

Research on the Impact of Digitalization on Risk Taking in Commercial Banks

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Abstract. Commercial banks are confronted with both tremendous opportunities and formidable challenges as a result of the digital transformation, given the swift growth of the digital economy and the advancement of financial technology. This paper selects 131 commercial banks as research samples from 2010 to 2023, and empirically examines the effect of digital transformation on bank risk-taking and its path. It is found that digital transformation of commercial banks can significantly reduce banks' risk taking. The mediation mechanism test shows that commercial bank digital transformation reduces bank risk-taking mainly by improving bank operational efficiency and reducing bank management costs.

Keywords: commercial banks, digital transformation, risk taking, operational efficiency, management costs

1. Introduction

Synergistic innovation between digital technology and the real economy has emerged as the primary means of enhancing the economy's quality and efficiency at a time when the digital economy wave is reshaping the social production paradigm and governance structure [1]. As an important hand to achieve the development of the digital economy and the integration of digital and real, digital transformation requires financial institutions, especially commercial banks, to penetrate the digital concept into the whole cycle of financial services and embed intelligent decision-making mechanisms into all aspects of business operations. With the value mining of data elements and the scenario-based application of digital technology, the banking industry can reconstruct the service boundary and business paradigm, and then develop a financial service ecosystem with the characteristics of the digital era. This change not only strengthens the support for the digital transformation of enterprises, but also strongly promotes the systematic integration of the digital economy and the real economy.

The relationship between digital transformation and commercial banks' risk-taking has been interpreted in a variety of ways in previous research. From a risk suppression standpoint, Jiang Hai and Tang Shenfeng discovered empirically that the use of digital technology can lower expenses and boost productivity by streamlining the risk management procedure and improving the effectiveness

of capital allocation in two ways, which in turn lowers banks' risk-taking [2]; some scholars believe that the application of digital technology within the bank will have a positive impact on the bank's risk-taking through the liquidity creation channel, the ex ante information channel, the management channel, and the ex post loss channel, etc [3]. According to several other academics, there is a non-linear relationship between commercial banks' risk-taking and digital transformation, Liu Huichao and Wang Shuhua demonstrate an inverted U-shaped link between the digital transformation of small and medium-sized banks and their level of risk, given the combined pressure of transformation costs and operational risks at the stage of technology introduction and system development; with digital technology and core business deeply integrated, using intelligent risk control platforms significantly improves the accuracy of risk warnings, reduces default risk, and ultimately decreases risk for small and medium-sized banks [4].

2. Theoretical analysis and research hypotheses

Driven by digital technology, the digital transformation of commercial banks has led to changes in the traditional business model of banks. The embedding of digital technology systems has effectively solved this problem. Commercial banks build a big data risk control system, integrate artificial intelligence algorithms and machine learning models to achieve an accurate match between customer risk preference portraits and dynamic credit assessment, alleviating the problem of information asymmetry. Long-tail customers will also be listed as key customers after the bank's digital transformation, which improves user stickiness, optimises the revenue structure while expanding the source of non-interest income, and commercial banks will actively adjust their risk preferences and reduce the proportion of high-risk asset allocations, forming a path of action for the impact of digital transformation on risk taking. Digital transformation improves profitability by broadening the bank's profit space, improves risk management ability and information recognition ability, reduces the risk brought about by information asymmetry, and then reduces the bank's overall risk-taking.

Considering the analysis above, Hypothesis 1: Commercial banks' digital transformation can lower their risk-taking.

Through cost-benefit analysis, when commercial banks undertake digital transformation, they must measure the cost of inputs against the expected benefits to ensure that the transformation can be most effective in improving operational efficiency and optimising resource allocation. First, from the standpoint of cost-effectiveness, commercial banks' digital transformation lowers overhead, capital expenses, and manual processes [5]. Second, from the perspective of revenue efficiency, the digital transformation of commercial banks can innovate service methods, enhance the ability to collect and analyse customer and market information, and accurately portray customer needs, thus enhancing customer acquisition and improving revenue efficiency. The improvement of operational efficiency leads to a more rational allocation of resources, helping banks to identify potential risks more accurately and reduce risk-taking effectively.

