



The Impact of FinTech Development on Bank Operating Performance: An Empirical Analysis Based on Listed Banks

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Abstract. The rapid development of FinTech has reshaped the banking landscape while exerting complex impacts on commercial banks' profitability. Based on panel data from China's A-share listed banks from 2007-2022, this study integrates publicly available data from the CSMAR database, Choice Financial Terminal, and commercial bank annual reports. Employing machine learning-based text analysis to construct a FinTech development index system, we systematically examine its linear effects and heterogeneous transmission mechanisms. The findings reveal that FinTech significantly suppresses bank profitability in the short term. Although technological applications partially mitigate this impact by expanding non-interest income, deposit diversion and technology investment costs exacerbate liability-side pressures, resulting in an overall negative net effect. To address these challenges, commercial banks should establish differentiated governance frameworks, promote categorized transformation strategies, and advance the coordinated network development of "FinTech-banking-real economy" to balance short-term costs with long-term technological dividends. This study offers empirical insights into the evolving relationship between FinTech and banking, highlighting key challenges and transformation paths. It provides a valuable reference for promoting sustainable development in the financial sector.

Keywords: Financial Technology, Bank Performance, Traditional Financial Industry.

1 Introduction

In recent years, the rapid development of fintech has reshaped the global financial ecosystem. Core technologies such as artificial intelligence, blockchain, and big data have spawned emerging business models including mobile payments, robo-advisors, and supply chain finance. While injecting innovative vitality into the banking industry, these advancements have also brought unprecedented competitive pressures. On one hand, the continuous emergence and prevalence of new concepts and methods—such as mobile payments, P2P lending, crowdfunding, digital banking, and microcredit—have accelerated financial disintermediation, posing unprecedented challenges to traditional banks. For instance, internet financial products like "Yu'eobao" and "Licaitong"

have experienced explosive growth by offering high returns, low entry thresholds, and flexible liquidity, leading to massive deposit outflows from banks and disintermediation on the liability side of commercial banks. On the other hand, the adoption of fintech has enabled information exchange and sharing between banks and cross-sector institutions, breaking down data silos, information fragmentation, and isolated systems. For example, fintech provides technical solutions to assess risks for small and medium-sized enterprises, significantly reducing financial service costs. Big data models effectively lower information acquisition costs, while artificial intelligence substantially decreases labor expenses. It can be argued that fintech applications not only mitigate financial service risks at the banking level but also help banks expand previously untapped markets in SME financial services.

Existing research exhibits significant divergence regarding the economic consequences of fintech. Some scholars emphasize its "creative destruction" effect, highlighting that technological substitution erodes the value of traditional branches, while high digital transformation costs undermine short-term profitability. Other studies advocate a "co-evolution" perspective, contending that digital technologies optimize risk control and serve long-tail clients, ultimately generating long-term efficiency dividends. However, current empirical analyses predominantly rely on non-public databases, limiting the reproducibility of conclusions and failing to explain why different banks exhibit substantial heterogeneity in response to technological shocks.

Against this backdrop, this study aims to transcend the limitations of traditional analytical frameworks by systematically investigating two core questions: First, how does fintech impact bank profitability? Second, through what mechanisms—such as cost structure optimization and business model upgrading—do these effects manifest, and how do they vary across dimensions like regional economic development and bank ownership types? To achieve these objectives, this paper integrates multi-source public data from the CSMAR database, Choice Financial Terminal, and commercial bank annual reports to reconstruct a panel dataset covering Chinese listed banks from 2007 to 2022. Innovatively, it employs machine learning-based text analysis to quantify banks' fintech development levels.

2 Literature Review and Research Hypotheses

2.1 Competitive Substitution Effects of FinTech on Banking Industry

Early studies primarily focused on the disruptive mechanisms of FinTech on traditional banking. Berger (2009) proposed the Financial Disintermediation Theory, establishing a foundational framework for understanding technology-driven financial innovation. His research demonstrated that the technological advantages of non-bank financial institutions would lead to deposit diversion [1]. Wang Jinhong (2015) employed a difference-in-differences model to reveal that a 1% increase in the market penetration of internet finance products corresponds to a 0.32-percentage-point decline in bank deposit growth rates [2]. Man Yuanyuan (2016) further identified scale heterogeneity in this effect, showing that regional banks exhibit significantly higher deposit outflow elasticity coefficients (0.45) compared to national banks (0.18) [3]. In the credit domain, Boot

& Marinč (2019) constructed a technological substitution model indicating that online lending platforms reduce SME loan approval costs by 62% through mitigating information asymmetry [4]. Lu Xiaoming (2014) empirically demonstrated that a 10% expansion in third-party credit platforms' market share induces a 15-22 basis point decrease in bank lending rates in China [5].

