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The Impact of Fintech on Credit Risk of Commercial Banks

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Abstract: The financial sector is undergoing new transformations with high integration and deep superposition of science, technology, and industry, just as the world as a whole is going through significant changes that have not been witnessed in a century. Commercial banks must adapt to the new normal of financial technology and use new achievements without forgetting to control risks. This paper starts with the concept of fintech and the advancing fintech technologies. Then summarizes the existing methods of fintech quantification. After that, collect some influencing factors of bank credit risk. Finally link fintech with bank credit risk, and and review the research in this area. At the end of this paper, the limitation of the previous studies and the possible future research directions are proposed.

Keywords: fintech, commercial bank, credit risk

1. Introduction

With the increasing application of financial technology, fintech is now divided into five categories: payment and settlement, investment, financing, insurance and financial technology infrastructure according to the application of technology in finance. The application of technology in finance is shown in Table 1. The object of this study is the risks that fintech brings to commercial banks. As a result of advances in science and technology, the business model of commercial banks has undergone great changes. The cutting-edge technologies represented by 5G, big data, cloud computing, blockchain, etc. have brought innovation to the financial business field, but also brought many opportunities to the risk management of commercial banks. Therefore, it is very necessary to realize more intelligent, efficient and convenient risk management.

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Tabel 1: The application of technology in finance.

The application of fintech	Content	Fintech involved
Payment and settlement	Mobile payment Digital currency	Blockchain
Investment	Robo-advisor Program trading	Artificial intelligence
Financing	Internet loan Individual credit reporting	Big data
Insurance	Intelligent fee Marketing tools	Big data, artificial intelligence
Infrastructure	Database Intelligent risk control	Cloud computing

2. Research on the Concept Development of Fintech

2.1. A Subsection Sample

Charnes et al. (1972), first mentioned the term "fintech", which represents the beginning of the sprouting of fintech. More and more research has been expanded on this. Lines (2017) thought “Fintech” is a compound word, a combination of financial services and technology . Puschmann (2017) emphasized that fintech is essentially a financial innovation. In China, Xie and Zou [1] regarded the Internet-based information technology integration product, particularly mobile payment, social network, cloud computing and other technologies have a profound impact on traditional finance and the entire financial system. They called this product as Internet finance [1]. The development of Internet finance has made the transaction mode more diversified, which is conducive to the improvement of resource allocation efficiency, but has dispersed the financial systemic risk. Since then, "Internet finance" has been mentioned many times. The authoritative definition of fintech is in 2016: the Financial Stability Board determined it as a new generation of financial services that combines the Internet and technology with the traditional financial service industry. After that, Internet finance gradually faded out of the stage and was replaced by “fintech”. Arner et al. [2], divided fintech into three periods: between 1866 and 1967, the financial service industry was a part of computer industry, known as 1.0 era. Since 1967, the computer industry has been transformed into the digital industry. By 1987, the financial service has been highly globalized and digitized. The main body of fintech is the financial service industry that uses technology to provide products and services under the traditional supervision.It is the 2.0 era. The 3.0 era began after 2008 as first start-ups and established technology firms have started to offer financial services and products directly to enterprises and the general public [2]. That is, after that, more research focused on fintech.

3. Research of Fintech in Commercial Banks

3.1. Application of Fintech in Commercial Banks

Ba [3] summarized fintech as the use of AI technology, block chain, big data, cloud computing, and other innovations. He used these in the fields of payment and settlement, commercial insurance, asset management and other stroll finance. After that, he also conducted more in-depth research on the blockchain and believed that the important direction of the digital transformation of China's banking industry is to establish a fintech layer [3]. Elliott et al. [4], also believes that blockchain and distrib-

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uted accounting technology have subversive innovative effects, and it has produced a series of innovations in the banking industry [4]. Gong et al. (2017), also believed that blockchain, as the most cutting-edge technology of fintech, will provide more new solutions to reduce asymmetric information and will have a great impact and change on future finance. Zhou and Yan [5] divided the financial science and technology innovation of Chinese commercial banks into financial science and technology innovation based on information technology and non-information technology financial innovation based on segmented industry technology according to the integration type of "Finance + technology" [5].

