However, the most direct problems brought about by these advantages are weak management and high risks. Because Internet finance is not connected to the credit information system of the People's Bank of China, and does not have the bank's back-regulation, risk control, and compliance mechanisms, it is prone to mixed risks.

Since 2018, P2P platforms such as Zhongdai.com, Netease world, and Youyi.com have gone bankrupt or ceased their services one after another. This is all because of the low threshold for Internet finance and the lack of supervision. Because it only has a simple credit investigation, it is easy to be used by criminals, and then maliciously

defrauding loans and absconding with money. In addition, transactions on mobile platforms are easily subject to technical tampering. At present, the laws related to Internet finance are still immature, and they are prone to hacker attacks or frauds. It is difficult to guarantee the security of consumers' funds and information, and thus, the risk is very high.

On the other hand, the current disadvantage of commercial banks is that there are too many levels of management structure and long information transmission paths, which makes their response to the market particularly slow. Therefore, the response speed of commercial banks is much lower than that of Internet finance companies. The second problem is that the bank's business design is relatively rigid, and it has to follow tedious business processes, which makes the customer experience poor. The third problem is that commercial banks have not made enough efforts in technological development. Compared with Internet finance, commercial banks have insufficient innovation, which also makes most of the online services developed by commercial banks in recent years draw on the Internet financial system. Without new ideas, it is difficult to be as flexible and convenient as Internet finance.

Finally, the industry issue of commercial banks became more serious after the outbreak of Covid-19 in China in December 2019, there was an outbreak of a new pneumonia virus in Wuhan, China, which is spread by droplets. It was to curb the development of the infection that the Chinese government used a lockdown to restrict the movement of people, with all human contact being minimized. For three months in early 2020, almost all Chinese people stayed out of their homes and tried to avoid contracting the virus, and this pattern of lockdown continues to this day. This greatly affected the offline business of commercial banks, as any financial needs while people were confined to their homes could only be solved online. Therefore, since the beginning of the epidemic, Internet finance has grown by leaps and bounds because of its online, no-touch model, resulting in a more intense conflict between the business of Internet finance and commercial banks.

To sum up, the biggest problem for commercial banks is how to adjust the business structure and how to deepen the innovation to adopt the Internet finance model. Similarly, the urgent problem to be solved in Internet finance is how to ensure the safety of investment. This article considers the two together and finds that they are actually complementary. Therefore, this research hopes to find an approach to adjust the functional structure of commercial banks and Internet finance at the same time, so that the two can work together in certain fields, and then develop in depth in the fields where they have competitive advantages. Avoid waste of human resources and resources due to malicious competition, and promote the vigorous development of China's financial industry as a whole.

Most of the existing research studies the impact of Internet finance on the comprehensive business performance of commercial banks from a qualitative level, and there is a lack of quantitative research. In most quantitative studies, the impact of Internet finance on the overall comprehensive performance of commercial banks is discussed. For example, Shen Yue conducted a panel analysis of the data of 36 commercial banks in China in 2015, which proved that due to the influence of technology spillover effects, Internet finance has a significant positive effect on the comprehensive business performance of commercial banks. Most other quantitative researches analyze financial indicators of comprehensive performance. For example, in Dong Jichang's (2020) study, he used panel regression analysis to quantitatively analyze the profitability, liquidity, security, growth and other financial performance of commercial banks.

This makes the literature gap in this field first and foremost due to the lack of quantitative research. Secondly, most of the existing quantitative studies discuss the impact of Internet finance on the overall performance of commercial banks, but there is a lack of further research focus on the specific sub-segment of commercial banks. The current research is superficial as overall data can contribute little on making

effective suggestions for the future development model of Internet finance and commercial banks. In addition, the impact of the 2019 epidemic has not been discussed by existing research, its influence can not be ignored as the social distancing and blockade brought by the epidemic have a considerable impact on the offline business of commercial banks. Thus, whether the impact of Internet finance on commercial banks has strengthened before and after the epidemic has not been explored yet.

To sum up, this study will make improvements to these three literature gaps, adopt quantitative methods, and empirically test the impact of Internet finance on the three traditional businesses of commercial banks, which is deposit business, loan business, and intermediary business, based on a panel regression model. And innovatively doing the heterogeneity impact analysis on different types of banks to explore the differences in the extent to which they are affected. Finally, this article will compare the changes in the impact of Internet finance on the performance of commercial banks before and after the epidemic, put forward some suggestions for the innovation and further progress of China's financial industry in the coming post-epidemic era.

1.3 Research Questions

The research questions of this study will involve issues from three perspectives. This paper first hopes to explore the impact of the scale of Internet finance on the performance of the three traditional businesses of commercial banks. Furthermore, hope to study whether there is heterogeneity in the impact of different types of commercial banks on Internet finance, and finally to explore what changes the epidemic will bring to the impact. This paper summarizes the following 6 research questions from three perspectives:

1. What is the relationship between Internet finance (IV) and the deposit business performance (DV) of commercial banks in China before and after the epidemic?

2. What is the relationship between Internet finance (IV) and the loan business performance (DV) of commercial banks in China before and after the epidemic?

3. What is the relationship between Internet finance (IV) and the intermediary business performance (DV) of commercial banks in China before and after the epidemic?

4. What is the relationship between Internet finance (IV) and the international business performance (DV) of commercial banks in China before and after the epidemic?

5. What is the relationship between Internet finance (IV) and the comprehensive performance (DV) of commercial banks in China before and after the epidemic?

1.4 Research Objectives

The general objectives of this research are to find the linear and nonlinear relationship between Internet finance and commercial bank performance, to analyze the heterogenous impacts of internet finance have on different kinds of commercial banks in China, and to compare the impact of Internet finance have on the performance of commercial banks before and after the epidemic.、

1. To examine the relationship between Internet finance (IV) and the deposit business performance (DV) of commercial banks in China before and after the epidemic.

2. To examine the relationship between Internet finance (IV) and the loan business performance (DV) of commercial banks in China before and after the epidemic.

3. To examine the relationship between Internet finance (IV) and the intermediary business performance (DV) of commercial banks in China before and after the epidemic.

4. To examine the relationship between Internet finance (IV) and the international business performance (DV) of commercial banks in China before and after the epidemic.

5. To examine the relationship between Internet finance (IV) and the comprehensive

performance (DV) of commercial banks in China before and after the epidemic.

1.5 Scope of the study

The research scope of this paper will be China's financial industry, focusing on the performance of Internet finance and commercial banks from 2012 to 2021. This range will cover 25 commercial banks listed in Shanghai Stock Exchange in China, including city commercial banks, state-owned commercial banks and joint-equity commercial banks. It also includes the main components in Internet finance, which is the transaction performance of third-party payment, P2P microfinance, crowdfunding, and virtual currency.

The main reason for choosing this time period is that Internet finance has entered the third stage after 2012, and many substantive financial businesses and products have been developed, which has magnified the influence of Internet finance. This article divides 2012 to 2019 into the pre-epidemic period and 2019 to 2021 as the post-epidemic period, because the impact of the epidemic on China began at the end of 2019 and has continued to the present. The choice of commercial banks is mainly based on the type of bank. Six state-owned banks and 12 joint-stock banks are the most important players in China's banking industry. They are most represented by having the highest number of clients and transactions. In addition, the influence of city commercial banks in the city is also very considerable, so some city banks are also selected into the research scope.

1.6 Contribution of the study

This paper will reallocate the functional division of the financial system according to the strengths and weaknesses of Internet finance and commercial banks themselves, reconcile the current vicious competitive relationship between Internet finance and

commercial banks, transforming them into a harmonious relationship of mutual promotion and mutual benefit.

To accomplish these, this article aims to find the intrinsic relationship between Internet finance and commercial banks' segmented business, provide statistical evidence, thus make effective suggestions for market regulators to adjust the business structure of both parties, deepen the innovation and electronic process of commercial banks, improve the security and the credit system of Internet finance simultaneously.

In addition, from an investor's perspective, this paper hopes to contribute to improving the efficiency and volume of China's financial markets. In particular, it aims to promote the development of innovative financial instruments made by commercial banks, which can bring more financing opportunities to lenders. On the other hand, addressing the security issues of Internet finance can optimize the financial market and improve investor confidence to bring better liquidity and more capital to the market.

Overall, this paper hopes to facilitate growing the competitive advantages of both internet finance and commercial banks, avoid the waste of resources caused by malicious competition, then promote the overall development of China's finance industry.

1.7 Keywords definition

Internet Finance：It refers to a new financial business model in which traditional financial institutions and Internet companies use Internet technology and information and communication technology to realize financing, payment, investment and information intermediary services.

Commercial bank: It refers to a financial institution that undertakes credit

intermediary through deposits, loans, exchange, savings and other businesses, and its main business scope is absorbing public deposits, issuing loans and other intermediary businesses.

Deposit business：Deposit is a credit behavior in which the public deposits funds in the bank based on the trust in the bank and can withdraw money at any time or at an agreed time.

Loan business： It refers to an economic behavior in which a bank lends funds to those in need of funds at a certain interest rate according to national policies, and agrees to return it within a time limit. Generally, it is required to provide a guarantee, a house mortgage, or proof of income, and a good personal credit report can be applied.

Intermediary business：It refers to the bank taking advantage of technology, information, institutional network, capital and reputation, not using or less using the bank's capital, to handle payment, consultation, agency, guarantee, leasing and other entrustment for customers as an intermediary and agent matter. Banks provide these financial services and charge certain intermediary fees for business activities.

International business: It refers to the business activities conducted by commercial banks internationally involving foreign currency or foreign customers, mainly including international settlement business, international credit and investment, foreign exchange business, etc.

1.8 Research Organizing

The framework of this research is organized as followed, Chapter 1 is the introduction of the basic background and research objective. Chapter 2 elaborate the literature review and how this study develop the hypotheses. Chapter 3 outlined the research methodology and the fourth section will demonstrate the results, and Chapter 4 will be the remarks and conclusion of the whole study.

CHAPTER 2

LITERATURE REVIEW & HYPOTHESES DEVELOPMENT

2.1 Introduction

In the literature review section, we will first go through the underpinning theory, as this study mainly focuses on the business structure of Internet finance and commercial banks, so there are many theories about economic theory and financial institutions that can be used as our underpinning. Then we go through the previous studies related to this topic, analyze their framework and content, sort out the impact factors found in previous studies, use them as control variables or impact factors, and develop hypothesis based on the theory and previous literature. Finally, the theoretical framework would present the relationships between all the independent, dependent, control variables.

2.2 Theoretical underpinnings

2.2.1 Theoretical pillars of internet finance

The concept of Internet finance was first proposed academically in 2012. As more and more information stored digitally (McKinsey Global Institute 2011), investors can obtain information from the Internet to more accurately assess the creditworthiness of individuals or firms, which forms the information basis for financial behavior (Xie and Zou 2012).

Simultaneously, the computing power of Internet technology continues to improve, and the advancement of cloud computing and quantum computing technology brings better computing volume and speed (Liu 2011), which can significantly

reduce transaction costs and solve the problem of information asymmetry. With the help of big data, the level of risk estimation and management in financial markets has improved, and the set of feasible transactions has expanded (Xie and Zou 2012)

Therefore, the ideal Internet financial system will approach Walrasian equilibrium, which is a general equilibrium theory holds that when the economic system is in equilibrium, the prices of all consumer goods and factors of production will be an equilibrium value, that is, consumers can obtain the maximum effect and producers can obtain the maximum reward. When participants in the financial market use Internet technology to solve the problems of information asymmetry and transaction costs, the financial system will tend to a Walrasian equilibrium development without intermediaries and markets (Mas-Colell et al. 1995)

2.2.2 Theory of financial market

In essence, the traditional financial market requires financial institutions to provide intermediary services because of information asymmetry and transaction costs (Mishkin 1995), but the Internet will bring fundamental changes to the form of financial markets.

The information asymmetry theory holds that sellers know more about commodity information than buyers in the market, and the party with more information can send reliable signals and profit to the party with less information. In reality, the market with information asymmetry problem is flawed, and the development of information service industry and information technology can solve the information asymmetry problem (Akerlof, 1970; Rothschild & Stiglitz, 1976; Spence, 1973; Stiglitz, J, 1997) .

