IMPACT OF INTERNET MONEY MARKET FUNDS ON LOANS OF COMMERCIAL BANKS IN CHINA

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IMPACT OF INTERNET MONEY MARKET FUNDS ON LOANS OF COMMERCIAL BANKS IN CHINA

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LIST OF ABBREVIATIONS

ARDI	Annualized Return Difference Between Deposits and Internet Money Funds
DIFF-GMM	Difference GMM
DS	Growth Rate of Deposit Size
GDP	Gross Domestic Product
GMM	Generalized Method of Moments
IC	Interest Cost Growth Rate
IMFS	Internet Money Fund Size Growth Rate
LR	Lending Rate
LS	Growth Rate of Bank Loan Size
SYS-GMM	System GMM

KESAN DANA PASARAN WANG INTERNET KEATAS PINJAMAN BANK KOMERSIAL CHINA

ABSTRAK

Bank perdagangan di China mula mengeluarkan dana wang Internet pada 2013, dan menjelang 2023, jumlah nilai pasaran bersihnya melebihi deposit gabungan empat bank perdagangan terbesar China. Apabila dana wang Internet mengalihkan sejumlah besar deposit bank, ia mengurangkan sumber pembiayaan untuk pinjaman bank, yang membawa terhadap pertumbuhan yang lemah dalam perniagaan pinjaman. Antara 2014 dan 2022, 50% dari kadar pertumbuhan saiz pinjaman bank tersenarai menunjukkan arah aliran menurun. Menurut teori kesan penggantian, terdapat tahap tertentu kesan penggantian antara dana wang Internet dan deposit; pada masa yang sama, deposit bank juga merupakan sumber dana untuk pinjaman bank, yang memberi kesan ketara terhadap pinjaman bank. Oleh itu, kertas kerja ini mengkaji kesan dana wang Internet ke atas pinjaman bank dan kesan pengantaraan deposit dalam kesan di atas. Model panel yang bercirikan dinamik dianggarkan menggunakan kaedah GMM bagi menganalisis data tahunan untuk sembilan tahun bagi 20 bank perdagangan yang disenaraikan sebelum 2014 di China. Didapati bahawa pertumbuhan pesat dalam saiz dana wang Internet menghalang kadar pertumbuhan saiz pinjaman. Kadar pertumbuhan saiz deposit menjadi pengantara 27.42% dalam pengaruh dana wang Internet ke atas pinjaman bank. Akibatnya, bank perlu mengambil beberapa langkah untuk meningkatkan perniagaan pinjaman mereka, seperti mengenakan sekatan ke atas dana wang Internet, merasionalkan harga mereka dan meningkatkan hasil deposit.

IMPACT OF INTERNET MONEY MARKET FUNDS ON LOANS OF COMMERCIAL BANKS IN CHINA

ABSTRACT

Commercial banks in China began issuing Internet money funds in 2013, and by 2023, its total net market value could rival the combined deposits of China's four largest commercial banks. As Internet money funds divert large amounts of bank deposits, they may reduce the source of funding for bank loans, leading to weak growth in the lending business. Between 2014 and 2022, 50% of the listed banks' loan size growth rate showed a downward trend. According to the theory of substitution effect, there is a certain degree of substitution effect between Internet money funds and deposits; meanwhile, bank deposits serve as the primary source of funding for bank loans, significantly impacting bank loans. Therefore, this thesis investigates the impact of Internet money funds on lending operations as well as the mediation effect of deposits in said impact. A panel model with dynamic features is estimated using the GMM method and analyzed using nine years of annual data from twenty commercial banks listed in China before 2014. The study found that the rapid growth in Internet money funds dampened the size of loans. Deposits play a mediating role of 27.42% in the influence of Internet money funds on bank loans. As a result, banks need to take a series of measures to boost their lending business, such as imposing restrictions on Internet money funds, rationalizing their pricing, and increasing the yield on deposits.

CHAPTER 1

INTRODUCTION

1.1 Overview

The research background introduces the current status of bank lending businesses and Internet money funds. The problem statement explores the research questions of this thesis, and the research questions are decomposed into the effect of Internet money funds on loans and the mediation effect of deposits in them. After that, this thesis's research scope, significance, and framework are clarified.

1.2 Background of Economies

1.2.1 Bank Loans

Commercial banks are an important part of China's financial system and critical in promoting economic development and financial stability. The total assets of commercial banks exceed RMB 250 trillion, accounting for about 70% of the total assets of China's financial system(China Banking Regulatory Commission, 2020). As the leading financial institutions in China, commercial banks play an important role in capital financing, payment and settlement, deposit and loan (Cai, 2020). The Bank loan business refers to the activities of commercial banks in providing financial support to individuals, enterprises, and other organizations. In the lending business, the bank provides funds to the borrower and charges the borrower a certain amount of interest and fees according to the agreed terms. The main sources of funds for bank loans include bank deposits, interbank lending, central bank loans, capital market financing, international financial markets, asset securitization, own capital,

and so on. Among them, bank deposits are an essential source of funds for bank loans(Zhang et al., 2020). Commercial bank loans can be categorized into different types of loans: personal consumption loans, housing loans, vehicle loans, business loans, and so on. Commercial banks determine the interest rate standard for loans by evaluating the borrower's credit status, repayment ability, and loan purpose. In China, lending rates are regulated by the central bank. The central bank influences banks' lending rates by setting benchmark interest rates and adjusting reserve requirement ratios. In addition, according to the competition in the market and the supply and demand of funds, commercial banks adjust their lending rates within a certain range.

