ISSN 2523-4714
UDC 336

T. Prokhorova, Shangyuan Guo
School of Business of BSU, Minsk, Belarus

THE IMPACT OF DIGITAL TRANSFORMATION ON CREDIT RISK OF CHINESE STATE-OWNED COMMERCIAL BANKS

The article substantiates the need to manage credit risks in terms of their role in the emergence of banking crises. The current situation of digital transformation of the banking industry in China has been studied. An empirical analysis of the impact of digital transformation of state and non-state commercial banks on credit risks is presented. Recommendations are formulated for organizing credit risk control in the context of digital transformation.

Keywords: *commercial banks*, *digital transformation*, *credit risk*

For citation: Prokhorova T., Guo Shangyuan. The impact of digital transformation on credit risk of Chinese state-owned commercial banks. *Biznes. Innovatsii. Ekonomika = Business. Innovations. Economics*. Minsk, 2023, iss. 8, pp. 107–113.

Т. В. Прохорова, Шаньюань Го
Институт бизнеса БГУ, Минск, Беларусь

ВЛИЯНИЕ ЦИФРОВОЙ ТРАНСФОРМАЦИИ НА КРЕДИТНЫЙ РИСК КИТАЙСКИХ ГОСУДАРСТВЕННЫХ КОММЕРЧЕСКИХ БАНКОВ

В статье обосновывается необходимость управления кредитными рисками с точки зрения их роли в возникновении банковских кризисов. Изучена текущая ситуация цифровой трансформации банковской отрасли Китая. Представлен эмпирический анализ влияния цифровой трансформации как государственных, так и негосударственных коммерческих банков на кредитные риски. Сформулированы рекомендации по организации управления кредитными рисками в условиях цифровой трансформации.

Ключевые слова: *коммерческие банки*, *цифровая трансформация*, *кредитный риск*

Для цитирования: Прохорова, Т. В. Влияние цифровой трансформации на кредитный риск китайских государственных коммерческих банков / Т. В. Прохорова, Шаньюань Го // Бизнес. Инновации. Экономика : сб. науч. ст. / Ин-т бизнеса БГУ. – Минск, 2023. – Вып. 8. – С. 107–113.

Introduction

Digital transformation is a comprehensive and systematic process that has a positive impact on the development of the banking industry. However, the implementation of digitalization measures is associated with many problems. In modern macroeconomic conditions, commercial banks face high risks, one of the most significant is commercial risk.

Digital transformation involves an organization adopting a comprehensive digital approach to transform its business model to operate in a more advanced and efficient digital mode [1]. Digital transformation consists of two aspects: digital transformation within a company helps you work faster and more flexibly, and also modernizes the internal environment of the company; digital transformation outside the organization will help the company achieve higher customer satisfaction. Digitalization undoubtedly has a positive effect for commercial banks, in particular, it allows optimizing the business processes of bank lending. Thanks to digital transformation, commercial banks will be able to more effectively use cloud technologies and big data technologies to analyze customer information and can make a more accurate assessment of the customer's creditworthiness.

However, digital transformation is a comprehensive and complex process, and its implementation faces a number of challenges, which exacerbate existing risks and create new ones [2]. In particular, following the digital transformation of commercial banks, many online credit products have lower entry thresholds for customers and allow for quick issuance of loans, which increases the credit risks of banks. In addition, credit products may be issued to some customers with poor credit histories, especially in the event of a data system failure.

The purpose of the presented study is to assess the impact of digital transformation on the amount of credit risks of Chinese commercial banks and to formulate recommendations for improving the digital transformation process.

In world practice, many methods have been developed for analyzing credit risks; economic and mathematical modeling is widely used. In the research of modern scientists, balance sheets are used; market; macroeconomic; rating; hybrid models [3].

In this work, time series analysis methods and a panel data model were used to study the relationship between the degree of digital transformation and the level of bank credit risk. The data of Chinese state-owned commercial banks and non-state-owned commercial banks from 2012 to 2021 are exploring as samples to examine the relationship between digital transformation of commercial banks and bank credit risk by constructing a panel data model.

The data of 15 banks are selected as the sample for empirical analysis. These banks include both large state-owned banks and joint-stock commercial banks and urban commercial banks, which have good governance and complete financial data and can better represent the development of commercial banks in China.