The transaction cost theory defines transaction cost as the cost of obtaining

accurate market information when a transaction occurs. Therefore, transaction costs consist of information search costs, negotiation costs, contracting costs, monitoring costs, and costs of dealing with potential breaches (Williamson, 1981). After the gradual formation of the Internet market, the network has significantly reduced transaction costs: O' Connor and O' Keefe in 1997 proposed that the network can reduce the negotiation cost in transactions; Dutta, Kwan and Segev in 1998 also proposed that the network can reduce the cost of supervision and contracting;

Behavioral finance (Shefrin and Statman, 1994) believes that investors have self-control, psychological accounts, and avoidance of regret, which is contrary to the rational decision-making such as Rational Expectation and Risk Aversion assumed by traditional financial theory. This theory explains the unwise choices investors make in real capital markets. Driven by the Internet, the communication between investors has become more convenient and efficient, making the financial behavior of groups closer to the theory of behavioral finance.

Efficient Markets Hypothesis (Fama et al, 1969) believes that investors who participate in the market are rational and can respond quickly and reasonably to market information, so all valuable information will be reflected in the stock price trend. With the support of big data technology, the transmission and processing of market information will become faster, which makes the acquisition of market information and price fluctuations much timely. In other words, the Internet brings securities markets closer to the efficient market hypothesis.

Bilateral market theory refers to two parties trading through an intermediate platform, where the most significant feature is the existence of bilateral network effects, which is also its theoretical basis. That is, the supply and demand sides of a certain commodity have cross-network externalities, and the increase in the quantity of party A will give party B more choices and bring about a larger

gathering of party B. A larger gathering of party B will in turn attract a larger gathering of party A. The difference between bilateral and unilateral markets is therefore that pricing no longer uses traditional cost-plus pricing rules, but is influenced by both buyers and sellers. Almost all online shopping platforms, taxi and rental platforms today are typical of bilateral markets, and the greatest value demonstrated by bilateral markets is the simultaneous reduction of transaction costs for users on both sides of the AB.

2.2.3 Network effects, Economies of scale and feasible transactions

Like most Internet fields, Internet finance has three characteristics, Economies of scale, Network effects and feasible transaction set.

Economies of scale (Smith, 1776) means that in operations with high fixed costs, the variable cost is low, and the increase in product output can reduce unit costs, so expanding the scale of operations can achieve higher profits, that is, economies of scale.

Network effects are a phenomenon similar to scale effects brought about by the Internet, where more users join the same network, each user gains more marginal value from a product (Katz & Shapiro, 1994). The Internet makes the entry threshold for participating in the financial market lower and brings more users. Based on these two theories, Internet finance can form a competitive advantage by exploiting economies of scale and network effects.

Feasible transactions theory argues that the Internet has expanded the scope of feasible transactions, making impossible transactions possible (Xie and Zou 2012). For instance, the Internet makes lending, investment and other behaviors free from geographical restrictions. Investors no longer need to choose nearby. It also reduces the restrictions on transaction objects, it is possible to directly trade with

strangers or unfamiliar institutions.

2.2.4 Spillover Effect

The spillover effect refers to the development of something in one aspect that facilitates the development of other aspects of that thing. Academically there are three main types, which are knowledge spillover effect, technology spillover effect and economic spillover effect. The technology spillover effect refers to the fact that companies with technological advantages in the same industry will spread their advanced technologies and business models to other companies (Campbell, 2011).

In consequence, the advanced network information technology possessed by Internet finance will catalyze the development and innovation of traditional commercial bank technology due to the technology spillover effect.

2.2.5 Long-tail effect

Ba Shusong (2012) pointed out that the development of information technology has not only greatly reduced the cost of financial transactions, but also its unique low-cost and low-threshold features have broken through time and geographical restrictions, effectively expanding the scope of financial transaction services and providing more transaction opportunities for small institutional investors and small financiers. Therefore, Internet finance has explored more potential customers than commercial banks, and these potential users are called long tail in statistics. this is because most of people's demand is concentrated in the head, and the demand in the head is described as popular, while the demand in the tail is personalized, fragmented and small, and this part of demand with relatively low profit ratio will form a long tail on the demand curve, that is, Long Tail Effect.

2.3 Previous studies

2.3.1 Internal indicators and external factors that affect the performance of commercial banks

There have been many studies determine the factors affecting the performance of commercial banks in the past, and early studies focused on many non-internet influencing factors and tended to explore the impact of banks' internal indicators and external financial environment.

Berger, Hasan & Zhou (2009) suggest that in developing countries, bank ownership affects performance. In the case of China, for example, foreign banks are more efficient than domestic banks. Chaudron (2018) and Gropp & Heider (2010) demonstrate that the size of commercial banks has a positive and significant effect on the performance of banks and that the natural logarithm of total asset shows a linear relationship. Meanwhile, the ratio of total equity to total assets has been shown to have a significant effect on bank performance in the empirical studies that exist, but the views are not uniform (Mamatzakis and Bermpei 2016): some scholars argue that commercial banks with a higher capital ratio are more secure, can withstand potential loss, and that their greater equity will point to a larger scale of operations (Athanasoglou, Brissimis, and Delis 2008). Other scholars argue that, according to the agency cost theory, lower equity to assets may lead to higher firm value, that is, better bank performance (Berger and Di Patti, 2006).

Tran, Lin, and Nguyen (2016) empirically demonstrate that banks with higher liquidity have lower profitability because banks will have more liquid assets and liabilities, which facilitates the expansion of their lending, deposit business. Also, the impact of GDP, an indicator that captures the productivity of the whole country, on bank performance has been inconsistently stated in various studies. Tan & Floros (2012) examines the effect of GDP growth on bank profitability in China

over the period 2003 to 2009, and found the significant negative relationship betwwen GDP growth and bank profitability. However, other scholars have obtained a more expected answer as Abdul Razak (2015) demonstrated a significant positive relationship between GDP and the performance of commercial banks in Malaysia.

2.3.2 Impact of Internet finance on the performance of commercial banks

Since 2012, Internet finance has gradually emerged in China, and many scholars have noticed that the development of Internet finance has an impact on the performance of commercial banks, trying to identify the relationship between them.

Prior to this, Robert and William (2007) empirically analyzed the impact of 5,000 Internet financial firms on the performance of 400 community banks in the U.S. They concluded that Internet finance significantly contributed to the business level of commercial banks, and its innovative transaction models significantly reduced transaction costs and increased transaction frequency, positively contributing to the development of financial systems in developing countries. Subsequently, some Chinese scholars also demonstrated that the development of information technology has reduced transaction costs and by virtue of its low-cost and low-threshold features break through time and geographical restrictions and expand the scope of available transactions, Internet finance will provide more opportunities for small investors and financiers (Ba Shusong, 2012).

The mainstream research view is that Internet finance has impacted on the traditional business of commercial banks. Stijin (2000) showed that the nature of the financial industry in developed countries has changed due to the rise of Internet finance. Berley and Eisenman suggested in an earlier study in 2006 that Internet finance has significant advantages which will negatively affect the business of

commercial banks. Subsequently, a study proved that third-party payment platforms represented by Alipay can divert the loan, deposit and intermediate business of commercial banks and increase the risk for the going concern of commercial banks (Wang Yunquan & Wang Guochen, 2013). Other scholars have empirically analyzed the impact of Internet finance on commercial banks from the perspective of Internet+retail, and the results show that the development of Internet finance will divert the intermediate business and deposit business of commercial banks and negatively affect loan business (Zheng Zhilai, 2015). Bei Weizhi (2011) also found that the basic payment function of banks was taken over by third-party payments and was significantly diverted from business and customers. However, it has also been argued that the interest rates of online loans offered by Internet finance are much higher than those of commercial banks, which may make the impact of Internet finance on commercial banks' loan business insignificant (Chen Wenjie & Xu Xueliang, 2021)

2.3.3 Internet finance facilitates the innovation of commercial banks

Some recent studies have emerged that Internet finance can facilitate the intelligent transformation of commercial banks. Li Yonggang considers that the development of information technology in Internet finance has increased the efficiency and quality of financial transactions, which is conducive to promoting commercial banks' business disintermediation. Wu Xiaoqiu (2014) also believes that the development of Internet finance technology is conducive to promoting cooperation between commercial banks and financial institutions in other fields and accelerating commercial banks' information innovation. The development of technologies such as big data, cloud computing, and machine learning has improved the accuracy and speed of banks in measuring credit risk, enabling them to manage risk more effectively (Wu, 2015). Jing (2015) makes the same point, and she thinks that the Internet has broken the information isolation problem and improved risk management level.

The latest research coincidentally focuses on how commercial banks can innovate, and most scholars believe that Internet finance can provide direction for bank innovation. Woo, J. (2018) through the analysis of the management structure of banks, argues that commercial banks should learn from internet finance, unify the supervision of online and offline business, abandon the fixed rules, become Principle-based to serve customers to design products more personalized and diversified.

2.4 Hypothesis Development

The most important profit of commercial banks comes from three traditional businesses, intermediate business, deposit business and loan business, and this paper also separates the international business as a separate object of study. Previous studies have found some relationships between Internet finance and commercial banking, on the basis of which this paper will link theoretical underpinnings to develop five hypotheses.

2.4.1 *Hypothesis 1* - Internet finance have negative impact on intermediary business of commercial banks

Unlike other traditional businesses, intermediary business does not constitute assets and liabilities in the bank's financial statements, but only provides intermediary services to earn non-interest income.

Since commercial banks have been intermediaries in the traditional financial market, the fees and intermediary service fees it charges are typical transaction costs. According to the transaction cost theory, the network reduced the problem of asymmetric information. Some Internet companies are using the C2C model to significantly reduce the cost of negotiation and contracting costs in transaction

costs, which all greatly reduced the transaction costs. According to the supply and demand relationship, customers will turn to the lower price of Internet finance to broker business for them, which causes a squeeze and substitution for the intermediary business of banks, resulting in a reduction of bank commission and fee income.

Third-party payment, as an important part of Internet finance, mainly squeezes the intermediary business of commercial banks through bilateral market theory. According to the bilateral market theory, buyers and sellers (ABs) will rely on the same platform that provides intermediary services, an increase in the number and scale of either party will attract the gathering of the other party. Therefore, the wide customer base owned by third-party payment platforms brings a surprising number of potential customers for their financial services, which makes the entrustment and financial services provided by third-party payment platforms have more opportunities to transact with more customers and have price advantages, which will squeeze the intermediary business of banks and divert the intermediary business of commercial banks.

Long tail effect has pointed out that in the past, the demand of the tail end was often ignored by commercial banks because it was too personalized and low gross profit, while Internet finance, such as Yue Bao, precisely met the demand of many long-tail customers, and even the smallest amount of deposit could buy the financial products in Yue Bao. Internet finance flexibly meets the long-tail demand to seize the market share of commercial banks' wealth management products and reduce the commission income of commercial banks' intermediary business.

Previous studies have found that the development of Internet finance affects the service consulting business and off-balance sheet business of commercial banks, which subsequently reduces the commission and fee income of commercial banks (Li Dan, 2014). After comparison, it is found that based on traditional payment

methods, the percentage of commission earned by commercial banks POS is as high as 1-2%, while if the same transactions are made using third-party payment platforms such as Alipay and Yue Bao, the commission will be greatly reduced to 2‰ -4‰. This means banks' commission income will be reduced to 3.5‰, makes the intermediate income of commercial banks significantly lower after Internet finance joins the market (Liu lei, Yin Lijun, Li Xiuting & Dong Jichang, 2022). In addition, some scholars have found that third-party payment attracts many potential customers with its convenient basic payment function, and the advertisements of financial product recommendations on third-party payment websites attract many users, which has a significant negative impact on the diversion of potential customers from commercial banks, which in turn affects the intermediate business of commercial banks (Bei Weizhi, 2011).

Based on the above, this study proposes Hypothesis 1.

Hypothesis 1: Internet finance has a significant negative impact on the intermediary business performance of commercial banks.