The growth rate of bank loan size is the percentage increase in total bank loans over a given period relative to total loans in the previous period. This indicator reflects the extent of bank lending operations expansion and market demand changes. Higher growth rates usually indicate a robust bank lending business, reflecting a vibrant economy and a thriving credit market. At the same time, lower growth rates indicate weak market demand or increased bank risk control (Fridson, 1998; Schnabl & Hoffmann, 2007; Gardo & Martin, 2010; Prasad et al., 2019). Figure 1.1 shows the annual loan size growth rate of all listed banks in China before 2014 (see Section 1.6 for a detailed list of banks) from 2014 to 2022, which shows that the loan size growth rate of 50% of listed banks has been on a downward trend. This downward trend reflects banks' strengthening of risk control, which rigorously assesses the credit status of borrowers and prudently issues loans without pursuing the growth of loan size. This reduces the incidence of non-performing loans. As the economy grows, the credit market matures. The lower growth rate also means that the market is stabilizing, no longer relying on high loan amounts to sustain economic growth, and the quality of economic development has improved.

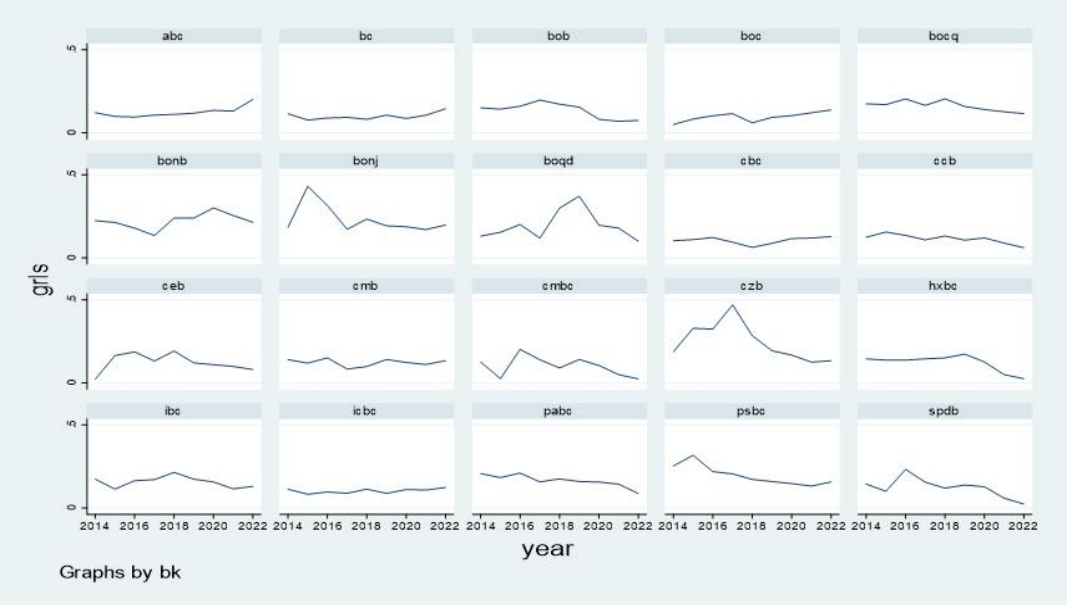

Figure 1.1Growth Rate of Loan Size of Listed Banks in China(2014-2022)

*Source: Banks' annual reports

1.2.2 Internet Money Fund

Internet money fund is an alternative product that integrates Internet cloud computing with money funds. The essence of this product still belongs to the category of money fund (Cheng et al., 2022), but through the docking with e-commerce platforms, Internet companies, or other life service consumer merchants, customers can directly purchase and redeem the fund online, enjoying a higher return than that of bank deposits, and at the same time can realize direct consumption with fund shares on the Internet platform. Before 2013, due to the high purchase threshold of financial products, savings deposits were the primary way to finance Chinese people. In June 2013, an Internet money fund called Yu'E Bao was launched. With its high yield and liquidity, coupled with the fact that it could be used directly for Taobao's consumer settlement, the scale of Yu'E Bao snowballed, causing various banks to launch their Internet money funds (Yang, 2017; Xu, 2021; Tuheti, 2023).

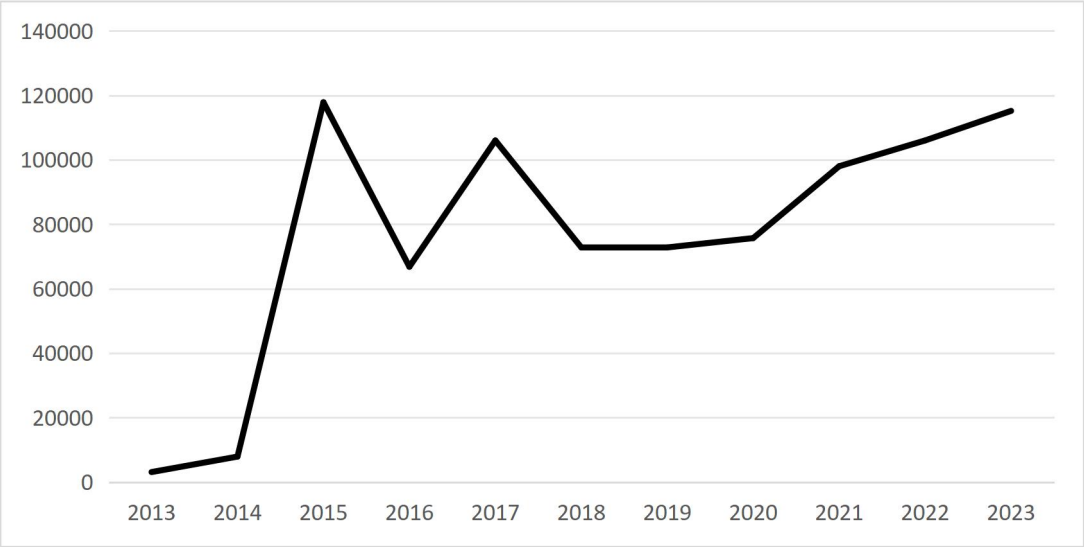

Figure 1.2 Line Chart of Total Market Value Trend of Chinese Internet Money Market Funds (Unit: Hundred Million Yuan)

*Source: China Securities Investment Fund Association (2013-2023).