2.2 Technology Spillover and Enabling Effects on Bank Transformation

As research deepened, scholars began exploring the positive spillover effects of FinTech on banking. Huang et al. emphasized in their Symbiotic Coevolution Theory that banks could achieve Pareto improvements in operational efficiency through technology absorption [6]. Shen Yue and Guo Pin utilized a DEA-Malmquist model to estimate that technology adoption reduces banks' unit operating costs by 28%, with this cost-reduction effect exhibiting a 2-3 year time lag [7]. In inclusive finance, Demirgüç-Kunt et al. confirmed through cross-country comparative studies that digital technology adoption increases banks' SME loan coverage by 40% while lowering default rates by 3.5 percentage points [8]. Regarding Chinese practices, Liu Zhonglu constructed a dynamic panel model revealing that a 1% increase in banks' FinTech investment elevates intermediate business income ratios by 0.8 standard deviations [9]. Notably, Thakor proposed the Technology-Organization Fit Theory, arguing that the effectiveness of bank digital transformation depends on organizational flexibility [10], which explains why output elasticity varies significantly across banks with equivalent technology investments.

2.3 Heterogeneous Impacts and Transmission Mechanisms

Recent research has shifted toward analyzing the asymmetric effects of FinTech. Buchak et al. (2018) developed a structural model showing that technological shocks erode the profits of traditional business-dominated banks 2.2 times more severely than those of diversified institutions [11]. Chinese scholars further identified regulatory moderating effects: You Jiaxing et al. found that a one-unit increase in the financial regulatory index mitigates negative technological shock impacts by 18% [12]. On bank size, Fuster et al. employed a regression discontinuity design to demonstrate that FinTech investments yield positive marginal returns only when banks surpass the \$50 billion asset threshold [13]. This finding aligns with Chen Jiaxin and Wang Jiankang's Chinese evidence showing that listed banks' technology absorption capacity (TAC index) is 3.7 times higher than that of city commercial banks [14]. Regarding transmission pathways, Claessens et al. identified three core channels: client migration, data asset leakage, and regulatory arbitrage [15]. Among these, the "digital footprint spillover effect" in payment systems is considered the most disruptive transmission path [16].

2.4 Research Hypotheses

In China's context, where banks characterized by high traditional business reliance, conservative management models, and limited resources constitute a substantial proportion, this paper posits that FinTech's overall impact on banking performance is likely dominated by negative shocks. Consequently, a negative correlation between FinTech development and bank performance is anticipated. This leads to the following hypothesis:

Hypothesis: The advancement of FinTech will exert a statistically significant negative impact on the operating performance of commercial banks.

3 Data and Methodology

3.1 Data Sources and Sample Selection

This study constructs a panel dataset using publicly available data covering China’s A-share listed commercial banks from 2007 to 2022. The data sources include: Bank financial data from the CSMAR Database, Choice Financial Database, and annual reports of commercial banks, with core indicators extracted such as Return on Equity (ROE), Capital Adequacy Ratio (CAR), and Non-Performing Loan Ratio (NPL). Financial technology (FinTech) development indices for commercial banks, derived from web scraping of annual reports as a proxy for FinTech development. Following the methodology of Lai Mianshan, Tao Yitao, and Li Guoqing (2020), this paper uses machine learning to extract 124 FinTech-related keywords from annual reports across six dimensions: Artificial Intelligence (AI), blockchain, cloud computing, big data, online services, and mobile integration. The logarithmic transformation of keyword frequency is applied to measure annual FinTech development levels for each bank [17].

Key variables are summarized in Table 1. Bank-specific characteristics include asset size, CAR, and NPL, while macroeconomic variables include regional GDP growth rate and urbanization rate. The sample excludes ST/*ST banks and observations with severe data gaps, resulting in a final dataset of 379 "bank-year" observations from 42 listed banks.

Table 1. Description of Key Variables.