2.4.2 *Hypothesis 2* - Internet finance have negative impact on debt business of commercial banks

Loan business is the main business for banks to obtain profit income. Banks use the cash they absorb to provide loans to institutions or individuals who need funds, and the lenders return the principal and interest at maturity, the interest income generated from the loans is the main source of income for the bank's debt business.

The economies of scale proposed by Smith (1776) argues that in operations with high fixed costs, an increase in product output can reduce unit costs. The Internet has been used to bring scale effects to the loan market (Katz & Shapiro, 1994). As more depositors and lenders join the same network, Internet finance can take advantage of the scale effect to give a relatively high lending efficiency, without

requiring customers to provide special proof of loan eligibility, income streams, and other proof of repayment ability, and only require simple identity verification to obtain loans of different amounts. Internet loans have encroached on the loan business of commercial banks with simple procedures.

Furthermore, feasible transactions theory suggests that the Internet can expand the scope of feasible transactions and make impossible transactions possible (Xie and Zou 2012). This allows for lending and investment behavior to be separated from the constraints of distance and class, with a wider range of counterparties and an increase in the variety of investors from commercial banks to multiple parties such as individual and institutional investors, which inevitably leads to a market where financing is more easily available, thus attracting those who need loans. Thus, Internet finance can divert the loan business of commercial banks with a bigger loan market.

Previous studies have found that third-party payment platforms, light lending platforms and other Internet financial institutions, represented by Alipay and Hua Bei, have a significant negative impact on commercial banks' lending business with their more favorable loan terms (Wang Yunquan & Wang Guochen, 2013). The development of loans from Internet finance puts a lot of pressure on commercial banks' ongoing operations, marketing and innovation (Qiao Haishu & Lv Huimin, 2014). Huang Yue and Huang Jian (2016) have proposed that the development of big data, cloud computing and artificial intelligence technologies has led to an increasing number of online e-commerce and software companies getting involved in the financial sector, which has increased competition in the loan business area and caused a squeeze on banks' traditional asset business. In additional, third-party payment software developed by online e-commerce companies has diverted liquid deposits and time deposits that originally belonged to commercial banks, which affects the amount of cash absorbed by banks and is detrimental to commercial banks in their lending business. (Ma Yubo, 2017).

Based on the above, this study proposes hypothesis 2.

Hypothesis 2: Internet finance has a significant negative impact on the debt business performance of commercial banks

2.4.3 *Hypothesis 3* - Internet finance have negative impact on deposit business of commercial banks

The deposit business of commercial banks, also called liability business, mainly refers to the business of customers' demand storage and time storage in commercial banks, and these deposits of cash are the largest source of funds for commercial banks. The difference in interest rates between deposit business and loan business constitutes commercial banks' profits.

Similarly, the three basic theories of Internet amounts: economies of scale, network effects and feasible transactions theory are still able to show that financial institutions with the help of the Internet can take advantage of scale effects and reduce unit costs by increasing the volume of transactions (Smith, 1776). Together with the network effects, the more users join the same Internet financial system, the higher the marginal value can be generated (Katz & Shapiro, 1994). And with the support of the theory of Feasible transactions, the Internet will expand the range of objects that can be traded, so that the storage behavior is not limited by geographical location or even by national boundaries (Xie and Zou 2012). Based on the above theory, Internet finance can make the deposit business more convenient and flexible, which may divert the deposit business of commercial banks.

Some previous studies have discussed the impact of internet finance on the deposit business of commercial banks. Some scholars have studied the demand storage business offered by third-party payment platforms, which argues that under China's

regulatory Under the Chinese regulatory system, the customer's third-party payment account is separated from the bank account. Although there is a direct payment agreement between the two accounts, it's the same as inserting a third-party institution between the bank and the terminal, thus the funds will be kept longer in the third-party platform. At the same time, the massive popularity of digital currencies heralds the arrival of a cashless society in the future, which will significantly weaken the deposit business of banks (Zhou Liping, 2017).

As an example, Yue Bao allows users to transfer their idle funds temporarily deposited in Alipay to get more stable "storage income", which is actually the income from investing in Tianhong Capital Management's public funds. But what is unique is that the investment amount in the Yue Bao can be called for payment at any time. So Yue Bao has also greatly captured the deposit business of banks not only by its higher interest rate but also high liquidity (Xia, H., Hou, Z, 2016). Wang Jinhong (2015) empirically analyzed the impact of Internet finance on the profitability of commercial banks by constructing indicators to measure the overall performance of commercial banks, and its findings proved that the liability business of commercial banks, that is, the deposit business, is most negatively affected by Internet finance.

Based on the above, this study proposes hypothesis 3.

Hypothesis 3: Internet finance has a significant negative impact on the deposit business performance of commercial banks

2.4.4 *Hypothesis 4* - Internet finance have positive impact on intermediary business of commercial banks

International business mainly refers to the business activities of commercial banks that involve foreign currency or foreign customers in the international arena, and

the businesses designed for international trade are mostly international settlement business, international credit and investment, and foreign exchange business. This paper specifically separates international business from the three major businesses of commercial banks for research.

In recent years, global trade has continued to grow steadily and foreign trade is of great significance to China. Cross-border trade often involves different countries, different industrial chains and different banking practices and rules. At the meantime, cross-border trade generally involves larger amounts of money, mostly cross-border remittances from enterprises, requiring commercial banks to act as remittance intermediaries. Therefore, long transaction timelines, multiparty involvement and complexity are the current difficulties for commercial banks to assist cross-border trade.

Internet finance as a new financial institution, the credit system behind its support is not yet perfect, and the third-party payment platform is actually an intermediary between commercial banks and transaction terminals, so Internet finance does not have the ability to handle large international trade, but Internet finance has the technology to innovate products for the international business of commercial banks, improve the efficiency of logistics and document flow transmission. The Internet can provide technical innovation for the international trade business handled by commercial banks. For example, the use of e-banking technology can realize the paperless transmission of information between enterprises and banks, and E-presentation technology can provide an Internet channel to realize the electronic flow of credit documents in international trade, reducing international trade costs and improving efficiency (Wang Yan et al., 2014).

Based on the above, this study proposes hypothesis 4.

Hypothesis 4: Internet finance has a significant positive impact on the

2.4.5 *Hypothesis 5 -* **Internet finance have positive impact on Comprehensive business of commercial banks**

The comprehensive business of commercial banks refers to the overall profitability level of commercial banks.

Nowadays, it must be acknowledged that Internet finance has impacted on the business of commercial banks by virtue of its huge relative advantages over traditional commercial banks: convenience, low threshold, high yield, high liquidity and compatibility. However, according to the technology spillover effect, Internet finance will spread advanced technology and business models to commercial banks as a company with technological advantages in the financial industry (Campbell, 2011), therefore, Internet finance may have a positive impact on the business of commercial banks in general.

Specifically, there are three effects that can explain the spillover effect of Internet finance. The first is the competition effect, where the rapid development of Internet finance has caused internal competition in the financial industry, which has prompted commercial banks to innovate and improve efficiency. Then, the linage effect refers to the fact that Internet finance needs the support of commercial banks in the field of credit and virtual currency storage, because if the services are provided by Internet companies only, their security and trustworthiness will be greatly reduced, so the cooperation between Internet finance companies and commercial banks opens up new business models for commercial banks and provides opportunities for commercial banks to learn advanced technologies, which helps to promote the progress of commercial banks. Finally, the imitation effect, commercial banks can imitate the operation mode of Internet finance companies, learn the concept of personalization of Internet finance and pay more

attention to the tail-end needs, so as to further promote the innovation of commercial banks.

Previous study has noted the spillover effect of Internet finance on commercial banks. Dong collected data from 24 Chinese commercial banks and empirically analyzed them to demonstrate a significant positive effect of Internet finance on the comprehensive business performance of commercial banks (Dong et al., 2020).

Based on the above, this study proposes hypothesis 5.

Hypothesis 5: Internet finance has a significant positive impact on the comprehensive business performance of commercial banks

2.5 Theoretical Framework
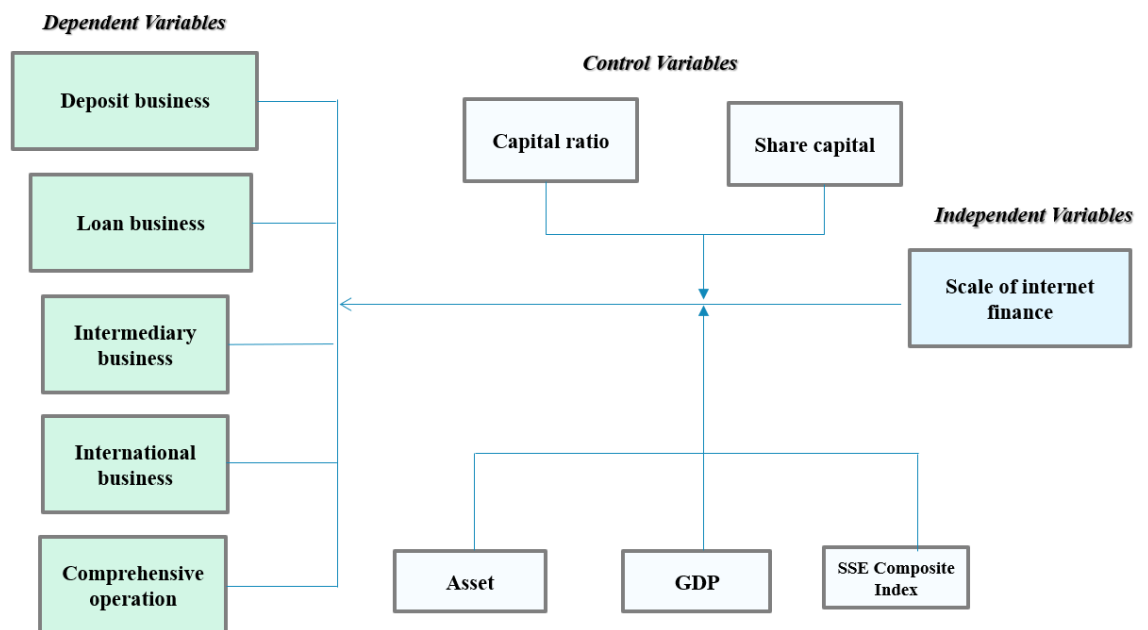
Figure 2.1: Theoretical Framework of research

2.6 Summary

In the literature review & hypotheses development chapter, Researcher will first go

through the underpinning theory, most of which are fundamental theories of the Internet and capital markets. Then researcher reviewed relative previous studies to identify the impact of internet finance on the business performance of commercial banks, and on this basis, researcher proposed five hypothesis and five dependent variables. Then researcher collected other drivers that affect bank performance and set them as control variables. Finally got theoretical framework, which demonstrates that this article attempts to test the interrelationship between dependent variable (deposit business, loan business, intermediary business, international business) with independent variables (internet finance), and control three variables (asset, capital ratio, share capital, GDP and SSE Composite index).

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

This chapter will briefly introduce population and sample size of this study, and state all the measurement of independent variables, dependent variable and control variables. Then it will proceed to data collection method and analysis process, where the regression model and error examination method will be performed.

3.2 Sample Size and Selection

This study will use the operation performance of commercial banks in China as dependent variable. In order to select representative data, the population of this study is conducted on the listed commercial banks in Shanghai Stock Exchange in China for which data are publicly available, complete, and accessible.

The sample size of this study is 24 listed commercial banks obtained from population, including 7 city commercial banks, 6 state-owned commercial banks and 12 joint-equity commercial banks. The selected sample includes all state-owned & joint-equity commercial banks and part of city commercial banks, because the former is generally larger in scale and has a profound influence in China. However, city commercial banks mostly serve in a certain city, and their data are greatly affected by local factors, so as their numbers are numerous. Thus, in order to reduce the disturbance of interference factors to the results, this study will randomly select 7 of the 134 city commercial banks as samples.

In the Sample, the proportions of city commercial banks, state-owned commercial banks and joint-equity commercial banks are 28%, 24% and 48% respectively. This ratio can observe the performance responses of the three banks more evenly, so that the observed data of each bank can be used as statistically significant evidence.