Figure 1.2 shows the trend of the total market capitalization of Internet money funds in China. According to the data published by the China Securities and Funds Association, from June 2013 to February 2023, the total market capitalization of China's Internet money funds grew from 0.31 trillion yuan to 1,1517.2 billion yuan. As of the end of 2022, the top four commercial banks in China, Industrial and Commercial Bank of China, Construction Bank of China, Agricultural Bank of China, and Bank of Communications, announced in their annual reports that the demand deposits of their customers were: 3393 billion yuan, 3155 billion yuan, 3972 billion yuan, and 1013 billion yuan, respectively. The funds deposited by Internet money funds can already compete with the deposits of head banks. The rapid growth of the volume of Internet money funds reflects the public's recognition and broad participation in the product. In addition, the issuance of Internet money funds by banks can enhance their competitiveness, enrich their product range, expand their market share, promote digital transformation, and enrich their sources of income. Specifically, the first is to enhance the competitiveness of banks and enrich the

product variety (Zhou & Tu, 2020). With most banks launching Internet money funds, other banks must launch investment products with similar features to retain customers and attract new investors. Banks issuing high-yield and high-liquidity Internet money funds can enrich their product range, enhance their competitiveness in the financial market, and improve customer satisfaction and loyalty. Second, it expands the customer base and market share (Wu & Zhang, 2020; Dong & Yin, 2020). The low threshold and convenience of Internet money funds attract more individual investors to participate, especially young people and Internet users. Banks can expand their customer base and increase their market share by issuing such products. Attracting Internet users also helps to enhance the brand influence and market competitiveness of banks and promote healthy growth of their overall business. Third, it promotes fintech development and banks' digital transformation (Chen et al., 2017). The consumer settlement integration function of Internet money funds enhances the digital experience of financial services and makes customers' financial operations more convenient. This can further promote the development of financial technology and banks' digital transformation to improve operational efficiency and service level, in line with the modern customer demand for convenience and efficiency. Fourth, banks can issue Internet money funds to collect fund management fees and increase the channels for income sources.

Internet money funds are still money funds in nature and are a low-risk investment tool. Their primary investment targets include but are not limited to, the following (Zhou et al., 2015; Loubere, 2017; Wang, 2018). First are short-term bonds such as government, agency, and financial bonds. These bonds usually have low risk and short maturities and can provide relatively stable returns. However, if a bond defaults, the net value will be lost. Second are bank deposits, which are money funds

that deposit a portion of their funds in banks to earn interest on the deposits. Since the funds are usually huge, banks will offer relatively higher interest rates to attract these large deposits. Third are short-term bills such as commercial paper and short-term financing bonds. These bills usually have a short maturity and low risk. Fourth, bank certificates of deposit are a type of time deposit that usually has a short maturity and a fixed interest rate. Fifth, reverse repurchase agreements are short-term lending arrangements in which the monetary fund lends money as a lender and receives an inevitable return. In addition, the specific monetary fund investment portfolio will vary according to the fund's investment strategy and objectives. Different monetary funds have different investment targets and weight allocations (McLoughlin & Meredith, 2017).

Internet money funds and traditional money funds are invested in the money market fund products. Their investment targets and risk characteristics are relatively similar, but three differences remain. First is the consumer settlement process. Internet money funds can be used directly for network platform consumption settlement; investors only need to be in the consumption platform for one-step operation. However, behind it involves the docking of two platforms. In the first step, the online shopping platform sends a payment request to the bank; in the second step, the bank calculates the fund's share that needs to be redeemed based on the payment amount and the fund's net asset value. Moreover, it automatically redeems the corresponding fund shares. After redemption, the funds will be transferred to the online shopping platform to complete the payment. The emergence of Internet money funds simplifies the operation of two platforms and multiple steps into one step, significantly improving convenience. Traditional money funds usually need to be redeemed first, and then consumer settlement is carried out. Therefore, Internet

money funds are more convenient than traditional money funds for online consumption (Birch & Young, 1997; Seetharaman & Raj, 2009; Alzoubi et al., 2022). Second is the investment threshold. Internet money funds usually have a lower investment threshold, with a minimum purchase amount of 1 RMB. On the other hand, traditional money funds have higher investment thresholds, usually starting at 1,000 RMB. Third is transaction time and liquidity. Internet money funds can be traded 24 hours daily to meet users' network consumption settlement needs. On the other hand, the trading hours of traditional money funds are restricted by fund companies' working hours, generally from 9:00 to 17:00 (Ma et al., 2022). Traditional money funds and deposits differ in terms of yield, liquidity, risk, and ease of operation. Deposits are safer and can be used directly for online spending. Traditional money funds cannot satisfy the monetary needs of investors' trading motives and, therefore, have yet to generate a significant substitution effect.