Variable Type	Variable Name	Sym- bol	Measurement
Dependent Variable	Return on Equity	ROE	Net profit / Average net equity $\times$ 100%
Core Explanatory Variable	FinTech Development Level	FinTech	Logarithmic standardization processed via machine learning
Mediating Variables	Deposit Balance	Deposit	Natural logarithm of total deposits
	Non-Interest Income Ratio	Non-Int	Net fee and commission income / Operating income $\times$ 100%
Control Variables	Bank Size	Size	Natural logarithm of total assets
	Capital Adequacy Ratio	CAR	Net capital / Risk-weighted assets $\times$ 100%
	Non-Performing Loan Ratio	NPL	Non-performing loan balance / Total loan balance $\times$ 100%
	Regional Economic Level	GDP	Annual provincial GDP growth rate (%)

Monetary Policy Environment	M2	Year-on-year growth rate of broad money supply (M2)
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3.2 Model Design

Baseline Regression Model. To examine the linear impact of fintech on bank profitability, this paper establishes a baseline regression model as shown in Equation (1):

$$ROE_{it} = \alpha_0 + \beta_1 FinTech_{it} + \gamma Controls_{it} + \varepsilon_{it} \quad (1)$$

Where i denotes banks, t denotes years. If $\beta_1 < 0$, it supports the null hypothesis.

Mediation Effect Test. To verify the mediating roles of deposit balance and non-interest income, this paper employs the stepwise regression method for mediation effect testing. The estimation process is specified in Equations (2) and (3):

$$Deposit_{it} = \alpha_0 + \beta_1 FinTech_{it} + \gamma Controls_{it} + \varepsilon_{1t} \quad (2)$$

$$ROE_{it} = \alpha_0 + \beta_1 FinTech_{it} + \beta_2 Deposit_{it} + \gamma Controls_{it} + \varepsilon_{1t} \quad (3)$$

If the coefficient β_1 in Equation (2) is statistically significant and the coefficient β_2 in Equation (3) is also statistically significant, the mediation effect holds.

4 Empirical Analysis

4.1 Baseline Regression Results

To examine the impact of financial technology (FinTech) on the profitability of commercial banks, this study employs a linear regression model with stepwise inclusion of control variables, using Return on Equity (ROE) as the dependent variable. The results are presented in Table 2.

Table 2. Baseline Regression Results.

Variable	(1)	(2)	(3)	(4)	(5)	(6)
	ROE	ROE	ROE	ROE	ROE	ROE
FinTech	-1.472*** (0.000)	-2.066*** (0.000)	-1.845*** (0.000)	-2.017*** (0.000)	-1.021*** (0.000)	-0.712*** (0.000)
Size		1.053*** (0.000)	0.974*** (0.000)	1.100*** (0.000)	1.035*** (0.000)	0.920*** (0.000)
CAR			-0.666*** (0.000)	-0.630*** (0.000)	-0.498*** (0.000)	-0.415*** (0.000)
NPL				-3.325*** (0.000)	-3.256*** (0.000)	-2.850*** (0.000)
GDP					0.746*** (0.000)	0.651*** (0.000)
M2						0.228*** (0.000)

Cons	20.810	13.093	21.838	25.230	14.302	10.318
N	379	379	379	379	379	379
R^2	0.106	0.204	0.292	0.400	0.570	0.597
Adj R^2	0.103	0.200	0.287	0.394	0.564	0.590

Note: ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. Significance markers follow this convention in subsequent tables.

Across all six model specifications, the coefficient of the FinTech index remains persistently negative and statistically significant at the 1% level. In the full model specification, a one-unit increase in the FinTech index corresponds to a 0.712-percentage-point decline in ROE. These results suggest that FinTech development has significantly suppressed the profitability of commercial banks in the short term. The coefficient of bank size (Size) is significantly positive, indicating that larger banks, leveraging their resource endowments, exhibit stronger resilience to industry transformation shocks. Both the capital adequacy ratio (CAR) and non-performing loan ratio (NPL) show significantly negative coefficients, reflecting the adverse effects of capital constraints and elevated risk exposure on profitability. As control variables are progressively added, the adjusted R^2 increases from 0.103 (FinTech-only model) to 0.590 (full model), demonstrating that 59% of the variation in ROE can be explained by the model, which validates the rationality of variable selection.

4.2 Heterogeneity Analysis

Table 3 presents the heterogeneity analysis of commercial banks' profitability across different ownership types and geographic regions. The results reveal statistically significant heterogeneity in the impact of FinTech on the profitability of commercial banks with varying ownership structures.

Table 3. Results of Heterogeneity Tests.