Fintech is widely used in the development of credit financial products. Srivastava and Gopalkrishnan [6] applied big data to analyze the consumer behavior, multiple cross combinations of credit products and the relationship between emotion and customer feedback of Indian customers.It was discovered that banks may provide banks and customers with better financial information in the age of big data applications, resulting in more advantages for both banks and clients. Credit products will continue to develop and expand to a wider range [6]. It is mentioned in the China Financial Technology Report 2021 that the five major state-owned banks average invested in fintech exceeding 20 billion yuan in 2021. Sheng and Fan (2020) pointed out that the business management, product design, strategic layout, marketing channels and risk control links of commercial banks have changed greatly due to fintech.

Fintech can play a great role in information acquisition and affect the credit risk control of banks. The uncertainty of the borrower's repayment on time or in full is the mainly source of credit risk of commercial banks. Wang et al. [7] pointed out the uncertainty is mainly divided into horizontal and vertical factors: the vertical uncertainty is determined by the external macroeconomic environment and the horizontal uncertainty mainly comes from the information asymmetry when commercial banks lend to enterprises [7]. Lapavitsas and Santos [8] pointed out that the emerging fintech alleviates the information asymmetry between banks and borrowers, thus controlling the credit risk of banks [8]. Xie and Zou [1] believed that fintech such as big data can increase more sources of information channels and obtain more and more accurate customer information than traditional methods [1].

Fintech has also given a lot of suggestions on credit services for little- and medium-sized enterprises of commercial banks. Ding and Zhao [9] believed that the profit model of Internet micro credit companies is using cloud computing technology, they can extract high-value information such as credit characteristics, risk preference and capital demand from big data, quickly complete the matching of both lenders and borrowers, effectively manage risks, and achieve profits while improving efficiency [9]. Zhao and Zhao (2015) mentioned the risk control system of micro public banks based on big data application has made up for the defects of traditional credit rating and more accurately and effectively allocated financial resources.

3.2. Quantitative Methods Used in the Literature on Fintech in Commercial Banks

The key to understand how fintech and credit risk interact is lies in the quantitative method of fintech. As fintech is a relatively new concept and it is difficult to extract data about fintech, how to measure the development level of fintech is still a difficult problem in the financial field. Lv and Zhang (2020), studied and discussed the principles of scientificity, systematization, objectivity, comprehensiveness, comparability, operability and quantification in the construction of the evaluation index system for the development level of financial science and technology. It also puts forward 6 first level indicators, including resource input, service capacity, risk control capacity, basic capacity, R & D capacity and application capacity, and 15 second level indicators [10]. Due to the difficulty of data acquisition, it is difficult to obtain indicators, and the reliability and validity analysis and indicator reduction need

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to be further completed. Therefore, most of the current studies use the following methods to measure the level of fintech development:

Select existing fintech related indexes. The existing research mostly uses the financial technology index of Peking University to represent the development level of fintech. For example, Ding [11] adopted this index as the core independent variable, and found that the risk-taking motivation of the bank's liability side decreased in direct proportion to the region's fintech development [11]. Other existing indicators are also used. China Digital HP financial index was used by Qiu et al. (2018) as an indicator to measure the development of fintech.

Text mining method. Shen and Guo [12]: Based on the concept of financial function, establish the initial lexicon, and determine the initial lexicon of four dimensions from the perspective of financial function. Then calculate the word frequency of keywords with the aid of the Baidu search engine, and then apply correlation analysis to select successful keywords. After that, using the Pearson correlation analysis approach to determine the correlation coefficient between each keywords' word frequencies and the annual average of the unguided DEA Malmquist index after the initial keywords' word frequencies have been standardized [12]. With reference to Larson and Farber (2011), the remaining 11 keywords were retained. Finally, factor analysis is applied to synthesize Internet finance index. Later, many studies have used this method for reference, such as Jin et al. [13], obtained news search terms of various banks in 2010-2018 using Python web crawler technology. But what is different from the former is that its search statistics are the results of the number of news, not the frequency of keywords [13].

Text mining is a relatively novel method to evaluate the state of financial science and technology development. However, due to the large amount of data required, there are many factors that will affect the search results. For example, the degree of attention of news by Internet users will affect the search frequency of news, and the different investment of banks in advertising will also have a great impact on this. Therefore, it is very important to find more stable data and consider the differences in different terms of scale and business volume of banks.