This study will observe panel data from 2016 to 2021, that is, selected commercial banks and Internet finance related operating data from 2016 to 2021, where 2016 to 2019 will also be used as the pre-epidemic data set and 2019 to 2022 as the post-epidemic data set.
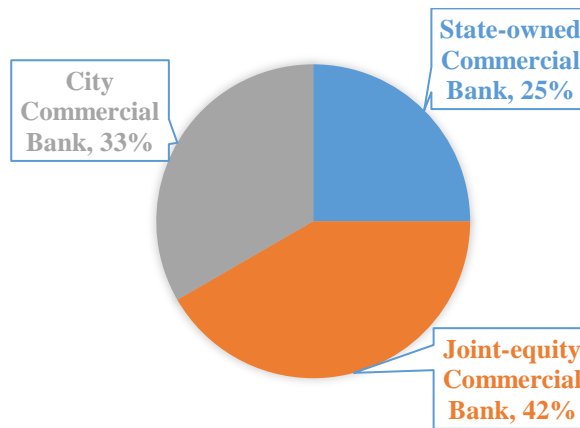
Table 3.1：Different kinds of commercial banks distribution in total sample

Population	The listed commercial banks in Shanghai Stock Exchange in China.
Sample	24 listed commercial banks, including 8 city commercial banks, 6 state-owned commercial banks and 10 joint-equity commercial banks
Interval	From 2012 to 2021, 2012 to 2019 represent for pre-epidemic duration and 2019 to 2021 represent for post epidemic duration.

Table 3.2：Population, sample size and time interval of research

3.3 Variables measurement

Dependent & Independent Variables:

Variables	Measurement	Symbol	Previous Study
Deposit business	Natural logarithm of total deposit amount	Deposit	(Gosaye, 2016)
Loan business	The natural logarithm of total loan amount	Loan	(Liu, 2022)
Intermediary business	The natural logarithm of commission income	Intermediary	(Dong, 2021)
International business	The natural logarithm of income classified into international regions	International	(Demirgüç-Kunt & Huizinga, 2012)
Comprehensive operation	The natural logarithm of total income	Overall	(Dong, 2021)
Scale of internet finance	The natural logarithm of the sum of transaction sizes of P2P and third-party payment	IntFinance	(Liu, 2022)

Table 3.3：Measurements of IVs and DVs

Control Variables:

Variables	Measurement	Symbol	Previous Study
Size	The natural logarithm of total assets	Size	(Chaudron, 2018)
Capital ratio	The ratio of total equity to total assets	Capratio	(Mamatzakis and Bermpei 2016)
Market value	The natural logarithm of values of outstanding capital stock	Value	(Tran, Lin, and Nguyen, 2016)
GDP	The natural logarithm of GDP	GDP	(Abdul Razak, 2015)
Overall performance of Shanghai Stock Exchange	The natural logarithm of SSE index	SSE	(Ping, K. G.., & Kusairi, S., 2020)

Table 3.4：Measurements of CVs

(Model 1-for hypothesis 1)

$$Dep_{it} = C + \beta_1 IF_{it} + \beta_2 SIZE_{it} + \beta_3 Cap_{it} + \beta_4 Stock_{it} + \beta_5 GDP_{it} + \beta_6 SSE_{it} + \varepsilon$$

(Model 2-for hypothesis 2)

$$loan_{it} = C + \beta_1 IF_{it} + \beta_2 SIZE_{it} + \beta_3 Cap_{it} + \beta_4 Stock_{it} + \beta_5 GDP_{it} + \beta_6 SSE_{it} + \varepsilon$$

(Model 3-for hypothesis 3)

$$Mid_{it} = C + \beta_1 IF_{it} + \beta_2 SIZE_{it} + \beta_3 Cap_{it} + \beta_4 Stock_{it} + \beta_5 GDP_{it} + \beta_6 SSE_{it} + \varepsilon$$

(Model 4-for hypothesis 4)

$$Inter_{it} = C + \beta_1 IF_{it} + \beta_2 SIZE_{it} + \beta_3 Cap_{it} + \beta_4 Stock_{it} + \beta_5 GDP_{it} + \beta_6 SSE_{it} + \varepsilon$$

(Model 5-for hypothesis 5)

$$Bop_{it} = C + \beta_1 IF_{it} + \beta_2 SIZE_{it} + \beta_3 Cap_{it} + \beta_4 Stock_{it} + \beta_5 GDP_{it} + \beta_6 SSE_{it} + \varepsilon$$

3.4 Data Collection Method

This study will mainly use secondary data. For dependent variable, this study use the interest income to measure the deposit business performance of commercial banks, similarly, interest expense and commission income are used to measure loan business and intermedia business performance. Also, to adopt Dong's (2021) Comprehensive operating performance indicators as measuring the comprehensive business performance, researcher need to collect the financial data of profitability, liquidity, safety, and growth.

So this study will obtain China's banking data from the WIND database and Bank Focus database (www.bvdinfo.com), which are both public databases and its data can be retrieved directly.

For independent variables, the scale of internet finance can be measured by the sum

of transaction sizes of crowdfunding, P2P and third-party payment, which can be obtained from iReasearch database (www.iresearch.com.cn).

For control variables, those detailed financial data can be determined through annual report of commercial banks as supplementary. GDP growth rate and SSE Index can be collected from China Macroeconomic Database (www.ceicdata.com).

3.5 Analysis Process

This study will analyze data based on the regression equation listed before, the panel regression model will be adopted to assess the effectiveness of each variable. Four models will be conducted to examine the impact on different dependent variables.、

To investigate the inter-relationship between internet finance and the business performance of commercial banks, and take the dynamic, heterogeneous and endogenous in to consideration, this study adopts OLS POOLS model, Fixed effect model and random model to estimate research equations ((Dong, 2021). Fixed effect and random effect regression can control the section or period, Bringing more statistically significant estimating equations. F test, Hausman test will be used to identify the most optimal panel regression model for each equation.

3.5.1 LLC unit root test

LLC unit root test will be used to guarantee the stationarity of the data. Because the panel data used in this model has 24 cross-sections and 10-year intervals, it contains a relatively large amount of data. Therefore, the data of each variable needs to be tested for stationarity before conducting the panel regression to ensure the validity of the regression model, this is because un-stationary data can cause the error of pseudo-regression. In this paper, researcher will carry out a unit root test on each panel data using LLC. if the result of LLC unit root test is significant, can reject the

null hypothesis and consider the data to be stationary. However, if the result of the LLC unit root test is not significant, the data is considered to have unit root and not stationary, so the data needs to be processed for 1st difference and then the LLC test is conducted again until the result is stationary.

3.5.2 Correlation analysis

To avoid multicollinearity problems, this study will display a pairwise correction matrix that includes all the variables, then determine the relatively moderate levels of correlations in all variables. The researcher will then compare the absolute value of the correlation value to 0.80 to check whether there exist multicollinearity problems among the variables, if the correction is larger than 0.80, then it is likely to have multicollinearity problems. If multicollinearity problems exist, the researcher will try to redefine the variable by reducing the dimensionality of the variable.

3.5.3 Hausman Test

If the F test is significant, it rejects the null hypothesis that there is no individual effect, indicating the random effect model is better than pooled OLS. Then the Hausman test is adopted to detects endogenous regressors in the regression model, if the Hausman test is significant, choose fixed effect model other than random effect model, otherwise, random effect regression will be used to estimate equations.

3.5.4 Pre and Post Epidemic Comparison

To examine the changes in the impact of Internet finance on the performance of commercial banks before and after the epidemic, in addition to the overall panel regression analysis of the data, this study will conduct two panel regressions in different time periods, namely compare 2012 – 2019 with 2012 – 2021.This research was obligated to use data from 2012 to 2021 as the data representing the impact of

epidemic, it is because if only data of 2019 - 2021 be used, the period will be too short to make significant estimate. Thus, researcher can only compare the variations brought about by the epidemic.

If the regression coefficient is proved to be significant, compare the coefficients of the independent variables in the two regression equations. The larger the coefficient, the greater the influence of Internet finance on the performance of commercial banks, and vice versa.

3.5.5 Heterogeneity Test

Finally, this study will conduct a heterogeneity test across different banks. That is to observe whether there is heterogeneity in the impact of Internet finance on the comprehensive performance of different types of banks. To this end, different panel regression will be conducted as for different type of banks, i.e., three independent panel regression analysis for city commercial banks, state-owned commercial banks and joint-equity commercial banks. After proving that the regression coefficients are significant, compare the coefficients of the independent variables in the three regression equations to prove the existence of heterogeneity.

The F-test will be used throughout the paper to test the overall explanatory degree of the model, based on which the T-test will be used to test the significance of regression coefficient of each independent variable.

3.6 Summary

This chapter briefly go through the methodology of the study. The sample size of this study is 25 listed commercial banks, including 7 city commercial banks, 6 state-owned commercial banks and 12 joint-equity commercial banks. It then introduces in detail how this study measures all the particular variables and the data collection method. All relative data will be obtained from public database and annual

reports. Then this study will make the use of the panel regression mode to assess the effect of each variable, and displayed a pairwise correction matrix to avoid multicollinearity problems. Finally, a method for evaluating the strength of influence and the existence of heterogeneity by comparing the absolute values of regression coefficients is presented.

In summary, this is the main research method of this paper, and the presentation of the process and results will be carried out in the next Chapter.

CHAPTER 4

RESULTS DISCUSSION

4.1 Introduction

In this chapter, the collected sample data will be processed by Eviews to estimate equation. First, all the variable data has be taken natural logarithm to reduce the volatility of data and estimates the variance brought by difference in units and forms. This chapter will detail the descriptive analysis to observe the data distribution, extreme value, mode, mean and other statistics. Then the LLC unit root test will be conducted to examine the stationary of data, a rigorous correlation analysis was performed to detect whether there was multicollinearity between the respective variables. After this researcher use F test and Hausman Test to determine whether to use a Fixed Effect Model or Random Effect model and estimate the regression equation.

Researcher will then test the results and determine whether the hypothesis is rejected, compare the difference between the pre- and post-epidemic results, infer whether covid-19 has made the impact of Internet finance on commercial banks stronger or weaker, and discuss the heterogeneity of that impact on different types of banks.

4.2 Result

4.2.1 Descriptive Analysis

Considering the difference dimensions of variables, researcher took the natural logarithm of each variable to standardize it, all the data processing mode and definition is as shown in Table 4.1:

Independent variable	sign		Defination
IntFinance	+	ln()	Natural logarithm of the sum of transaction sizes of P2P and third-party payment
Dependent variable	sign		Defination
Deposit	+	ln()	Natural logarithm of total deposit amount
Loan	+	ln()	Natural logarithm of total loan amount
Intermediary	+	ln()	Natural logarithm of commission income
International	+	ln()	Natural logarithm of income classified into international regions
Overall	+	ln()	Natural logarithm of total income
Control variables			
Size	+	ln()	Natural logarithm of total assets
Capratio	+		The ratio of total equity to total assets
Value	+	ln()	Natural logarithm of values of outstanding capital stock
GDP	+	ln()	Natural logarithm of GDP
SSE	+	ln()	The natural logarithm of SSE index

Table 4.1:Description of dependent, independent and control variable

First, *Table 4.2* provides a view of the frequency of different types of banks selected in the sample. Among all 240 observations, joint-equity banks have become the largest group at a weight of 42%, followed by city banks, account for 33%, and the state-owned banks weighted at 25%. It can be seen from the frequency result that each kind of bank is close to evenly distributed, this ensures that the experimental results of this study will not be biased towards any particular kind of bank.