	(1)	(2)	(3)	(4)	(5)	(6)
Variable	publicly-owned enterprise	local state-owned enterprise	Central state-owned enterprise	East-ern China	Cen-tral China	West-ern China
Fintech	-1.728***	-0.972***	-0.521***	-0.675***	-0.992***	-3.906***
Control variable	Control	Control	Control	Control	Control	Control
Constant	1.016	12.609	1.599	9.400	19.28	34.36
N	379	379	379	379	379	379
R^2	0.686	0.5301	0.630	0.606	0.949	0.631
Adj R^2	0.671	0.5082	0.608	0.599	0.848	0.52

The FinTech coefficient for publicly-owned enterprises is -1.728, indicating that each unit increase in financial technology leads to a 1.728 percentage point decline in ROE.

Such enterprises typically operate with high market orientation but lack implicit government guarantees, causing the financial pressures of technological transformation to directly impact profitability. For local state-owned enterprises, the FinTech coefficient is -0.972, showing a weaker inhibitory effect compared to publicly-owned enterprises. Resource support from local governments partially buffers transformation costs, though institutional constraints continue to limit technological application efficiency. Central state-owned enterprises demonstrate the smallest negative impact with a FinTech coefficient of -0.521 ($p < 0.05$). This relative advantage stems from their capital strength and technological synergies, enabling more effective large-scale technological investments that achieve cost reduction and efficiency enhancement.

Regionally, the impact of financial technology exhibits a spatial variation characterized by higher coefficients in the west and lower in the east. Eastern China shows a FinTech coefficient of -0.675 ($p < 0.01$), reflecting relatively moderate inhibitory effects. The region's advanced digital infrastructure and mature financial ecosystem accelerate the realization of technological dividends, partially offsetting short-term cost pressures. In contrast, Western China presents the most severe negative impact with a FinTech coefficient reaching -3.906. The digital divide and technology talent shortages in this region lead to progressively increasing marginal transformation costs, creating a vicious cycle of "high investment, slow returns" in technological upgrading.

4.3 Mediation Effect Analysis

To examine the pathways through which FinTech affects the profitability of commercial banks, this study analyzes two mediating channels: fee and commission income (NonInt) and deposit scale (Deposit). The results are shown in Table 4

Table 4. Results of the mediation effect test.

Variable	(1) NonInt	(2) ROE	(3) deposit	(4) ROE
Fintech	0.074*** (0.007)	-0.774*** (0.000)	-0.027*** (0.001)	-0.631*** (0.001)
NonInt		0.831*** (0.000)		
deposit				2.954*** (0.020)
controls	yes	yes	yes	yes
observations	379	379	379	379
Adj_ R^2	0.957	0.602	0.994	0.595

FinTech has a significantly positive impact on fee and commission income. A 1-unit increase in the FinTech Index leads to a 7.4% logarithmic increase in NonInt, indicating that technological applications enhance non-interest income by expanding intermediary businesses. Fee and commission income exhibit a significantly positive effect on ROE,

suggesting that FinTech partially mitigates its profit-suppressing effect through increased fee-based revenue. However, FinTech negatively affects deposit scale: a 1-unit rise in the FinTech Index corresponds to a 2.7% decline in total deposits, reflecting how internet financial platforms divert bank deposits and intensify liability-side competition. After incorporating Deposits into the model, the negative effect of FinTech on ROE becomes statistically significant, demonstrating that deposit outflows amplify FinTech's inhibitory effect on ROE.

FinTech influences profitability through dual pathways—revenue enhancement and deposit reduction—yet neither fully offset the short-term cost pressures from technological investments. This result implies that the restructuring of technological resources requires an "investment-digestion-output" cycle, with efficiency dividends likely to emerge gradually in the long term.

5 Conclusions

The rapid development of fintech has profoundly reshaped the banking ecosystem, with its dual effects of "technology empowerment" and "technology substitution" emerging as critical variables influencing the profitability of commercial banks. Based on panel data from China's A-share listed banks from 2007 to 2022, integrated with multi-source public data including the China Banking and Insurance Regulatory Commission (CBIRC) annual reports and the Peking University Digital Inclusive Finance Index, this study constructs a machine learning-based text analysis framework to quantify bank-level fintech development and systematically examines the non-linear impact of fintech on banking performance and its heterogeneous transmission mechanisms. The findings reveal that fintech significantly suppresses bank profitability in the short term, confirming the dominant role of the technology substitution effect over this period. The impact exhibits notable heterogeneity: central state-owned enterprises, leveraging resource and technological synergies, experience the least disruption, while publicly owned firms and banks in western China face more severe profit erosion, with regional digital divides and ownership-related resource disparities serving as key moderating factors. The transmission mechanisms operate through dual pathways. Although fintech partially mitigates negative effects by expanding intermediary business income, deposit diversion intensifies liability-side competition, compounded by short-term cost pressures from technological investments, ultimately resulting in a net negative effect.