Internet money funds and bank deposits differ in the following two aspects. First is the rate of return. Internet money funds and bank demand deposits can be used directly to pay for online purchases. However, the yield of Internet money funds is usually relatively high, while the yield of bank deposits is relatively low. Internet money funds can be invested in various short-term, low-risk financial instruments in pursuit of a higher rate of return. Still, they also come with a particular investment risk. On the other hand, the yield of bank deposits is usually fixed but relatively stable and reliable. For example, in November 2023, ICBC issued the ICBC Credit Suisse Express Money Fund with an annualized return of 1.9%, while the annualized interest rate of ICBC demand deposits in the same period was 0.2% (data from ICBC's official website). Second is risk and volatility. The rate of return of the Internet money fund is affected by the fluctuation of the market situation and the

fund portfolio, and there is a certain degree of risk, which requires investors to bear the investment risk. Bank deposits are usually considered a low-risk investment, and the principal and interest of deposits are generally determined. They are also protected by the deposit insurance system, which allows depositors to receive a certain amount of insurance compensation in the event of bank failure or insolvency.

Table1.1 Characteristics of Internet Money Funds, Traditional Money Funds,

Characteristics/Products	**Internet money funds**	**Traditional money funds**	**Bank deposits**
Investment Instrument	Short-term bonds, bank deposits, short-term bills, reverse repurchase	Short-term bonds, bank deposits, short-term bills, reverse repurchase	Issuance of loans and investments.
Investment threshold	Minimum investment amount of ￥1	The general starting amount is ￥1,000.	There is no minimum deposit amount requirement.
Liquidity	24/7 Trading	Subject to the working hours of the fund company.	E-accounts are available 24 hours a day.
Convenience of consumption settlement	It can be used directly to settle online consumption.	We need to redeem the fund before settlement.	They are directly used to settle daily consumption.
Yield and Risk	Relatively high yield, uncertain return, investment risk.	Relatively high yield, uncertain return, investment risk.	Low yield, fixed income, shallow risk.

*Source: Banks' annual reports

1.3 Problem Statement

Figure 1.2 shows China's rapid development of Internet money funds during the sample period. As of 2023, the total net value of Internet money funds has reached 1,151.72 billion yuan, similar in size to the total deposits of China's four commercial banks with the most significant assets. First, this has created a massive

diversion of banks' deposit business, which may reduce their loan funding sources. Figure 1.1 shows that the growth rate of loan size of more than 50% of listed banks in China has become a downward trend, which can be seen in the Internet money funds to weaken the loan business growth. Theoretically, the loan business of Chinese commercial banks is one of their most important sources of income. According to the annual reports of the top five commercial banks in China in terms of asset size in 2022 (Bank of China, China Construction Bank, Agricultural Bank of China, Industrial and Commercial Bank of China, Bank of Communications), the income from lending business accounted for more than 70% of the overall income structure of the bank. The profits of Internet money funds come mainly from management fees and service charges, with lower profit margins ranging from about 0.1% to 0.5%. The net profit margin of the lending business is between 2% and 4%, much higher than Internet money fund profits (Murau & Pforr, 2020; Morgan et al., 2022). Banks' resource allocation is shifted from high-profit deposit and loan business to low-profit Internet money fund business, which compresses banks' profit margins. Therefore, solving the problem of the lack of development of bank lending business is very important to enhance bank profits.

Second, as banks compete to issue Internet money funds, the price war in a highly competitive market environment may further dilute the profit of the already low-margin Internet money fund business. This causes banks to further increase deposit rates to maintain their deposit base (Kassim & Majid, 2009).

Thirdly, it increases banks' operational risks. According to China First Financial's public reports, more than 310 defaults occurred in China's pooled trust products throughout 2020, involving defaulted projects amounting to more than RMB 160 billion. In 2021, China's real estate company, Evergrande Group, erupted

into a debt crisis, with its total liabilities exceeding RMB 2.4 trillion. Since 2020, there have been frequent defaults in China's bond market, and some Internet money funds would invest in high-risk bonds, resulting in a fall in fund net value or even losses. This situation not only affects the trust of investors but also probably increases the overall operational risk of banks. Therefore, despite the advantages of Internet money funds, such as market share and rich product variety for banks, it may reduce sources of loan funds necessary for developing businesses and raise investment risks. Therefore, it is my question of 'what is the effect of Internet money funds on loans by commercial banks in China' that this study aims to answer.

Moreover, Internet money funds are somewhat homogeneous with bank deposits, and according to the theory of substitution effect and existing research, Internet money funds will have a certain degree of substitution effect on deposits. Deposits are the primary source of funds for bank loans. The diversion of bank deposits by Internet money funds may reduce the source of bank loanable funds. Deposits may partially mediate the path of Internet money funds' impact on loans. It is further interesting to understand how deposits may mediate the relationship between Internet money funds and loans by commercial banks in China.

1.4 Research Questions

this thesis's research question is consistent with the problem statement. Specifically, there are two sub-questions.

i. What is the impact of Internet money market funds on the loan size of commercial banks in China?

ii. Will deposit mediate the relationship between the impact of Internet money market funds on the size of bank loans?

1.5 Research Objectives

this thesis is specifically divided into two research objectives.

i. To examine the impact of Internet money market funds on the size of loans of commercial banks in China.

ii. To analyze the mediation effect of deposits in the impact of Internet money market funds on the size of bank loans.

1.6 Scope of the Study

Internet money funds began to appear in 2014; in order to include more samples while eliminating banks with more missing data, this thesis ultimately selects all banks listed in China before 2014 as the research sample, namely the following 20 commercial banks: Bank of Communications, Bank of China, Industrial and Commercial Bank of China, Agricultural Bank of China, Construction Bank of China, Postal Savings Bank, China Merchants Bank, Minsheng Bank, Everbright Bank, Zheshang Bank, Industrial Bank, Pudong Development Bank, Ping An Bank, Huaxia Bank, China Zhongxin Bank, Bank of Beijing, Bank of Nanjing, Bank of Ningbo, Bank of Chongqing, Bank of Qingdao.