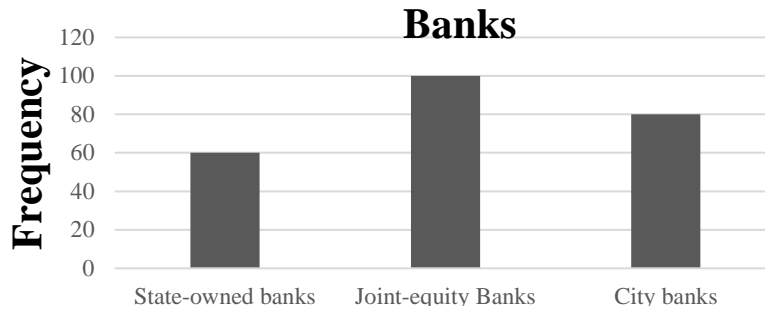| Type	Banks	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	State-owned banks	60	25	25	24
	Joint-equity Banks	100	42	42	67
	City banks	80	33	33	100
	total	240	100	100	

Table 4.2: Frequency results of banks

According to Figure 4.1, this shows the change in trade volume of Internet finance between 2012-2021. From the bar chart, it is obvious to see that the transaction volume of Internet finance is growing rapidly from 2012 to 2016, and its annual growth rate is maintained at 400%-500% many times, which visualizes the soaring of the initial development of Internet finance. Starting from 2017, its scale began to show a steady trend of high growth.
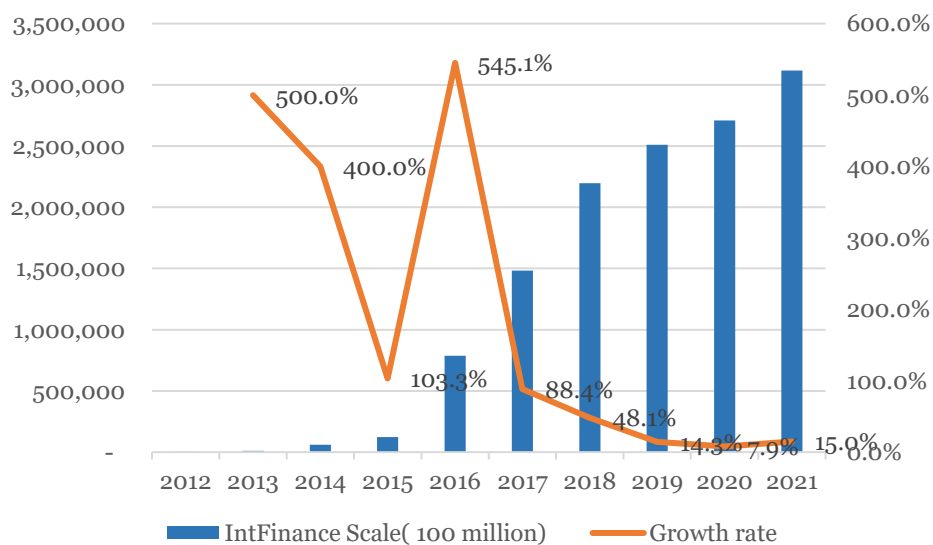
Figure 4.1:The growth trend of transaction scale of Internet financial from 2012 to 2021

Figure 4.2 illustrates China's GDP and SSE index of Shanghai Stock Exchange from 2012 to 2021. From the Figure 4.2, we can observe that GDP has been growing steadily, and the SSE Index, although with some fluctuations, has also been basically stable at around 3000 after 2016. This indicates that both the stock exchange market and the average macroeconomic development level in China have been rising

relatively smoothly without major fluctuations.

Figure 4.2: The Macroeconomic data performance from2012 to 2021(GDP growth rate and SSE index)

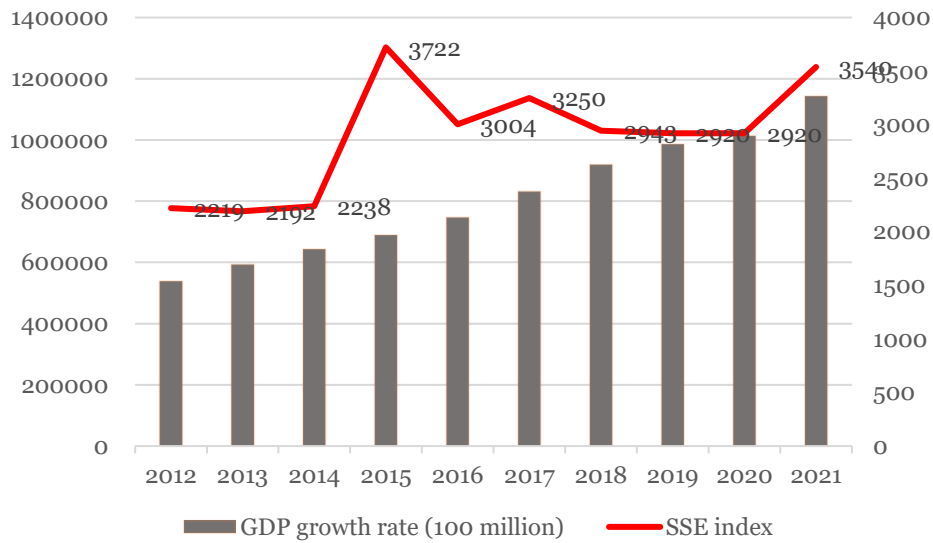Table 4.3 presents the descriptive statistics for all variables, and all the data have be taken natural logarithm. The mean value of deposit is 12.9967, The mean value of deposit is 12.9967, while the mean value of loan is 27.9649, which indicates that the amount of loan for all banks is much larger than the amount of deposit. The minimum value of deposit is 10.7162 which has a huge difference to its maximum of 30,8922. This indicates that there is a huge difference in the volume of deposits across banks, and there are relatively few banks with particularly large deposit because the median is equal to 12.2922, meanwhile the standard deviation of deposit is relatively large which also proves that there is a large difference in the volume of deposits across banks.

The difference between the maximum and minimum values of loan is not large, 30.6596 and 23.5783 respectively, which indicates that the difference in loan volume between banks is not large, implying that there are many banks with little deposit volume that lend excess loans.

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The mean value of bank intermediary revenue is 23.3374, with a maximum value of 25.8687 and a minimum value of 18.3269, which indicates that these data are relatively evenly distributed, and the std. deviation of intermediary is 1.6622, which is a relatively small variance proving that the difference in intermediary revenue between banks is not significant

Since the data on banks' international income comes from the foreign income section of the banks' financial reports, some smaller banks do not have foreign operations, which explains its minimum is 0 with a median of 0, too. The std. deviation of Deviation of international income is quite large can also be explained by the fact that the value of foreign income for small banks is 0.

The overall performance of all banks is close to each other as its mean is 25.0793 with a minimum of 21.0834 and maximum of 27.5721.

The trade volume of internet finance has been increasing at a steady rate during these years, therefore its minimum is 26.0216 and maximum is 33.3731. It is worth noting that the mean of internet finance trade volume is much larger than any of business segment in banks. Additionally, the control variables are all descriptive to indicate the size, capital ratio, market value of each bank, the small differences in these size parameters indicate that there are no particularly pronounced volume differences between the selected banks, they all have a relatively small std. Deviation.

The Std. deviation of GDP and SSE are 0.2386 and 0.1821, this is quite small deviation that it can be inferred the macro environment have no drastic changes.

Descriptive Statistics

	Mean Statistic	Median Statistic	Minimum Statistic	Maximum Statistic	Std. Deviation Statistic	Observations
Deposit	12.9967	12.2922	10.7162	30.8922	3.7157	240
loan	27.9649	28.0827	23.5783	30.6596	1.5018	240
Intermediary	23.3374	23.6677	18.3269	25.8687	1.6622	240
International	11.0393	0.0000	0.0000	25.6585	11.6866	240
overall	25.0793	25.2737	21.0834	27.5721	1.4213	240
Intfinance	31.0803	32.3135	26.0216	33.3731	2.4776	240
Size	28.7344	28.8001	25.2355	31.1913	1.3429	240
Capratio	0.0670	0.0664	0.0234	0.0971	0.0126	240
value	23.8926	23.6888	21.0401	26.5993	1.5032	240
GDP	31.9981	31.9980	31.6174	32.3704	0.2386	240
SSE	7.9544	7.9832	7.6924	8.2219	0.1821	240

Table 4.3: Descriptive statistics for variables

4.2.2 Correlation Analysis

Variables	Deposit	Loan	Intermediary	International	Overall	Intfinance	Size	Capratio	Value	GDP	SSE
Deposit	1.000										
Loan	0.458	1.000									
Intermediary	0.438	0.966	1.000								
International	0.356	0.766	0.789	1.000							
Overall	0.469	0.990	0.977	0.776	1.000						
Intfinance	0.036	0.276	0.235	0.062	0.213	1.000					
Size	0.470	0.993	0.966	0.768	0.994	0.256	1.000				
Capratio	0.294	0.599	0.550	0.537	0.536	0.555	0.547	1.000			
Value	0.505	0.925	0.885	0.725	0.927	0.121	0.935	0.442	1.000		
GDP	0.038	0.294	0.211	0.076	0.218	0.937	0.261	0.625	0.123	1.000	
SSE	0.026	0.195	0.184	0.039	0.161	0.709	0.192	0.375	0.086	0.657	1.000

Table 4.4: Pairwise correlation matrix

Table 4.4 displays the pairwise correlation for all the variables include IV DV and CV. Across the board, there are many groups of variables with very high level of correlation, which is not a good phenomenon because it may lead to multicollinearity problems. However, this is justifiable because our data are all centered on banks' revenues and revenue-related indicators. Although the control variables are not directly related to revenues, there must be some intrinsic connection between the data measuring banks' asset size, market capitalization and banks' revenues, which can easily be explained by the fact that the larger the bank is, the greater the revenue it

generates.

A more detailed analysis of the correlation matrix, based on the theory of Bryman and Cramer (1997), where simple correlations between variables do not show multicollinearity until the correlation exceeds 0.80 or 0.90, reveals quite clearly that:

1. The level of correlation between Loan and intermediary is 0.9663, which is very high collinearity, but because loan and intermediary both act as dependent variable, they will not bring multicollinearity issue to model. The same is true for loan with overall and Intermediary with overall

2. The level of correlation between Size and loan together with Value of loan is very high, 0.9659 and 0.8845 each. Meanwhile, size and value are also highly positive correlated (0.9349), which points to a serious multicollinearity issue. Because although loan is a dependent variable, size and value are both control variables. The correlation between them will bring multicollinearity issue, making the model insignificant.

In order to solve the multicollinearity issue between Size and Value, considering that their own measures have similar economic significance, size measures the total asset while value measures the market value of that bank, researcher decided to directly drop one of them to reduce the multicollinearity issue.

By conducting hierarchical regression, in which the size and value variable were added one by one to select the more significant one. As Size can better explain the model, it is kept while the Value variable is dropped.

As a consequence, the model modified to:
(Model 1-for hypothesis 1)

$$Dep_{it} = C + \beta_1 IF_{it} + \beta_2 SIZE_{it} + \beta_3 Cap_{it} + \cancel{\beta_4 Value_{it}} + \beta_5 GDP_{it} + \beta_6 SSE_{it} + \varepsilon$$

(Model 2-for hypothesis 2)

$$loan_{it} = C + \beta_1 IF_{it} + \beta_2 SIZE_{it} + \beta_3 Cap_{it} + \beta_4 Value_{it} + \beta_5 GDP_{it} + \beta_6 SSE_{it} + \varepsilon$$

(Model 3-for hypothesis 3)

$$Mid_{it} = C + \beta_1 IF_{it} + \beta_2 SIZE_{it} + \beta_3 Cap_{it} + \beta_4 Value_{it} + \beta_5 GDP_{it} + \beta_6 SSE_{it} + \varepsilon$$

(Model 4-for hypothesis 4)

$$Inter_{it} = C + \beta_1 IF_{it} + \beta_2 SIZE_{it} + \beta_3 Cap_{it} + \beta_4 Value_{it} + \beta_5 GDP_{it} + \beta_6 SSE_{it} + \varepsilon$$

(Model 5-for hypothesis 5)

$$Bop_{it} = C + \beta_1 IF_{it} + \beta_2 SIZE_{it} + \beta_3 Cap_{it} + \beta_4 Value_{it} + \beta_5 GDP_{it} + \beta_6 SSE_{it} + \varepsilon$$

4.2.3 LLC unit root test

The researcher conducts LLC unit root test on each variable to test its stationary, all variables' LLC unit root test have a prob less than 0.05 (95% confidence level), indicating that all variables showed significant result in LLC test, thus the null hypothesis is rejected, which means all the variable do not have a unit root.