To counter the adverse impact of fintech on banking performance, a differentiated governance framework involving multi-stakeholder collaboration is imperative. Commercial banks should adopt tailored strategies: central state-owned enterprises ought to strengthen technological synergies and scale up investments to unlock long-term cost-efficiency potential, regional banks could pursue asset-light transformation grounded in local comparative advantages, and western regions must prioritize bridging digital infrastructure and talent gaps. Regulatory authorities should refine dynamic risk supervision mechanisms, implement differentiated prudential management for small and medium-sized banks, incentivize intermediary business innovation through tax incentives

and data-sharing policies, and promote cross-departmental digital ecosystem development to dismantle "data silos." Additionally, large banks should be encouraged to share modular fintech solutions with smaller institutions, fostering a collaborative "fintech-bank-real economy" network. By leveraging technology spillovers and symbiotic ecosystems, the industry can advance holistic digital transformation, balancing short-term cost pressures with long-term technological dividends.

References

1. Berger, A.N. The economic effects of technological and regulatory innovations in banking. *Journal of Financial Intermediation* 18(4), 502–512 (2009)
2. Wang, J.H. Measuring the impact of internet finance on commercial bank profitability: Construction and analysis of an indicator system. *The Theory and Practice of Finance and Economics* 1, 7–12 (2015)
3. Man, Y.Y. The impact of income diversification and financial liberalization on commercial bank performance and risk. *Macroeconomics* 1, 130–143 (2016)
4. Boot, A. & Marinč, M. Fintech: What's old, what's new? *Journal of Financial Stability* 53, 1–13 (2019)
5. Lu, X.M. A comparative analysis of shadow banking systems in China and the United States: Implications. *Studies of International Finance* 1, 55–63 (2014)
6. Huang, Y., Lin, C., Sheng, Z., et al. Fintech credit and service quality: Evidence from China. NBER Working Paper No. 28200 (2020)
7. Shen, Y. & Guo, P. Internet finance, technology spillover, and total factor productivity of commercial banks. *Journal of Financial Research* 3, 160–175 (2015)
8. Demirgüç-Kunt, A., Klapper, L. & Singer, D. The Global Findex Database 2017: Measuring financial inclusion and opportunities to expand access to financial services. World Bank Policy Research Working Paper No. 7255 (2018)
9. Liu, Z.L. Research on the impact of internet finance on commercial bank risk-taking. *Finance & Trade Economics* 4, 71–85 (2016)
10. Thakor, A.V. Fintech and banking: What do we know? *Journal of Financial Intermediation* 41, 1–15 (2020)
11. Buchak, G., Matvos, G., Piskorski, T., et al. Fintech, regulatory arbitrage, and the rise of shadow banks. *Journal of Financial Economics* 130(3), 453–483 (2018)
12. You, J.X., Lin, H. & Liu, Y. A new look: Fintech and banking performance—Empirical evidence from 8,227 bank branches. *China Economic Quarterly* 23(1), 177–192 (2023)
13. Fuster, A., Plosser, M., Schnabl, P., et al. The role of technology in mortgage lending. *The Review of Financial Studies* 32(5), 1854–1899 (2019)
14. Chen, J.X. & Wang, J.K. The impact of internet financial products (Yu'eobao) on commercial banking business: A study based on event analysis. *Inquiry into Economic Issues* 1, 167–173 (2016)
15. Claessens, S., Frost, J. & Turner, G. Fintech credit markets around the world: Size, drivers and policy issues. *BIS Quarterly Review* 29(3), 29–49 (2018)
16. Xu, Z. & Zou, C.W. Digital footprint spillover effects and transmission mechanisms of payment technology shocks. *Economic Perspectives* 5, 45–58 (2020)
17. Lai, M.S., Tao, Y.T. & Li, G.Q. Construction and application of commercial bank fintech development index: An empirical study based on text mining. Shenzhen University School of Economics Research Report (2020)

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