1.7 Significance of the Study

Regarding theoretical significance, this thesis resolves the theoretical controversy about the impact of Internet money funds on the size of commercial

bank loans. Currently, domestic and foreign scholars are divided in this area. Researchers with a sample of Chinese commercial banks have argued through theoretical analysis that the funds raised by Internet money funds will eventually flow back to banks, thus promoting the development of bank lending business or having an insignificant impact on it (Owen & Fogelstrom, 2005; Liao, 2018; Mancini-Griffoli et al., 2019; Fan, 2021), but this view lacks empirical analysis. In contrast, researchers with a sample of commercial banks in developed countries have argued through empirical analysis that Internet money funds will change the funding structure of banks' liabilities, raise banks' financing costs, and indirectly inhibit the increase in loan size (McCabe et al., 2013; Cipriani et al., 2013; Pennacchi, 2017; Choi, 2021; Tong & Wang, 2022), but this view fails to take into account the situation of China's unique socio-economic background and financial market characteristics. this thesis provides more convincing evidence through empirical analysis that considers China's unique financial environment and clarifies the negative impact of Internet money funds on lending. In particular, the results of this study challenge the views of some previous scholars. Although China's degree of national development, the strictness of financial regulation, the payment and consumption functions of Internet money funds, and the investment habits of its residents are significantly different from those of developed countries, Internet money funds do have a dampening effect on bank lending business. This finding provides academics with a Chinese perspective, enriches existing theoretical studies on the impact of Internet money funds on bank loan size, and resolves theoretical disputes. Second, this study innovatively analyzes the mediation effect of deposits on the effects of Internet money funds on bank lending. While previous studies have demonstrated the substitution effects of Internet money funds on bank deposits, few

have conducted an empirical analysis of their transmission pathways. this thesis empirically analyzes and verifies the partial mediating role of deposits in the impact of Internet money funds on bank loan size. This finding bridges the gap of existing studies and helps scholars to explore further the substitution effect between different products in the financial market and their transmission paths.

In terms of practical significance, first, for commercial banks, the study results show that the development of Internet money funds constitutes an attack on the bank lending business and that deposits partially mediate the impact of Internet money funds on bank lending. This is of guiding significance for banks in developing correct business strategies and helping them understand how the substitution effect of Internet money funds on deposits is transmitted to the lending business. The diversion of bank deposits by Internet money funds reduces the bank's loanable funds. It causes banks to shift funds from the high-margin deposit and loan business to the low-margin Internet money funds. Based on this finding, banks can restrict the investment amount of Internet money funds through purchase restriction measures to maintain the deposit base, ensure the stable supply of loan funds, promote the development of the loan business, and make the bank's resources inclined to high-profit deposit and loan products. At the same time, banks can also strengthen Internet money funds' risk management to ensure asset quality and avoid ignoring potential risks in pursuit of scale growth. Finally, the development of Internet money funds relies on higher returns and benefits from the combination with financial technology, which brings customers a more convenient financial service experience. Therefore, banks can develop personalized financial planning assistants based on artificial intelligence to provide customers with customized investment

advice and financial planning services, thus enhancing their advantages in fierce competition.

1.8 Definition of Key Terms

Table 1.2 Definitions of Key Terms

Terms	Operational Definition
Internet Money Fund	Internet money funds are money funds issued by banks that can be used for consumer settlements on internet platforms.
Bank Deposit	Bank deposits are where investors deposit funds in a bank and can withdraw them at any time and receive interest returns.
Bank Loan	The bank provides funds to the borrower, and the borrower repays the funds and interest over an agreed period.

1.9 Organization of the Research

this thesis investigates the effect of Internet money funds on bank loans and the mediation effect of bank deposits in the above impact. The specific research framework is shown in Figure 1.3.