According to the result, all results are significant, rejecting the null hypothesis that the variable has common unit root, illustrating all variables are stationary, and this is premise for efficient model. The stationary data prevent pseudo-regression for regression models.

Levin, Lin & Chu t*

Variables	Statistic	Prob.**		Cross-sections	Obs
Null: Unit root (assumes common unit root process)					
DEPOSIT	-10.746	0.0000	***	24	192
LOAN	-4.5842	0.0000	***	24	192
INTERMEDIARY	-5.5960	0.0000	***	24	192
INTERNATIONAL	-2.3405	0.0096	***	12	96
OVERALL	-12.0533	0.0000	***	24	192
INTFINANCE	-2.1251	0.0168	***	24	192
SIZE	-13.2240	0.0000	***	24	192
CAPRATIO	-9.0917	0.0000	***	24	192
VALUE	-11.3127	0.0000	***	24	192
GDP	-26.3837	0.0000	***	24	192
SSE	-4.5941	0.0000	***	24	192

Table 4.5: Results of Levin, Lin & Chu Test

4.2.4 Hausman Test

In order to choose the most suitable model for regression, this study use Hausman Test for deciding adopt fix effect model or random effect model. After conducting Hausman test for each group of models, the results shown as follows:

Hausman Test

Test Summary	Model 1 (DV=deposit) Chi-Sq. St Prob.			Model 2(DV=loan） Chi-Sq. St Prob.			Model 3(DV=intermediary） Chi-Sq. St Prob.		
Cross-section random	0.864377	0.9728	-	1.01942	0.961	-	0.0000	1.0000	invalid
Period random	0.688125	0.7089	-	0.105705	0.9485	-	0.0000	1.0000	invalid
Cross-section random and period randon	0.95432	0.6205	-	1.412894	0.4934	-	3.435425	0.1795	-
	Random effect model			Random effect model			Random effect model		

Hausman Test

Test Summary	Model 4 (DV=international) Chi-Sq. St Prob.			Model 5 (DV=comprehensive) Chi-Sq. St Prob.		
Cross-section random	0.0000	1.0000	invalid	2.006745	0.8482	-
Period random	0.0000	1.0000	invalid	1.403514	0.4957	-
Cross-section random and period randon	8.595611	0.0136	***	1.342776	0.511	-
	Fixed effect model			Random effect model		

Table 4.6: Outcome of Hausman Test

Because the null hypothesis of Hausman Test is that the preferred model is random effects, but according to the result, it is obvious that most models' prob is larger than 0.05(95% confidence interval), thus it cannot reject the null hypothesis and random effect model is selected. Except for model 4, its prob is smaller than 0.05, thus it should reject the H0, indicating that this model is preferred to adopt fix effect model.

4.2.5 Regression Result

Then this study selects the most appropriate regression (Fixed effect model/random effect model) for the five models of this study based on the results of Hausman Test, and the data of the five models with time interval 2012-2021 are analyzed separately, with the results shown in table 4.7, which represents estimate equation of the models with the effect of the epidemic considered.

2012-2021 Variable	Model 1 (DV=deposit) Coefficient	Prob.		Model 2 (DV=loan) Coefficient	Prob.		Model 3 (DV=intermediary) Coefficient	Prob.	
C	-1.077251	0.4445	-	-11.76703	0.0001	***	48.72575	0.0000	***
INTFINANCE	-0.006315	0.0421	**	-0.030268	0.0005	***	0.14734	0.0000	***
SIZE	0.378232	0.0000	***	1.066396	0.0000	***	1.179682	0.0000	***
CAPRATIO	-0.01234	0.9835	-	9.676557	0.0000	***	8.679441	0.0025	***
GDP	0.116578	0.0228	**	0.326729	0.0011	***	-2.039964	0.0000	***
SSE	-0.041142	0.0415	**	-0.13484	0.0118	**	0.103863	0.3493	-

*** P<0.01, ** P<0.05.* P<0.1

2012-2021	Model 4(DV=international）			Model 5(DV=comprehensive）		
Variable	Coefficient	Prob.		Coefficient	Prob.	
C	132.4641	0.1859	-	6.597657	0.1957	-
INTFINANCE	-0.262677	0.3525	-	-0.00647	0.7061	-
SIZE	5.048632	0.0000	***	1.047038	0.0000	***
CAPRATIO	231.4278	0.0000	***	5.623733	0.0000	***
GDP	-8.302837	0.0174	**	-0.370226	0.0322	**
SSE	-1.028404	0.5586	-	0.008249	0.9396	-

*** P<0.01, ** P<0.05.* P<0.1

Table 4.7: Summary of outcome of model 1-5 (Time period of 2012-2021)

The researcher then changed the time interval of the data to 2012-2019 and regressed each model once more to obtain the results shown in table 4.8, which represents the estimate equation without the effect of the Covid-19.

2012-2019	Model 1 (DV=deposit)			Model 2(DV=loan）			Model 3(DV=intermediary）		
Variable	Coefficient	Prob.		Coefficient	Prob.		Coefficient	Prob.	
C	-0.490755	0.8052	-	-15.59519	0.001	***	42.14208	0.0000	***
INTFINANCE	-0.005133	0.0273	**	-0.04053	0.0011	***	0.132714	0.0000	***
SIZE	0.372878	0.0000	***	1.070679	0.0000	***	1.186831	0.0000	***
CAPRATIO	0.149887	0.8286	-	9.671513	0.0000	***	10.94707	0.0004	***
GDP	0.100884	0.1561	-	0.447266	0.004	***	-1.816048	0.0000	***
SSE	-0.038515	0.0726	*	-0.112996	0.0422	**	0.046492	0.677	-

*** P<0.01, ** P<0.05.* P<0.1

2012-2019	Model 4(DV=international）			Model 5(DV=comprehensive）		
Variable	Coefficient	Prob.		Coefficient	Prob.	
C	174.3511	0.2069	-	6.103458	0.4653	-
INTFINANCE	-0.163876	0.6431	-	-0.007706	0.7441	-
SIZE	5.027862	0.0000	***	1.04299	0.0000	***
CAPRATIO	240.0265	0.0000	***	5.9604	0.0000	***
GDP	-9.640076	0.0381	**	-0.350061	0.2041	-
SSE	-1.303475	0.415	-	0.006179	0.9552	-

*** P<0.01, ** P<0.05.* P<0.1

Table 4.8: Summary of outcome of model 1-5 (Time period of 2012-2019)

4.3 Discussion of results

Next, the results of each group are interpreted.

4.3.1 Model 1 - Deposit

The result in Table 4.9 illustrates that the coefficients of internet finance (Intfinance) under the random effect regression model 1 are both significantly negative for the period between 2012 to 2021 and 2012 to 2019, indicating that the development of internet finance has negative impact on deposit business of commercial banks. For the pre pandemic period, the coefficient = -0.005133and $p < 0.05$, while for the period post pandemic, the coefficient = -0.006315 and $p < 0.05$, indicating the impact of internet has been exacerbated by the pandemic. Generally, this result supports that the increase in the volume of Internet finance business crowds out the deposit business of commercial banks, and Covid 19 exacerbates this effect, where the increase in the size of Internet finance transactions under pandemic brings about a decrease in the amount of bank deposit.

Deposit is the main method commercial banks obtain capital, but recent development of internet finance has diverted deposit away from commercial banks. Previous studies found similar results. Hou, Gao, & Wang (2016) argue that Internet finance is able to offer consumers a higher deposit interest rate than commercial banks by virtue of its advantages in technology and by virtue of its flexibility and the ample number of customers brought by bilateral markets. Due to the large impact the third-party payment platform has on their potential customers, the basic payment functions and other liability business of commercial banks are occupied by internet finance. (Yao, Di, Zheng, and Xu, 2018). Recently, the deposit business of commercial banks has gradually slowed down, which proves that the development of Internet finance, especially the development of third-party payments, has indeed weakened the deposit function of commercial banks.

Consequently, the empirical results are consistent with the previous result, hence the hypothesis 3 cannot be reject. The internet finance indeed has significant negative impact on the deposit business of commercial banks. And the impact of covid 19 has exacerbated this negative effect, making the bank's deposit business even more withered.

Period	2012 - 2021			2012 - 2019		
	Model 1 (DV=deposit)			Model 1 (DV=deposit)		
Variable	Coefficient	Prob.		Coefficient	Prob.	
C	-1.077251	0.4445	-	-0.490755	0.8052	-
INTFINANCE	-0.006315	0.0421	**	-0.005133	0.02727	**
SIZE	0.378232	0.0000	***	0.372878	0.0000	***
CAPRATIO	-0.01234	0.9835	-	0.149887	0.8286	-
GDP	0.116578	0.0228	**	0.100884	0.1561	-
SSE	-0.041142	0.0415	**	-0.038515	0.0726	*

*** P<0.01, ** P<0.05.* P<0.1

Table 4.9: Regression result summary of model 1 for the period 2012 -2021 and 2012 -2019.

4.3.2 Model 2 － Loan

The result in Table 4.10 illustrates that the coefficients of internet finance (Intfinance) under the random effect regression model 2 are both significantly negative for the period between 2012 to 2021 and 2012 to 2019, indicating that the growth of internet finance has negative impact on loan business of commercial banks pre and post pandemic. For the period between 2012 to 2021, the coefficient = -11.76703 with $P < 0.05$, while the period of 2012 to 2019 has a coefficient = -15.59519 with $P < 0.05$, indicating the impact of internet has been exacerbated by the pandemic.

Generally, this result supports that the increase in the volume of Internet finance business encroaches on the loan business of commercial banks. however, it is very interesting to note that the Covid-19 pandemic attenuated the impact of Internet

finance on loan business, that is, during the post covid-19 period, Internet finance diverted less of the loan business of commercial banks. The continued increase in size reduces the total loan amounts of commercial banks, but the reduction is less than before the epidemic.

This may indicate that the economic downturn and turmoil brought about by the epidemic made consumers trust in Internet finance and turn to banks for borrowing, or it may be because the economic downturn period brought about after the epidemic made it difficult for businesses to function and increased their borrowing demand, which mostly turned to commercial banks (Wu, D. D., & Olson, D. L., 2020). This triggers a deeper inquiry in this paper to explore whether there is a difference in the response of loan from individuals and firms to Internet finance, which will be explored in 4.5 additional test there.

Loan is the main business by which commercial banks gain profit, but the empirical results show that the development of Internet finance has diverted the loan business of banks. Previous studies have found similar results. Cai and Liang (2017) have suggested that the development of technologies such as big data, cloud computing, and artificial intelligence has strengthened the competitiveness of Internet finance and caused a crowding out and diversion effect on the deposit and loan business of commercial banks. Online e-commerce and third-party payment platforms have become involved in the financial business, which can have a negative impact on the scale of bank deposits and loans (Huang Y and Huang J, 2016).

Consequently, the empirical results are consistent with the previous result, hence the hypothesis 2 cannot be reject. The internet finance indeed has significant negative impact on the loan business of commercial banks. However, after the covid-19 outbreak, the impact caused by Internet finance has diminished.

Period	2012 - 2021			2012 - 2019		
	Model 2（DV=loan）			Model 2（DV=loan）		
Variable	Coefficient	Prob.		Coefficient	Prob.	
C	-11.76703	0.0001	***	-15.59519	0.001	***
INTFINANCE	-0.030268	0.0005	***	-0.04053	0.0011	***
SIZE	1.066396	0.0000	***	1.070679	0.0000	***
CAPRATIO	9.676557	0.0000	***	9.671513	0.0000	***
GDP	0.326729	0.0011	***	0.447266	0.004	***
SSE	-0.13484	0.0118	**	-0.112996	0.0422	**

*** $P<0.01$, ** $P<0.05$.* $P<0.1$

Table 4.10: Regression result summary of model 2 for the period 2012 -2021 and 2012 -2019.