The principle of economy of scale points out that as the scale of production expands, the cost of a single product decreases, and the marginal efficiency increases accordingly. In the process of digital transformation, digital technology empowerment breaks through the time and space constraints of traditional financial services, improves the convenience and accessibility of financial services, realises the centralised configuration and shared management of cross-sectoral and cross-regional resources through the constructed unified digital platform, improves the quality and efficiency of single business processing, and reduces the management cost of unit business. In terms of business transformation, banks have gradually reduced their path dependence on physical outlets through

digital channel reconstruction strategies and promoted the online presence of their business, thus improving operational efficiency and cutting costs [6]. Reducing the management costs of commercial banks is conducive to reducing the risks they bear. On the one hand, the reduction of management costs allows banks to have more funds to strengthen the internal control system, put more resources into the field of risk control, so as to be able to take appropriate preventive measures in a timely manner, effectively control the risks, and reduce the overall level of risk-taking. On the other hand, the use of digital technology decreases the bank's risk-taking by improving the quality and timeliness of information transmission, which boosts internal coordination efficiency and lowers communication costs [7].

The second research hypothesis states that by increasing operational effectiveness and cutting administrative expenses, commercial banks' digital transformation can lower their risk-taking.

3. Research design

3.1. Definition of variables

3.1.1. Explained variable

The level of risk-taking by commercial banks is the main explanatory variable in this article. In the existing literature, the common indicators for measuring banks' risk-taking include Z-value, non-performing loan ratio and risk-weighted asset ratio. Given that the Z-value is a comprehensive measure of a bank's operational stability, profitability and financial leverage, and can comprehensively characterise a bank's risk level, this paper chooses to use the Z-value as an indicator of commercial bank risk-taking. Considering the characteristics of Z-value with sharp peaks and thick tails and high degree of skewness, the natural logarithm of Z-value is taken. The higher the Z-value, the lower the commercial banks' risk-taking, or the smaller the banks' risk-taking, as a negative sign. Based on the research method of Ding Ning and Wu Xiao, this paper will use the following formula to calculate the Z value [8]:

$$Z = (ROA_{it} + CAR_{it}) / \sigma(ROA_{it}) \quad (1)$$

Where ROA_{it} is the return on assets of commercial banks, $\sigma(ROA_{it})$ is the standard deviation of the return on assets using a rolling standard deviation every three periods, and CAR_{it} is the percentage of equity assets. The larger the value of $\ln Z$, the lower the bank's risk-taking.

3.1.2. Primary explanatory variable

In order to gauge the extent of digital transformation of commercial banks, this study uses the digital transformation index of Chinese commercial banks, which was developed by Xie Xuanli and Wang Shihui from the Digital Finance Research Centre of Peking University [9]. The index is derived from the three aspects of management, business, and strategic digitization, and integrates these three dimensions to construct an overall index of commercial banks' digital transformation.

3.1.3. Control variables

Chose the following control variables based on Guo Feng et al.: size of the bank (LNZC), represented as the natural logarithm of commercial banks' total assets; deposit-to-lending ratio (LDR), measured as the ratio of the bank's total loans to its total deposits; return on interest-earning

assets (NIM), expressed as the proportion of its net interest revenue to the bank's total interest-earning assets; Capital Adequacy Ratio (ANMZ), measured by the bank's year-end capital adequacy ratio; and Non-Interest-Inducing Assets Ratio (NIIR), measured by the proportion of non-interest income [10].

3.1.4. Mediating variables

On the basis of the theoretical analyses in the previous section, this paper finally selects operating efficiency (ZZWR) and management cost (GLCB) as mediating variables. Referring to the study of Jiang Hai et al. (2023), the operating efficiency of commercial banks is measured by the total asset turnover ratio, and the larger the value of this indicator, the higher the operating efficiency of the bank. On the other hand, the ratio of operational income to management cost is used to calculate management cost; the higher the ratio, the higher the management cost of the bank.

3.2. Modelling

This study builds the following regression model for empirical research in order to confirm the effect of digital transformation on bank risk-taking:

$$Risk_{i,t} = \alpha_0 + \alpha_1 DT_{i,t} + \alpha_2 Control_{i,t} + \mu_i + \theta_t + \varepsilon_{i,t} \quad (2)$$

where i denotes an individual bank, t denotes time, the explanatory variable commercial bank risk-taking is captured by $Risk_{i,t}$, Z-Score denotes the Commercial banks' digital transformation, $Control_{i,t}$ denotes the control variables mentioned above, μ_i represents the fixed effect of commercial banks individually, θ_t indicates that commercial banks have a year-fixed influence, and $\varepsilon_{i,t}$ denotes the random error term.

To test study H2, the following mediation model was constructed:

$$ZZWR_{i,t} = \beta_0 + \beta_1 DT_{i,t} + \beta_2 Control_{i,t} + \mu_i + \theta_t + \varepsilon_{i,t} \quad (3)$$

$$GLCB_{i,t} = \gamma_0 + \gamma_1 DT_{i,t} + \gamma_2 Control_{i,t} + \mu_i + \theta_t + \varepsilon_{i,t} \quad (4)$$

where $ZZWR_{i,t}$ denotes operational efficiency, $GLCB_{i,t}$ denotes management costs, $Control_{i,t}$ denotes the relevant control variable, and the other symbols have the same meaning as described earlier.