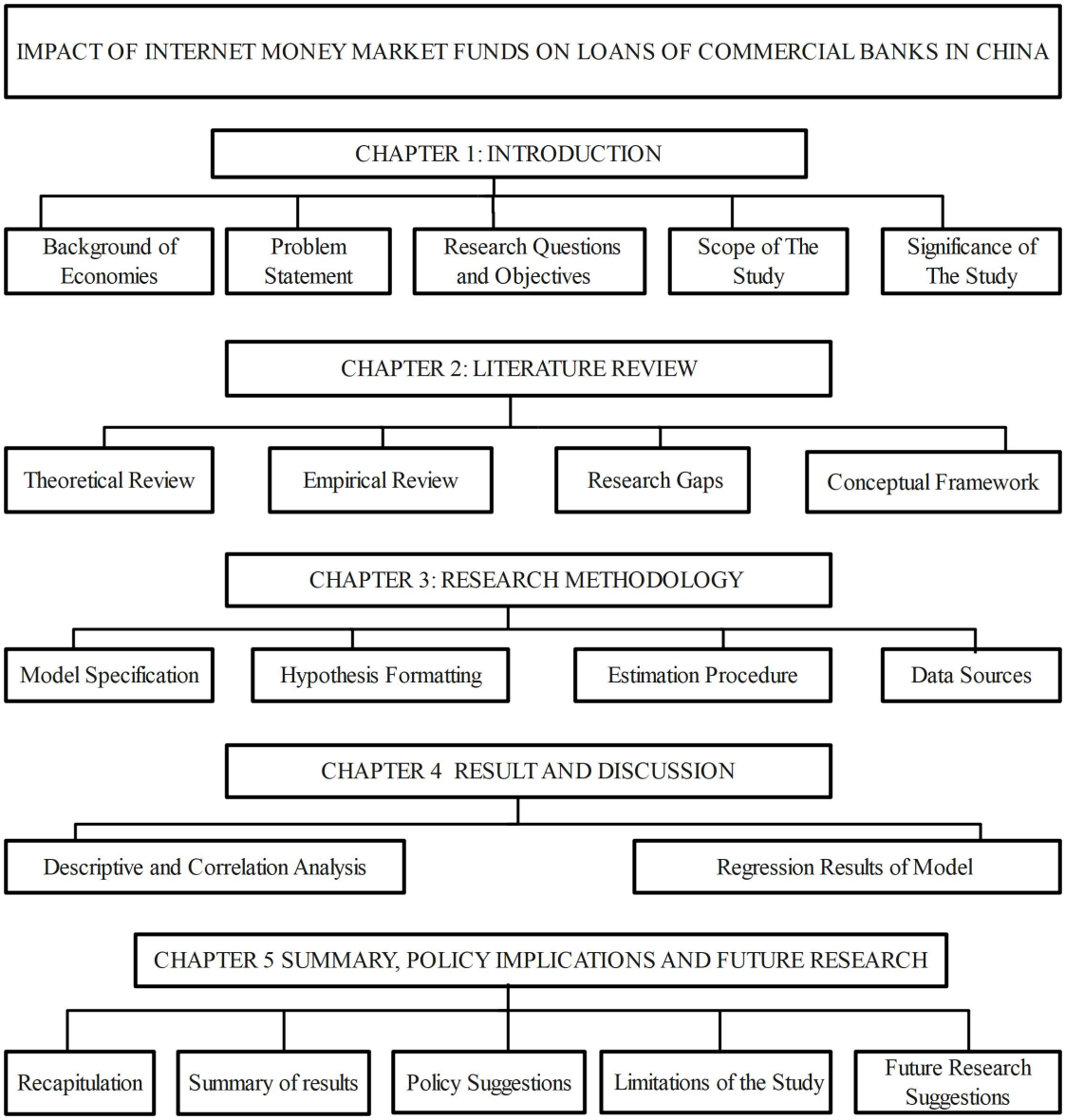

Figure 1.3 Research Framework

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter aims to explain the impact of Internet money funds on lending and the mediation effect of deposits from the perspective of a theoretical review. The first part discusses the substitution effect theory, money supply theory, money demand theory, and mediation effect theory. According to the substitution effect theory, there exists a certain degree of substitution effect between Internet money funds and deposits, so the growth rate of Internet money fund size, annualized return difference between deposits and Internet money funds may have an impact on the growth rate of deposit size, which affects the growth rate of loan size by influencing the bank's source of loanable funds. According to the theory of money supply, the theory of money demand, the lending rate, the growth rate of bank interest cost, and the GDP growth rate may impact the growth rate of loan size by affecting the demand and supply of loans. At the same time, whether Internet money fund affects loans through deposit can be verified through the mediation effect theory. The second part is the empirical review, which summarizes the results of the empirical analysis of each variable in the existing literature. These empirical studies provide empirical evidence on the relationship between Internet money funds and loans, which provides a reference for this study. The third section identifies the research gap. There is still disagreement on whether the impact of Internet money funds on loan size is positive or negative. The last section introduces the conceptual framework of this study. The conceptual framework will include the relevant theoretical basis, research variables, etc.

2.2 Theoretical Review

2.2.1 Substitution Effects Theory

The substitution effect is represented by the economist Marshall (1890). It is theorized that at a fixed income level, changes in the selling price of goods affect the quantity of goods demanded(Ogaki, 1990).

Internet money funds can influence the asset selection behavior of Chinese residents and divert their deposits (Guo & Shen, 2016; Dong et al., 2020). Firstly, r_m as the Internet money fund yield is introduced into the bank deposit supply function: D_s (r_d), which becomes D_s (r_d , r_m). Through Internet money fund products, residents can invest their deposits and cash into the money market with higher yields. At this time, the deposits absorbed by banks in the deposit market are affected by the bank deposit interest rate r_d and related to the Internet money fund yield r_m.

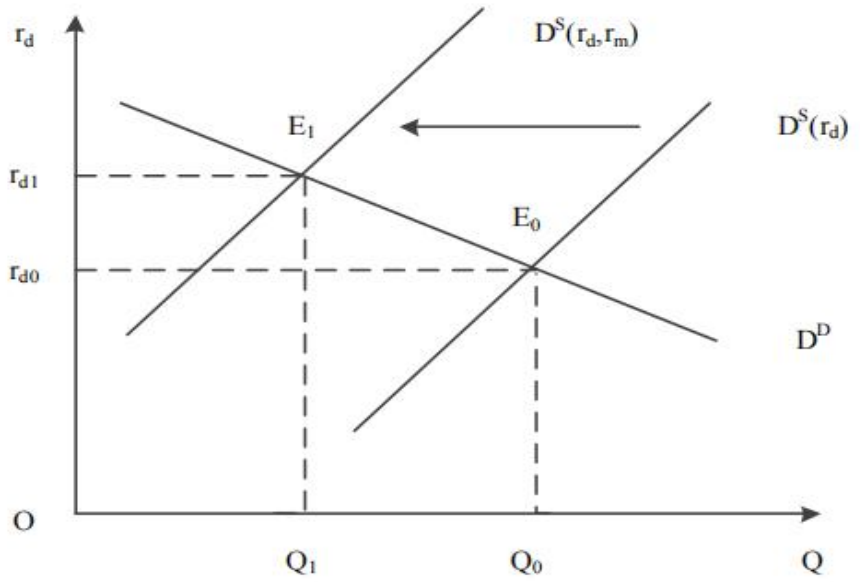

Figure 2.1 Substitution Effects Model

Secondly, the substitution effect of Internet money funds on deposits also indicates that the increase in the yield of Internet money fund products will reduce the supply of residents' deposits. Therefore, in the case of r_d no change, the supply curve of residents' deposits shifts left; at this time, if the bank's demand for residents' deposits remains unchanged, i.e., the demand curve for deposits is not shifted, the leftward shift of the supply curve of residents' deposits will make the market interest rate for bank deposits, r_{d1}, higher than the original equilibrium level, r_{d0}. This suggests that, under perfect market conditions, Internet money funds would, to some extent, increase bank deposit rates.