4.3.3 Model 3 － Intermediary

The result in Table 4.11 illustrates that the coefficients of internet finance (Intfinance) under the random effect regression model 3 are both significantly positive for the period between 2012 to 2021 and 2012 to 2019, indicating that the growth of internet finance has positive impact on intermediary business of commercial banks both pre and post pandemic. For the period between 2012 to 2021, the coefficient = 0.14734 with $P < 0.05$, while the period of 2012 to 2019 has a coefficient = 0.132714 with $P < 0.05$, indicating the impact of internet has been facilitated under pandemic.

The intermediary business of banks represents the non-interest income that banks provide for intermediary services. Generally, this result rejects the claim that the Internet has captured the intermediary business of commercial banks, which also rejects the hypothesis 1 with this study. It is inconsistent with most previous studies, but there are a few studies that have reached the same result. Most scholars believe that platforms of Internet finance offering lower fees will attract more potential customers, especially users from third-party payment platforms, which will reduce the fee and commission income of commercial banks (Liu lei, Yin Lijun, Li Xiuting & Dong Jichang, 2022).

But it has also been empirically proven by scholars that the innovation of financial business practice carried by internet finance has spread their technology and ideas to traditional commercial banks. The internet adoption for financial services is created by internet companies but penetrated and lead commercial banks to change business mode, promote innovation, upgrade strategy (Thakur & Srivastava, 2014).

Therefore, the innovation made by commercial banks in recent years in intermediary services has led to a shift towards more personalized and convenient financial products, which is positively influenced by the Spillover Effect of Internet finance (Campbell, 2011).

Period	2012 - 2021			2012 - 2019		
	Model 3(DV=intermediary）			Model 3(DV=intermediary）		
Variable	Coefficient	Prob.		Coefficient	Prob.	
C	48.72575	0.0000	***	42.14208	0.0000	***
INTFINANCE	0.14734	0.0000	***	0.132714	0.0000	***
SIZE	1.179682	0.0000	***	1.186831	0.0000	***
CAPRATIO	8.679441	0.0025	***	10.94707	0.0004	***
GDP	-2.039964	0.0000	***	-1.816048	0.0000	***
SSE	0.103863	0.3493	-	0.046492	0.677	-

*** $P<0.01$, ** $P<0.05$.* $P<0.1$

Table 4.11: Regression result summary of model 3 for the period 2012 -2021 and 2012 -2019.

4.3.4 Model 4 － International

It can be seen from the result in table 4.12, the $p > 0.05$ suggests that the coefficient of internet finance is insignificant in model 4, indicating the regression result has no statistical meaning. This is most likely due to the fact that the number of commercial banks with international business is too small and most of the data collected for commercial banks are zero, which makes the sample size too small to lead to statistically significant results.

Period	2012 - 2021			2012 - 2019		
	Model 4(DV=international）			Model 4(DV=international）		
Variable	Coefficient	Prob.		Coefficient	Prob.	
C	132.4641	0.1859	-	174.3511	0.2069	-
INTFINANCE	-0.262677	0.3525	-	-0.163876	0.6431	-
SIZE	5.048632	0.0000	***	5.027862	0.0000	***
CAPRATIO	231.4278	0.0000	***	240.0265	0.0000	***
GDP	-8.302837	0.0174	**	-9.640076	0.0381	**
SSE	-1.028404	0.5586	-	-1.303475	0.415	-

*** P<0.01, ** P<0.05.* P<0.1

Table 4.12: Regression result summary of model 4 for the period 2012 -2021 and 2012 -2019.

4.3.5 Model 5 － Comprehensive

It can be seen from the result in table 4.13, the p > 0.05 suggests that the coefficient of internet finance is insignificant in model 4, indicating the regression result has no statistical meaning. This may be because the 10-year time period may be too short and insufficient for the overall performance. This is because the overall performance is affected by many factors and it does not vary significantly. Therefore, if research want to find out the relationship between comprehensive performance and Internet finance, it need more samples and longer time period observations to support it.

Period	2012 - 2021			2012 - 2019		
	Model 5(DV=comprehensive）			Model 5(DV=comprehensive)		
Variable	Coefficient	Prob.		Coefficient	Prob.	
C	6.597657	0.1957	-	6.103458	0.4653	-
INTFINANCE	-0.00647	0.7061	-	-0.007706	0.7441	-
SIZE	1.047038	0.0000	***	1.04299	0.0000	***
CAPRATIO	5.623733	0.0000	***	5.9604	0.0000	***
GDP	-0.370226	0.0322	**	-0.350061	0.2041	-
SSE	0.008249	0.9396	-	0.006179	0.9552	-

*** P<0.01, ** P<0.05.* P<0.1

Table 4.13: Regression result summary of model 5 for the period 2012 -2021 and 2012 -2019.

One of previous study had appear the same insignificant result, and it is suspected that the independent variables and error term are not independent, which cause the model 5 endogenous. Thus, they performed the dynamic GMM model to re-estimate the model (Dong, 2021). Then this study follows that previous study to re-estimate the model 5 using Dynamic GMM model. The result is shown in table 4.14.

The regression results of GMM model show that the first order lag term, second order lag term and the third order lag term of dependent variable are all significant while the internet finance also has significant positive impact, implying that the overall performance itself influences the following year performance and internet finance has long-term positive effect on the comprehensive performance of commercial banks. This is consistent with many previous studies, as internet finance has created the driving force for the reform of commercial banks, applying the e-finance to improve traditional financial services (Chen & Zhen, 2011). In addition, the spillover effect of the development of Internet finance has led to the reform of traditional commercial banks, and many new risk assessment and management technics have been adopted for commercial banks (Qiao, Chen, &Xia, 2018)

From the overall view, the development of internet finance has promoted the comprehensive performance of commercial banks when taking the lag terms of overall performance in to consideration. Thus, hypothesis 5 cannot be rejected.

Method: Panel Generalized Method of Moment

Transformation: First Difference

Instrument specification: @dyn(OVERALL,-2) @dyn(INTFINANCE,-2,-4)

Variable	Model 5(DV=overall）		
	Coefficient	Prob.	Sig.
OVERALL(-1)	0.367307	0.0000	***
OVERALL(-2)	-0.242741	0.0000	***
OVERALL(-3)	0.16928	0.0022	***
INTFINANCE	0.079174	0.0000	***
SIZE	0.55099	0.0000	***
CAPRATIO	-0.669916	0.4733	-
GDP	0.499424	0.0000	***
SSE	-0.228553	0.0000	***

Table 4.14: Regression result of GMM model for model 5

4.4 Heterogeneity Test

This paper will explore the heterogeneity in the responses of different types of banks to the impact of Internet finance by examining three sub-models in turns:

Sub-model A: Model on data excludes large state-owned commercial bank

Sub-model B： Model on data excludes joint-equity commercial bank

Sub-model C： Model on data excludes city commercial bank

The regression results are then compared with each other to explore which types of banks are most sensitively affected by Internet finance and how sensitive different types of banks are to different businesses. The results of three sub-model are presented in **Table 4.15- Table 4.17:**

Sub- Model A: excludes large state-owned commercial bank

Variable	Model A1 (DV=deposit)		Model A2(DV=loan）			Model A3(DV=intermediary）			Model A4(DV=international）			Model A5(DV=comprehensive）		
	Coefficient	Prob.	Coefficient	Prob.		Coefficient	Prob.		Coefficient	Prob.		Coefficient	Prob.	
C	-0.571302	0.5879 -	-17.20944	0.0000	***	61.1446	0.0000	***	142.3039	0.3074	-	8.20417	0.1829	-
INTFINANCE	-0.009213	0.0022 ***	-0.041239	0.0002	***	0.18757	0.0000	***	-0.352259	0.3574	-	-0.001743	0.9321	-
SIZE	0.435627	0.0000 ***	1.100215	0.0000	***	1.278914	0.0000	***	5.599703	0.0000	***	1.058794	0.0000	***
CAPRATIO	0.216914	0.6326 -	7.612766	0.0000	***	10.93537	0.0012	***	251.3669	0.0001	***	6.54513	0.0000	***
GDP	0.031858	0.3806 -	0.492859	0.0002	***	-2.562802	0.0000	***	-9.065562	0.0675	*	-0.439918	0.0365	**
SSE	-0.055451	0.0028 ***	-0.176774	0.0088	***	0.141871	0.2696	-	-0.956447	0.684	-	0.021226	0.8697	-

*** P<0.01, ** P<0.05.* P<0.1   *** P<0.01, ** P<0.05.* P<0.1

Table 4.15: Summary of outcome of sub-model A

Sub- Model B: excludes joint-equity commercial bank

Variable	Model A1 (DV=deposit)			Model A2(DV=loan）			Model A3(DV=intermediary）			Model A4(DV=international）			Model A5(DV=comprehensive）		
	Coefficient	Prob.		Coefficient	Prob.		Coefficient	Prob.		Coefficient	Prob.		Coefficient	Prob.	
C	-1.49123	0.4628	-	-13.20648	0.0009	***	31.20996	0.0001	***	133.323	0.034	***	1.998095	0.6576	-
INTFINANCE	-0.003684	0.4172	-	-0.037565	0.0027	***	0.083591	0.0005	***	0.115672	0.5416	-	-0.022697	0.1315	-
SIZE	0.332652	0.0000	***	1.071896	0.0000	***	1.184807	0.0000	***	2.932954	0.0001	***	1.048878	0.0000	***
CAPRATIO	-0.170098	0.8366	-	9.563834	0.0000	***	7.369547	0.0172	***	83.48844	0.0025	***	4.483109	0.0000	***
GDP	0.183884	0.0074	***	-0.137365	0.0776	-	0.065594	0.6569	-	-1.022165	0.3918	-	-0.015506	0.8702	-
SSE	-0.037842	0.1853	-	0.373249	0.0048	***	-1.429871	0.0000	***	-6.556053	0.0044	***	-0.205524	0.1782	-

*** P<0.01, ** P<0.05.* P<0.1   *** P<0.01, ** P<0.05.* P<0.1

Table 4.16: Summary of outcome of sub-model B

Sub- Model C: excludes city commercial bank

Variable	Model A1 (DV=deposit)			Model A2(DV=loan）			Model A3(DV=intermediary）			Model A4(DV=international）			Model A5(DV=comprehensive）		
	Coefficient	Prob.		Coefficient	Prob.		Coefficient	Prob.		Coefficient	Prob.		Coefficient	Prob.	
C	-0.140588	0.9426	-	-4.506372	0.1125	-	59.41386	0.0000	***	77.93644	0.5838	-	9.765817	0.0598	*
INTFINANCE	-0.005954	0.1788	-	-0.013084	0.1108	-	0.168998	0.0000	***	-0.512403	0.1912	-	0.003462	0.8394	-
SIZE	0.363743	0.0000	***	0.99163	0.0000	***	0.955499	0.0000	***	5.36589	0.0001	***	1.020163	0.0000	***
CAPRATIO	0.580006	0.4962	-	12.05565	0.0000	***	13.38113	0.0004	***	293.2577	0.0000	***	5.977945	0.0000	***
GDP	0.109184	0.1074	-	0.13584	0.1481	-	-2.200696	0.0000	***	-6.831134	0.1571	-	-0.457488	0.0093	***
SSE	-0.030734	0.2620	-	-0.088376	0.0875	*	0.119994	0.3761	-	-0.608956	0.8039	-	0.020922	0.8469	-

*** P<0.01, ** P<0.05.* P<0.1   *** P<0.01, ** P<0.05.* P<0.1

Table 4.17: Summary of outcome of sub-model C

If the coefficient of independent variable is larger in the sub-models, it indicates that particular excluded commercial bank has less response to the internet finance, and oppositely, if the coefficient is smaller in the sub-model, indicating that excluded commercial bank has more response to internet finance.

The comparison result is shown in Table 4.18, the result of heterogeneity test is compared with the original regression result, the transformation ratios for model 1(deposit) are 45.9%, -4.7% and -5.7%, respectively. This result can be interpreted as the coefficient of sub-model A is 45.9% larger than original regression, indicating the state-owned banks has less response to internet finance, while the coefficient of sub-model B is -4.7% smaller and coefficient of sub-model C is -5.7% smaller than original regression, indicating the internet finance has the greatest influence on city commercial banks than joint equity commercial banks, and least impact on state-owned banks.