Select representative indicators. It is one of the most common and representative methods in the existing literature to measure the level of fintech investment by selecting fintech related indicators. Gu and Yang [14] used the factor analysis method to synthesize the Internet finance comprehensive development index measurement model through the Internet finance payment and clearing, resource allocation, risk management and information processing function index measurement model, and measured the comprehensive development level of Internet finance [14]. This is a very intuitive method, but the disadvantage is that it measures the comprehensive development level of the fintech industry and cannot extract the fintech development level of commercial banks.

4. Research of Credit Risk of Commercial Banks

4.1. Macroeconomic Impact on Bank Credit Risk

Scholars all over the world have done some research on whether the macro-economy affects the credit risk of banks. In foreign studies, Rajan (1994) proposed the credit driven low-frequency business cycle theory, which showed the impact on bank credit risk. This theory successfully explained the Bank of England crisis in the 1990s. Micco & Panizza [15] found that the loan growth rate is closely related to the macroeconomic impact measured by the GDP growth rate. They also found that the credit cycle of industrialized countries is lower than that of developing countries [15]. Louzis et al. (2012) conducted an empirical analysis on Greek banking sector's non-performing loan rate and found that GDP, employment rate and deficit rate significantly impacted the banks' non-performing loan rate.

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Numerous academics in China are also researching the link between credit risk and macroeconomics. Li and Suo [16] conducted an empirical investigation on the connection between cyclical changes in the economy and non-performing loans by using the time series method. The findings demonstrate a substantial inverse dynamic association between economic fluctuations and non-performing loans under the credit cycle features of China's economic fluctuations [16]. Kong believes that macroeconomic fluctuations affect the profitability of credit assets [17].

4.2. Competition Between Banks Affects Its Own Credit Risk

Peng and Li [18] conducted empirical research on GMM model of dynamic panel system and panel data threshold model based on pertinent data from 24 urban commercial banks in China between 2008 and 2013. The results show that the intensification of bank price competition caused by the marketization of deposit and loan interest rates will increase the income volatility and bankruptcy risk of urban financial institutions. This will make it harder to raise capitalization levels and increase the risk of non-performing loans [18]. Keeley (1990) has the same conclusion. The research shows that with the increasingly fierce competition among banks, the franchise value declines. Banks will increase their risk bearing, leading to an increase in credit risk. However, the research results of Arping [19] are opposite. He believes that the intensified competition will lead to a decline in profits, and banks will face threats. Banks will reduce their risk exposure to cope with this situation [19].

4.3. Operational Efficiency of Banks Affects Credit Risk

Khan et al. [20] found that by studying the data from American commercial bank holding firms, it may be determined that the credit risk rises when bank funding is difficult. But capital adequacy ratio can limit credit risk. However, there are still controversies about whether commercial banks' capital adequacy level can manage credit risk [20]. Calem & rob (1999) thinks that the capital scale and risk bearing of banks have a "U" shaped relationship that initially declines and then grows. It means that when the capital scale exceeds the critical value, the bank will bear greater risks.

5. Research of the Influence of Fintech on Credit Risk of Commercial Banks

In recent years, fintech has attracted more and more attention, and its position in the financial sector has also been increasingly enhanced, especially for commercial banks. Among them, fintech has a more complex effect on commercial banks' credit risk. Many scholars continue to explore this topic. The current research shows that scholars have divergent results.

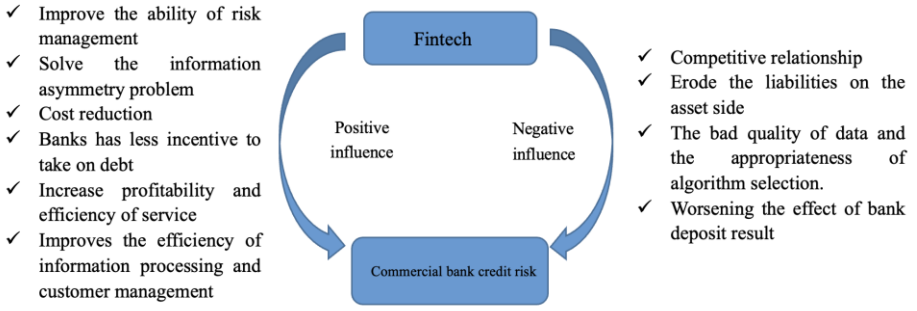

Figure 1: The influence of fintech on credit risk of commercial banks.