The development of money funds has led to an increase in market interest rates on bank deposits, resulting in an increase in interest payments on bank deposits, a rise in bank financing costs, and, other things being equal, a corresponding increase in bank lending rates. The surge in bank lending rates will cause borrowers' borrowing costs to become higher, their intention to borrow lower, and their demand for borrowing reduced, ultimately resulting in a decline in the size of bank lending (Mckinnon, 1993).

Internet money funds provide investors with a new channel for storing and investing funds, diverting residential deposits that would otherwise be deposited in banks. As the size of Internet money funds grows, banks face increased outflow pressure on deposits, which can raise their deposit rates to attract deposits and indirectly increase their financing costs, leading to higher interest rates on loans, which in turn suppresses demand for loans and reduces the size of loans (McCabe et al., 2013; Cipriani et al., 2013; Pennacchi, 2017; Choi, 2021; Tong & Wang, 2022). Deposits are the primary source of bank loan funding. Regarding the annualized return difference between deposits and Internet money funds, residents will tend to

invest their funds in investment products with higher yields. When the annualized returns of Internet money funds are higher than those of bank deposits, residents will transfer their funds from bank deposits to Internet money funds, decreasing bank deposits and reducing the amount of funds available to banks for lending. In this case, banks will increase deposit rates and lending rates to attract more deposits and cover higher funding costs, which will lead to a decrease in demand for loans and ultimately to a decrease in the size of loans (Berlin & Mester, 1999; Kassim & Majid, 2009). Regarding the interest cost growth rate, higher deposit rates increase interest expenses and financing costs for banks, which will reduce the willingness of banks to grant loans and slow down the size of loans (Rousseas, 1985; Elyasiani et al., 1995; Lian, 2017).

2.2.2 Money Supply Theory

Money supply theory is mainly concerned with the formation and operation mechanism of money supply; due to the different theoretical foundations, money supply theory is divided into the old and new views. The old view is represented by Friedman and Schwartz (1971), and the new view is represented by Tobin (1977). The main difference between the two is that the old view does not consider the influence of nonbank financial institutions and interest rates on the money supply and assumes that the money multiplier, etc., remains constant, that the central bank has control over the base money, and that the money supply is therefore determined mainly by the central bank. On the other hand, the new view assumes that the money supply is determined jointly by the central bank, commercial banks, and the non-banking sector. However, the starting point for analyzing money supply in both the

old and new views is the money multiplier model, which is also the core of money supply theory.

According to the money multiplier model, the money creation process mainly involves commercial banks creating more money supply through the base money provided by the central bank. Base money consists of currency issued by the central bank and deposits made by commercial banks with the central bank, which are liabilities of the central bank. There are three main ways for the central bank to put in base money: conducting open market operations, adjusting the reserve requirement ratio, and providing loans directly to the banking system. After acquiring base money, commercial banks make loans to the non-banking sector, creating the asset side of the balance sheet (loans to the non-banking sector) and the liability side (deposits from the non-banking sector, which is the money supply). In a simplified model of money creation, the money supply is equal to the sum of deposits, and the process of money creation is also the process of credit creation. In this process, the money multiplier can be expressed as:

$$\text{Money multiplier} = m = \frac{M}{B} \tag{2.1}$$

As mentioned earlier, the money supply M consists of cash (C) and deposits (D), and the base money B consists of cash (C) and deposit reserves (R). The ratio of cash holdings to deposits (C/D) is known as the cash holdings ratio (b), and the ratio of deposit reserves to deposits (R/D) is known as the reserve ratio (r), such that Equation (2.1) can be converted to:

$$\text{Money multiplier} = m = \frac{M}{B} = \frac{1+b}{1+r} \tag{2.2}$$

The money multiplier model is simple, intuitive, and widely used. However, it does not consider the impact of interest rates, which is inconsistent with reality. It cannot explain the relationship between money supply and interest rates. Based on Poole's analytical framework, Bofinger (2010) established a price theory model covering interest rates and money supply. The model is based on the balance sheets of the central bank and commercial banks and assumes that the demand for money is equal to the demand for credit and the supply of money is equal to the supply of credit, thus treating the credit market as a 'macro-money' market, and obtaining the money demand formula:

$$M^D = C_{\mathrm{r}}^D = C_{\mathrm{r}}^D(\mathrm{i_c}, Y) \tag{2.3}$$

The money supply equation follows from solving for the bank's optimal supply of loans. It follows from the asset-liability balance equation for an individual bank:

$$\text{Asset side} = C_{rB/NB}^{\mathrm{j}} + R^{\mathrm{j}} = D^{\mathrm{j}} + C_{rCB/B}^{\mathrm{j}} = \text{Liability side} \tag{2.4}$$

Specifically, $C_{rB/NB}^{\mathrm{j}}$ is loans to the non-banking sector, R^{j} is reserves of commercial banks, D^{j} is deposits of the non-banking sector, and $C_{rCB/B}^{\mathrm{j}}$ is loans received from the central bank.