Concept and content of credit risk

Since 1980, banking crises have been widespread worldwide, and more than half of the countries have experienced serious problems in their banking systems. The debt-based banking crisis in Latin America in the early 1980s, the Savings and Loan Association crisis in the United States in the 1990s, and the financial crisis in Mexico in 1994 have shown that credit risk poses a great impact and threat to the safety of banks and the development of the world economy [4].

Credit risk is the most lethal of all risks faced by banks. At present, the credit risk metrics management system of Chinese commercial banks is not yet sound, so is difficult to help commercial banks effectively reduce credit risk [5]. Credit risk has long been viewed by the entire financial industry as the oldest and most dominant financial risk, and its widespread existence is a reflection of an important feature of the modern financial economy. Research and studies on this unchanged topic of credit risk have never ceased, and control methods have emerged [2].

However, there is no uniform definition of credit risk. In a narrow sense, it is only a risk of loan default, which is the possibility of loss of loan funds due to uncertainties in the management of the bank's business operations. In a broader sense, credit risk has been broadened to include the performance of economic activities in the field of credit and the probability of loss due to various uncertainties that cause a serious deviation from the goals and benefits of the credit process.

In accordance with the legislation of the Republic of Belarus, credit risk is the risk of the bank experiencing losses, non-receipt of planned income due to non-fulfillment, untimely or incomplete fulfillment by the debtor of financial and other property obligations to the bank in accordance with the terms of the agreement or legislation[1].

Credit risk often has the following characteristics:

1) Objectivity. Credit risk always exists objectively and does not shift by human will. In business management, it can only be minimized and maximized in terms of losses and gains.

2) Uncertainty. Credit risk is a concomitant of various uncertainties, and it is a product of the constant changes in macroeconomic activities. It is impossible for people to fully grasp his regularity.

[1] Инструкция об организации системы управления рисками : постановление Правления Национального банка Респ. Беларусь, 29 окт. 2012 г., № 550 : с изм. и доп., внесенными постановлениями Правления Национального банка от 26.06.2020 № 214; 19.07.2021 № 207. – URL: https://www.nbrb.by/legislation/documents/pp550(12).pdf (дата обращения: 09.05.2023).

3) Duality. Credit risk has both positive and negative deviations, that can motivate people to better develop innovation, gain extra income, and promote financial deepening.

4) Relevance. This objective property of credit risk determines that it is influenced not only by its own economic activities and decisions, but also by the behavior of the economic activities of its service recipients.

5) Controllability. Credit risk is difficult to eliminate. As long as we adopt a proactive attitude, find reasonable mechanisms and measures, and turn reactive into proactive, we can minimize its adverse impact in economic activities.

With the development of the economy, the credit system dominated by bank credit has become a key factor in the operation of the economy, and production and transactions based on contractual contracts are becoming more and more common in modern economic activities. Credit risk is a concentrated reflection of economic risk [6]. In short, bank credit risk is the possibility of loss or gain. Both losses and gains are inevitable phenomena in a particular economic mechanism. The study of bank credit issues should not be limited to banks themselves, but should also be integrated into the level of economic operation.

Once the economic operation process is born against the economic laws, then the bank's credit capacity will be constrained with it. According to this understanding, bank credit risk should be defined as the probability of loss of bank funds in the whole process due to the role of various potentially unstable factors in economic activity, which cause the economic agent to deviate from its own course and possible deviation of actual earnings from its own goals [7].

Current Situation of Digital Transformation and Credit Risk in Chinese Commercial Banks

The People's Bank of China released the results of the self-assessment of digital capabilities for the implementation of the Financial Technology Development Plan (2019–2021) [8]. From the overall situation, there is still a large room for the improvement. The average score of the digital capability self-assessment of the surveyed banks is 3.01 from 5, and about half of the surveyed banks score below 3 in the self-assessment. There are some differences in the six categories of digital capabilities, with relatively high self-assessment scores for strategic planning (3.47 points) and business processes (3.27 points), relatively low self-assessment scores for technological innovation (2.45 points). And in descending order for other areas: data governance (3.03 points), organizational culture (2.97 points) and ecological cooperation (2.88 points) [8]. Thus, there is a lot of potential to unlock opportunities.

Credit risk is one of the main risks faced by commercial banks. The credit risk of commercial banks is managed and controlled by the internal risk supervisory department in addition to the supervision and management of the China Banking Regulatory Commission (CBRC), and the non-performing loan ratio is an important indicator of the credit risk of banks. The higher balance of non-performing loans of commercial banks means the worse asset quality of commercial banks and the greater credit risk they face.