This proves that heterogeneity does exist between different types of banks, which is consistent with the findings of the prior study. Dong (2020) argues that urban

commercial banks, which have the most flexible management systems and relatively small size, are more affected by Internet finance as they can optimize their business strategies very quickly after being exposed to Internet finance. State-owned commercial banks are also least affected by Internet finance because of their large size and the fact that changes in their decisions often need to be approved at various levels, even by the government, to determine their business strategies.

Transformation ratios: compared to result in Table 7

	model 1	model 2	model 3
Sub-model A	45.9%	36.2%	27.3%
Sub-model B	-4.7%	24.1%	-43.3%
Sub-model C	-5.7%	-56.8%	14.7%

Table 4.18: Transformation ratios compared with heterogeneity test

4.5 Additional test on individual loan and enterprise loan business

According to regression result comparison between pre and post pandemic period, Covid-19 pandemic increase the impact of internet finance on deposit and intermediary business of commercial banks, but decreases the impact on loan business.

Therefore, in this study, the loan data of banks are categorized and separated into individual loan and enterprise loan, try to indicate specific impact on individual loan and enterprise loan by adding two new models. The new variable measures the individual loan performance are the income of loan from individuals which can be found in the income segment in yearly financial report, and so as the enterprise loan.

Loan   (individual) $= C + \beta_1 IntFinance_{it} + \beta_2 SIZE_{it} + \beta_3 Cap_{it} + \beta_5 GDP_{it} + \beta_6 SSE_{it} + \varepsilon$ (Additional -Model 6)

Loan   (enterprise) $= C + \beta_1 IntFinance_{it} + \beta_2 SIZE_{it} + \beta_3 Cap_{it} + \beta_5 GDP_{it} +$

$\beta_6 SSE_{it} + \varepsilon$ (Additional - Model 7)

Additional regression

Variable	Model 6 (DV=individual loan)			Model 7(DV=Enterprise loan）		
	Coefficient	Prob.	sig.	Coefficient	Prob.	sig.
C	-52.52076	0.0000	***	-6.033926	0.4420	-
INTFINANCE	-0.05423	0.0186	**	0.018845	0.0002	***
SIZE	1.144839	0.0000	***	0.968548	0.0000	***
CAPRATIO	3.397318	0.3365	-	16.8269	0.0000	***
GDP	1.171048	0.0000	***	-0.08593	0.7432	-
SSE	-0.214103	0.1356	-	-0.232362	0.154	-

*** P<0.01, ** P<0.05.* P<0.1

Table 4.19: Regression result summary of additional model 6 and model 7 for the period of 2012-2021

As shown in the Table 4.19, the coefficient of internet finance is significant negative in model 6 and significant positive in model 7 with both $p < 0,05$, indicating that the growth of internet finance has seized the loan from individual side of commercial banks but facilitate the loan from enterprise side of commercial banks.

The results of the empirical analysis support the fact that with the continuous development of Internet finance, the demand for personal loans has shifted more to Internet finance. This is because it tends to feature simple procedures, short processes, low borrowing thresholds, and small amounts, combined with the personalized services and products that Internet finance offers to address the tail-end needs of customers, all of which attract small and medium-sized lenders, also known as personal loan borrowers.

Simultaneously, the results of the empirical analysis demonstrate a positive relationship between the development of Internet finance and the enterprise loan business of commercial banks, which indicates the demand for enterprise loans handled by commercial banks is not negatively affected by the development of internet finance, implying that Internet finance does not seize enterprise loans, but rather promotes the income of commercial banks from enterprise loans.

This may be because loan demands from enterprises are often large in amount and require sound loan information as credentials to ensure corporate compliance, so it is difficult for loan demands from enterprises to be replaced by Internet finance. The epidemic has accentuated the security issues of Internet finance loans, and it is possible that enterprises will favor commercial banks for loans considering the risks and regulatory compliance.

4.6 Summary

Based on the descriptive analysis and correlation analysis, and then the adoption of LLC root test and Hausman test, this study estimates the regression by mainly use of random effect model, and finally found the significant negative relationship between internet finance with the deposit and loan business of commercial banks, also detect the significant positive impact of internet finance on the intermediary and comprehensive business of commercial banks. But unfortunately, researcher failed to find enough significant relationship of international business, possibly due to the insufficient of sample. Then the study discusses the impact of Covid-19 as well as the heterogeneity among different kinds of banks. On the last, an additional test is conducted to determine the impact on individual loan and enterprise loan separately.

CHAPTER 5

CONCLUSION

5.1 Introduction

The last chapter will conclude the whole study, where will review the logical flow of the whole study, from the inspiration of this study to the contribution of this study, review what urgent problems this paper raises, to the way of data collection, and discuss the final results of this study. The paper will then determine the application of this study, pointing out the contributions of this study to improve and enrich the academic community and even to society. In the end, the paper will critically present the existing limitations, point out the shortcomings found during the study, pave the way for the subsequent research, and suggest constructive improvements to future researchers.

5.2 Conclusion of the study

Recently, the transaction volume and coverage of Internet finance have been increasing rapidly, and its business has been gradually expanded from the initial payment to cover almost all financial services. Undoubtedly, Internet finance has encroached on many business areas that originally belonged to traditional commercial banks, which also makes Internet finance and commercial banks both provide deposit and loan, intermediary and other services, and the products are highly homogeneous and vicious competition. In recent years, the industry has experienced significant problems, with traditional commercial banks lacking technological innovation and Internet finance having security issues. Therefore, the domestic financial services industry is in urgent need of restructuring, and Internet

finance and commercial banks should each take responsibility in the areas they are best at.

Therefore, this study proposed to determine the impact internet finance cause on each segment business of commercial banks, then give advice on how they can re-allocate functions and coexistence after.

Then, after the review of previous studies, this study developed five hypothesis. To do empirical analysis, this study use the transaction volume as independent variables, adopt random effect or fixed effect model to analysis the panel data from 2012 to 2021 of 24 commercial banks in China, while data collection is in the help with WIND database. In running the regression model, some variables (size, GDP, capital ratio, SSE) were controlled for in this study to make the model more statistically explanatory.

This paper uses Eviews for regression analysis, and after using F test and Hausman Test, it is found that the optimal model is random effect model except for model 4 (international). The regression result indicate that the internet finance has significant negative impact on the deposit, loan business performance of commercial banks, while have significant positive relationship with the intermediary and comprehensive business, but do not show significant result on international business due to the insufficient sample size.

Meanwhile, by comparison of the results of two SAMPLES before the epidemic (2012-2019) and after the epidemic (2012-2021), this paper finds that Covid-19 pandemic strengthens the effect of Internet finance on deposit and intermediary, but diminishes the negative effect of Internet finance on loan business.

In order to explore the reasons that make the impact of Internet finance on loan business weaken during epidemics, this paper adds two models to investigate the

response of individual loan and enterprise loan to Internet finance, and finds that the development of Internet finance steals the business volume of individual loan, but increases the business volume of enterprise loan.

In further, the results of the Heterogeneity Test illustrate that city commercial banks are the most sensitive to the impact of Internet finance, joint-equity is the following, and state-owned banks are the least affected by Internet finance.

5.3 Application of your study

This study provides solid empirical evidence that Internet finance has a significant negative impact on commercial banks' deposit, loan business in general, which demonstrates that Internet finance has seized commercial banks' payment and storage business by virtue of its convenience and online transactions. In these businesses, Internet finance has technical advantages, and the response of consumers proves that the third-party payment function provided by the mobile platform has convenient the life of the public, therefore, Internet finance should vigorously develop its deposit, loan and payment function, and commercial banks should appropriately give up seizing the market share with third-party payment, instead, commercial banks should consider cooperating with the payment function of Internet finance to provide safe and reliable protection for Internet finance.

In further, additional test determined that individual loans are more sensitive to internet finance than enterprise loan, which means that internet finance does attract more and more individuals to lend on the platform, but there are many enterprises that still choose commercial banks as lending institutions for security and trust considerations. This suggests hint for commercial banks that they should focus on the demand of enterprise loan while the internet finance can satisfy the demand of individual loan. And also, internet finance is always good at personalizing

customized products making it meet the needs of individual lenders, while commercial banks can enhance the security and compliance of loans to meet the needs of large enterprises.

According to the results of the empirical analysis, Internet finance plays a role in promoting the intermediary business of commercial banks, which instructs that commercial banks should continue to innovate their financial products and intermediary services and reform their financial products to online and personalized under the premise of ensuring safety and compliance, while Internet finance should seek the assistance of commercial banks to comply with their products and be assisted by commercial banks for pre-review.

Although this study did not obtain significant results about the international business of commercial banks, many previous studies found that the international service of commercial banks does not get weakened by the development of Internet finance. Other studies dealing with the security of Internet finance suggest that the lending business of online financial services should be subject to stricter border restrictions to avoid illegal money laundering, illegal transfer of assets and other tax problems. Therefore, the recommendation from this paper for the international business segment lies in regulating the cross-border consumption process of Internet finance, restricting its business of overseas loans, and making commercial banks as the main body of overseas business. financial regulation should support commercial banks to develop their overseas business and take up the majority demand for overseas consumption and loans, while setting stricter regulations to restrain the non-compliant Internet finance overseas business.

Finally, according to the results of heterogeneity analysis in this paper, city commercial banks should be the pioneer of commercial bank innovation because it itself is most influenced by commercial banks and it has the advantages of high flexibility and innovation ability because of its own small volume and simple

management structure. Therefore, city commercial banks should be the first one to try innovation and reform in cooperation with Internet finance, while the least affected state-owned commercial banks act as a stable and reliable backing.

5.4 Limitations of the study and recommendations for future studies

This study currently has a few limitations. First, because Internet finance has developed only 10 years since 2012, which is a slightly insufficient time interval, the sample size of this paper may not be sufficient. Second, this paper generally uses the most direct method in measuring each variable, but for some variables, such as comprehensive performance, international business and internet finance itself, they should be measured using a more comprehensive and multidimensional measurement, and the overly direct measurement in this paper may make the results less accurate. For instance, this paper generally using total income to measure comprehensive performance, it is not suitable as only the profitability is taken into concern while other things like liquidity, security, going concern is not considered. Thus, it is expected for future studies to design a thoroughly considered measurement for the performances of commercial banks.

Thirdly, there are certain control variables that are not significant in some models, especially the SSE index, which is not significant in most of the models. This may be due to objective reasons, probably in the sample selected for this paper, the SSE index really did not have an effect on the DV. It is also possible that the banks selected for this paper are heterogeneous and the effect of the control variables on DV in the total sample is dispersed out due to the heterogeneity in size and geographic location of different commercial banks. Therefore, subsequent studies with more effort on sub-sample studies of commercial bank heterogeneity may see more significant control variables, and subsequent studies are strongly recommended to do more sub-sample tests on the heterogeneity of commercial banks' especially on

geographical location and user groups.

Finally, in this paper, only the OLS model was considered in the initial design of the model, and only in subsequent analysis done on the comprehensive performance was the Generalized Method of Moment used, implying that the effect of the lag term of DV was considered in only one model in this paper. According to the results of the GMM model, the first order lag term, second order lag term and third order lag term of the comprehensive performance were all significant, indicating that the effect of lag term may also be present in other models. Therefore, subsequent studies were suggested to adopt the time log model with consider of autoregression, which would result in a higher model compliance.

5.5 Summary

After the whole study, researcher successfully found the impact of internet finance on the deposit, loan, intermediary, international and comprehensive business performance of commercial banks. Researcher hopes to bring some guidance to financial regulators and help to re-allocate the functional division between commercial banks and internet finance, so that the collaboration of China's financial system can be more efficient and promote the optimization and digital reform of the whole financial system. There are still many limitations in this paper, and researcher hopes that future research will break these limitations and improve this study to better stage.

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APPENDIX

ID	Firm/ Country Name	Year	Deposit	Loan	Intermediary	International	overall	IntFinance	size	capratio	value	GDP	SSE