The profit function for a single bank is denoted as:

$$\prod^{\mathrm{j}} = \mathrm{i_c}\, \mathrm{C}_{\mathrm{rB/NB}}^{\mathrm{j}} - \mathrm{i_D}\, \mathrm{D}^{\mathrm{j}} - \mathrm{i_R} \left(\mathrm{C}_{\mathrm{rCB/B}}^{\mathrm{j}} - \mathrm{R}^{\mathrm{j}} \right) - \mathrm{O} - \mathrm{V} \tag{2.5}$$

Specifically, $\mathrm{i_c}$ is the lending rate, i_D is the deposit rate, i_R is the central bank lending rate, O is the fixed operating cost of commercial banks, and V is the variable

cost incurred in credit operations, assuming that the variable cost is mainly the cost of default, which depends on the total amount of the loan and the probability of default ($d = \beta C^{j}_{rCB/B}$ /Y):

$$V = \beta (C^{j}_{rB/NB})^2 / Y \tag{2.6}$$

Subject to the constraints of equation (2.4), the optimal loan supply is obtained by substituting (2.6) into the profit function and taking the first-order derivative:

$$C^{j}_{rB/NB} = \frac{i_c - i_R}{2\beta} Y \tag{2.7}$$

The entire market-wide loan volume, or money supply, for a market with n commercial banks is:

$$C_{rB/NB} = n\frac{i_c - i_R}{2\beta} Y = M^S \tag{2.8}$$

The equilibrium model of the credit market (macro money market) can be obtained by connecting equations (2.3) and (2.8) (Figure 2.2). The model as a whole shows the process of money supply creation, the behavior of the central bank, commercial banks, and the non-banking industry, and the movement of the money supply in relation to interest rates.

Therefore, according to the money supply theory, bank lending rates, bank interest costs, and the size of deposits may directly impact the size of loans. The central bank controls the money supply by adjusting interest rates, and higher lending rates increase the cost of borrowing, inhibiting the willingness of enterprises and individuals to borrow. The increase in banks' interest costs will compress their net

interest income, thus affecting their ability to lend. Banks will pass on this increased cost by raising the interest rate on loans, dampening the demand for loans. Bank deposits are considered an essential component of the money supply. An increase in deposits provides banks with more funds that can be used to make loans, thus increasing the money supply (Bofinger, 2010). Therefore, there is a negative correlation between bank lending rates and loan size. An increase in lending rate leads to a decrease in the demand for loans, which in turn leads to a decrease in the size of loans (Ibrahim & Shah, 2012; Jiri Gregora et al., 2019; Dia et al., 2023). There is a negative correlation between bank interest cost and loan size. If the cost of bank interest increases, it leads to a decrease in the size of loans. An increase in the size of bank deposits directly increases the bank's loanable funds, which in turn contributes to the growth of loan size. However, it also depends on the bank's lending policy and the expectation of loan demand.

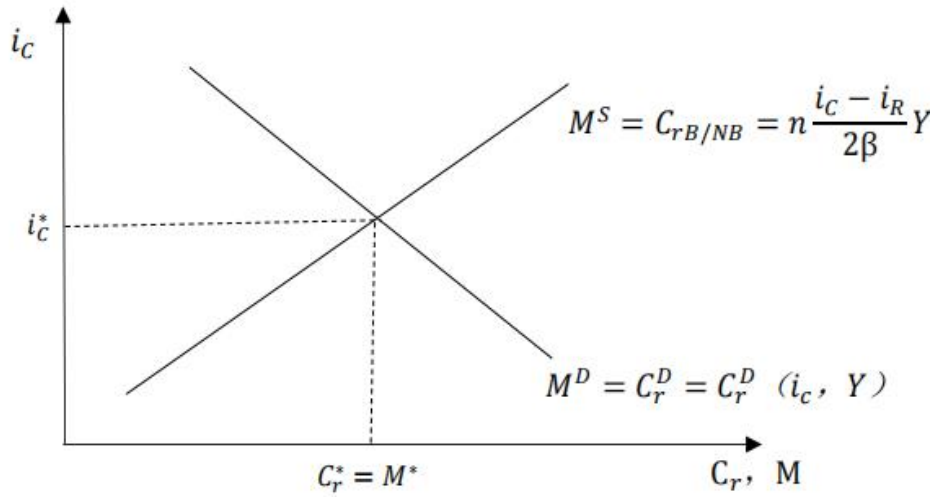

Figure 2.2 Credit Market Model

2.2.3 Monetary Demand Theory

The quantity theory of money was the earliest theory of the demand for money, represented by Fisher's transaction equation, viz:

$$MV \equiv PT \tag{2.9}$$

Specifically, M is the quantity of money, V is the velocity of money circulation, P is the price level, and T is the transaction size. Considering that the size of transactions is difficult to count, later scholars assumed that it is approximately equal to real GDP (denoted by Y), and the Fisher Transaction Equation can be converted to:

$$MV \equiv PY \tag{2.10}$$

The quantity theory of money considers V to be a relatively stable variable that depends largely on a country's population's consumption and payment habits and the characteristics of the country's payment system(Fisher, 1989). If the velocity of money circulation is regarded as a constant V', equation (2.10) can be transformed as:

$$M^D=PY/V' \tag{2.11}$$

The above equation is the cash balance theory proposed by Marshall (1923). The inverse of the velocity of money circulation is also known as the Cambridge K. From the three formulas, the demand for money is positively correlated with the real GDP and the price level. It has no relationship with the interest rate. This is the main element of the early theory of money demand, corresponding to the narrow money M1.

Keynes (1936) put forward the famous 'liquidity preference theory' that people have three main motives for holding money: transaction, precautionary, and