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5.1. Fintech Has Increased the Credit Risk of Commercial Banks

Some studies believe that fintech brings more credit risks to commercial banks.Wang [21], based on the perspective of financial function, found that the expansion of fintech will lead to a competitive relationship with conventional commercial banks, erode the liabilities of commercial banks and carry out differentiated competition with banks on the asset side, which has an bad impact on commercial banks[21]. Guo and Shen [22] conducted an empirical test on 83 commercial banks in China through a multiple intermediary effect model [22]. The research demonstrates that the growth of Internet finance has dramatically increased bank risk bearing through two channels, including deteriorating the deposit structure and raising the interest payment cost. As for Internet finance, the regulatory authorities can build a risk regulatory system with both generality and particularity to prevent various risks while promoting the role of Internet Finance. Ashta & Herrmann [23] believes that artificial intelligence is conducive to reducing the comprehensive cost of banks and improving the differentiated competitiveness. However, the accuracy of artificial intelligence is determined by the quality of data and the appropriateness of algorithm selection. Therefore, artificial intelligence will bring potential credit risk to commercial banks [23].

5.2. Fintech Has Decreased the Credit Risk of Commercial Banks

However, some other studies believe that fintech provides new technical methods and solutions for reducing credit risk. Fintech will promote financial transformation and upgrading.

Guo and Shen [12] constructed the Internet finance index as the core explanatory variable through text mining method, and concluded that the Internet finance has a "U" trend on bank credit risk [12]. Yang and Duan [24] think that the information technology innovation led by data, cloud computing and blockchain has solved the information asymmetry problem faced by commercial banks. In particular, the application of blockchain technology can realize the truthful recording of massive data and make it difficult for artificial fraud, which is convenient for banks to conduct real credit evaluation on enterprises, thus reducing the bank's credit risk [24]. Based on the panel data of 40 Commercial Banks in China from 2011 to 2019, Yang and Hong [25] found that the fintech index was significantly adversely connected with the credit risk of commercial banks. The use of fintech by commercial banks can effectively alleviate information asymmetry in credit, improve credit quality and significantly reduce credit risk. Fintech also improves the efficiency of information processing and customer management of commercial banks, controls the concentration of loans and the excessive growth of loans, thereby dispersing and reducing credit risks [25].

In general, commercial banks use fintech to improve the traditional business model, improve the efficiency and ability of profitability, enhance the risk control ability, and greatly reduce the credit risk.

6. Conclusion

This paper collates the literature from five aspects: Concept development of fintech, Research of fintech in commercial banks, Research on quantitative methods of commercial banks in fintech, Research of credit risk of commercial banks, Research of the influence of fintech on credit risk of commercial banks. The current research has clearly defined the concept of fintech. A certain research on fintech from different angles has been done. In recent years, people have paid more and more attention to fintech. Fintech plays an important role in the whole financial market. Many scholars start from the risk of fintech and continue to explore. However, because the time of fintech application is short, there are still limitations in some aspects.

In the current fintech quantification methods, there are certain limitations in using the existing fintech related indexes or using the relevant representative indicators. And in the text mining method,

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there also has deviation due to other influencing factors in the selected data and omissions in the database selection. The most important thing is that the sample size is relatively small. The paper reduces the error by increasing the number of selected banks and adding keywords related to financial technology. It is necessary to continue to explore how to narrow the gap with the reality in measuring the development level of fintech. But in current history, the fintech of banks has advanced significantly, and the disclosure of fintech information by banks has become more and more complete. The fintech index calculated by text mining may be more accurate in the future. However, due to the tedious operation of the text mining method, we need to continue to find a more concise and convenient method to calculate the fintech index.

Currently, there is a fair amount of study on the credit risk of commercial banks, but there is less literature that systematically and thoroughly examines how fintech level affects the credit risk of commercial banks. Most of them are from a certain angle, such as based on micro and small enterprises. Therefore, the next direction should link the research on the credit risk of commercial banks and the development of financial technology. And there are few quantitative studies, so it's an interesting study to use the updated quantitative model to conduct empirical research on this topic. This paper sorts out the positive and negative views on the impact of fintech on the credit risk of commercial banks. This paper finds that more research supports fintech to reduce bank credit risk. But more comprehensive quantitative studies are needed to explore this complex problem.

Fintech still has great potential for improvement. Commercial banks are constantly exploring the innovation and development of fintech. However, commercial banks still need to strengthen the new risk management and control in the development of fintech, so as to realize that commercial banks do not lose scientific and technological dividends and do not increase risks.

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