3.3. Sample selection and data sources

Given the availability of data, panel data of a total of 131 commercial banks for the period from 2010 to 2023 are selected as a sample for this study. The financial data of commercial banks used in this study are obtained from databases such as WIND, CSMAR and CNRDS. For some of the missing data, some of the missing values were supplemented by manually finding bank financial statements and interpolation. The "digital transformation of commercial banks" index was created by Peking University's Digital Finance Study Center study group and is used by the commercial banks' digital transformation index.

4. Analysis of empirical results

4.1. Benchmark regression analysis

This paper uses a two-way fixed-effects model for benchmark regression analysis, and the results are shown in Table 1. column (1) shows that digital transformation of commercial banks significantly reduces risk-taking, and the result remains significant after adding control variables in column (2). Columns (3) to (5) analyse the three sub-indicators of strategic, operational and managerial digitisation, respectively, and all confirm that digital transformation helps to reduce bank risk-taking, supporting Hypothesis 1.

Table 1: Benchmark regression analysis results

VARIABLES	Risk	Risk	Risk	Risk	Risk
	(1)	(2)	(3)	(4)	(5)
DT	0.041** (2.40)	0.037*** (2.75)			
DT_ZL			0.009*** (2.68)		
DT_YW				0.016* (1.76)	
DT_GL					0.023* (1.85)
LNZC		-10.212*** (-2.62)	-10.109** (-2.58)	-10.358*** (-2.65)	-10.141** (-2.60)
NIIR		0.057** (2.33)	0.056** (2.29)	0.059** (2.41)	0.056** (2.27)
LDR		0.084 (1.37)	0.096 (1.54)	0.090 (1.47)	0.087 (1.41)
NIM		1.833*** (3.52)	1.811*** (3.46)	1.836*** (3.55)	1.791*** (3.41)
ANMZ		0.047 (1.61)	0.050* (1.71)	0.049 (1.65)	0.048 (1.63)
Constant	29.859*** (28.63)	99.289*** (2.96)	99.064*** (2.94)	100.915*** (3.02)	100.217*** (2.99)
Observations	1,834	1,834	1,834	1,834	1,834
R-squared	0.870	0.899	0.899	0.898	0.898
Id FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes

Note: ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively, with t-values in parentheses.

4.2. Mechanism analysis

The operating efficiency of banks is enhanced by digital transformation, as indicated by column (2) of Table 2. Commercial banks have significantly enhanced their risk management capabilities by realising improvements in operational efficiency through digital transformation. By optimising processes using advanced technologies, banks speed up business processing, improve accuracy, reduce operating costs, and are able to respond quickly to market changes and seize business opportunities. As a result, digital transformation reduces banks' level of risk-taking by improving operational efficiency.

According to the information in column (3), the regression coefficient of digital transformation is significantly negative, implying that it is effective in reducing the bank's administrative costs. This leads to a reduction in operating expenses, freeing up resources for business expansion and risk prevention and control. The increase in profitability reduces banks' reliance on risky assets and mitigates the problem of risk accumulation. Therefore, hypothesis 2 is verified.

Table 2: Mechanism analysis results

VARIABLES	Risk	ZZWR	GLCB
	(1)	(2)	(3)
DT	0.037*** (2.747)	0.000*** (2.773)	-0.029** (-2.527)
Control	Yes	Yes	Yes
Observations	1834	1834	1834
R-squared	0.890	0.799	0.548
Id FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes

Note: ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively, with t-values in parentheses.

5. Conclusions and recommendations

This study uses data from 131 commercial banks from 2010 to 2023 to investigate how digital transformation affects banks' risk-taking. The study shows that, first, digital transformation significantly reduces banks' risk-taking through data-driven intelligent risk control systems by improving credit risk identification and reducing overall risk. Second, digital transformation indirectly enhances banks' risk resilience by improving operational efficiency and reducing administrative costs.

First, digital transformation is a trend in the development of the banking industry, which should be comprehensively promoted at the strategic level to enhance competitiveness using digital technology. Commercial banks should cooperate with fintech companies to establish an online service system, reduce costs, optimize profit models and reduce risk-taking through digital operations.

Second, we will promote digital transformation, fully integrate artificial intelligence, cloud computing and big data into operations management, and enhance the risk resilience of commercial banks.

Acknowledgements

This study was funded by the 2024 National Social Science Foundation Late Grant cum Excellent Doctoral Dissertation Publication and Excellent Academic Book Reprint Project [No. 24FGLB154].

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