Table 1 shows the trend of non-performing loans and non-performing loan ratio of commercial banks from 2016 to 2022, which are counted and published by China Banking Regulatory Commission.

Table 1

Non-performing loan ratio and non-performing loan amount of commercial banks in China

Year	Non-performing loan balance (trillion yuan)	Non-performing loan ratio (%)
2016	1.51	1.74
2017	1.71	1.74
2018	2.03	1.83
2019	2.41	1.86
2020	3.5	1.92
2021	2.8	1.73
2022	2.98	1.63

Source: [10].

In 2017, the NPL ratio of commercial banks in China is 1.74 % [9], reaching a maximum of 1.92 % in 2020, and sliding to 1.71 % in 2022 [10]. According to the regulatory regulations of the CBRC, the NPL ratio of Chinese commercial banks should not be higher than 5 % [11]. And it can be found from Table 1 that the NPL ratio level of commercial banks has been lower than this regulatory standard since 2016. However, this does not necessarily indicate that the risk management capability of commercial banks has been improved.

In June 2023, the loan balance of financial institutions in domestic and foreign currency was 235.73 trillion yuan, an increase of 10.6 % year on year, of which the loan balance of commercial banks was 196.96 trillion yuan. During the same period, commercial banks' non-performing loan balance was 3.2 trillion yuan, up 217.2 billion yuan from the end of the previous year. In the first six months of 2023, financial institutions wrote off 465.4 billion yuan of problem loans [12].

At present, the global economic growth is sluggish. In this context, commercial banks should pay attention to strengthen the management of credit risk, improve the quality of commercial banks' credit assets and prevent the accumulation of bank credit risk.

According to the evaluation standard of the U.S. banking industry, banks with better asset quality tend to have a non-performing loan ratio of less than 0.5 %. To reach the 0.5 % standard, Chinese commercial banks still have a difficult task, especially rural commercial banks and state-owned commercial banks, which should improve their credit management system, strengthen their internal control, enhance the quality of bank assets and thus strengthen their ability to cope with credit risks in their future operations.

Empirical Analysis of the Impact of Digital Transformation on Credit Risk of Chinese State-owned Commercial Banks

In selecting the sample subjects, state-owned commercial banks, joint-stock banks, and urban commercial banks were included in a comprehensive manner. The data sources are the annual reports of the banks, the WI Harper database, the Guotaian database, and the National Bureau of Statistics. The 15 banks selected are Bank of China, Construction Bank, Industrial and Commercial Bank of China, Bank of Communications, Agricultural Bank, Minsheng Bank, CITIC Bank, Everbright Bank, Ping An Bank, Industrial Bank, Bank of Beijing, China Merchants Bank, Bank of Nanjing, Huaxia Bank, and Bank of Ningbo. These banks have good governance and complete financial data, which can better represent the development and performance level of Chinese commercial banks. The data of these banks from 2012 to 2021 are selected as the sample data.

There is no consensus among academics on the measurement indicators of digital transformation of commercial banks. Through the latest research results of CSMAR – Digital Economy Research Database, data on the degree of digitalization of listed banks were selected to measure the degree of digitalization of sample banks using the digital technology application field.

In general, the larger the asset size, the more assets a commercial bank has available to address credit risk, and the less credit risk a commercial bank will face. Therefore, the credit risk of commercial banks shows a negative relationship with the size of bank assets.

The capital adequacy ratio of commercial banks and the national inflation rate also have an impact on the credit risk of banks. And the more adequate capital indicates that commercial banks are more capable of coping with risks. A higher inflation rate indicates a poorer macroeconomic level and commercial banks may face greater credit risk.

Model building:

$$NDR_{it} = \beta_1 DF_{it} + \beta_2 LNSIZE_{it} + \beta_3 IR_{it} + \beta_4 LR_{it} + \varepsilon_{it},$$

where NDR – non-performing loan rate; DF – degree of digitization (according CSMAR database data); $LNSIZE$ – bank size (natural logarithm of total assets at the end of the year); IR – inflation rate; LR – liquidity ratio; i – represents the i-th bank and t denotes time; ε_{it} – residual term.

In order to avoid the problem of spurious regression in model estimation, it is necessary to build the model with a stationary time series to ensure the reliability of the model results. To determine whether the variables are stationary or not, we first conduct unit root test on the variables and use *ADF* (Augmented Dickey – Fuller) test to test the stationary of the variables, see Table 2.

Table 2

ADF test results

Variables	Test form	ADF statistic value	ADF statistic critical value			Conclusion
			1 %	5 %	10 %	
NDR	(C, T, 0)	–5.3712	–4.6239	–3.7094	–3.3126	Stationary
DF	(C, T, 0)	–4.1374	–4.6162	–3.7104	–3.297799	Stationary
LNSIZE	(C, T, 0)	–4.1059	–4.6162	–3.7104	–3.2977	Stationary
IR	(C, T, 0)	–3.4059	–4.6678	–3.7332	–3.3103	Stationary
LR	(C, T, 0)	–6.1329	–4.6678	–3.7332	–3.3103	Stationary

Note. *C* represent the constant term; *T* – the trend term; $K = 0$ represents the order of stationarity.

S o u r c e: authors' developed.

This is a statistical test that belongs to the unit root test which tests the null hypothesis. The Eviews software was chosen to conduct regression analysis, and the results are shown in Table 3.

Table 3

Table of regression coefficients

Variables	Coefficient	*t*-statistic	*P*-value
DF	–0.349***	–11.128	0.001
LNSIZE	–0.336***	–9.245	0.002
LR	–0.288***	–8.175	0.007
IR	0.213**	7.204	0.042
R^2	0.849		
F_VALUE	71.26		

Note. *** ⇔ $\alpha = 0.01$; ** ⇔ $\alpha = 0{,}05$; * ⇔ $\alpha = 0{,}10$.

S o u r c e: authors' developed.

The R^2 coefficient is greater than 0.7, which indicates that the model can explain the dependent variable well.

The *F* – value is greater than the critical value, which indicates that the regression equation passes the adequacy test.

The regression coefficient of *DF* is $|-0.349|$ and the *t* value is $|-7.128|$, and the regression coefficient is significant at the 1 % level, which indicates that the digital transformation of commercial banks is beneficial for commercial banks to reduce credit risk.

Among the control variables, inflation rate is positively related to bank credit risk, bank liquidity is negatively related to bank credit risk, and bank size is negatively related to bank credit risk.

Further verify the impact of digital transformation on credit risks shows that the impact is more pronounced in state-owned commercial banks.

Measures to support digital transformation

The digital economy is an economy of interconnectivity, sharing and openness, an economy in which practitioners reconfigure the business models with new technologies and digital processes to achieve a better and more efficient allocation of resources. It can be foreseen that organizations that promote intelligence, digitalization and technology will certainly be able to withstand the risks and cope better with the challenges in the future [13].

Developing an effective business strategy will help ensure the successful implementation of the transformation of commercial banks. The work related to the transformation should be led by a chairman, and a digital transformation office will be created at the headquarters to ensure the effective

implementation of the developed strategy. The office at headquarters is responsible for coordinating the departments involved in the transformation, managing the transformation budget and managing the personnel involved.

At the same time, strategy goals must be broken down into individual projects and modules that are carefully monitored to ensure the feasibility of transformation initiatives. During the period of transformation, weekly as well as monthly reporting and communication are necessary to ensure that the problems existing in the bank during the period of transformation can be resolved effectively and intelligently, and that the formulated strategic program can be implemented smoothly and with good results.

In the process of digital transformation of commercial banks, it is necessary to optimize the interaction between the business unit and the IT department. The business department must have technical staff, and the technical department must know the business processes. Banks need to take steps to create digital talent to achieve an overall improvement in the quality of their workforce. Accordingly, staffing levels need to be continually adjusted, as well as investing in a personal technology infrastructure platform to support digital talent.

Conclusions

In modern conditions of development of the banking industry, credit risks are among the most significant. The credit risk management system of Chinese commercial banks is not yet reliable, and therefore requires study and adjustment of the application methodology.

In the course of empirical analysis of data from large state-owned banks, joint-stock commercial banks, as well as urban commercial banks, the following conclusions were drawn:

– the share of non-performing loans of Chinese commercial banks has been trending downward in recent years;

– the digital transformation of Chinese commercial banks helps reduce the credit risk faced by banks;

– the impact of digital transformation of state-owned commercial banks on credit risk is higher than that of non-state-owned commercial banks.

In the process of digital transformation of commercial banks, it is necessary to optimize the organizational structure; first of all, it is recommended to create a digital transformation office at the headquarters to ensure the effective implementation of the digital transformation strategy. Office staff will be responsible for coordinating the work of departments involved in the transformation, managing the transformation budget and managing personnel involved in transformation activities and projects. The proposals presented in this article are aimed mainly at the heads of state-owned commercial banks in China, but can be successfully applied in other banking structures in various countries.

References

1. Lu Miao Miao, Sun Zhong Hui, Liu Xiaoye. Internal competitive pressure or external competitive impact? – A study on the motivation of digital transformation of commercial banks. *Dongyue Series*, 2023, vol. 44 (03), pp. 132–140.

2. Guo Mingjing. Research on the problems and countermeasures of comprehensive risk management of small and medium-sized commercial banks in China in the context of digital transformation. *Shanghai Business*, 2023, no. 04, pp. 94–96.

3. Tkatchev A., Shypunou A. Using mathematical economic models in the activities of credit rating agencies. *Vestnik Belorusskogo gosudarstvennogo ekonomicheskogo universiteta = Belarusian State Economic University Bulletin*, 2021, no. 3, pp. 65–72 (in Russian).

4. Wang Minghao, Guan Long. Study on digital transformation of commercial banks' credit management. *Foreign Economic and Trade*, 2023, no. 04, pp. 49–52.

5. Wu Jing, Zhou Nan, Cui Kai. Research on digital transformation of commercial banks' credit model. *Business Development Economics*, 2023, no. 8, pp. 89–91.

6. Jiang Zhenxing. Status and experience of digital transformation of commercial banks in the context of «digital China». *Journal of Modern Finance*, 2023, no. 03, pp. 4–8.

7. Meng Wenxia. How to synchronize talent building in commercial banks under digital transformation. *Human Resources*, 2023, no. 6, pp. 36–37.

8. A survey study on digital transformation of Chinese commercial banks. Banking and credit. Tsinghua Financial Review. 2020, China. Available at: https://baijiahao.baidu.com/s?id=1668274301377923146&wfr=spider&for=pc (accessed 9 May 2023).

9. How many sets of data on the formation and disposal of non-performing loans of Chinese commercial banks in recent years? *Headline Business Network*, 2023. Available at: http://ttjyt.com/index.php?m=content&c=index&a=show&catid=9&id=749 (accessed 10 May 2023).

10. CBRC: As of the end of 2017, the non-performing loan rate of commercial banks was 1.74 %. First Finance and Economics, 2018. Available at: https://www.yicai.com/news/5399631.html (accessed 9 May 2023).

11. Non-performing loan ratio of banking sector to drop to 1.92 % by the end of 2020. Xinhua News Agency, 2021. Available at: http://www.gov.cn/xinwen/2021-01/22/content_5581989.htm (accessed 9 May 2023).

12. First half of 2023: Multidimensional analysis of non-performing loans of commercial banks. Available at https://mbd.baidu.com/newspage/data/landingsuper?context= %7B %22nid %22 %3A %22news_9625179786563047353 %22 %7D&n_type=1&p_from=4 (accessed 9 May 2023).

13. Guo Shangyuan. Credit Transformation of Commercial Banks in the Context of Digitization. Aktual'nye vektory belorussko-kitaiskogo torgovo-ekonomicheskogo sotrudnichestva: sbornik statei III Mezhdunarodnoi nauchno-prakticheskoi konferentsii, Minsk, 16 dekabrya 2022 [Current vectors of Belarusian-Chinese trade and economic cooperation: collection of articles of the III International scientific and practical conference, Minsk, December 16, 2022]. Minsk, 2023, pp. 212–219 (in Russian).

Information about the authors

Prokhorova T. – PhD in Economic sciences, Associate Professor; associate professor at the Department of business administration, School of Business of BSU, e-mail: prokhorova@sbmt.by

Guo Shangyuan – PhD student, School of Business of BSU, e-mail: 709742898@qq.com

Информация об авторах

Прохорова Татьяна Владимировна – кандидат экономических наук, доцент; доцент кафедры бизнес-администрирования, Институт бизнеса БГУ, e-mail: prokhorova@sbmt.by

Го Шаньюань – аспирантка, Институт бизнеса БГУ, e-mail: 709742898@qq.com

Received by editorial board 02.10.2023

Статья поступила в редколлегию 02.10.2023